



1015 North 98th Street
Suite 300
Omaha, NE 68114-2334

architecture
landscape architecture
interior design
construction management



Lewis Central High School Entry Addition

3504 Harry Langdon Blvd.
Council Bluffs, Iowa 51503

Project Manual Combined Contract

BCDM Project Number: 5551-00
19 June 2025

**DIVISION 00 – PROCUREMENT AND
CONTRACTING REQUIREMENTS**

SECTION 00 01 07
SEALS PAGE

ARCHITECT:

	I HEREBY CERTIFY THAT THE PORTION OF THIS TECHNICAL SUBMISSION DESCRIBED BELOW WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND RESPONSIBLE CHARGE. I AM A DULY REGISTERED PROFESSIONAL ARCHITECT UNDER THE LAWS OF THE STATE OF IOWA. SIGN & DATE: <u><i>Gregory S. Stieren</i> 6/19/2025</u> PRINTED NAME: GREGORY S. STIEREN LICENSE NUMBER: 07744 MY LICENSE RENEWAL DATE IS JUNE 30, 2027 PAGES/ SHEETS/ DIVISIONS COVERED BY THIS SEAL:
ONLY THESE COPIES OF THIS DOCUMENT SIGNED IN CONTRASTING INK COLOR ARE TO BE CONSIDERED CERTIFIED OFFICIAL COPIES PER IOWA ADMINISTRATION CODE 554D.	Divisions 0 through 12

STRUCTURAL ENGINEER:

	I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA <u><i>James F. Lange</i> 6/19/25</u> JAMES F LANGE, SE LICENSE NUMBER: 20084 LICENSE RENEWAL DATE: DECEMBER 31, 2025 PAGES / SHEETS / DIVISIONS COVERED BY THIS SEAL: 03, 05

MECHANICAL ENGINEER:

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	 06/19/2025
	MATTHEW M. SARGENT (date)
	License Number P21077
	My license renewal date is December 31, 2025
Pages or sheets covered by this seal:	
Divisions 21, 22, and 23	
<u>Specifications</u>	

ELECTRICAL ENGINEER:

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	 06/19/2025
	MARY R. WURST (date)
	License Number 22287
	My license renewal date is December 31, 2025
Pages or sheets covered by this seal:	
Division 26 and Division 28, Section 28 46 00	
<u>Specifications</u>	

END OF SECTION

SECTION 00 01 10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- A. 00 01 07 – Seals Page
- B. 00 01 10 – Table of Contents
- C. 00 11 13 - Advertisement for Bids
- D. 00 20 13 - Instructions to Bidders
- E. 00 30 30 - Bid for Combined Contract
- F. 00 31 32 - Geotechnical Data
- G. 00 60 00 - Project Forms
- H. 00 63 00 - Clarification and Modification Forms
- I. 00 72 00 - General and Supplementary Conditions

SPECIFICATIONS

2.01 DIVISION 01 -- GENERAL REQUIREMENTS

- A. 01 10 00 - Summary
- B. 01 25 00 - Substitution Procedures
- C. 01 29 00 - Progress and Payment
- D. 01 30 00 – Administrative Requirements
- E. 01 31 00 - Project Meetings
- F. 01 40 00 - Quality Requirements
- G. 01 50 00 - Temporary Facilities and Controls
- H. 01 60 00 – Product Requirements
- I. 01 78 00 – Closeout Submittals

2.02 DIVISION 02 -- EXISTING CONDITIONS

- A. 02 41 00 - Demolition

2.03 DIVISION 03 – CONCRETE

- A. 03 30 00 – Cast-in-Place Concrete
- B. 03 32 20 – Concrete Floor Underlayment
- C. 03 45 00 – Precast Architectural Concrete

2.04 DIVISION 04 – MASONRY

- A. 04 20 00 – Unit Masonry

2.05 DIVISION 05 -- METALS

- A. 05 12 00 – Structural Steel Framing
- B. 05 31 00 – Steel Decking
- C. 05 40 00 – Cold-Formed Metal Framing
- D. 05 50 00 – Metal Fabrications

2.06 DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

- A. 06 10 00 – Rough Carpentry
- B. 06 20 00 – Finish Carpentry
- C. 06 41 00 – Architectural Wood Casework

2.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

- A. 07 05 53 – Fire and Smoke Assembly Identification
- B. 07 11 13 – Bituminous Dampproofing
- C. 07 19 00 – Water Repellents
- D. 07 21 00 - Thermal Insulation
- E. 07 21 19 – Foamed-In-Place Insulation
- F. 07 27 00 – Air Barriers
- G. 07 42 13.23 – Metal Composite Material Wall Panels
- H. 07 53 23 – EPDM Thermoset Single-Ply Roofing
- I. 07 62 00 – Sheet Metal Flashing and Trim
- J. 07 84 00 – Firestopping
- K. 07 92 00 – Joint Sealants

2.08 DIVISION 08 – OPENINGS

- A. 08 12 13 – Hollow Metal Frames
- B. 08 14 16 – Flush Wood Doors
- C. 08 43 13 – Aluminum-Framed Storefronts
- D. 08 71 00 – Finish Hardware
- E. 08 71 13 – Power Door Operators
- F. 08 80 00 – Glazing

2.09 DIVISION 09 -- FINISHES

- A. 09 21 16 - Gypsum Board Assemblies
- B. 09 30 00 – Tiling
- C. 09 51 00 – Acoustical Ceilings
- D. 09 65 00 – Resilient Flooring
- E. 09 68 00 – Carpeting
- F. 09 90 00 – Painting
- G. 09 99 90 – Color Schedule

2.10 DIVISION 10 – SPECIALTIES

- A. 10 11 00 – Visual Display Units
- B. 10 14 19 – Dimensional Letter Signage
- C. 10 21 23 – Cubicle Curtains and Track
- D. 10 26 00 – Wall and Door Protection
- E. 10 28 00 – Toilet, Bath, and Laundry Accessories

2.11 DIVISION 11 – NOT USED

2.12 DIVISION 12 – FURNISHINGS

- A. 12 24 00 – Window Shades
- B. 12 35 30 – Manufactured Casework

2.13 DIVISIONS 13 AND 14 – NOT USED

2.14 DIVISION 21 – FIRE SUPPRESSION

- A. 21 04 00 – Common Requirements for Fire Suppression
- B. 21 05 00 – Common Work Results for Fire Suppression
- C. 21 13 00 – Fire-Suppression Sprinkler Systems

2.15 DIVISION 22 -- PLUMBING

- A. 22 04 00 – Common Requirements for Plumbing
- B. 22 05 19 – Meters and Gages for Plumbing Piping
- C. 22 05 23 – General-Duty Valves for Plumbing Piping
- D. 22 05 53 – Identification for Plumbing Piping and Equipment
- E. 22 07 19 – Plumbing Piping Insulation
- F. 22 10 05 – Plumbing Piping
- G. 22 10 06 – Plumbing Piping Specialties
- H. 22 40 00 – Plumbing Fixtures

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

- A. 23 04 00 – Common Requirements for HVAC
- B. 23 05 23 – General-Duty Valves for HVAC Piping
- C. 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- D. 23 05 53 – Identification for HVAC Piping and Equipment
- E. 23 05 93 – Testing, Adjusting, and Balancing for HVAC
- F. 23 07 13 – Duct Insulation
- G. 23 07 19 – HVAC Piping Insulation
- H. 23 09 13.13 – Instrumentation and Control Devices for HVAC
- I. 23 09 93 – Sequence of Operations for Building Management Control System
- J. 23 21 13 – Hydronic Piping
- K. 23 21 14 – Hydronic Specialties
- L. 23 31 00 – HVAC Ducts and Casings
- M. 23 33 00 – Air Duct Accessories
- N. 23 36 00 – Air Terminal Units
- O. 23 37 00 – Air Outlets and Inlets
- P. 23 82 00 – Convection Heating and Cooling Units

2.17 DIVISION 26 -- ELECTRICAL

- A. 26 04 00 – Common Requirements for Electrical
- B. 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- C. 26 05 26 – Grounding and Bonding
- D. 26 05 29 – Hangers and Supports
- E. 26 05 33.13 – Conduit
- F. 26 05 33.16 – Boxes

- G. 26 09 23 – Lighting Controls
- H. 26 27 26 – Wiring Devices
- I. 26 51 00 – Interior Lighting
- J. 26 56 00 – Exterior Lighting

2.18 DIVISION 27 – COMMUNICATIONS

- A. 27 05 01 – Common Work Results for Communications
- B. 27 05 27 – Grounding and Bonding for Communications Systems
- C. 27 05 28 – Pathways for Communications Systems
- D. 27 05 53.01 – Identification for Communications Systems
- E. 27 15 13 – Communications Copper Horizontal Cabling
- F. 27 15 43 – Communications Faceplates and Connectors

2.19 DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

- A. 28 05 00 – Common Work Results for Electronic Security
- B. 28 13 00 – Electronic Access Control System
- C. 28 46 00 – Fire Detection and Alarm

2.20 DIVISION 31 – EARTHWORK

- A. 31 10 00 – Site Clearing
- B. 31 20 00 – Earthwork
- C. 31 22 00 – Grading

END OF SECTION

**SECTION 00 11 13
ADVERTISEMENT FOR BIDS**

1.01 THE OWNER:

- A. Lewis Central Community School District, 4121 Harry Langdon Blvd., Council Bluffs, Iowa 51503.

1.02 THE ARCHITECT:

- A. BCDM Architects , 1015 North 98th Street, Suite 300, Omaha, Nebraska 68114.
- B. BCDM Project No. 5551-00

1.03 TO: POTENTIAL BIDDERS

- A. The Lewis Central Community School District will receive sealed bids for a Combined Contract, including General, Mechanical and Electrical Work for the Lewis Central High School Entry Addition located at 3504 Harry Langdon Boulevard, Council Bluffs, Iowa 51503.
- B. The Project consists of the construction of approximately 1,375 square feet of new addition, 2,647 square feet of renovation.
- C. Bids must be on a Lump Sum basis.
- D. Bids for the Lewis Central High School Entry Addition will be received until 2:00 p.m. local time, July 17, 2025, at the Lewis Central Education Resource Center located at 4121 Harry Langdon Blvd., Council Bluffs, Iowa
- E. Bids received after this time will not be accepted. Bids will be publicly opened and read aloud.
- F. Bidding Documents may be examined at the following exchanges after June 19, 2025:
 - 1. DODGE DATA & ANALYTICS, 4300 Beltway Place, Suite 150, Arlington, TX 76018
 - 2. OMAHA BUILDERS EXCHANGE, 4159 South 94th Street, Omaha, NE 68127
 - 3. CONSTRUCT CONNECT, 30 Technology Parkway South, Suite 500, Norcross, GA 30092-2912
 - 4. LINCOLN BUILDERS BUREAU, 5910 South 58 St., Suite C, Lincoln, NE 68516
 - 5. MASTER BUILDERS OF IOWA, 4100 Westown Pkwy, West Des Moines, IA 50266
 - 6. SIOUX CITY BLUE PRINT, 709 Douglas Street, Sioux City, Iowa 51101
 - 7. SIOUX CITY CONSTRUCTION LEAGUE, 3900 Stadium Drive, Sioux City, Iowa 51102
 - 8. STANDARD SHARE, <http://www.standardsharev3.com>
- G. Bidders may obtain Bidding Documents electronically from A & D Technical Supply, 4320 South 89th Street, Omaha, Nebraska 68127 (402-592-4950) OR from Master Builders of Iowa, 4100 Westown Pkwy, West Des Moines, IA 50266 (515 288-8904) from 8:00 a.m. until 5:00 p.m. local time, Monday through Friday, in accord with the Instructions to Bidders.
- H. Bid security in the amount of 5 percent of the bid must accompany each bid in accord with the Instructions to Bidders.
- I. There will be a Pre-Bid Conference held at Lewis Central High School at 9:00 a.m. local time on Thursday, June 26, 2025. Attendance of this Pre-Bid Conference is **suggested** for all General Contractors. Other subcontractors are highly encouraged to attend this Pre-Bid Conference.
- J. The Owner reserves the right to reject any or all bids and to waive informalities or irregularities in the bidding.

DR. BRENT HOESING

SUPERINTENDENT OF SCHOOLS

LEWIS CENTRAL COMMUNITY SCHOOL DISTRICT

END OF SECTION

**SECTION 00 20 13
INSTRUCTIONS TO BIDDERS**

PROJECT NAME: LEWIS CENTRAL HIGH SCHOOL ENTRY ADDITION

PROJECT CITY/STATE: COUNCIL BLUFFS, IOWA

BCDM PROJECT NO.: 5551-00.

1.01 INFORMATION FOR BIDDERS:

- A. To be considered, bids must be made in accord with these Instructions to Bidders.
- B. Bidding Documents. Copies of the Bidding Documents may be obtained electronically from the printer, A & D Technical Supply, 4320 South 89th Street, Omaha, Nebraska 68127 (402-592-4950) OR from Master Builders of Iowa, 4100 Westown Pkwy, West Des Moines, IA 50266 (515 288-8904) between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday. Planholder's list and addenda, if any, may be viewed at www.adtechsupply.com OR www.mbi.build.
- C. Examination. Bidders shall carefully examine the Bidding Documents and construction site to obtain firsthand knowledge of existing conditions. Contractors will not be given extra payments for conditions which can be determined by examining the Bidding Documents.
- D. Submission of a bid will be construed that bidders are in compliance with this instruction.
- E. Questions. Submit all questions about Bidding Documents to the Architect, except Mechanical and Electrical questions shall be submitted to the Consulting Engineer, Alvine Engineering. Replies will be issued to all Bidders of record as Addenda to the Drawings and Project Manual, and will become part of the Contract. The Architect/ Engineer and the Owner will not be responsible for oral clarification. Questions received less than 48 hours before the bid opening that will affect project construction schedule or project cost cannot be answered.
- F. Substitutions. To obtain approval to use unspecified products, bidders shall submit written requests at least 14 calendar days before the bid date and hour. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. If the product is acceptable, the Architect/Engineer will approve it in an Addendum issued to all bidders of record.
- G. Voluntary Substitutions. In the proper spaces shown on the Bid Form, proposals for substitute materials of other makes, but of similar design and equal quality, capacity and performance, are desired. The name and catalog number of proposed substitute items shall be given. The proposal of the substitute item is for the information of the Owner in the selection of desired materials from the successful bidder and will not affect the award of the Contract. The Lump Sum Base Bid shall be based upon the products specified or approved by Addendum.
- H. Basis of Bids. The bidder must include all bid items shown on the bid form; failure to comply may be cause for rejection. No segregated bids or assignments will be considered.
- I. Bid Security. Cash or a certified check, cashier's check, money order, or bank draft payable to the Lewis Central Community School District or a bid bond executed by the bidder, in the amount of 5 percent of the amount of the bid, shall be submitted with each bid.
- J. If a Bid Bond is submitted, it shall be issued by a surety company authorized by the State of Iowa to issue such bonds, and shall be acceptable to the Owner, and shall be submitted on AIA Document A310, February 1970 or later edition.
- K. Bid Security of the 2 lowest bidders will be retained until a contract is entered into and required bonds and insurance filed. This period will not exceed 30 days after the date of receipt of bids. The Bid Security of others will be returned after tabulation of bids is completed.
- L. Sales and Use Tax:
 - 1. Iowa Use Taxes shall be paid on all supplies and materials used in, and made component parts of, the Project.

Lewis Central High School
Entry Addition

2. Iowa Sales Taxes shall not be paid on qualified building materials purchased, or withdrawn from inventory, which will be incorporated into real property for Project.
 3. The Owner is a designated exempt entity and will complete an online application to register this Contract with the Iowa Department of Revenue and Finance. The Owner will distribute Tax Exemption Certificates and Authorization Letters to the Contractor and all Subcontractors who have been identified at, or before filing of the Performance Bond. Refer to Iowa Department of Revenue and Finance publications available at <http://www.state.ia.us/tax/business/Contr-ExEnt-Index.html>.
- M. Federal Excise Tax. The Owner is exempt from Federal Excise Tax. The bidder shall exclude from his bid all Federal Excise Tax on taxable items.
- N. Preparation of Bids. Bids shall be made on unaltered bid forms furnished by the Architect/Engineer. Fill in all blank spaces, and submit one copy. Bids shall be signed with the name typed below the signature. Where the bidder is a corporation, the bid must be signed with the legal signature of an officer authorized to bind the corporation to a Contract.
- O. Permits and Fees. Unless specifically noted below, all required permits and fees shall be applied and paid for by the General Contractor (or Subcontractor as coordinated by the GC).
- P. All utility company charges and inspection fees shall be paid by the appropriate Contractor or Subcontractor. All licenses (both permanent and temporary) necessary to perform the work shall be applied and paid for by the Contractor and appropriate Subcontractors.
- Q. Online Submittal Service Use and Fees. The General Contractor shall be responsible for establishing, paying the fees for, coordinating and utilizing an Online Submittal Service designed specifically for transmitting submittals between construction team members. See Section 01 30 00 - Administrative Requirements for additional information.
- R. Insurance requirements for the Contractor shall be as specified in the Supplementary Conditions of the Contract for Construction.
- S. Submittal: Bids shall be submitted in opaque, sealed envelopes bearing on the outside the bidder's name and address, and marked "Bid for Lewis Central High School Entry Addition - Combined Contract." If bids are sent by mail, they shall be received prior to the Bid Date and Time by Dr. Brent Hoising - Superintendent of Schools, Lewis Central Community School District - 4121 Harry Langdon Blvd., Council Bluffs, Iowa 51503.
- T. Modification and Withdrawal. Bids may not be modified after submittal. Bidders may withdraw bids at any time before opening, but may not resubmit them. No bid may be withdrawn or modified after the bid opening, except where the award of the Contract has been delayed for 30 days or more.
- U. Acceptance or Rejection of Bids. The Owner may reject any or all bids or waive defects in any bid if it be in his interest to do so.
- V. The Owner and the Architect/Engineer may make such investigations as they deem necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to them all such information and data for this purpose as they may request. The Owner and the Architect/Engineer reserve the right to reject any bid if the evidence submitted by, or investigation of such bidder fails to satisfy them that such bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein. Conditional bids may not be accepted.
- W. Disqualification. The Owner reserves the right to disqualify bids, before or after opening, upon evidence of collusion with the intent to defraud or other illegal practices upon the part of the bidder.
- X. Opening. Bids will be received until 2:00 p.m., local time, on July 17, 2025, at the Lewis Central Education Resource Center located at 4121 Harry Langdon Blvd., Council Bluffs, Iowa 51503. Bids received after this time will not be accepted.
- Y. Bids will be publicly opened and read aloud.

- Z. Schedule for Award of Contract and Substantial Completion. The required Substantial Completion date and date of Final Completion are specified in Section 01 10 00 . While the paragraph above entitled "Modification and Withdrawal" requires that bids remain firm and valid for 30 days after the receipt of bids, it is the Owner's intent to present the bids and award a Contract on July 21, 2025.

END OF SECTION

SECTION 00 30 30
BID FOR COMBINED CONTRACT

PROJECT NAME: LEWIS CENTRAL HIGH SCHOOL ENTRY ADDITION

PROJECT CITY/STATE: COUNCIL BLUFFS, IOWA

BCDM PROJECT NO.: 5551-00

0.01 BIDDING INFORMATION:

- A. Bid of _____ a
corporation organized and existing under the laws of the State of
_____; or a partnership consisting of
_____, partners; or an
individual hereinafter called the bidder.
- B. To: Dr. Brent Hoelsing
Superintendent of Schools
Lewis Central Community School District
4121 Harry Langdon Blvd.
Council Bluffs, Iowa 51503
- C. The undersigned acknowledges that he/she has received and familiarized himself/herself with the following:
1. Project Manual dated June 19, 2025.
 2. Drawings:
 - a. Sheets G0-0 thru G0-1 (2 Sheets)
 - b. Sheets C0-1 thru C1-5 (7 Sheets)
 - c. Sheets A0-0 thru A6-2 (9 Sheets)
 - d. Sheets S1-1 thru S3-1 (5 Sheets)
 - e. Sheets M0-0 thru M5-0 (7 Sheets)
 - f. Sheets E0-0 thru E6-0 (6 Sheets)
 - g. Sheets T0-0 thru T8-1 (6 Sheets)
 3. Addenda: No. _____ through _____
- D. The undersigned further acknowledges that he/she has visited the site and familiarized himself/herself with local conditions affecting the cost of the Work at the place where the Work is to be done.
- E. In submitting this bid, the undersigned agrees:
1. To furnish all material, labor, tools, expendable equipment, and all utility and transportation services necessary to perform and complete, in a workmanlike manner, all of the Work required for the Combined Contract, including General Construction, Mechanical Work and Electrical Work in accord with the Bidding Documents prepared by BCDM and its subconsultants, for the consideration hereinafter set forth.
 2. To hold his/her bid open for 30 days after the receipt of bids, and to accept the provisions of the Instructions to Bidders regarding disposition of Bid Security.
 3. To enter into and execute a Contract, if awarded on the basis of this bid, and to furnish a Performance Bond and a Payment Bond in accord with the General Conditions and General Requirements of this Contract.
 4. To start and complete the Work according to the schedule specified in Section 01 10 00, and as shown on the Drawings.

0.02 BIDDING REQUIREMENTS:

- A. **LUMP SUM BASE BID.** The undersigned hereby proposes and agrees to perform the foregoing, for the Lump Sum of

_____ Dollars

(\$ _____).

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern).

- B. **VOLUNTARY SUBSTITUTIONS.** The undersigned proposes the following Voluntary Substitutions:

1.	<u>Product</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Difference in Cost</u>
a.	_____	_____	_____	Add/Deduct \$ _____
b.	_____	_____	_____	Add/Deduct \$ _____
c.	_____	_____	_____	Add/Deduct \$ _____
d.	_____	_____	_____	Add/Deduct \$ _____

- C. The undersigned has attached the required Bid Security as stated in the Instructions to Bidders.
- D. In submitting this bid, it is understood that the right to reject any and all bids and to waive irregularities in the bidding has been reserved by the Owner.

Dated this _____ day of _____, 2025

Name of Bidder

Address

City / State / Zip

Authorized Officer

Telephone Number

Fax Number

END OF SECTION

**SECTION 00 31 32
GEOTECHNICAL DATA**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Two subsurface exploration reports have been prepared for this Project.
- B. General - Report 1: The subsurface exploration report has been prepared for this site by Thiele Geotech, Inc. The report is dated February 27, 2025 and is numbered TG Project No. 24655.01 and is included at the end of this section.
- C. General - Report 2: The subsurface exploration report has been prepared for this site by Thiele Geotech, Inc. The report is dated June 4, 2025 and is numbered TG Project No. 25231.01 and is included at the end of this section.
- D. Use of Data: This report is not a warranty of subsurface conditions or the continuity of such conditions between soil borings. The Contractor shall visit the site and acquaint himself with all existing conditions. This report provides recommendations for the construction of footings, foundations and grade supported slabs. Earthwork recommendations are also included. The Contractor shall perform the work in accordance with this report as well as Specification Section 31 20 00 - Earthwork and the Civil Drawings.

1.03 QUALITY ASSURANCE

- A. A soils engineer will be retained by the Contractor to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading.
- B. Adjustment of Work: Readjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Documents without specific approval from the Architect.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



Geotechnical Exploration Report

Lewis Central High School Addition

**3504 Harry Langdon Boulevard
Council Bluffs, Iowa**

	I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.	
	<u>Raeanna C. D. Thiele</u> RAEANNA C. D. THIELE LICENSE NUMBER 24569 MY LICENSE RENEWAL DATE IS DECEMBER 31, 2025	<u>6/4/25</u> DATE
PAGES OR SHEETS COVERED BY THIS SEAL: <u>Report (10 pages) Plus Appendix</u>		

Prepared for:

Lewis Central Community School District
4121 Harry Langdon Boulevard
Council Bluffs, Iowa, 51503

June 4, 2025

TG Project No. 25231.01

THIELE GEOTECH, INC.
13478 Chandler Road
Omaha, Nebraska 68138-3716
402.556.2171 Fax 402.556.7831
www.thielegeotech.com

Geotechnical Exploration Report
Lewis Central High School Addition

Table of Contents

INTRODUCTION	1
PROJECT DESCRIPTION	2
SURFACE AND SUBSURFACE CONDITIONS	3
SITE CONDITIONS	3
LOCAL GEOLOGY	3
SOIL CONDITIONS	4
GROUND WATER OBSERVATIONS	4
ANALYSIS AND RECOMMENDATIONS	5
GENERAL	5
EARTHWORK AND EXCAVATIONS	5
SHALLOW FOUNDATIONS	6
INTERACTION WITH EXISTING STRUCTURES	7
SEISMIC SITE CLASS	7
FLOOR SLABS	7
SURFACE DRAINAGE AND LANDSCAPING	8
OTHER RECOMMENDATIONS	9
APPENDIX	

INTRODUCTION

Thiele Geotech, Inc. has completed a geotechnical exploration study for the proposed Lewis Central High School addition located at 3504 Harry Langdon Boulevard in Council Bluffs, Iowa. The purpose of this study was to identify the general soil and ground water conditions underlying the site; to evaluate engineering properties of the existing soils; to provide earthwork and site preparation recommendations; and to recommend design criteria and parameters for foundations and other earth supported improvements.

This study included soil borings, laboratory testing, and engineering analysis. A series of two test borings was spaced across the project site at strategic locations. The field and laboratory data are presented in the Appendix, along with a description of investigative methods.

The drilling and testing performed for this study were conducted solely for geotechnical analysis. No analytical testing or environmental assessment has been conducted. Any statements or observations in this report regarding odors, discoloration, or suspicious conditions are strictly for the information of our client. If an evaluation of environmental conditions is desired, a separate environmental assessment should be conducted. This study did not include biological assessment (e.g. mold, fungi, bacteria) or evaluation of measures for their control.

It should also be noted that this report was prepared for design purposes only, and may not be sufficient for a contractor in bid preparation. Prospective contractors should evaluate potential construction problems on the basis of their own knowledge and experience in the local area and on similar projects, taking into account their own intended construction methods and procedures.

This report is an instrument of service prepared for use by our client on this specific project. The report may be duplicated as necessary and distributed to those directly associated with this project, including members of the design team and prospective contractors. However, the technical approach and report format shall be considered proprietary and confidential, and this report may not be distributed in whole or in part to any third party not directly associated with this project. By using and relying on this report, all other parties agree to the same terms, conditions, and limitations to which the client has agreed.

PROJECT DESCRIPTION

Our understanding of the project is based upon information provided by BCDM Architects.

The project consists of constructing an approximately 1,400 square feet, single-story, slab-on-grade addition to the east side of the existing Lewis Central High School located at 3504 Harry Langdon Boulevard in Council Bluffs, Iowa. The planned addition will include three new offices, an SRO room, and a new entrance with a vestibule. Structural loading information provided stated maximum column loads of 36 kips.

A grading plan was not provided at the time of this report. Because grades are relatively flat at the location of the addition, we assume that cuts and fills of a foot or less will be required to match the existing finished floor elevation.

SURFACE AND SUBSURFACE CONDITIONS

SITE CONDITIONS

The project site is at Lewis Central High School located at 3504 Harry Langdon Boulevard in Council Bluffs, Iowa. The site is generally bound to the north by StorageMart and Harry Langdon Boulevard, to the east by the Lewis Central football and baseball field, to the south by a tree line/former railroad, and to the west by Highway 92. The area was surfaced with grass at the time of our exploration. The topography of the project site is generally flat, with gradual slopes down away from the existing building.

LOCAL GEOLOGY

The project site is located on an alluvial fan within the floodplain of the Missouri River. The alluvial fan is associated with the Mosquito Creek. The alluvial fan is the result of a depositional setting produced when the relatively steep Mosquito Creek reached the broad, flat Missouri River Valley. Alluvial fans are typically formed when streams or rivers with a relatively high velocity have their velocities checked by advancing into a flatter region.

The Omaha/ Council Bluffs area consists of a broad range of loess-covered hills that have been bisected by the valley of the Missouri River. Tributary streams and creeks such as the Mosquito, Indian, Honey, and Papillion, that flow into the Missouri River have also eroded and bisected the loess-covered hills, but to a lesser degree.

The surface geology of the Missouri River Basin is Pleistocene in age and consists of eolian (wind-blown) deposits of Peoria and Loveland loess. The loess formed in dune-shaped hills between major drainageways. The Peoria loess typically consists of silty lean clays that are stiff when dry but become softer with increasing moisture content. The Peoria often exhibits low unit weight and is collapse susceptible. The Loveland loess is an older deposit, and typically consists of lean clays. The Loveland generally exhibits higher unit weights and shear strengths than the Peoria.

The loess overlies Pleistocene glacial deposits of Kansan till. The till consists of lean to fat clays mixed with sand, gravel, and occasional cobbles. The glacial deposits are generally fairly deep, but are sometimes near the surface at lower elevations on steep slopes. Pennsylvanian limestone and shale form the bedrock unit below the glacial deposits. The depth to bedrock is normally great, and rock is rarely encountered in construction.

Along drainageways, alluvial and colluvial deposits are typically present. These soils were formed by erosion of the adjoining loess-mantled hills. Alluvial deposits are generally present along creeks and in major drainageways. The upper several feet of alluvium are usually stiffer due to the effects of desiccation. Colluvial soils are usually located at the base of steep slopes and in upland draws, and are formed by local creep and sloughing.

SOIL CONDITIONS

The soils encountered in the test borings generally consisted of man-placed fill and alluvium.

Man-placed fill was encountered at the surface of both borings, extending to a depth of 3 feet. It was generally described as brown or dark gray, moist to very moist, firm to hard, lean clay. The fill was compacted from 94 to over 100 percent of the maximum dry density, based on an assumed Standard Proctor (ASTM D698).

Alluvium was encountered beneath the fill in both borings, extending to a termination depth of 16.5 to 20 feet. It was generally described as dark gray, dark brown, gray, grayish brown, or gray, very moist to wet, soft to firm, lean clay.

Ranges of engineering properties from laboratory tests on selected samples are presented in Table 1.

Table 1 - Laboratory Results

Soil Layer	Moisture Content (%)	Dry Unit Weight (pcf)	Unconfined Compressive Strength (tsf)	Standard Penetration Values (N)*	Classification (LL/PI)
Man-placed fill	17 to 25	98 to 114	1.0 to 1.8	--	CL (39/16)
Alluvium	25 to 33	87 to 91	0.9 to 1.6	4 to 6	CL (visual)

* Standard Penetration Values are actual field recorded values and have not been corrected for hammer energy

GROUND WATER OBSERVATIONS

Ground water levels were observed in the borings as presented in Table 2. Note that ground water levels may fluctuate due to seasonal variations and other factors. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current ground water conditions.

Table 2 - Water Level Observations

Boring Number	Boring Elevation (ft.)	Water Level (ft. below grade)		Ground Water Elevation (ft.)
		During Drilling	End of Drilling	
B-1	985	13.0	14.8	972

ANALYSIS AND RECOMMENDATIONS

GENERAL

The soils encountered at this site consisted of man-placed fill and alluvium. Footings are expected to extend through the fill and bear on the alluvium. These soil conditions are capable of supporting the proposed addition on a shallow spread foundation system. Ground water was encountered in one of the borings at a depth of 13 feet below existing ground surface. Ground water is not anticipated to be encountered during construction of the addition. However, it should be noted that ground water levels may fluctuate due to seasonal variations and other factors.

EARTHWORK AND EXCAVATIONS

Rubble and waste materials from site clearing and demolition should be removed from the site and lawfully disposed or recycled. Waste materials should not be buried on-site. Where trees are cleared, the stumps should be excavated and removed.

Relocation of any existing utility lines within the zone of influence of proposed construction areas should also be completed as part of the site preparation. The lines should be relocated to areas outside of the proposed construction. Excavations created by removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to recompact the fill. In addition, the base of the excavations should be evaluated by a geotechnical engineering representative prior to placement of fill.

Topsoil and vegetation should be stripped to a depth of 4 to 6 inches in areas to be disturbed during grading, including borrow and fill areas. Stripping depths will likely vary and should be adjusted to remove all vegetation and root systems. A representative of the geotechnical engineer should monitor the stripping operations to observe that all unsuitable materials have been removed. Care should be exercised to separate these materials to avoid incorporation of the organic matter in structural fill sections.

Surfaces to receive fill should be broken up and recompact to allow new fill to bond to the existing soil. Slopes steeper than 5H:1V should be benched before placing fill.

The excavated site soils will generally be suitable for reuse as structural fill, although some moisture conditioning may be required. Any off-site borrow should be a clean, inorganic silt or lean clay with a liquid limit less than 45 and a plasticity index less than 20. Borrow material should not contain an appreciable amount of roots, rock, or debris, and should not contain any foreign material with a dimension greater than 3 inches.

All fills should be placed and compacted as structural fill. Fill should be placed in thin lifts not to exceed 8 inches loose thickness. Structural fill should be compacted with a sheepsfoot type roller to a minimum

of 95 percent of the maximum dry density (ASTM D698, Standard Proctor). Moisture content should be controlled to between -3 and +4 percent of optimum.

Backfill soils in utility trenches should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum. Lift thicknesses should be appropriately matched to the type of compaction equipment used. Backfill soils around foundations, basement walls, and retaining walls should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum. Granular backfill should not be used in exterior trenches or around foundation elements.

Quality control testing is an important part of any earthwork operation. It is recommended that a representative of the geotechnical engineer periodically monitor earthwork operations to verify proper compliance with these recommendations, including compaction levels.

OSHA's Construction Standards for Excavations require that the contractor's excavation activities follow certain worker safety procedures. These include a requirement that excavations over 4 feet deep be sloped back, shored, or shielded. The soils encountered in the test borings generally classify as type B and C soils according to the OSHA standard. The maximum allowable slope for an unbraced excavation in these soils is 1H:1V and 1.5H:1V, respectively, although other provisions and restrictions apply. Excavations over 20 feet deep require specific design by a licensed Professional Engineer. The contractor is solely responsible for site/excavation safety and compliance with OSHA regulations. The geotechnical engineer assumes no responsibility for site safety, and the above information is provided only for consideration by the designers.

SHALLOW FOUNDATIONS

The site conditions identified are favorable for the use of conventional spread foundations to support structural loads. Based on our bearing capacity and settlement analysis, a net allowable bearing pressure of 1,500 pounds per square foot was determined. This allowable bearing pressure may be used to size wall footings and column pads. The bearing pressure was calculated based on a safety factor of 3 against bearing failure. Foundation settlements are estimated at less than 1 inch total and ½ inch differential over a span of 20 feet. If maximum design loads significantly exceed 36 kips for columns or 3 kips per foot for walls, this bearing pressure may not be applicable and should be reevaluated.

It is recommended that column footings be at least 3 feet square and that load bearing wall footings be at least 16 inches wide. Exterior footings and footings in unheated areas should be founded a minimum of 3.5 feet below adjacent grade to provide reasonable frost protection. It is recommended that all footings be steel reinforced.

The condition of the bearing soils can vary and should be observed by the geotechnical engineer at the time of excavation. If unsuitable bearing soils are identified, they should be improved by compaction

or replaced by structural fill. As an alternative, the footing bottom could be extended through unsuitable materials if suitable material is present below.

INTERACTION WITH EXISTING STRUCTURES

It is anticipated that some new footings will be installed adjacent to existing footings where the addition connects to the existing building. New footings should bear at about the same elevation as existing footings. Where excavations extend lower than the existing foundation, care should be taken to avoid disturbing the bearing soils of the existing footings. Excavations should not extend below an imaginary plane projecting out and down from the bottom edge of the existing footings at a 1H:1V slope.

We assume that the existing building does not have a basement. However, we should be notified if the structure does have a basement as placement of new footings next to existing basement walls should not be allowed to avoid overloading the wall and due to concern over the quality of existing backfill.

Some overlap in stress distribution from the new and existing footings may occur, and could cause some minor movements of the existing structure. Maintaining a clear distance between footings equal to the width of the new footing would significantly reduce this risk. The design should also account for some differential movements between the addition and the existing structure.

SEISMIC SITE CLASS

Seismic structural design requirements are dictated by a site classification based on average soil properties within the top 100 feet. Based on our local experience, the soil profile was estimated below the maximum boring depth. The average undrained shear strength was then estimated based on the actual laboratory testing and on assumed soil properties for the deeper soil profile.

The site classifies as Site Class D (stiff soil profile) according to Table 1613.3.3 of the 2018 International Building Code.

FLOOR SLABS

To avoid localized slab failures, it is important that interior backfill around foundation elements and in plumbing trenches be properly compacted. Interior backfill should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum (ASTM D698, Standard Proctor).

To provide uniform support for floor slabs, the upper 6 inches of the subgrade should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum (ASTM D698, Standard Proctor). Care should be taken to maintain the condition of the subgrade. Areas that become saturated, frozen, or disturbed should be reworked prior to slab placement. Any unstable areas should be excavated and replaced with structural fill. A granular cushion beneath

the floor slab is considered a construction convenience and may be used, but is not considered critical to proper slab performance.

A 10 mil thick vapor retarder is recommended beneath the concrete to inhibit upward migration of moisture through the slab. Care should be taken when finishing concrete placed directly on a vapor retarder to minimize potential problems with curling and blistering.

Interior partition walls weighing up to 1,000 pounds per lineal foot may be supported directly on the floor slab. It is recommended that control joints be provided between partition walls that bear on the floor slab and walls supported on footings. Entrance slabs should be designed as structural stoops with a cavity beneath the slab to accommodate frost heave.

Contraction joints are important to control the location of cracks in the floor slab that result from stresses caused by normal drying shrinkage. Joints should be cut as soon as practical after the concrete has set sufficiently to support foot traffic, and must be cut before any shrinkage cracks form. Contraction joints should be cut to a minimum of $\frac{1}{4}$ of the slab thickness ($\frac{1}{5}$ of the thickness for early entry saw method). Joints should be spaced no more than 30 times the thickness of the slab or 15 feet maximum. Panels should be kept as square as possible, with the length to width ratio limited to 125 percent. Dowel bars should be used for load transfer across construction joints where slabs are subjected to heavy loads. Joints should be carefully planned and laid out to match column lines and to meet reentrant corners. Joints should be perpendicular to edges and should not form angles less than 45 degrees or over 225 degrees. To accommodate the relative movement that commonly occurs between floors and foundations, isolation joints should be provided against walls, and diamond or circular isolation joints should be constructed around columns.

SURFACE DRAINAGE AND LANDSCAPING

The long-term performance of any project is contingent upon keeping the subgrade soils at more or less constant moisture content, and by not allowing surface drainage a path to the subsurface. Positive surface drainage away from structures must be maintained at all times. Landscaped areas should be designed and built such that irrigation and other surface water will be collected and carried away from the structure.

Construction staging and grading should provide for removal of surface water from the site. If prolonged ponding of surface water occurs, removal and replacement of wet or disturbed soils may be necessary. Temporary grades should be established to prevent runoff from entering excavations or footing trenches. Backfill should be placed as soon as structural strength requirements are met, and should be graded to drain away from the building.

The final grade of the foundation backfill and any overlying pavements should have a positive slope away from foundation walls on all sides. For grass or landscape covered areas, a minimum slope of 1

inch per foot for 5 to 10 feet away from the building is recommended. A minimum slope of 2 percent is recommended for grassed or landscaped areas of the site away from the building. For paved areas, minimum slopes of 1 percent for concrete pavements and 1½ percent for asphalt pavements are recommended. Pavements and exterior slabs that abut the structure should be carefully sealed against moisture intrusion at the joint.

OTHER RECOMMENDATIONS

During detailed design, additional issues may arise and possible conflicts may occur with our recommendations. Such issues and conflicts should be resolved through dialogue between the geotechnical engineer and designers. It is recommended that the geotechnical engineer review the final design, including the plans and specifications, to verify that our recommendations are properly interpreted and incorporated into the design.

If any changes are made in the design of the project, including the nature or location of proposed facilities on the site or significant elevation changes, the analysis and recommendations of this report shall not be considered valid unless the changes are reviewed. The analysis and recommendations of this report should not be applied to different projects on the same site or to similar projects on different sites.

The analysis and recommendations in this report are based upon borings at specific locations. The nature and extent of variation between boring locations is impossible to predict. Because of this, geotechnical recommendations are preliminary until they have been confirmed through observation of site excavation and earthwork preparation. If variations appear during subsequent exploration or during construction, we may reevaluate our recommendations and modify them, if appropriate. The geotechnical engineer should be retained during construction to observe compliance with the recommendations of this report and to provide quality control testing of earthwork construction. If these services are provided by others, including the contractor, the entity that provides construction phase observation and testing shares responsibility as the geotechnical engineer of record for implementing or modifying these recommendations.

Respectfully submitted,
Thiele Geotech, Inc.

Prepared by,

Collin R. Steimer, E.I.

Prepared under the supervision of,

Raeanna C.D. Thiele

Raeanna C.D. Thiele, P.E.
Iowa License 24569

P:\25231.01\GEOTECHNICAL EXPLORATION REPORT - LEWIS CENTRAL HIGH SCHOOL ADDITION.DOCX

APPENDIX

Subsurface Exploration Methods

Legend of Terms

Boring Location Plan

Boring Logs

Soil Test Summary

SUBSURFACE EXPLORATION METHODS

The fieldwork for this study was conducted on May 7, 2025. The exploratory program consisted of two test borings drilled at the approximate locations shown on the Boring Location Plan. Boring locations were selected to provide the desired site coverage and were adjusted to accommodate access conditions. The boring locations were laid out using a handheld GPS and coordinates interpreted from Google Earth. Elevations were also obtained from Google Earth. The boring locations and elevations should only be considered accurate to the degree implied by the methods used to define them.

Test borings were advanced using flight augers powered by a truck-mounted drill rig. Soil samples were obtained at selected depths as indicated on the boring logs. A 3-inch nominal diameter thin-walled sampler was hydraulically pushed to obtain undisturbed samples. Disturbed samples were obtained by driving a 2-inch nominal diameter split barrel sampler while conducting standard penetration tests (SPT). The SPT values presented on the boring logs are actual field recorded numbers and have not been corrected for hammer energy or overburden.

The boring logs were prepared based on visual classification of the samples and drill cuttings, and by observation of the drilling characteristics of the subsurface formations. The logs have been supplemented and modified based on the laboratory test results and further examination of the recovered samples. The stratification lines on the boring logs represent the approximate boundary between soil types, but the insitu transition may be gradual.

Water level observations were made at the times stated on the boring logs. The borings were backfilled with drill cuttings at the completion of the fieldwork.

The field boring logs were reviewed to outline the depths, thicknesses, and extent of the soil strata. A laboratory testing program was then developed to further classify the basic soils and to evaluate the engineering properties for use in our analysis.

Laboratory tests to further classify the soils included visual classification, moisture content, dry unit weight, and Atterberg limits. The shear strengths of cohesive samples were evaluated using the unconfined compression test.

The boring logs and related information in this report are indicators of subsurface conditions only at the specific locations and times noted. Subsurface conditions, including ground water levels, at other locations of the site may differ significantly from conditions that exist at the sampling locations. Also note that the passage of time may affect conditions at the sampling locations.

LEGEND OF TERMS

Soil Description Terms

<u>Consistency - Fine Grained</u>	<u>Consistency - Coarse Grained</u>	<u>Moisture Conditions</u>
Very Soft, Soft, Firm, Hard, Very Hard	Very Loose, Loose, Medium Dense, Dense, Very Dense	Dry, Slightly Moist, Moist Very Moist, Wet (Saturated)

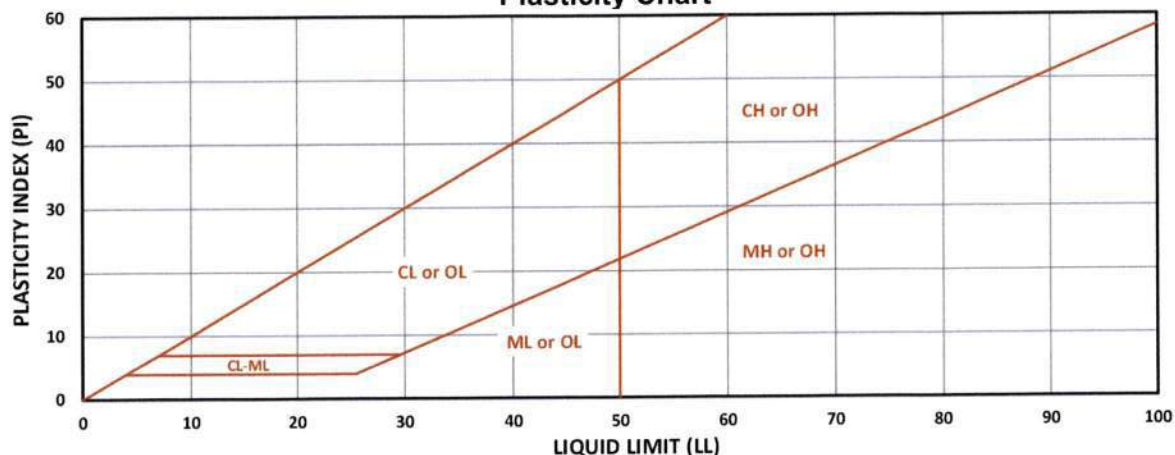
Sample Identification

<u>Sample Type</u>	<u>Sample Identification</u>	<u>Laboratory Data</u>
U -- Undisturbed (Shelby Tube)	No. -- Number	MC -- Moisture content
S -- Split barrel (disturbed)	SPT -- Standard penetration test	γ_d -- Dry unit weight
C -- Continuous sample	bpf -- blows per foot	q_u -- Unconfined compression
A -- Auger cuttings (disturbed)	Rec -- Recovery	LL/PI -- Liquid limit & plasticity index

Unified Soil Classification System

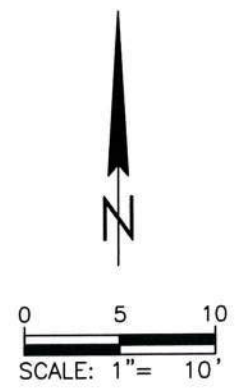
Unified Soil Classification System			
Peat	Pt	Highly organic soils Clay - Liquid Limit > 50 * Silt - Liquid Limit > 50 * Clay - Liquid Limit < 50 * Silt - Liquid Limit < 50 *	50% or more smaller than No. 200 sieve
Fat Clay	CH		
Elastic Silt	MH		
Lean Clay	CL		
Silt	ML		
Silty Clay	CL-ML	Silty Clay *	
Clayey Sand	SC	Sands with 12 to 50 percent smaller than No. 200 sieve *	More than 50% larger than No. 200 sieve and % sand > % Gravel
Silty Sand	SM		
Poorly-Graded Sand with Clay	SP-SC	Sands with 5 to 12 percent smaller than No. 200 Sieve *	
Poorly-Graded Sand with Silt	SP-SM		
Well-Graded Sand with Clay **	SW-SC		
Well-Graded Sand with Silt **	SW-SM		
Poorly-Graded Sand	SP	Sands with less than 5 percent smaller than No. 200 sieve *	
Well-Graded Sand **	SW		
Clayey Gravel	GC	Gravels with 12 to 50 percent smaller than No. 200 Sieve *	More than 50% larger than No. 200 sieve and % gravel > % sand
Silty Gravel	GM		
Poorly-Graded Gravel with Clay	GP-GC	Gravels with 5 to 12 percent smaller than No. 200 sieve *	
Poorly-Graded Gravel with Silt	GP-GM		
Well-Graded Gravel with Clay **	GW-GC		
Well-Graded Gravel with Silt **	GW-GM		
Poorly-Graded Gravel	GP	Gravels with less than 5 percent smaller than No. 200 sieve *	
Well-Graded Gravel **	GW		
* See Plasticity Chart for definition of silts and clays ** See Criteria for Sands and Gravels for definition of well-graded			

Plasticity Chart

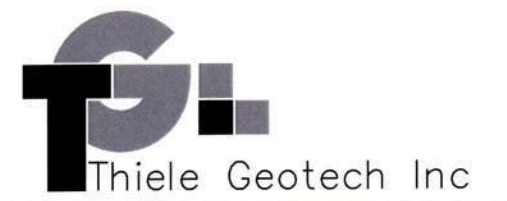


Criteria for Sands and Gravels

Boulders	Cobbles	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	FINES (silt or clay)
Sieve size	12"	3"	3/4"	#4	#10	#40	#200
Well-graded sands (SW) $C_u = D_{60}/D_{10} \geq 6$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							
Well-graded gravels (GW) $C_u = D_{60}/D_{10} \geq 4$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							



LEGEND:
 ◆ BORING LOCATION



BORING LOCATION PLAN

PROJECT
 LEWIS CENTRAL HIGH SCHOOL ADDITION
 3504 HARRY LANGDON BOULEVARD
 COUNCIL BLUFFS, IA
 JOB # 25231.01 DATE: 6/2/2025



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT Lewis Central Community School District

PROJECT NAME Lewis Central High School Addition

PROJECT NUMBER 25231.01

PROJECT LOCATION 3504 Harry Langdon Boulevard, Council Bluffs, IA

DRILLING DATE 5/7/2025

SURFACE Grass

GROUND ELEVATION 985 ft

BORING DEPTH 20.0 feet

DRILLING METHOD Flight

HOLE SIZE 6 inches

GROUND WATER LEVELS:

DRILLER Dan Morrissey

DRILL RIG Track

▽ DURING DRILLING 13.0 ft / Elev 972.0 ft

LOGGED BY Jose Guerrero

CHECKED BY Broc Burmeister

▽ END OF DRILLING 14.8 ft / Elev 970.2 ft

NOTES Boring backfilled with cuttings

AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	brown	hard	lean clay	fill	trace gravel	U-1	12			16.6	114.4	1.82	39	23	16	
5		very moist	dark gray	firm	lean clay	alluvium	roots	U-2	12			28.0	88.5	0.93				
			dark brown					U-3	12			29.0	90.9	1.19				
10																		
		wet	gray	soft				U-4	12			33.4	87.1					
15																		
			grayish brown					U-5	12			30.6	90.6					
20																		

Bottom of borehole
at 20.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT Lewis Central Community School District

PROJECT NAME Lewis Central High School Addition

PROJECT NUMBER 25231.01

PROJECT LOCATION 3504 Harry Langdon Boulevard, Council Bluffs, IA

DRILLING DATE 5/7/2025 SURFACE Grass

GROUND ELEVATION 985 ft BORING DEPTH 16.5 feet

DRILLING METHOD Flight HOLE SIZE 6 inches

GROUND WATER LEVELS:

DRILLER Dan Morrissey DRILL RIG Track

DURING DRILLING None encountered

LOGGED BY Jose Guerrero CHECKED BY Broc Burmeister

END OF DRILLING None encountered

NOTES Boring backfilled with cuttings

AFTER DRILLING Not measured

TG COLUMNS - GINT STD US LAB.GDT - 6/4/25 13:08 - P:\25231.01\LEWIS CENTRAL HIGH SCHOOL ADDITION\LEWIS CENTRAL HIGH SCHOOL ADDITION.GPJ

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		very moist	brown	firm	lean clay	fill		U-1	12			25.4	98.2	1.02				
5		very moist	dark gray	hard	lean clay	alluvium		U-2	12			30.8	89.8	1.60				
				firm			appreciable gravel	S-3		6		25.2						
10			gray	firm			roots											
15								S-4		4		32.8						

Bottom of borehole
at 16.5 feet.



Thiele Geotech
13478 Chandler Road
Omaha, NE 68138
Telephone: 402-556-2171
Fax: 402-556-7831

SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT Lewis Central Community School District

PROJECT NAME Lewis Central High School Addition

PROJECT NUMBER 25231.01

PROJECT LOCATION 3504 Harry Langdon Boulevard, Council Bluffs, IA

Boring Number	Sample Number	Depth	Water Content (%)	Unit Weight		Void Ratio	Sat. (%)	Unconfined Compression		Atterberg Limits		%<#200 Sieve	Class.	Other Tests
				Wet Density (pcf)	Dry Density (pcf)			q _u (tsf)	Strain (%)	LL	PI			
B-1	U-1	0.5-2.0'	16.6	133.4	114.4	0.472	95	1.82	8.9	39	16		CL	
	U-2	3.5-5.0'	28.0	113.2	88.5	0.904	84	0.93	3.1					
	U-3	8.5-10.0'	29.0	117.3	90.9	0.853	92	1.19	5.2					
	U-4	13.5-15.0'	33.4	116.2	87.1	0.935	97							
	U-5	18.5-20.0'	30.6	118.3	90.6	0.861	96							
B-2	U-1	0.5-2.0'	25.4	123.1	98.2	0.716	96	1.02	3.2					
	U-2	3.5-5.0'	30.8	117.4	89.8	0.877	95	1.60	6.6					
	S-3	8.5-10.0'	25.2											
	S-4	15.0-16.5'	32.8											



Geotechnical Exploration Report

Lewis Central High School Pavement Replacement

**3504 Harry Langdon Boulevard
Council Bluffs, Iowa**

	I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.	
	<u>Raeanna C. D. Thiele</u> RAEANNA C. D. THIELE LICENSE NUMBER 24569 MY LICENSE RENEWAL DATE IS DECEMBER 31, 2025	<u>2/27/25</u> DATE
PAGES OR SHEETS COVERED BY THIS SEAL: <u>Report (11 pages) Plus Appendix</u>		

Prepared for:

Lewis Central Community School District
4121 Harry Langdon Boulevard
Council Bluffs, Iowa, 51503

February 27, 2025

TG Project No. 24655.01

THIELE GEOTECH, INC.

13478 Chandler Road
Omaha, Nebraska 68138-3716
402.556.2171 Fax 402.556.7831
www.thielegeotech.com



Geotechnical Exploration Report
Lewis Central High School Pavement Replacement

Table of Contents

INTRODUCTION	1
PROJECT DESCRIPTION	2
SURFACE AND SUBSURFACE CONDITIONS	3
SITE CONDITIONS	3
LOCAL GEOLOGY	3
EXISTING PAVEMENT	4
SOIL CONDITIONS	4
GROUND WATER OBSERVATIONS	5
ANALYSIS AND RECOMMENDATIONS	6
GENERAL	6
PAVEMENT AND POST-TENSIONED SLAB SUBGRADE PREPARATION	6
EARTHWORK AND EXCAVATIONS	7
PAVEMENTS	8
SURFACE DRAINAGE AND LANDSCAPING	10
OTHER RECOMMENDATIONS	11
APPENDIX	

INTRODUCTION

Thiele Geotech, Inc. has completed a geotechnical exploration study for the proposed pavement replacement and tennis court construction located at Lewis Central High School at 3504 Harry Langdon Boulevard in Council Bluffs, Iowa. The purpose of this study was to identify the general soil and ground water conditions underlying the site; present the relevant engineering properties of the existing soils; provide earthwork and site preparation recommendations; and recommend design criteria and parameters for pavements, tennis court construction, and other earth supported improvements.

This study included soil borings, laboratory testing, and engineering analysis. A series of 14 test borings was spaced across the project site at strategic locations. The field and laboratory data are presented in the Appendix, along with a description of investigative methods.

The drilling and testing performed for this study were conducted solely for geotechnical analysis. No analytical testing or environmental assessment has been conducted. Any statements or observations in this report regarding odors, discoloration, or suspicious conditions are strictly for the information of our client. If an evaluation of environmental conditions is desired, a separate environmental assessment should be conducted. This study did not include biological assessment (e.g. mold, fungi, bacteria) or evaluation of measures for their control.

It should also be noted that this report was prepared for design purposes only, and may not be sufficient for a contractor in bid preparation. Prospective contractors should evaluate potential construction problems on the basis of their own knowledge and experience in the local area and on similar projects, taking into account their own intended construction methods and procedures.

This report is an instrument of service prepared for use by our client on this specific project. The report may be duplicated as necessary and distributed to those directly associated with this project, including members of the design team and prospective contractors. However, the technical approach and report format shall be considered proprietary and confidential, and this report may not be distributed in whole or in part to any third party not directly associated with this project. By using and relying on this report, all other parties agree to the same terms, conditions, and limitations to which the client has agreed.

PROJECT DESCRIPTION

Our understanding of the project is based upon information provided by Project Advocates and Lamp Ryneerson.

The project consists of replacing the parking lot and sidewalks located on the east side of the school and constructing new tennis courts at Lewis Central High School. The new post-tensioned concrete tennis courts will be constructed southwest of the school. We assume that concrete pavement will be used in the drive lanes, parking, and sidewalk areas.

Based on both the Overall Grading Plan and Grading Plan, prepared by Lamp Ryneerson, cuts and fills of a foot or less will be required to achieve finished grades for the parking lot and sidewalk reconstruction and tennis court construction. The remainder of the exterior grading is expected to be similar. No site retaining walls are planned as part of the project and all slopes are proposed at 3H:1V or flatter.

The northwest end of the proposed tennis courts lies within a United States Army Corps of Engineers (USACE) levee critical area of a Flood Risk Reduction Project (FRRP) constructed by the USACE Public Law (PL) 84-99 Rehabilitation and Inspection Program. The critical area for a levee is generally considered to extend from 300 feet riverward to 500 feet landward of a FRRP's centerline. Specifically, this area falls within the critical area of the USACE L-624-627-611-614 Mosquito Creek and Upper Pony Creek levee system. If excavations are planned in the critical area, it is our understanding that USACE approval will be required prior to construction. Recommendations for tennis court construction related to the levee are not included in the scope of this study.

SURFACE AND SUBSURFACE CONDITIONS

SITE CONDITIONS

The project site is at Lewis Central High School located at 3504 Harry Langdon Boulevard in Council Bluffs, Iowa. The site is generally bound to the north by StorageMart and Harry Langdon Boulevard, to the east by the Lewis Central football and baseball field, to the south by a tree line/former railroad, and to the west by Highway 92. This area was surfaced with either asphalt, concrete, or grass at the time of our exploration. The topography of both project sites is generally flat, with gradual slopes down to the southeast.

LOCAL GEOLOGY

The project site is located on an alluvial fan within the floodplain of the Missouri River. The alluvial fan is associated with the Mosquito Creek. The alluvial fan is the result of a depositional setting produced when the relatively steep Mosquito Creek reached the broad, flat Missouri River Valley. Alluvial fans are typically formed when streams or rivers with a relatively high velocity have their velocities checked by advancing into a flatter region.

The Omaha/ Council Bluffs area consists of a broad range of loess-covered hills that have been bisected by the valley of the Missouri River. Tributary streams and creeks such as the Mosquito, Indian, Honey, and Papillion, that flow into the Missouri River have also eroded and bisected the loess-covered hills, but to a lesser degree.

The surface geology of the Missouri River Basin is Pleistocene in age and consists of eolian (wind-blown) deposits of Peoria and Loveland loess. The loess formed in dune-shaped hills between major drainageways. The Peoria loess typically consists of silty lean clays that are stiff when dry but become softer with increasing moisture content. The Peoria often exhibits low unit weight and is collapse susceptible. The Loveland loess is an older deposit, and typically consists of lean clays. The Loveland generally exhibits higher unit weights and shear strengths than the Peoria.

The loess overlies Pleistocene glacial deposits of Kansan till. The till consists of lean to fat clays mixed with sand, gravel, and occasional cobbles. The glacial deposits are generally fairly deep, but are sometimes near the surface at lower elevations on steep slopes. Pennsylvanian limestone and shale form the bedrock unit below the glacial deposits. The depth to bedrock is normally great, and rock is rarely encountered in construction.

Along drainageways, alluvial and colluvial deposits are typically present. These soils were formed by erosion of the adjoining loess-mantled hills. Alluvial deposits are generally present along creeks and in major drainageways. The upper several feet of alluvium are usually stiffer due to the effects of desiccation. Colluvial soils are usually located at the base of steep slopes and in upland draws, and are formed by local creep and sloughing.

EXISTING PAVEMENT

Cores were taken at all boring locations (See Boring Location Plan in the Appendix) to determine the thickness and composition of the existing pavement sections. Table 1 presents the results of the cores and the core numbering coincides with the boring numbering. A photographic log of the pavement cores is included in the Appendix of this report.

Table 1 – Existing Pavement & Subgrade Values

Core Number	Pavement Thickness (inches)	Subgrade Density (pcf)	Subgrade Moisture Content (%)
B-3	8.0 (Asphalt)	108.2	19.9
B-4	6.6 (Asphalt)	109.1	18.7
B-5	1.6 (Asphalt)*	112.2	18.6
B-6	6.3 (Asphalt)	102.7	20.4
B-7	6.1 (Asphalt)	102.4	19.5
B-8	7.3 (Asphalt)	105.0	23.5
B-9	5.3 (Concrete)	109.6	19.4
B-10	8.0 (Asphalt)	106.4	20.9
B-13	4.7 (Asphalt)	106.1	20.0
B-14	7.3 (Asphalt)	101.4	23.2
*Lower portion of core not retrieved			

SOIL CONDITIONS

The soils encountered in the test borings generally consisted of man-placed fill and alluvium.

Man-placed fill was encountered at the surface or beneath the pavement in all borings excluding B-11, extending to a depth of 3 to 3.5 feet in borings B-1, B-4, B-9, and B-12, and to a termination depth of 5 feet in borings B-2, B-3, B-5 through B-8, B-10, B-13, and B-14. It was generally described as dark brown, grayish brown, gray, brown, or dark gray, moist to very moist, soft to very hard, lean clay, fat clay, or silt. The fill encountered in borings B-1, B-2, B-11, and B-12 ranged in compaction from approximately 83 to 87 percent of the maximum dry density, based on an assumed Standard Proctor (ASTM D698). The fill encountered at pavement subgrade elevation in borings B-3 through B-10, B-13, B-14 ranged in compaction from 90 to over 100 percent of the maximum dry density, based on an assumed Modified Proctor (ASTM D1557).

Alluvium was encountered at the surface of boring B-11 and beneath the man-placed fill in borings B-1, B-4, B-9, and B-12, extending to a termination depth of 5 feet in all borings. It was generally described as dark gray or dark brown, very moist, firm, lean clay or fat clay.

Ranges of engineering properties from laboratory tests on selected samples are presented in Table 2.

Table 2 - Laboratory Results

Soil Layer	Moisture Content (%)	Dry Unit Weight (pcf)	Unconfined Compressive Strength (tsf)	Classification (<i>LL/PI</i>)
Man-placed fill	18 to 28	86 to 112	0.5 to 3.8	CL (47/18, 34/11, 44/23, 44/18) CH (visual) ML (32/8, 27/2)
Alluvium	26 to 31	86 to 89	1.1 to 1.5	CL (visual) CH (visual)

GROUND WATER OBSERVATIONS

Ground water was not encountered in any of the test borings during or at the end of the drilling operation. However, it must be noted that ground water levels may fluctuate due to seasonal variations and other factors. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current ground water conditions.

ANALYSIS AND RECOMMENDATIONS

GENERAL

The soils encountered in the test borings generally consisted of a layer of man-placed fill in most borings overlying alluvial deposits. Most of the fill appeared to be dense and well-compacted in the existing pavement areas and all alluvium was firm. However, some of the man-placed fill and alluvium on-site classified as fat clay, which can exhibit moderate shrink/swell potential. Expansive soils can damage pavements and playing courts with moisture variations. Recommendations to address this concern are provided in the Pavement and Post-Tensioned Slab Subgrade Preparation section.

Ground water was not encountered in any boring during our exploration. Therefore, we do not anticipate that ground water will be encountered during construction. However, it should be noted that ground water levels may fluctuate due to seasonal variations and other factors.

PAVEMENT AND POST-TENSIONED SLAB SUBGRADE PREPARATION

The 3.5 to 5 feet samples in borings B-1 and B-13, classified as expansive fat clay which have the tendency to shrink/swell with slight changes in moisture conditions. Soils of this nature can damage overlying pavements as moisture conditions change over time. Therefore, at minimum we recommend fat clay soils exposed at pavement and tennis court subgrade elevations should be maintained in a moist condition prior to placing pavements (i.e., within 0 to +4 percent of optimum). Maintaining these soils in a moist condition reduces the potential for heave.

The fill encountered in the footprint of the tennis courts displayed relatively low density and compressive strength properties and potentially may present challenges for subgrade compaction efforts above. Therefore, if there are issues with achieving the recommended compaction specifications of the subgrade soils at the time of construction, recompaction of a limited area below this level should be considered as a bridging layer. This would involve removing the top 12 inches, then compacting the next 6 to 12 inches to 95 percent of the maximum dry density (ASTM D698, Standard Proctor) at a moisture content between -3 and +4 percent of optimum. The top 12 inches of subgrade should then be compacted to a minimum of 90 percent of the maximum dry density on the upper side of optimum moisture content (0 and +4 percent) (ASTM D1557, Modified Proctor).

If very soft or wet soils are encountered at the time of tennis court construction, consideration could be given to chemically treat the subgrade soils with Class C fly ash and should be considered as a bid option.

If fly ash is used, the procedure is as follows: We recommend approximately 12 to 14 percent of class "C" fly ash by dry unit weight of the soil be incorporated into the upper 9 inches of the subgrade. A Bomag style rotomixer designed for this purpose should be used to ensure proper incorporation of the fly ash. The subgrade should be compacted within 2 hours of incorporating the fly ash as the mixture

will begin to set rapidly. The incorporated blend should be recompact on the upper side of optimum moisture content.

We assume a granular base will be placed beneath the post-tension courts. This material should be free-draining and could consist of ASTM #57 or #67 limestone or quartz. The granular layer should be placed over a geomembrane on the compacted subgrade and should be shaped smooth and compacted in loose lifts not exceeding 6-inches thickness. We recommend the use of a drain tile system within the aggregate base layer to collect/remove runoff and infiltration. If possible, this could be daylighted along the southwest side of the courts, connected to a storm sewer, or to a sump pump if grades are not conducive to drain. Construction traffic should not be allowed to travel across the prepared subbase.

It may be difficult to test compaction levels of the new aggregate base below the tennis courts due to the voids required for the material to be free-draining. An aggregate sample should be collected prior to placement to determine maximum laboratory density and practicality for field testing. If the material contains voids that would affect practical testing, a rolling pattern should be established to densify the aggregate base enough to provide stability, but not exceeding a point that the rock would break down and introduce fines that would limit drainage.

It should be noted that on past projects, disturbance of the subgrade has been observed in areas that are subject to repeated construction traffic, such as near the site entrance/exit. If this occurs, it should be expected that some remedial measures consisting of re-preparing the subgrade may be necessary.

EARTHWORK AND EXCAVATIONS

Rubble and waste materials from site clearing and demolition should be removed from the site and lawfully disposed or recycled. Waste materials should not be buried on-site. Where trees are cleared, the stumps should be excavated and removed.

Relocation of any existing utility lines within the zone of influence of proposed construction areas should also be completed as part of the site preparation. The lines should be relocated to areas outside of the proposed construction. Excavations created by removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to recompact the fill. In addition, the base of the excavations should be evaluated by a geotechnical engineering representative prior to placement of fill.

Topsoil and vegetation should be stripped to a depth of 4 to 6 inches in areas to be disturbed during grading, including borrow and fill areas. Stripping depths will likely vary and should be adjusted to remove all vegetation and root systems. A representative of the geotechnical engineer should monitor the stripping operations to observe that all unsuitable materials have been removed. Care should be exercised to separate these materials to avoid incorporation of the organic matter in structural fill sections.

Surfaces to receive fill should be broken up and recompacted to allow new fill to bond to the existing soil. Slopes steeper than 5H:1V should be benched before placing fill.

Except for fat clay within 2 feet of subgrade elevations, the excavated site soils will generally be suitable for reuse as structural fill, although moderate to significant moisture conditioning may be required. Any off-site borrow should be a clean, inorganic silt or lean clay with a liquid limit less than 45 and a plasticity index less than 20. Borrow material should not contain an appreciable amount of roots, rock, or debris, and should not contain any foreign material with a dimension greater than 3 inches.

All fills should be placed and compacted as structural fill. Fill should be placed in thin lifts not to exceed 8 inches loose thickness. Structural fill should be compacted with a sheepsfoot type roller to a minimum of 95 percent of the maximum dry density (ASTM D698, Standard Proctor). Moisture content should be controlled to between -3 and +4 percent of optimum.

Backfill soils in utility trenches should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum. Lift thicknesses should be appropriately matched to the type of compaction equipment used. Backfill soils around foundations, basement walls, and retaining walls should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum. Granular backfill should not be used in exterior trenches or around foundation elements.

Quality control testing is an important part of any earthwork operation. It is recommended that a representative of the geotechnical engineer periodically monitor earthwork operations to verify proper compliance with these recommendations, including compaction levels.

OSHA's Construction Standards for Excavations require that the contractor's excavation activities follow certain worker safety procedures. These include a requirement that excavations over 4 feet deep be sloped back, shored, or shielded. The soils encountered in the test borings generally classify as type B and C soils according to the OSHA standard. The maximum allowable slope for an unbraced excavation in these soils is 1H:1V and 1.5H:1V, respectively, although other provisions and restrictions apply. Excavations over 20 feet deep require specific design by a licensed Professional Engineer. The contractor is solely responsible for site/excavation safety and compliance with OSHA regulations. The geotechnical engineer assumes no responsibility for site safety, and the above information is provided only for consideration by the designers.

PAVEMENTS

Pavement performance is directly affected by the degree of compaction, uniformity, and stability of the subgrade. This is particularly important where traffic from heavy trucks is anticipated. The final subgrade should be reworked and compacted immediately prior to pavement construction. The subgrade should then be proof rolled following SUDAS Standard Specifications Section 2010 (3.06B), and any

unstable areas should be excavated and replaced to create a uniform and stable subgrade. Note, the compaction recommendations provided below are based on local experience and exceed the compactive effort that is required by SUDAS Standard Specifications (2024).

For concrete pavements, it is recommended that the upper 12 inches of the subgrade be compacted to a minimum of 90 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum (ASTM D1557, Modified Proctor). Where fat clay is exposed at subgrade elevations, moisture content should be maintained between 0 and +4 percent of optimum. Subgrade preparation should extend a minimum of 2 feet laterally beyond the edge of the pavement.

Under sidewalks, the upper 6 inches of the subgrade should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content between -3 and +4 percent of optimum (ASTM D698, Standard Proctor). Where fat clay is exposed at subgrade elevations, moisture content should be maintained between 0 and +4 percent of optimum. Subgrade preparation should extend laterally 6 inches beyond the edge of the sidewalk.

Based on the forgoing subgrade preparation procedures, recommended minimum pavement thicknesses are provided in Table 3. These minimum thicknesses are prescriptive values based on traffic classification, and not on a detailed analysis using traffic counts. Note that an aggregate base layer can improve drainage and long term performance but is commonly only used on higher capacity pavements. If an aggregate base layer is used, a subdrain system should be incorporated into design.

Table 3 - Minimum Pavement Thicknesses

Pavement Category	Pavement Type/Thickness (inches)
	Concrete
Sidewalks	4
Parking Areas	5
Pick-up/Drop-off/Bus Lanes	8
Dumpster Pads (including pickup area)	7
<i>Subgrade Support Values: CBR = 3, k= 120 pci</i> <i>Materials: (reference SUDAS Standard Specifications & City of C.B. Supplemental Specifications (2024 Editions))</i> <i>concrete mixture – C-4 (limestone or quartzite) ($f'_c = 4,000$ psi) (Division 7, Section 7010)</i>	

Contraction joints are important to control the location of cracks in concrete pavement that result from stresses caused by normal drying shrinkage and thermal effects. A proper jointing system will enhance structural capacity and prolong the life span of a concrete pavement as well as improve ride quality. Contraction joints should be cut to a minimum of $\frac{1}{4}$ of the slab thickness ($\frac{1}{5}$ of the thickness

for early entry saw method). Joints should be cut as soon as practical after the concrete has set sufficiently to support foot traffic, and must be cut before any shrinkage cracks form. Joints should be spaced no more than 24 times the thickness of the slab or 12½ feet maximum. Panels should be kept as square as possible, with the length to width ratio limited to 125 percent. Dowel bars should be used for load transfer across construction joints, and should be considered for contraction joints subjected to heavy truck traffic. Joints should be carefully planned and laid out to meet inlets, drainage structures, reentrant corners, and radiuses. Joints should be perpendicular to edges and radiuses, and should not form angles less than 45 degrees or over 225 degrees. Isolation joints should be provided around any structures.

We recommend that joints be sealed to reduce moisture infiltration and to reduce the accumulation of non-compressible materials. Joint sealing should be considered as a two part process, sealing of the exposed sawcut face of the concrete and sealing of the joint itself. Following sawcutting and cleaning the joints with compressed air, a penetrating concrete sealer (Silane, Silicate, or Silicate based) should be spray applied to the joint extending outwards a minimum of 8 inches either side of the sawcut. This penetrating sealer will help to limit moisture infiltration along the sawcut face, helping to mitigate premature joint damage from freeze-thaw cycles. Following the spray applied sealer, a hot pour joint sealer can be used to fill the sawcut. Use of backer rods is not recommended.

Backfill behind curbs and within islands/medians should consist of relatively impervious cohesive soils. Backfill should be compacted to a minimum of 95 percent of the maximum dry density (ASTM D698) to minimize subsidence and to reduce moisture infiltration around the edges of the pavement. Granular soils should not be used for fill in islands as this can increase infiltration into the subgrade. Porous fills, including granular material and loosely placed clay soils, also act as a reservoir that can allow moisture to seep through cracks and joints onto the pavement surface, sometimes long after the water is trapped. This condition is especially pronounced when loose backfill consolidates and allows surface water to pond.

SURFACE DRAINAGE AND LANDSCAPING

The long-term performance of any project is contingent upon keeping the subgrade soils at more or less constant moisture content, and by not allowing surface drainage a path to the subsurface. Positive surface drainage away from structures must be maintained at all times. Landscaped areas should be designed and built such that irrigation and other surface water will be collected and carried away from the structure.

Construction staging and grading should provide for removal of surface water from the site. If prolonged ponding of surface water occurs, removal and replacement of wet or disturbed soils may be necessary. Temporary grades should be established to prevent runoff from entering excavations.

OTHER RECOMMENDATIONS

During detailed design, additional issues may arise and possible conflicts may occur with our recommendations. Such issues and conflicts should be resolved through dialogue between the geotechnical engineer and designers. It is recommended that the geotechnical engineer review the final design, including the plans and specifications, to verify that our recommendations are properly interpreted and incorporated into the design.

If any changes are made in the design of the project, including the nature or location of proposed facilities on the site or significant elevation changes, the analysis and recommendations of this report shall not be considered valid unless the changes are reviewed. The analysis and recommendations of this report should not be applied to different projects on the same site or to similar projects on different sites.

The analysis and recommendations in this report are based upon borings at specific locations. The nature and extent of variation between boring locations is impossible to predict. Because of this, geotechnical recommendations are preliminary until they have been confirmed through observation of site excavation and earthwork preparation. If variations appear during subsequent exploration or during construction, we may reevaluate our recommendations and modify them, if appropriate. The geotechnical engineer should be retained during construction to observe compliance with the recommendations of this report and to provide quality control testing of earthwork construction. If these services are provided by others, including the contractor, the entity that provides construction phase observation and testing shares responsibility as the geotechnical engineer of record for implementing or modifying these recommendations.

Respectfully submitted,
Thiele Geotech, Inc.

Prepared by,

Collin R. Steimer, E.I.

Prepared under the supervision of,



Raeanna C.D. Thiele, P.E.
Iowa License 24569

APPENDIX

Subsurface Exploration Methods

Legend of Terms

Boring Location Plan

Boring Logs

Soil Test Summary

Photographic Log

SUBSURFACE EXPLORATION METHODS

The fieldwork for this study was conducted on December 23 and 26, 2024. The exploratory program consisted of 14 test borings drilled at the approximate locations shown on the Boring Location Plan. Boring locations were selected to provide the desired site coverage and were adjusted to accommodate access conditions. The boring locations were laid out in the field using a handheld GPS and coordinates obtained from Google Earth. Elevations were obtained from the Overall Grading Plan and Grading Plan, prepared by Lamp Rynearson. The boring locations and elevations should only be considered accurate to the degree implied by the methods used to define them.

Test borings were advanced using flight augers powered by a truck-mounted drill rig. Soil samples were obtained at selected depths as indicated on the boring logs. A 3-inch nominal diameter thin-walled sampler was hydraulically pushed to obtain undisturbed samples.

The boring logs were prepared based on visual classification of the samples and drill cuttings, and by observation of the drilling characteristics of the subsurface formations. The logs have been supplemented and modified based on the laboratory test results and further examination of the recovered samples. The stratification lines on the boring logs represent the approximate boundary between soil types, but the insitu transition may be gradual.

Water level observations were made at the times stated on the boring logs. The borings were backfilled with drill cuttings at the completion of the fieldwork.

The field boring logs were reviewed to outline the depths, thicknesses, and extent of the soil strata. A laboratory testing program was then developed to further classify the basic soils and to evaluate the engineering properties for use in our analysis.

Laboratory tests to further classify the soils included visual classification, moisture content, dry unit weight, and Atterberg limits. The shear strengths of cohesive samples were evaluated using the unconfined compression test.

The boring logs and related information in this report are indicators of subsurface conditions only at the specific locations and times noted. Subsurface conditions, including ground water levels, at other locations of the site may differ significantly from conditions that exist at the sampling locations. Also note that the passage of time may affect conditions at the sampling locations.

LEGEND OF TERMS

Soil Description Terms

Soil Description Terms		
<u>Consistency - Fine Grained</u> Very Soft, Soft, Firm, Hard, Very Hard	<u>Consistency - Coarse Grained</u> Very Loose, Loose, Medium Dense, Dense, Very Dense	<u>Moisture Conditions</u> Dry, Slightly Moist, Moist Very Moist, Wet (Saturated)

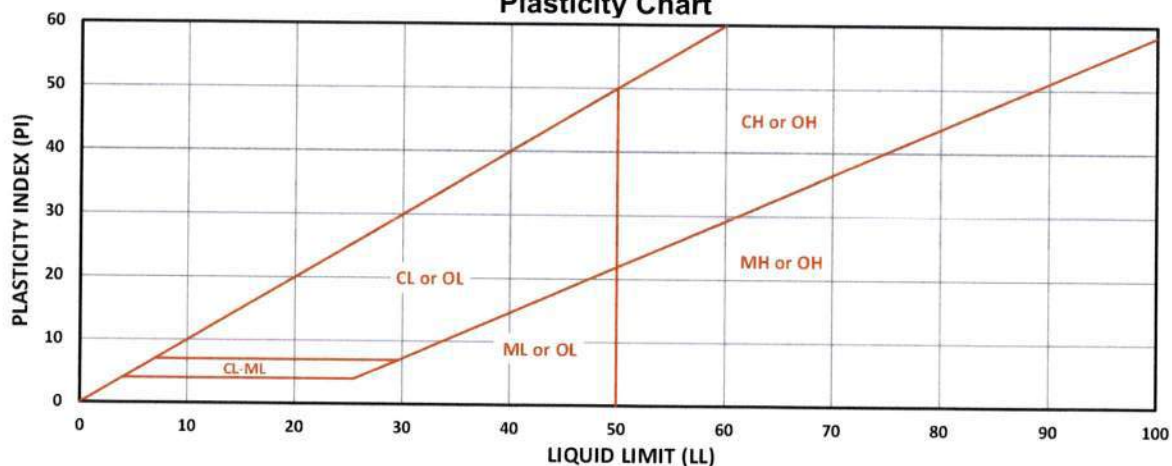
Sample Identification

Sample Identification		
Sample Type	Sample Data	Laboratory Data
U -- Undisturbed (Shelby Tube)	No. -- Number	MC -- Moisture content
S -- Split barrel (disturbed)	SPT -- Standard penetration test	γ_d -- Dry unit weight
C -- Continuous sample	bpf -- blows per foot	q_u -- Unconfined compression
A -- Auger cuttings (disturbed)	Rec -- Recovery	LL/PI -- Liquid limit & plasticity index

Unified Soil Classification System

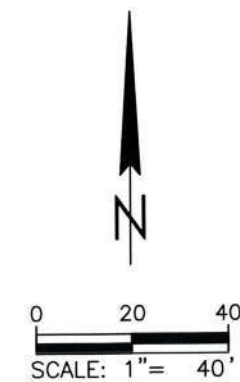
Unified Soil Classification System			
Peat	Pt	Highly organic soils Clay - Liquid Limit > 50 * Silt - Liquid Limit > 50 * Clay - Liquid Limit < 50 * Silt - Liquid Limit < 50 * Silty Clay *	50% or more smaller than No. 200 sieve
Fat Clay	CH		
Elastic Silt	MH		
Lean Clay	CL		
Silt	ML		
Silty Clay	CL-ML		
Clayey Sand	SC	Sands with 12 to 50 percent smaller than No. 200 sieve *	More than 50% larger than No. 200 sieve and % sand > % Gravel
Silty Sand	SM		
Poorly-Graded Sand with Clay	SP-SC	Sands with 5 to 12 percent smaller than No. 200 Sieve *	
Poorly-Graded Sand with Silt	SP-SM		
Well-Graded Sand with Clay **	SW-SC		
Well-Graded Sand with Silt **	SW-SM		
Poorly-Graded Sand	SP	Sands with less than 5 percent smaller than No. 200 sieve *	
Well-Graded Sand **	SW		
Clayey Gravel	GC	Gravels with 12 to 50 percent smaller than No. 200 Sieve *	More than 50% larger than No. 200 sieve and % gravel > % sand
Silty Gravel	GM		
Poorly-Graded Gravel with Clay	GP-GC	Gravels with 5 to 12 percent smaller than No. 200 sieve *	
Poorly-Graded Gravel with Silt	GP-GM		
Well-Graded Gravel with Clay **	GW-GC		
Well-Graded Gravel with Silt **	GW-GM		
Poorly-Graded Gravel	GP	Gravels with less than 5 percent smaller than No. 200 sieve *	
Well-Graded Gravel **	GW		
* See Plasticity Chart for definition of silts and clays ** See Criteria for Sands and Gravels for definition of well-graded			

Plasticity Chart



Criteria for Sands and Gravels

Extend for Sands and Gravels							
Boulders	Cobbles	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	FINES (silt or clay)
Sieve size	12"	3"	3/4"	#4	#10	#40	#200
Well-graded sands (SW) $C_u = D_{60}/D_{10} \geq 6$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							
Well-graded gravels (GW) $C_u = D_{60}/D_{10} \geq 4$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							

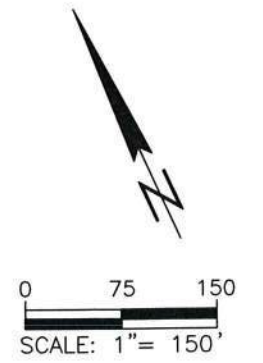
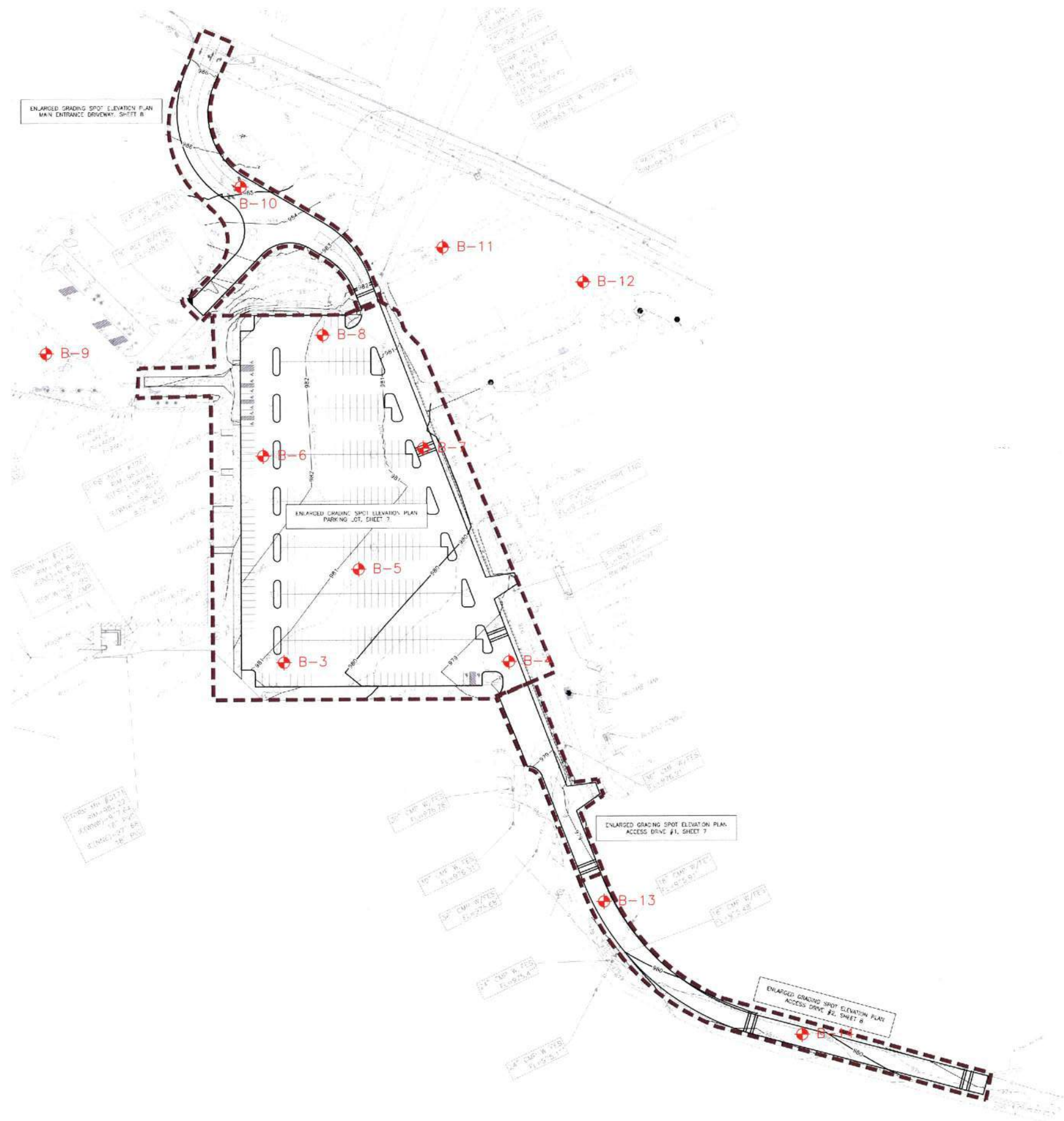


LEGEND:
 BORING LOCATION



PROJECT
 LEWIS CENTRAL HIGH SCHOOL
 PAVEMENT REPLACEMENT
 3504 HARRY LANGDON BLVD, COUNCIL BLUFFS, IA
 JOB # 24655.01 | DATE: 2/18/25

BORING LOCATION PLAN



LEGEND:

◆ BORING LOCATION



PROJECT
 LEWIS CENTRAL HIGH SCHOOL
 PAVEMENT REPLACEMENT
 3504 HARRY LANGDON BLVD, COUNCIL BLUFFS, IA
 JOB # 24655.01 | DATE: 2/18/25

BORING LOCATION PLAN



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/23/2024 SURFACE Grass GROUND ELEVATION 980 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Omar Ibarra DRILL RIG CME 45B #102 DURING DRILLING None encountered
LOGGED BY Nathan Wade CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		very moist	dark brown	soft	lean clay	fill	appreciable sand	U-1	12			24.6	89.6	0.49				
		very moist	dark gray	firm	fat clay	alluvium	roots	U-2	12			30.2	89.2	1.46				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/23/2024 SURFACE Grass GROUND ELEVATION 980 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Omar Ibarra DRILL RIG CME 45B #102 DURING DRILLING None encountered
LOGGED BY Nathan Wade CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	dark brown	firm	lean clay	fill	much sand, minor gravel	U-1	12			18.9	89.6		47	29	18	
		very moist	grayish brown				trace sand, trace gravel	U-2	12			27.8	90.3	0.91				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-3

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Asphalt GROUND ELEVATION 981 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0							8" asphalt											
		moist	gray	very hard	lean clay	fill	trace gravel	U-1	8			19.9	108.2	3.52				
							trace rubble (brick)											
			dark brown	firm				U-2	10			23.4	97.4	1.03				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-4

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Asphalt GROUND ELEVATION 978.5 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	brown	hard	silt	fill	6.6" asphalt minor sand	U-1	12			18.7	109.1	2.28				
5		very moist	dark gray	firm	lean clay	alluvium	roots	U-2	12			30.7	86.3	1.09				

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-5

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Asphalt GROUND ELEVATION 981 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0							5.8" asphalt											
		moist	grayish brown	very hard	silt	fill		U-1	12			18.6	112.2	3.11	32	24	8	
		very moist	dark brown	firm	lean clay		trace rubble (plastic)	U-2	12			25.5	96.4	1.22				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-6

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Asphalt GROUND ELEVATION 982.5 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	brown	firm	silt	fill	6.3" asphalt trace gravel	U-1	12			20.4	102.7					
			grayish brown		lean clay			U-2	10			23.7	101.7	0.79				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-7

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Asphalt GROUND ELEVATION 980.5 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0							6.1" asphalt											
		moist	brown	firm	lean clay	fill	minor sand, minor gravel	U-1	12			19.5	102.4					
		very moist	grayish brown				trace sand, trace gravel, silty	U-2	12			24.2	100.2	1.29				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-8

PAGE 1 OF 1

CLIENT	Lewis Central Community School District	PROJECT NAME	Lewis Central High School Pavement Replacement
PROJECT NUMBER	24655.01	PROJECT LOCATION	3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE	12/26/2024	SURFACE	Asphalt
DRILLING METHOD	Flight	HOLE SIZE	6 inches
DRILLER	Isaac Smith	DRILL RIG	CME 45B #1045
LOGGED BY	Jordan Skipper	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	982 ft
		BORING DEPTH	5.0 feet
		GROUND WATER LEVELS:	
		DURING DRILLING	None encountered
		END OF DRILLING	None encountered
		AFTER DRILLING	Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	grayish brown	firm	lean clay	fill	7.3" asphalt trace gravel	U-1	12			23.5	105.0	1.48	34	23	11	
		very moist	dark gray	very hard				U-2	12			25.8	98.1	3.84				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-9

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/26/2024 SURFACE Concrete GROUND ELEVATION 983 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Isaac Smith DRILL RIG CME 45B #1045 DURING DRILLING None encountered
LOGGED BY Jordan Skipper CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0							5.3" concrete											
		moist	grayish brown	hard	lean clay	fill	trace gravel	U-1	12			19.4	109.6		44	21	23	
		very moist	dark gray	firm	lean clay	alluvium	roots	U-2	12			26.2	88.9	1.14				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-10

PAGE 1 OF 1

CLIENT	Lewis Central Community School District	PROJECT NAME	Lewis Central High School Pavement Replacement
PROJECT NUMBER	24655.01	PROJECT LOCATION	3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE	12/26/2024	SURFACE	Asphalt
DRILLING METHOD	Flight	HOLE SIZE	6 inches
DRILLER	Isaac Smith	DRILL RIG	CME 45B #1045
LOGGED BY	Jordan Skipper	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	984.5 ft
		BORING DEPTH	5.0 feet
		GROUND WATER LEVELS:	
		DURING DRILLING	None encountered
		END OF DRILLING	None encountered
		AFTER DRILLING	Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0							8" asphalt											
		moist	grayish brown	hard	lean clay	fill	trace gravel, silty	U-1	12			20.9	106.4	1.95				
				very hard														
5								U-2	12			21.0	103.2	3.22				

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-11

PAGE 1 OF 1

CLIENT Lewis Central Community School District PROJECT NAME Lewis Central High School Pavement Replacement
PROJECT NUMBER 24655.01 PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA
DRILLING DATE 12/23/2024 SURFACE Grass GROUND ELEVATION 982 ft BORING DEPTH 5.0 feet
DRILLING METHOD Flight HOLE SIZE 6 inches GROUND WATER LEVELS:
DRILLER Omar Ibarra DRILL RIG CME 45B #102 DURING DRILLING None encountered
LOGGED BY Nathan Wade CHECKED BY Broc Burmeister END OF DRILLING None encountered
NOTES Boring backfilled with cuttings AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		very moist	dark brown	firm	lean clay	alluvium	roots	U-1	12			25.5						
5								U-2	12			28.8	87.8	1.16				

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-12

PAGE 1 OF 1

CLIENT	Lewis Central Community School District	PROJECT NAME	Lewis Central High School Pavement Replacement					
PROJECT NUMBER	24655.01	PROJECT LOCATION	3504 Harry Langdon Blvd, Council Bluffs, IA					
DRILLING DATE	12/23/2024	SURFACE	Grass	GROUND ELEVATION	981.5 ft	BORING DEPTH	5.0 feet	
DRILLING METHOD	Flight	HOLE SIZE	6 inches	GROUND WATER LEVELS:				
DRILLER	Omar Ibarra	DRILL RIG	CME 45B #102	DURING DRILLING				None encountered
LOGGED BY	Nathan Wade	CHECKED BY	Broc Burmeister	END OF DRILLING				None encountered
NOTES	Boring backfilled with cuttings			AFTER DRILLING				Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		very moist	brown	firm	lean clay	fill	trace gravel	U-1	12			27.0	86.1		44	26	18	
		very moist	dark gray	firm	lean clay	alluvium	roots	U-2	12			27.8	90.2	1.26				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-13

PAGE 1 OF 1

CLIENT	Lewis Central Community School District	PROJECT NAME	Lewis Central High School Pavement Replacement					
PROJECT NUMBER	24655.01	PROJECT LOCATION	3504 Harry Langdon Blvd, Council Bluffs, IA					
DRILLING DATE	12/26/2024	SURFACE	Asphalt	GROUND ELEVATION	979.5 ft	BORING DEPTH	5.0 feet	
DRILLING METHOD	Flight	HOLE SIZE	6 inches	GROUND WATER LEVELS:				
DRILLER	Isaac Smith	DRILL RIG	CME 45B #1045	DURING DRILLING				None encountered
LOGGED BY	Jordan Skipper	CHECKED BY	Broc Burmeister	END OF DRILLING				None encountered
NOTES	Boring backfilled with cuttings			AFTER DRILLING				Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	brown	hard	silt	fill	4.7" asphalt minor sand	U-1	12			20.0	106.1	1.60	27	25	2	
			dark gray	very hard	fat clay			U-2	12			23.9	102.0	4.31				
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech, Inc.
13478 Chandler Road
Omaha, NE 68138
Telephone: (402) 556-2171

BORING NUMBER B-14

PAGE 1 OF 1

CLIENT	Lewis Central Community School District	PROJECT NAME	Lewis Central High School Pavement Replacement					
PROJECT NUMBER	24655.01	PROJECT LOCATION	3504 Harry Langdon Blvd, Council Bluffs, IA					
DRILLING DATE	12/26/2024	SURFACE	Asphalt	GROUND ELEVATION	980.5 ft	BORING DEPTH	5.0 feet	
DRILLING METHOD	Flight	HOLE SIZE	6 inches	GROUND WATER LEVELS:				
DRILLER	Isaac Smith	DRILL RIG	CME 45B #1045	DURING DRILLING				None encountered
LOGGED BY	Jordan Skipper	CHECKED BY	Broc Burmeister	END OF DRILLING				None encountered
NOTES	Boring backfilled with cuttings			AFTER DRILLING				Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	brown	hard	silt	fill	7.3" asphalt minor sand	U-1	10			23.2	101.4					
			dark gray	firm	lean clay		appreciable sand, trace gravel	U-2	10			17.7						
5																		

Bottom of borehole
at 5.0 feet.



Thiele Geotech
13478 Chandler Road
Omaha, NE 68138
Telephone: 402-556-2171
Fax: 402-556-7831

SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT Lewis Central Community School District

PROJECT NAME Lewis Central High School Pavement Replacement

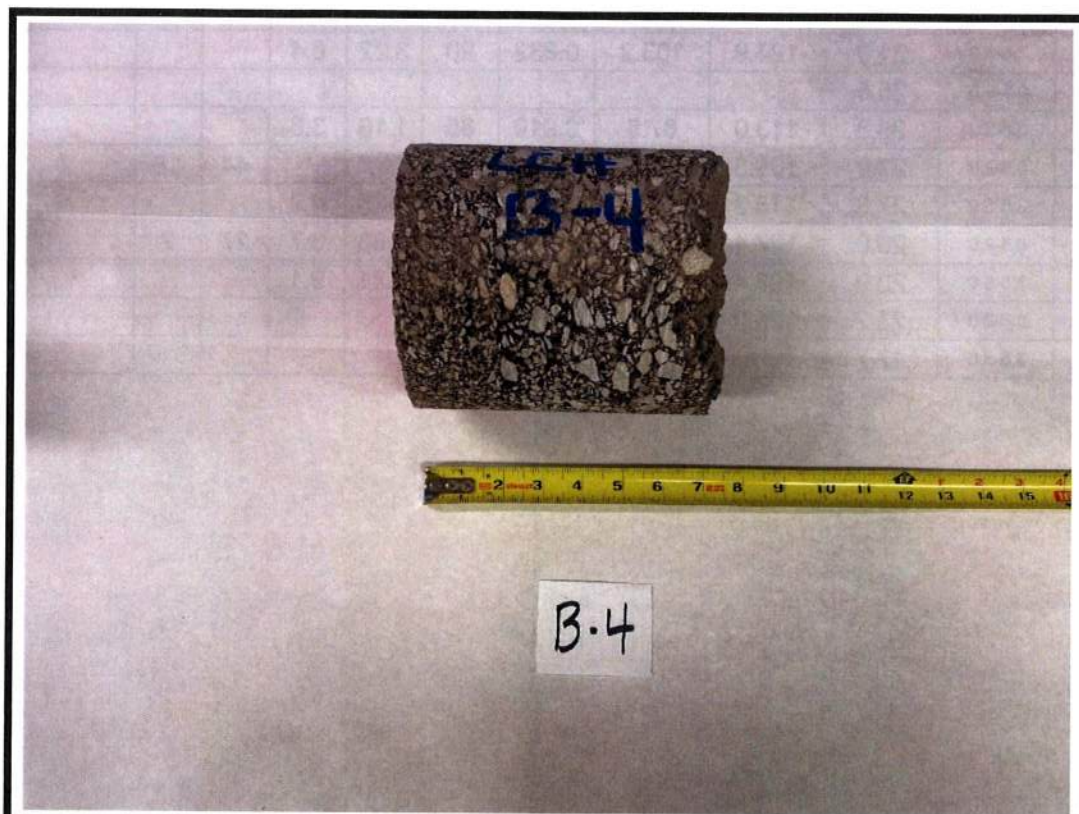
PROJECT NUMBER 24655.01

PROJECT LOCATION 3504 Harry Langdon Blvd, Council Bluffs, IA

Boring Number	Sample Number	Depth	Water Content (%)	Unit Weight		Void Ratio	Sat. (%)	Unconfined Compression		Atterberg Limits		%<#200 Sieve	Class.	Other Tests
				Wet Density (pcf)	Dry Density (pcf)			q _u (tsf)	Strain (%)	LL	PI			
B-1	U-1	0.5-2.0'	24.6	111.7	89.6	0.879	76	0.49	3.3					
	U-2	3.5-5.0'	30.2	116.1	89.2	0.889	92	1.46	5.4					
B-2	U-1	0.5-2.0'	18.9	106.5	89.6	0.881	58			47	18		CL	
	U-2	3.5-5.0'	27.8	115.3	90.3	0.866	87	0.91	6.4					
B-3	U-1	0.5-2.0'	19.9	129.7	108.2	0.558	96	3.52	8.5					
	U-2	3.5-5.0'	23.4	120.2	97.4	0.729	87	1.03	3.0					
B-4	U-1	0.5-2.0'	18.7	129.6	109.1	0.544	93	2.28	2.7					
	U-2	3.5-5.0'	30.7	112.8	86.3	0.952	87	1.09	3.4					
B-5	U-1	0.5-2.0'	18.6	133.1	112.2	0.501	100	3.11	5.4	32	8		ML	
	U-2	3.5-5.0'	25.5	121.0	96.4	0.748	92	1.22	3.2					
B-6	U-1	0.5-2.0'	20.4	123.6	102.7	0.641	86							
	U-2	3.5-5.0'	23.7	125.8	101.7	0.656	98	0.79	4.2					
B-7	U-1	0.5-2.0'	19.5	122.4	102.4	0.646	82							
	U-2	3.5-5.0'	24.2	124.5	100.2	0.681	96	1.29	2.6					
B-8	U-1	0.5-2.0'	23.5	129.7	105.0	0.604	100	1.48	2.3	34	11		CL	
	U-2	3.5-5.0'	25.8	123.5	98.1	0.717	97	3.84	6.7					
B-9	U-1	0.5-2.0'	19.4	130.9	109.6	0.538	98			44	23		CL	
	U-2	3.5-5.0'	26.2	112.2	88.9	0.895	79	1.14	4.1					
B-10	U-1	0.5-2.0'	20.9	128.7	106.4	0.583	97	1.95	2.8					
	U-2	3.5-5.0'	21.0	124.9	103.2	0.632	90	3.22	6.4					
B-11	U-1	0.5-2.0'	25.5											
	U-2	3.5-5.0'	28.8	113.0	87.8	0.919	85	1.16	3.8					
B-12	U-1	0.5-2.0'	27.0	109.3	86.1	0.958	76			44	18		CL	
	U-2	3.5-5.0'	27.8	115.3	90.2	0.867	87	1.26	4.7					
B-13	U-1	0.5-2.0'	20.0	127.4	106.1	0.588	92	1.60	3.7	27	2		ML	
	U-2	3.5-5.0'	23.9	126.4	102.0	0.652	99	4.31	9.1					
B-14	U-1	0.5-2.0'	23.2	125.0	101.4	0.661	95							
	U-2	3.5-5.0'	17.7											



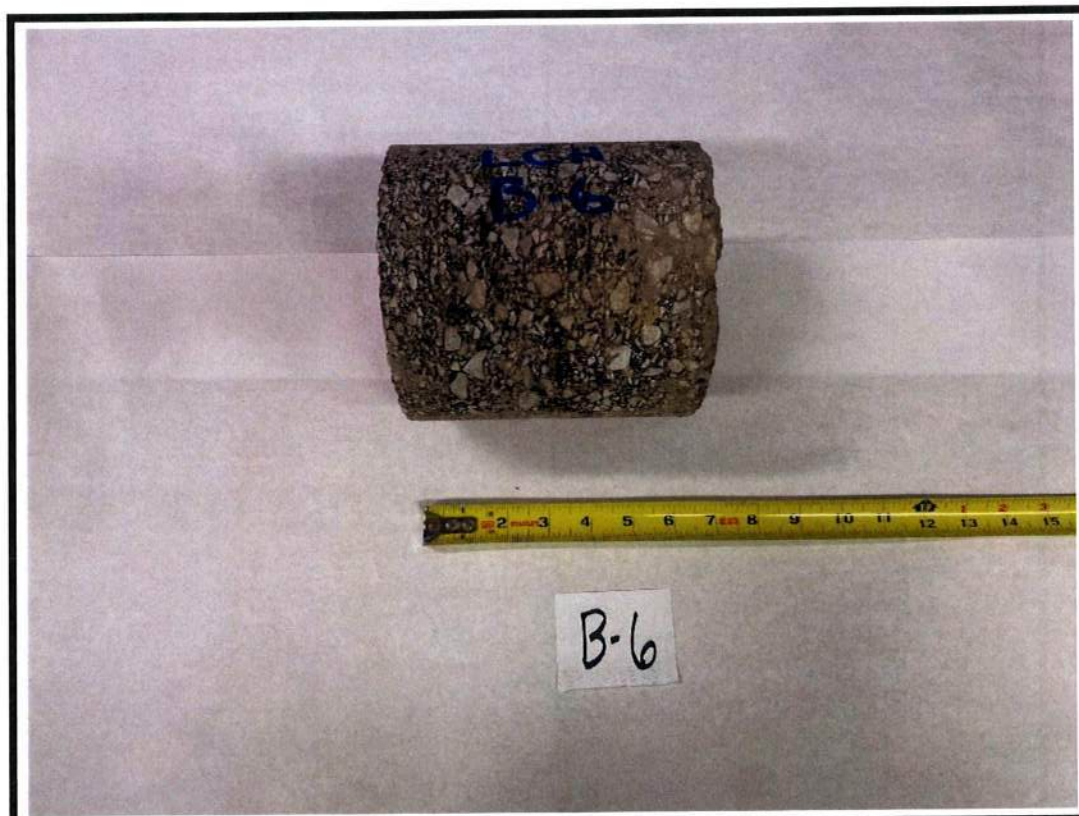
B-3



B-4



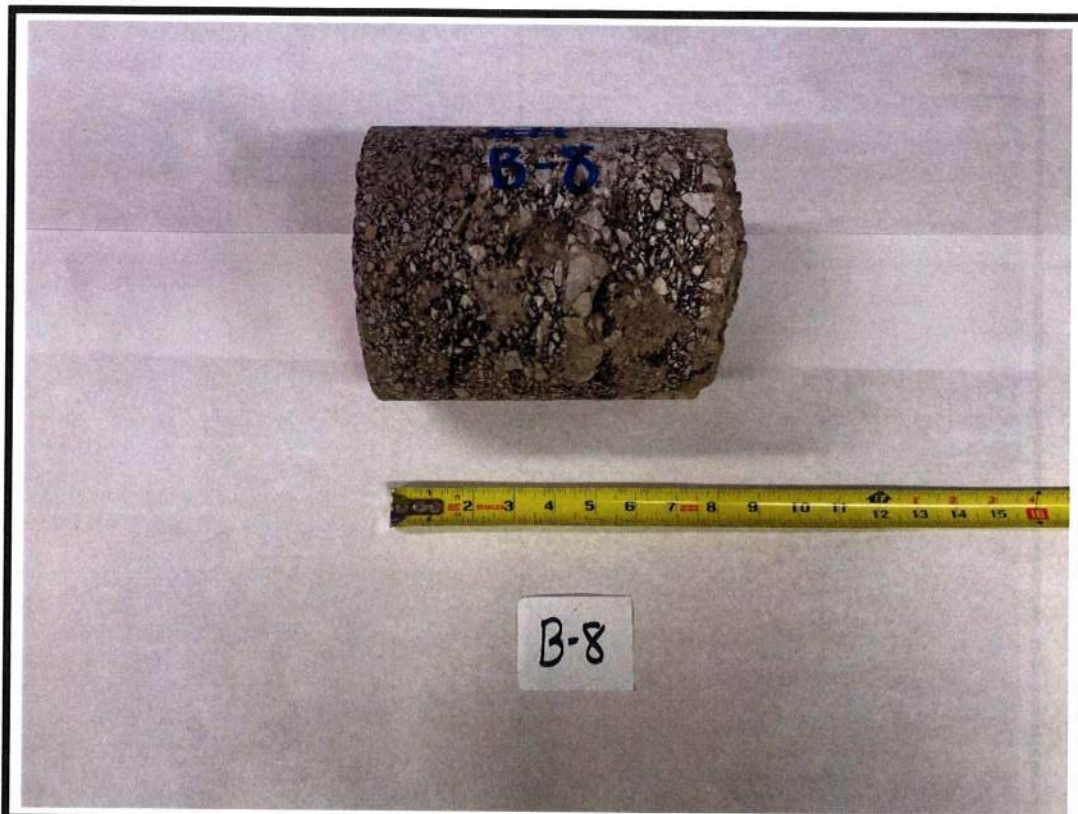
B-5



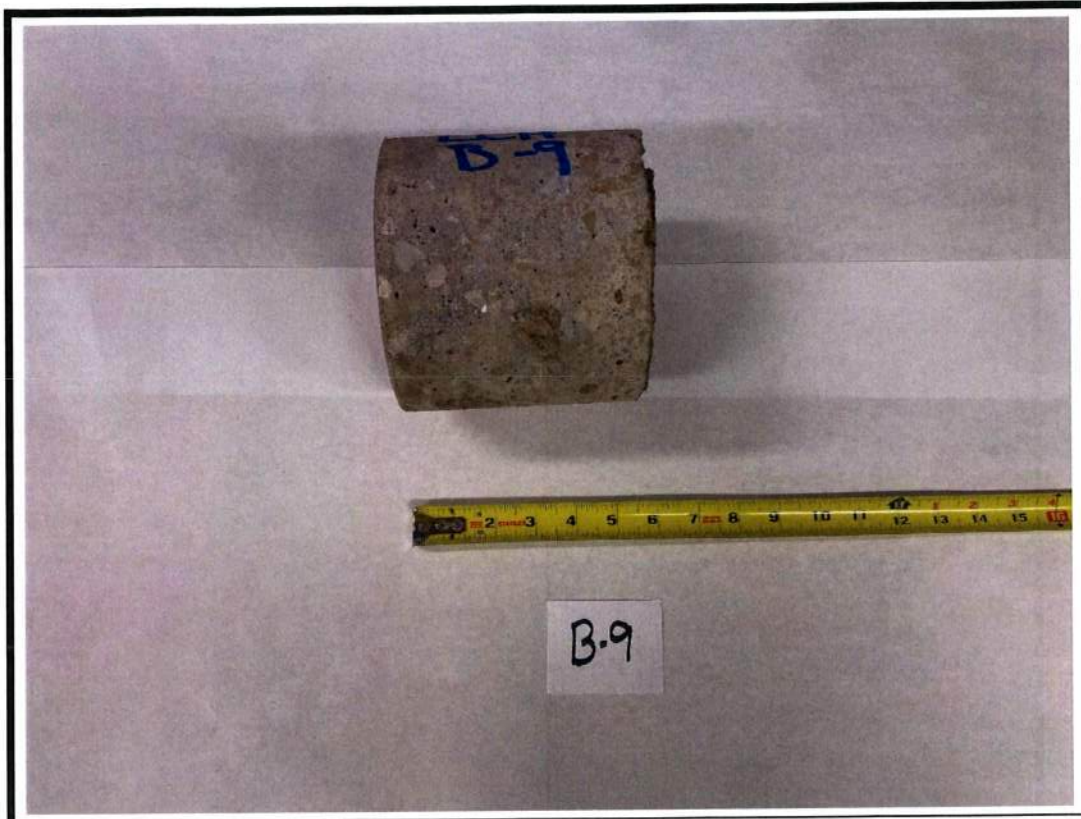
B-6



B-7



B-8



B-9



B-10



B-13



B-14

**SECTION 00 60 00
PROJECT FORMS**

PART 1 GENERAL

1.01 SUMMARY

- A. The following project forms shall be used for their indicated purpose. All forms shall be furnished and prepared by the Contractor, except as noted.
- B. These forms may be examined at the office of the Architect/Engineer.
- C. Standard American Institute of Architects (AIA) forms are available for purchase from the following address:
 - AIA Nebraska
 - 102 Architecture Hall, University of Nebraska-Lincoln
 - PO Box 80045
 - Lincoln, Nebraska 68501-0045
 - Phone: (402) 472-1456

1.02 PROJECT FORMS

- A. BID PROPOSAL FORM - STIPULATED SUM
 - 1. Copy included previously under Section 00 30 30.
 - 2. Submit one copy.
- B. BID BOND
 - 1. AIA Document A310.
 - 2. Submit one copy with bid.
- C. PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND
 - 1. Submit AIA Document A312.
 - 2. Submit three copies with contracts.
- D. CONTRACTOR'S QUALIFICATION STATEMENT
 - 1. AIA Document A305.
- E. GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
 - 1. AIA Document A201 as modified by Owner.
 - 2. Copy included following Section 00 72 00.
- F. APPLICATION AND CERTIFICATE FOR PAYMENT AND CONTINUATION SHEETS
 - 1. AIA Document G702 and AIA Document G703.
 - 2. Contractor to submit a minimum of three copies.
- G. CONSENT OF SURETY COMPANY TO FINAL PAYMENT
 - 1. AIA Document G707.
 - 2. Submit two copies.

PART 2 NOT USED.

PART 3 NOT USED.

END OF SECTION

**SECTION 00 63 00
CLARIFICATION AND MODIFICATION FORMS**

PART 1 SCOPE

1.01 GENERAL

- A. The following clarification and modification forms shall be used for their indicated purpose. All forms shall be furnished and prepared by the Architect/Engineer.
- B. These forms may be examined at the office of the Architect/Engineer.

1.02 SAMPLE FORMS

- A. CHANGE ORDER
 - 1. AIA Document G701.
 - 2. Furnished by Architect/Engineer.
- B. PROPOSAL REQUEST
 - 1. AIA Document G709
 - 2. Furnished by Architect/Engineer.
- C. ARCHITECT/ENGINEER'S SUPPLEMENTAL INSTRUCTIONS
 - 1. AIA Document G710
 - 2. Furnished by Architect/Engineer.
- D. CONSTRUCTION CHANGE DIRECTIVE
 - 1. AIA Document G714.
 - 2. Furnished by Architect/Engineer.

PART 2 NOT USED.

PART 3 NOT USED.

END OF SECTION

**SECTION 00 72 00
GENERAL AND SUPPLEMENTARY CONDITIONS**

OF THE CONTRACT FOR CONSTRUCTION

1.01 GENERAL CONDITIONS

A. ARTICLES 1 THROUGH 15

1. The General Conditions of this Contract is the American Institute of Architects' Document A201, THE GENERAL CONDITIONS OF THE CONTRACT FOR THE CONSTRUCTION, 2007 Edition, 16 Articles, 43 pages, hereinafter referred to as the General Conditions, a copy of which may be referred to at the office of the Architect/Engineer.

1.02 SUPPLEMENTARY CONDITIONS

A. MODIFICATIONS OF THE GENERAL CONDITIONS

1. The following supplements modify, change, delete from, or add to the "General Conditions of the Contract for Construction", AIA Document A201, 2007 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

B. MODIFICATION OF PARAGRAPH 2.2.5

1. Delete the last portion of this paragraph starting at "...Owner shall furnish..." and replace with the following:
"...Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the work."

C. MODIFICATION OF PARAGRAPH 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

1. Add the following Subparagraph 3.3.4:
"3.3.4 The Prime General Contractor shall be responsible for assuring that the Mechanical and Electrical Subcontractors and all other involved trades have properly coordinated the exact placement of ducts, piping, lights conduit and other items in order to fit those items within the spaces provided. After extensive coordination and investigation, the Mechanical, Electrical and Structural Engineers and the Architect believe that, to the best of their knowledge, the items shown will fit within the spaces provided above ceilings, in walls, etc., if there is a reasonable amount of on-site preplanning and coordinating by the involved trades. The Drawings are diagrammatical and thus, bidders should expect that minor changes in the location, exact routing and size/proportion of certain ducts and other items will be necessary in order to fit the available spaces. Extra costs will not be accepted by the Owner and redesign will not be performed by the Architect/Engineer if such costs or redesign are necessitated by the Contractor's failure to perform routine coordination of the involved elements before the first of those items are installed. Extra costs and/or design will be an acceptable alternative if the items shown will not fit after the reasonable amount of field coordination outlined above has been accomplished."

D. MODIFICATION OF PARAGRAPH 3.6, TAXES

1. Add the following at the end of Paragraph 3.6:
 - a. "See Instructions to Bidders for other information regarding the responsibility of the Contractor relating to taxes."

E. MODIFICATION OF PARAGRAPH 3.7 PERMITS, FEES AND NOTICES AND COMPLIANCE WITH LAWS

1. Add the following at the end of Subparagraph 3.7.1:
 - a. "See Instructions to Bidders for other information regarding responsibilities of the Owner and Contractor for obtaining permits and paying for them."

F. MODIFICATION OF PARAGRAPH 3.9, SUPERINTENDENT

1. Add the following Subparagraph 3.9.4:
 - a. "3.9.4" The project superintendent shall be on the site as a full time employee of the Contractor, and solely dedicated to his/her responsibilities as superintendent for this Project. The superintendent shall be the same person throughout the construction period, and on the site from beginning of construction through the date of Substantial Completion. If the superintendent cannot continue his/her responsibilities throughout the construction period, the Contractor shall notify the Architect/Engineer in writing immediately. Substituting superintendent personnel by the Contractor must be approved in writing by the Architect/Engineer. The credentials of the person to serve as superintendent shall be submitted to the Architect/Engineer for approval."

G. MODIFICATION OF PARAGRAPH 7.2, CHANGE ORDERS

1. Add the following Subparagraph 7.2.2:
 - a. "7.2.2 The maximum percent which shall be allowed for Contractor's combined overhead and profit shall be as follows:
 - 1) For the Subcontractor, 10 percent of the net extra cost of the work he/she performs.
 - 2) For the Contractor, 5 percent of the net extra cost of the work performed by the Subcontractors.
 - 3) For the Contractor, 10 percent of the net extra cost of the work he/she performs with his/her own forces.
 - (a) The cost shall include all direct and necessary production costs of the work itself, i.e., labor and items incidental to labor (such as public liability and workmen's compensation insurance, old-age and unemployment insurance, social security), pro-rata charges for foremen, material, and the use of power tools and equipment. Among the items to be considered as overhead and not as cost are supervision, superintendents, timekeepers, clerks, watchmen, small tools; incidental job burdens, and general office expense. Costs for other insurance not previously stated and bond(s) required by the Contract shall be added to the subtotal after the previously stated percentage increases for overhead and profit are calculated.
 - (b) For each Change Order issued, the Contractor shall furnish an itemized, bona fide, written proposal in multiple-copy form and with such supporting papers as the Architect/Engineer may require."

H. MODIFICATION OF PARAGRAPH 8.3, DELAYS AND EXTENSION OF TIME

1. At Subparagraph 8.3.1, in line 5, delete the words "and arbitration".

I. MODIFICATION TO PARAGRAPH 9.3, APPLICATIONS FOR PAYMENT

1. Add the following at the end of Subparagraph 9.3.2:
 - a. Application for Payment may also be submitted for materials stored off-site, but only if these materials are stored in an insured facility within a 50 mile radius of the project location, and only if the respective Application contains evidence that such materials are properly insured. The Architect/Engineer will furnish, "Off-Site Storage Agreement" forms which must be filled out and attached to each Application which requests payment for materials stored off-site. Invoices for the materials stored off-site shall also be attached to the Application."

J. MODIFICATION OF PARAGRAPH 11.1, CONTRACTOR'S LIABILITY INSURANCE

1. Delete Paragraph 11.1.2 in its entirety, and substitute the following:
 - a. "11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability specified below, or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made, shall be maintained without interruption from date of commencement of the work until date of final payment and termination of any coverage required to be maintained after final payment."
 - b. Insurance required by Section 11.1.2, shall be written for not less than limits of liability specified or required by law, whichever is greater:
 - c. Workers' Compensation - Statutory. Employers' Liability Insurance with minimum limits shown below
 - 1) Bodily injury by accident \$500,000 each accident
 - 2) Bodily injury by disease \$500,000 each accident
 - 3) Bodily injury by disease \$500,000 policy limit
 - d. Commercial General Liability Insurance, which shall be no less comprehensive and no more restrictive than coverage provided by a standard form Commercial General Liability Policy (ISO CG0001) with minimum limits shown below covering bodily injury, property damage and personal injury.
 - 1) General Aggregate Limit \$2,000,000
 - 2) Products Completed Operations Aggregate Limit \$2,000,000
 - 3) Personal and Advertising Injury Limit \$1,000,000
 - 4) Each Occurrence Limit \$1,000,000
 - 5) Fire Damage Limit (any one fire) \$ 50,000
 - 6) Medical Damage Limit (any one person) \$ 5,000
 - 7) This insurance must include the following features:
 - (a) Coverage shall be on an occurrence form and not claims made.
 - (b) Coverage for all premises and operations. Policy shall be endorsed to provide a per project aggregate endorsement.
 - (c) Personal and advertising injury.
 - (d) Operations by independent contractors.
 - (e) If work to be performed by Contractor includes construction or demolition operations within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, road beds, tunnel, underpass, or crossing, then such policy will include coverage for work done within 50 feet of a railroad right of way.
 - (f) Coverage for demolition of any building or structure, collapse, explosion, blasting, excavation and damage to property below surface of ground (XCU coverage)
 - (g) Policy shall not contain a total or absolute pollution exclusion. Coverage shall be provided for pollution exposures arising from products and completed operations. (As per standard CG0001 Pollution Exclusion or equivalent.)
 - (h) Products and completed operations shall be maintained for duration of work, and shall be further maintained for a minimum period of one year after final acceptance and payment, unless modified in the Special Provisions.
 - (i) In lieu of including Owner as an additional insured on Contractor's commercial general liability insurance, Owner, at its option, may require Contractor to provide an Owner's protective liability policy by special provision, or may allow Contractor to provide an Owner's protective liability policy by change order. If an Owner's protective liability policy is provided, minimum coverage, limits and exclusions shall be as shown above, and

Contractor's premium cost of obtaining such insurance shall be as shown above, and Contractor's premium cost of obtaining such insurance shall be considered incidental to work and shall not be subject to reimbursement by Owner.

- (j) Broad form blanket contractual liability to be included. Defense costs shall be in addition to policy limits.
- e. Automobile Liability Insurance, which shall be at least as broad as and no less restrictive than ISO form CA 0001, covering all owned, non-owned, hired and leased vehicles with a minimum combined single limit for bodily injury and property damage of \$1,000,000 per accident. Insurance must include contractual liability coverage.
Policy shall provide auto cargo pollution endorsement (ISO CA 99 48, or equivalent), if requested in special provisions. If work to be performed by Contractor includes construction or demolition operations within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, road beds, tunnel, underpass, or crossing, then such policy will include coverage for work done within 50 feet of a railroad right of way.
- f. Railroad Protective Liability, if required by Owner by special provision, or by an affected railroad, Contractor shall procure and maintain railroad protective liability insurance naming railroad as insured with minimum limit for bodily injury and property damage liability of \$2,000,000 per occurrence, \$6,000,000 aggregate, or with such other limits as railroad shall require. Original of said policy shall be furnished to railroad and a certified copy of said policy shall be furnished to Owner prior to any construction or entry upon railroad easement premises by Contractor.
- g. Umbrella/Excess Insurance: Limits of \$2,000,000 each occurrence and aggregate.
- h. Additional Insured Endorsements: Except for Workers' Compensation and Auto Liability, insurance specified shall:
 - 1) Name Owner and Architect/Engineer as an additional insured, including Completed Operations for one year, with respect to liability for bodily injury, property damage, or personal & advertising injury caused in whole or in part by Contractor's acts or omissions or the acts or omissions of those acting on your behalf.
 - 2) General Liability additional insured shall be primary and non contributory.
- i. Waiver of Subrogation in favor of Owner and Architect/Engineer on auto liability, general liability, workers compensation, and umbrella/excess liability.
- j. Certificate of Insurance
 - 1) 1. Contractor shall file with Owner and each additional insured, a Certificate of Insurance on the standard ACORD form (and other evidence of insurance requested by Owner or any other additional insured) as evidence of required coverages and limits, and showing additional insured and waiver of subrogation. Such certificate shall state that the insurer shall endeavor to notify Owner thirty (30) days in advance of cancellation of insurance coverages.
- k. Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools owned by mechanics, any tools, machinery, equipment, or motor vehicles owned or rented by Contractor or Contractor's agents, subcontractors, suppliers of their employees, as well as to any shed or other temporary structures, scaffolding and stagings, protective fences, and bridges.
- l. Contractor shall cause its insurance carrier providing physical damage insurance to Contractor, covering construction equipment, tools, temporary structures and supplies owned or used by Contractor, to provide a waiver of right of subrogation against Owner.
- m. Upon occurrence of any event, liability for which is herein assumed by Contractor, Contractor agrees to forthwith notify Owner in writing of such happening, which notice shall give details as to happening, cause as far as can be ascertained, estimate of loss or damage done, name of witnesses, if any, and stating amount of any claim.

- n. In event Owner has or obtains actual knowledge of any event, liability for which is herein assumed by Contractor, Owner agrees to notify Contractor of such event with a reasonable period of time after acquiring knowledge thereof; provided, however, that Owner shall have no duty to inspect project to obtain knowledge of such events, and provided further that Owner's failure to so notify Contractor shall not relieve Contractor of any liability or obligation which is herein assumed by Contractor."
 - K. MODIFICATION OF PARAGRAPH 11.3 PROPERTY INSURANCE
 - 1. Delete Paragraph 11.3 in its entirety, and substitute the following:
 - a. PROPERTY INSURANCE
 - 1) 11.3.1 It shall be the sole responsibility of the Contractor to maintain as minimum coverage insurance on the Work, all risk coverage in an amount equal to 100 percent of the replacement cost of the Work performed under this Contract with the 90 percent co-insurance clause, and, in addition, the Contractor shall be solely responsible for any amounts which may become payable as a result of any deductible provision, corridor, or self-insured retention of the policy or policies, as well as any losses arising from any uninsured perils. All risk coverage shall include protection against losses by theft of building materials, both installed and uninstalled. All risk coverage shall be maintained from Award of Contract through Substantial Completion.
 - 2) 11.3.2 It is a condition of the Contract that the Owner, Architect/Engineer, and all Contractors and their corporate sureties waive all rights of recovery against each other for damages caused by fire or other perils to the extent such damages are covered by any valid and collectible insurance, and further, that all property insurance policies shall include the standard "waiver of subrogation" clause."
 - L. MODIFICATION TO PARAGRAPH 11.4 PERFORMANCE BOND AND PAYMENT BOND
 - 1. Delete this paragraph in its entirety, and substitute the following:
 - a. PERFORMANCE BOND AND PAYMENT BOND"
 - 1) "11.4.1 A Performance Bond and Payment Bond, each in the amount equal to 100 Percent of the Contract Price, shall be submitted in duplicate to the Architect/Engineer prior to issuance of a Notice-to-Proceed or execution of the Owner-Contractor Agreement (whichever occurs first). Such bonds shall be issued by a surety company acceptable to the Owner and properly licensed in the State of Iowa. Such bonds shall be issued on AIA Document A312, 1984 Edition or later, amended to conform with applicable state statutes.
 - M. MODIFICATION OF PARAGRAPH 15.1.6, CLAIMS FOR CONSEQUENTIAL DAMAGES
 - 1. Delete the first part of the second sentence of Subparagraph 15.1.6 that states "This mutual waiver includes:", and substitute "This mutual waiver includes, but is not limited to:".
 - N. MODIFICATION OF PARAGRAPH 15.4, ARBITRATION
 - 1. Delete 15.4 in its entirety.
- 1.03 ADD ARTICLE 16 AS FOLLOWS:**
- A. ARTICLE 16 - ADDITIONAL CONDITIONS
 - 1. 16.1 - PRODUCT CERTIFICATION
 - a. 16.1.1 The Contractor shall provide to the Owner a written certification statement that all materials incorporated into the project do not contain asbestos. This certification must be submitted to the Owner prior to final closeout of the project.
 - 2. 16.2 - SMOKING LIMITATIONS
 - a. 16.2.1 The use of tobacco and/or use of tobacco products in any school building, upon school grounds or in any school vehicles owned, leased, or operated by the Lewis Central Community School District are prohibited.
 - 3. 16.3 - EXCLUSION OF PERSONS WITH CRIMINAL RECORDS

- a. 16.3.1 The Owner requires that firms agree to not assign any individual or agent to any work on an awarded project, requiring work on a Lewis Central Community School District site, with a criminal record of a serious nature including but not limited to any of the following: (a) a felony; (b) rape, including statutory rape, or any other sexual assault; (c) sexual conduct with a minor of any kind; (d) abuse of a minor child of any kind; (e) endangerment of a child or debauching a minor; (f) public indecency; (g) prostitution, pandering, or keeping a place of prostitution; (h) assault or battery; (i) kidnapping, false imprisonment or abduction; (j) child pornography; or (k) any offense in which a minor was a victim or a witness. Bidder agrees, by signing this proposal, to cooperate in obtaining any additional authorization or consent necessary to assure compliance with this requirement; to actively continue and implement this policy throughout any awarded project or contract period and to require implementation of this policy by any subcontractors and/or agents involved by the Bidder in the performance of any awarded project or contract.
- 4. 16.4 - FIRE SPRINKLER SYSTEM COORDINATION AND WARRANTY
 - a. 16.4.1 The General Contractor and Sprinkler Subcontractor shall meet with the Architect/Engineer to coordinate routing of all piping and head placement in exposed areas prior to submittal of shop drawings to ascertain the aesthetic requirements in such areas.
 - b. 16.4.2 The General Contractor shall take full responsibility for locating all fire sprinkler lines and heads within the building at locations not subject to freezing condition. For areas of building, where that is not deemed possible, a "dry" system shall be substituted as described in the fire sprinkler specifications. The Contractor, in locating such piping and heads, shall take into account the possibility that the interior space temperature may be reduced to approximately 60 degrees through the Owner's off-hours temperature control set back.
 - c. 16.4.3 In areas where concealment of sprinkler piping is required, if the General Contractor and/or Sprinkler Contractor determines that additional chases, bulkheads and other architectural modifications are required in order to conceal the piping while complying with the above freeze production requirements, he/she shall coordinate such concerns with the Architect/Engineer prior to submittal of shop drawings.
 - d. 16.4.4 All entry vestibules and other minimally conditioned spaces, where system piping, heads and/or drop nipples are subject to freezing, dry pendent sprinklers shall be used.
 - e. 16.4.5 The General Contractor shall coordinate installation of the fire sprinkler system with the insulation characteristics of the building, and warrant the fire sprinkler system against freezing for a period of 2 years from date of Substantial Completion. Such warranty shall cover the cost of repair including damaged building materials. Such warranty shall not cover freezing in the event of a loss of heat due to malfunction or shut down of mechanical heating system beyond normal set backs previously stated.

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

**SECTION 01 10 00
SUMMARY**

PART 1 GENERAL

1.01 WORK UNDER THIS CONTRACT INCLUDES:

- A. All material, labor, tools, expendable equipment, transportation and utility services, and all incidental items necessary to perform and complete, in a workmanlike manner, the Work required for the Combined Construction, including General, Mechanical and Electrical Work, for the Lewis Central High School Entry Addition.

1.02 WORK PERFORMED UNDER SEPARATE CONTRACTS. THE OWNER WILL LET SEPARATE CONTRACTS AS FOLLOWS:

- A. This Combined Contract (including General, Mechanical and Electrical Work)
- B. Security Alarm System (rough-in conduit under this Combined Contract)
- C. Other items as may be noted on the Drawings or specified herein

1.03 WORK FURNISHED BY OWNER OR OTHERS BUT INSTALLED UNDER THIS CONTRACT INCLUDES THE FOLLOWING:

- A. Paper Holders (PH-1), Towel Dispensers (TD-1), Soap Dispensers (SD-1); see Section 10 28 00.
- B. Fire Extinguishers (Fire Extinguisher Cabinets under this Combined Contract)
- C. Other items as may be noted in the Drawings or specified herein.

1.04 WORK BY OTHERS (VIA THE OWNER)

- A. Work furnished, installed and/or accomplished by the Owner or Others includes the following:
 - 1. Furnishings and other interior movable equipment items not specified herein.
 - 2. Technical and Special Equipment.
 - 3. Other items as may be noted on the Drawings or specified herein.

1.05 UTILITY COMPANY CHARGES

- A. All utility company charges and fees related to permanent service shall be paid by the Owner or the Contractor as outlined in the Mechanical and Electrical Specifications. See Section 01 50 00 - Temporary Facilities and Controls for the division of responsibility for payment of utility costs for energy used during construction.

1.06 SEQUENCE AND SCHEDULING OF THE WORK SHALL BE IN ACCORD WITH THE FOLLOWING:

A. Receipt of Bids	July 17, 2025
B. Presentation of Bids to Board of Education and Award of Contract	July 21, 2025
C. Start of Construction	July 22, 2025
D. Substantial Completion	July 31, 2026
E. Final Completion	August 20, 2026

1.07 CONTRACTOR USE OF PREMISES / WORK HOURS

- A. General: During the construction period, the Contractor shall have shared and limited use of the premises for construction operations. Work hours for the Contractors construction activities shall be limited to coincide with the needs of Lewis Central Community School District. In general, available work times shall be as follows:
 - 1. Owner Occupancy: Allow for continued Owner occupancy and use by the public.
 - 2. Driveways and Entrances: See Civil sheets for use of driveways, entrances, and areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. Use of the existing Building: Maintain the existing building in a weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building, contents, and its occupants during the construction period.
4. Use of the existing facilities restrooms is not allowed.
5. Coordinate with Owner for times of events and additional requirements.
6. School Year Activities: Work shall be limited to occur between the hours of 7am and 10pm and only on days when school is normally in-session (i.e. not on weekends, holidays, etc.)
7. Summer (when School is not in Session): Work shall be limited to occur between the hours of 7am and 6pm and only on normal weekdays (i.e. not on weekends, holidays, etc.)

1.08 CONSTRUCTION SCHEDULES

- A. If Contractor fails to adhere to the Construction Schedule, including accepted revisions, the Contractor shall promptly adopt such other or additional means and methods of construction as will make up the time lost and complete the Work in accordance with the Construction Schedule, at no additional cost to the Owner, except as specifically provided in the Contract.
- B. If the Owner notifies the Contractor of any change in the Contract, or if conditions arise which are likely to cause or are actually causing delays, the Contractor shall notify the Owner and Architect, in writing, within 5 days of such notice or the occurrence of such condition. This notice shall document the effect, if any, of such change or condition upon the Construction Schedule, with the reason therefore.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 25 00
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for requests for substitutions by the Contractor that do not require modification of Contract Sum or Contract Time.

1.03 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction proposed by the Contractor after award of the Contract and that do not require modification of Contract Sum or Contract Time are considered to be requests for substitutions.
- B. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested during bidding, and accepted by Addendum prior to award of the Contract.
 - a. Substitutions requested during bidding period must be submitted no later than 14 calendar days prior to date of bid opening.
 - 2. Specified choices of products and options included in the Contract Documents.

1.04 SUBMITTALS

- A. Substitution Request Submittal: Submit the following:
 - 1. Submit 2 copies of each request for substitution for consideration.
 - 2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
 - 3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work that will be necessary to accommodate the proposed substitution.
 - b. A comparison of qualities of the proposed substitution with those of the Work specified.
 - c. Product Data, including Drawings and fabrication and installation procedures.
 - d. Samples, where applicable or requested.
 - 4. Engineer/Architect Action: If necessary, the Engineer/Architect will request additional information or documentation for evaluation. The Engineer/Architect will notify the Contractor of acceptance or rejection of the substitution in the form of a letter from the Engineer/Architect.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. The Architect will receive and consider the Contractor's request for substitution only when all of the following conditions are satisfied:
 - 1. Extensive revisions to the Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of the Contract Documents.
 - 3. The request is timely, fully documented, and properly submitted.
- B. Requests for substitutions must be based on at least one of the following conditions:
 - 1. The request is directly related to an "or-equal" clause in the Contract Documents.
 - 2. The specified product cannot be provided within the Contract Time.
 - 3. The specified product cannot receive necessary approval by a governing authority.
 - 4. The specified product cannot be provided in a manner that is compatible with other materials.

Lewis Central High School
Entry Addition

- C. The Architect/Engineer's acceptance of Shop Drawings, Product Data, or Samples not complying with the Contract Documents does not constitute a valid request for substitution, nor do they constitute approval.
- D. It shall be the responsibility of the Mechanical Contractor to coordinate with the Electrical Contractor on all electrical requirements for the equipment prior to ordering. All requirement changes shall be the responsibility of the Mechanical Contractor/Supplier at no additional cost to the project.

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 29 00
PROGRESS AND PAYMENT**

PART 1 GENERAL

1.01 APPLICATIONS FOR PAYMENT

- A. Applications for Payment shall be submitted to the Architect/Engineer on or before the eighteenth day of each month for work completed and material stored up to the fifteenth day of that month. Applications for Payment shall be submitted in triplicate on AIA Documents G702 and G703, 1992 edition.

1.02 PAYMENT

- A. Upon review and recommendation by the Architect/Engineer, the Owner will, on or before the day following the second Monday of the following month, pay to the Contractor, on account of the Contract, 90 percent of the value of labor and materials incorporated in the Work and 90 percent of materials suitably stored in accord with Subparagraph 9.3.2 of the General Conditions, up to the fifteenth day of the preceding month.

1.03 REDUCTION IN RETAINAGE AFTER WORK IS 50 PERCENT COMPLETE

- A. After 50 percent of the Work is complete, and upon receipt of Applications for Payment accompanied by Consent of Surety to Reduction in or Partial Release of Retainage executed in triplicate on AIA Document G707A, 1994 or later Edition, the Architect/Engineer may, if he finds satisfactory progress is being made, recommend that any of the remaining Progress Payments be paid in full. The full retainage may be reinstated if the manner of completion of the work and its progress do not remain satisfactory to the Architect/Engineer or the Owner, or for other good and sufficient reasons, or if Surety revokes its Consent for Reduction in or Partial Release of Retainage.

1.04 REDUCTION IN RETAINAGE AFTER SUBSTANTIAL COMPLETION

- A. After Substantial Completion, and upon receipt of Applications for Payment accompanied by Consent of Surety to Reduction in or Partial Release of Retainage executed in triplicate on AIA Document G707A, 1994 or later Edition, and upon review and recommendation by the Architect/Engineer, the Owner will pay the Contractor, on account of the Contract, 95 percent of the value of labor and materials incorporated in the Work and 95 percent of the materials suitably stored in accord with Subparagraph 9.3.2 of the General Conditions, up to the fifteenth day of the preceding month.

1.05 FURTHER REDUCTION IN RETAINAGE

- A. The final 3 percent of the Contract Sum will not be paid until the Contractor has submitted to the Architect/Engineer, in triplicate, a written clearance from the Iowa Commissioner of Labor certifying that all payments then due of contributions to the fund or interest thereon, owing by reason of the performance of the Work under this Contract, have, in fact, been paid by the Contractor and his/her Subcontractors to the Unemployment Compensation Fund of the State of Iowa.

1.06 FINAL PAYMENT

- A. After Final Completion, and upon receipt of the Final Application of Payment submitted in triplicate on AIA Documents G702 and G703, 1992 Edition, accompanied by Consent of Surety Company to Final Payment and Contractor's Affidavit of Payment of Debts and Claims executed in duplicate on AIA Documents G707 and G706, 1994 or later Editions respectively, Contractor's Affidavit of Release of Liens executed in duplicate on AIA Document G706A latest edition, the Contractor's Release or Waiver of Liens from all subcontractors and suppliers and other items required in Section 01 78 00, and upon the review and recommendation of the Architect/Engineer, the Owner will pay the Contractor the entire balance of the Contract Sum.

Lewis Central High School
Entry Addition

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

BCDM Architects
1015 North 98th Street, Suite 300
Omaha, Nebraska 68114-2334

SUPPLEMENTAL OFF-SITE STORAGE AGREEMENT

PROJECT: _____

DATE: _____

The Undersigned understands and agrees that a portion of the payment made under Application and Certificate for Payment No. _____, to _____ (Contractor) for their work on _____ (Project) under Contract dated _____ represents payment for materials procured and to be furnished and installed under the terms of the contract and which are to be stored off the building site by contractor or sub-contractor until used in such construction work, such payment being made in advance of, rather than following, delivery of such materials to the building site as required by said construction contract, and under the following conditions:

1. Materials being paid for hereunder are to be plainly tagged or marked as Property of _____ (Project Owner).
2. Such materials shall be separately located and stored at jobsite and _____ (off-site location) and segregated in said place of storage, clearly marked the materials in this space as property of _____ (Project Owner).
3. Such materials shall be kept free from any liens or encumbrances by contractor or sub-contractor and shall be kept adequately insured against loss to _____ (Project Owner) by theft, fire or other casualty at the expense of the contractor or sub-contractor. Proof of Insurance is attached.
4. Such materials shall be stored as herein provided and moved to the building site as needed in the construction work without expense to _____ (Project Owner).
5. Material paid for and stored as herein provided are as follows:

Signed:

Contractor

Owner

Authorized Signature

Authorized Signature

Bonding Company for Contractor

BCDM Architects

Authorized Signature

Authorized Signature

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Section 01 29 00 - Progress and Payment
 - 1. Applications for Payment
 - 2. Supplemental Off-Site Storage Agreement
 - 3. Consent of Surety to Reduction in or Partial Release of Retainage
 - 4. Consent of Surety to Final Payment
 - 5. Contractor's Affidavit of Payment of Debts and Claims
 - 6. Certification of Unemployment Compensation Contributions
 - 7. Contractor's Affidavit of Release of Liens
 - 8. Release or Waiver of Liens from Subcontractors and Suppliers
- B. Section 01 40 00 - Quality Requirements
 - 1. Testing Reports
 - 2. Receipts from Testing Payments
- C. Section 01 78 00 - Closeout Submittals
 - 1. Inspection Certificates
 - 2. Certification of Unemployment Compensation Contributions
 - 3. Extra Stock
 - 4. Specified Product Warranties as listed in that Section
 - 5. Water System Disinfection Reports
 - 6. Operating and Maintenance Manuals
 - 7. Performance Test Reports
 - 8. Project Record Drawings

1.02 PROGRESS AND VALUE SCHEDULE

- A. Progress and Value Schedule shall be completed in duplicate on forms furnished by the Architect/Engineer at the Preconstruction Conference, and submitted prior to the first Application for Payment and shall reflect in detail all of the Work included under the Combined Contract.
- B. Value Schedule shall be broken out by individual specification section. A preliminary copy of this form shall be submitted to the Architect/Engineer to approve or modify the breakdown of line items before final copies are submitted.

1.03 LIST OF SUBCONTRACTORS AND MATERIAL SUPPLIERS

- A. List of Subcontractors and Material Suppliers shall be entered on the form furnished by the Architect/Engineer, and submitted in duplicate within 10 days after the Notice-to-Proceed or Award of the Project.

1.04 CERTIFICATE OF INSURANCE

- A. ACORD Insurance Certificate Form 25-S shall be submitted by the Contractor in duplicate before work is started on the site.

1.05 PERFORMANCE BOND AND PAYMENT BOND

- A. Performance Bond and Payment Bond each in the amount equal to 100 Percent of the Contract Price, shall be submitted in duplicate to the Architect/Engineer prior to issuance of a Notice-to-Proceed or execution of the Owner-Contractor Agreement (whichever occurs first). Such bonds shall be issued by a surety company acceptable to the Owner and properly licensed in the State of Iowa. Such bonds shall be issued on AIA Document A312, amended to conform with applicable state statutes.

1.06 AIA DOCUMENTS

- A. AIA Documents which are required for submittals in this or other sections of this Project Manual may be obtained from:
 - A.I.A. Nebraska
 - P.O. Box 80045
 - Lincoln, Nebraska 68501
 - (402) 472-1456
 - (800) 332-0265
- B. The Contractor at his/her option, may use electronic copies of the AIA documents by contacting the Client Contractor Billing Program, (1-888-272-4115).

1.07 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- A. Shop Drawings, Product Data and Samples shall be submitted as follows:
 - 1. **All shop drawings and product data submittals shall be submitted in electronic (PDF) format using an Online Submittal Service.** The Service shall be similar to Procore or Submittal Exchange and is a website service designed specifically for transmitting submittals between construction team members. The General Contractor shall be responsible for establishing, contracting with, coordinating and utilizing the on-line construction submittal services.
 - 2. Shop drawings shall be numbered consecutively within each Division. Each shop drawing transmittal form shall list only items within the Division.
 - 3. All shop drawings and samples related to color choices and color issues shall be submitted at one time with all samples and colors submitted in triplicate.
 - 4. The distribution area in the center of the sheet shall be for the use of the Architect/Engineer only.
 - 5. The Contractor shall review, mark-up and stamp all shop drawings prior to submittal to the Architect. The Architect will use red ink for his markings; the Contractor shall use a color other than red.
 - 6. Changes from the Contract Documents on a shop drawing shall be listed in a letter of explanation accompanying the shop drawing.
 - 7. Separate submittals for Section 03 30 00 - Cast-in-Place Concrete, concrete mix design, shall be sent to the Structural Engineer and the Civil Engineer. Concrete mix design submittals are to be divided into submittals solely for the building and submittals solely for the site. A submittal shall be sent to the Structural Engineer when the submittal addresses the building. A submittal shall be sent to the Civil Engineer when the submittal addresses the site.
 - 8. A copy of the following list shall be updated monthly and submitted with the Application for Payment.
 - 9. All shop drawing dimensions shall be in English units and metric units or English units only. Shop drawings with dimensions in metric units only will be rejected.

1.08 SUCCESSFUL CONTRACTOR/SUPPLIER

- A. The successful contractor/supplier may, at their option, obtain electronic drawing files for architectural drawings (A Series Drawings) for use in preparation of shop drawings. This information is available from BCDM upon written request. A non-refundable one time charge of \$150 per request plus \$20 per drawing file requested (plus shipping and handling if required) will be required at the time of receipt of electronic files. The use of these drawing files is intended solely for the preparation of drawings as required by these Contract Documents. All other uses are strictly prohibited by Copyright law. The user of these electronic drawing files assumes full responsibility for their accuracy and scale.

1.09 SHOP DRAWINGS, PRODUCT DATA AND RELATED SAMPLES

- A. Shop drawings, product data and related samples shall be submitted as noted within each specification section.

1.10 CERTIFICATES

- A. Miscellaneous Certifications shall be submitted in duplicate for all items so noted in individual Specification Sections.
- B. Termite Control Certification Letter shall be submitted in duplicate by the Termite Control Subcontractor to the Architect after application of the specified treatment. Such letter shall certify that the full treatment has been completely applied in accord with the specifications and all applicable regulations.
- C. Asbestos Certification. Submit 2 copies of the certification regarding use of asbestos-free products as required by the Supplementary Conditions.
- D. Wood Treatment Certification. Submit 2 copies of a letter certifying that all wood requiring pressure treatment has been treated as specified for water resistance or fire resistance as outlined in Section 06 10 00.
- E. Silicone Building Sealant Certification. Submit 2 copies of certificates indicating products have been pretested to comply with performance requirements indicated in Section 07 92 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



TRANSMITTAL NO.

CONTRACTOR

ADDRESS

THE CONTRACTOR HAS REVIEWED THE ENCLOSED SHOP DRAWINGS
AND CERTIFIES THAT ALL MATERIALS ARE IN COMPLIANCE WITH
THE CONTRACT DOCUMENTS EXCEPT AS SPECIFICALLY NOTED.

CONTRACT

DATE _____

**SECTION 01 31 00
PROJECT MEETINGS**

PART 1 GENERAL

1.01 PRE-BID CONFERENCE

- A. There will be a Pre-Bid Conference held at Lewis Central High School at 9:00 a.m. local time on Thursday, June 26, 2025. Attendance of this Pre-Bid Conference is **suggested** for all General Contractors. Other subcontractors are highly encouraged to attend this Pre-Bid Conference. Additional times may be made available by appointment. To make an appointment, contact Brett Wallace, Project Advocates at (712) 355-8261 or Brett@project-advocates.com.

1.02 PRECONSTRUCTION CONFERENCE

- A. The Prime (General) Contractor and the Mechanical and Electrical Subcontractors shall attend a preconstruction conference at a time and location to be determined to discuss and clarify Contract Administration procedures. Representatives of the Owner and the Architect/Engineer will also attend.

1.03 PROGRESS MEETINGS

- A. The Prime (General) Contractor shall convene and conduct progress meetings during normal working hours at the construction site as required by the Architect/Engineer to discuss the progress of construction and properly coordinate respective responsibilities and schedules. The time, date, and location of these meetings shall be set by agreement of those involved. The Mechanical and Electrical Subcontractors shall also attend these meetings. A representative of the Owner and the Architect/Engineer will also attend these meetings when required to coordinate schedules and working relationships with the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 TESTING AGENCY

- A. Testing Agency for all soils testing including all overexcavation, recompaction, fill, building backfill, and miscellaneous backfill for mechanical and electrical items, and for all concrete testing, steel testing, special inspections and all other inspections hereinafter specified shall be Thiele Geotech, Inc. Phone 402-556-2171.

1.02 NOTIFICATION OF TESTING AGENCY

- A. Notification of Testing Agency that materials are ready for sampling, observation and testing shall be made by the Contractor. Such notification shall be made at least one day in advance.

1.03 SAMPLING

- A. Sampling shall be made by the Testing Agency's authorized representatives. The location from which the sample was taken shall be noted on the Test Report.

1.04 REPORTS SHALL BE DISTRIBUTED BY THE TESTING AGENCY AS FOLLOWS:

A. Architect/Engineer	one copy
B. General Contractor	one copy
C. Owner	one copy
D. Concrete Producer (concrete tests only)	one copy
E. Steel Fabricator (steel tests only)	one copy

1.05 PAYMENT

- A. Payments shall be made for testing and special inspections by the Contractor who shall forward all receipts for payment by the Architect. Adjustment will be made on the basis of receipts for payment received by the Architect.

1.06 THE CONTRACTOR

- A. The Contractor shall be responsible for maintaining close communication with the Testing Agency, particularly during the overexcavation/filling/recompaction phases for the building addition in order to assure that they are notified as to the schedule when such work is or is not going to take place. If the Contractor persistently fails to notify the Testing Agency when that work is not going to take place due to weather or other reasons, the costs of the unnecessary trips to the site by the Testing Agency shall be paid by the General Contractor from his/her own funds.

1.07 RETESTING

- A. Retesting and re-inspection of inspections due to failure shall be paid by the Contractor.

1.08 PATCHING

- A. Patching, if required by the taking of samples, shall be made by the Contractor.

1.09 TESTS ARE SPECIFIED IN THE FOLLOWING SECTIONS:

- A. 03 30 00 - Cast-in-Place Concrete
- B. 04 20 00 - Unit Masonry
- C. 05 12 00 - Structural Steel Framing
- D. 05 21 00 - Steel Joist Framing
- E. 05 31 00 - Steel Decking
- F. 05 40 00 - Cold-Formed Metal Framing
- G. 07 84 00 - Firestopping

Lewis Central High School
Entry Addition

H. 31 20 00 - Earthwork

I. Div. 21 thru 23 Miscellaneous Backfill for Buried Mechanical Items

J. Div. 26 thru 28 Miscellaneous Backfill for Buried Electrical Items

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 WATER

- A. All water required for construction activities will be furnished by the Prime (General) Contractor as may be needed for the entire prosecution of the Work. The cost of the water used will be paid by the Prime (General) Contractor. The Contractor shall be responsible for furnishing all hoses and piping necessary to extend the water services to the construction areas, and shall be responsible for returning existing water sources to their original condition at completion of the project.

1.02 TEMPORARY POWER AND LIGHTING

- A. Temporary power will be provided throughout the construction period by the Prime (General) Contractor for use by all trades, Contractors, and Subcontractors for the following purposes:
 - 1. Operation of miscellaneous power tools and equipment
 - 2. Temporary lighting
 - 3. Power and lighting in temporary construction site office and storage buildings (if any).
 - 4. Testing and checking equipment
 - 5. Welding units
 - 6. Night security lighting
 - 7. Other general construction power needs
- B. All power sources, load centers, distribution boxes, circuit breakers, and other materials, including the methods of installing them, will be as required for safe working conditions and as required by applicable Codes and Ordinances.
- C. Where possible, at areas of the existing building in which construction work will take place, temporary lighting will be provided during the construction period by the Owner via the existing lighting for use by all trades, Contractors and Subcontractors up until such time where existing lighting which is to be removed is no longer operational. The Prime Contractor shall be responsible for adding whatever additional temporary lighting (over and above that provided by the existing building lighting) might be required for proper execution of the work. See list of required footcandle levels below. In areas where existing ceiling and lighting will be removed, the Prime (General) Contractor shall provide temporary lighting as specified below.
- D. At all new building areas, temporary lighting shall be provided during the construction period by the Prime (General) Contractor for use by all trades, Contractors, and Subcontractors for safe and adequate working conditions throughout the building, and shall provide minimum illumination measured in foot candles (FC) at the floor line as follows:

1. General area and walkway lighting	5 FC
2. Mechanical and electrical rooms	20 FC
3. General, electrical and mechanical rough work areas	10 FC
4. Concrete, masonry and finish work areas	20 FC
- E. Cost of electrical energy used during construction at all areas will be paid by the Owner. The Contractor shall make every effort to conserve the use of electrical energy and minimize those costs to the Owner.

1.03 SANITARY CONVENIENCES

- A. Sanitary conveniences for use by all persons employed on the Work shall be provided and maintained by the Prime (General) Contractor.
 - 1. New and existing building toilets, sinks, and other plumbing fixtures may not be used by Construction Personnel.

1.04 SECURITY AND WEATHER PROTECTION.

- A. The Prime (General) Contractor shall be responsible for proper security for the building at all times. He/she shall also schedule his/her work and provide temporary facilities and materials as

required to assure continuous proper weather protection of all spaces for the duration of the construction process.

- B. This requirement will be strictly enforced in order to minimize the potential for damage to the nearly completed Project and resulting time delays.

1.05 COLD WEATHER PROTECTION

- A. The Prime (General) Contractor shall be responsible for adequately protecting utilities, supplies, and equipment for the Work during cold weather. Items subject to cold weather damage shall be protected by covering, insulating, or storing in a heated space. During cold weather, temporary enclosures shall be erected at exterior openings which are not filled in immediately to minimize heat loss from the existing building.
- B. Temporary protection of new finishes. The Prime (General) Contractor and all Subcontractors shall protect carpet and other new finishes, whether installed under this Contract or by others as required to prevent damage to those materials due to construction activities which occur after those finishes are installed.

1.06 TEMPORARY HEAT

- A. Temporary heat for all building areas shall be furnished by the Prime (General) Contractor until the time when the permanent heating systems for those areas are operational. Up until that time, all temporary heating costs shall be paid for by the Prime (General) Contractor. Electric space heaters will not be acceptable for this preliminary heating source. After the permanent heating systems are operational, they may be used to supply temporary heat after approval to do so has been received from the Architect/Engineer, and the cost of fuel used will be paid by the Prime (General) Contractor.
- B. Wherever the permanent new heating and cooling systems are used to provide temporary heat and cooling, approval to use these systems must first be obtained from the Architect/Engineer. Costs for filter replacement, warranty extension to meet the requirements of the General Conditions, and cleaning at the termination of the heating and cooling periods shall be borne by the Prime (General) Contractor. Warranties for all equipment shall begin at the date of Substantial Completion even though the equipment may have been used for temporary heat and cooling prior to that time. See Section 01 11 00 for additional heating requirements of the existing building.
- C. **NO PROPANE BURNERS OR SIMILAR OPEN FLAME HEATERS WILL BE ALLOWED WITHIN THE BUILDING.**

1.07 DUSTPROOF ENCLOSURES

- A. When demolishing and remodeling portions of the existing building, the Prime Contractor shall provide temporary dustproof partitions at all openings where dust producing work will be accomplished in order to protect the existing building areas scheduled to remain from dust and dirt. Temporary partitions shall consist of a minimum of wood or metal studs with untaped 1/2-inch gypsum wallboard on the public side (both sides if they are both exposed to the public). Where required by the applicable Code Authorities, temporary partitions shall be 5/8-inch fire-taped, fire-rated GWB on both sides of wood or metal studs. The Contractor shall also erect temporary walls where excessively noisy activities would severely hamper adjacent occupied room functions.

1.08 MAINTENANCE OF EXITS

- A. During renovations of the existing building, the Prime Contractor shall maintain means of egress, free and unobstructed from the existing exits as required by the City of Council Bluffs Building Inspector, State Fire Marshal, and other responsible authorities.

1.09 BARRICADES, FENCES, AND PROTECTION

- A. The Prime (General) Contractor shall erect temporary barricades, fences and other protective items as necessary to provide for the general safety of the public during the construction of this project. As a minimum, 4-foot high sound snow fencing with posts at 10-foot centers shall be provided. These minimum requirements may be exceeded by the Contractor at his/her option

since he/she is responsible for safety at the project site. Where the existing fencing is removed to provide temporary access to the site, it shall be reinstalled or replaced to match existing conditions at the end of the construction day.

1.10 OFFICES AND STORAGE FACILITIES FOR THE CONTRACTORS AND SUBCONTRACTORS

- A. The Prime (General) Contractor shall maintain on the site as necessary for the proper conduct of the Work offices and storage facilities for the Contractor and Subcontractors. After consulting with the Architect/Engineer, these shall be located on the site so that they cause no interference to Work performed on the site under this Contract or by others or to traffic on adjoining streets. Material and equipment may not be stored on parking and drive areas without permission of the Owner, and such items may not be stored on public streets without permission of the City of Council Bluffs.
- B. Removal of temporary offices and storage facilities. Upon completion of the project, or as directed by the Architect/Engineer, remove the temporary offices and storage facilities, and leave the premises in the condition required by the Contract. All areas affected by the construction shall be finely graded to the profile shown on the Drawings (or to their original profile at areas where the existing contours are shown to be unchanged) in preparation for installation of sod or seed by the Owner. The Contractor shall make every effort to restrict his/her construction activities to the areas shown to receive grade changes and enclosed by the construction fence.

1.11 PARKING

- A. Parking for construction personnel may take place on the existing parking lot areas as directed. Details related to on-site parking to be coordinated with the Owner once a contract has been awarded. Parking on public streets must be coordinated and approved by the City of Council Bluffs. Permitted parking on public streets shall not cause inconvenience and disturbance to neighbors and traffic near the site.

1.12 CLEAN UP

- A. The Prime (General) Contractor shall maintain all site areas involved in the Work of this Contract in a clean condition throughout the construction period. The Contractor shall also clean adjoining streets soiled by removal activities as may be required by the governing authorities. In addition, all paving areas shall be cleaned of all dirt, dust, debris and snow at time of Substantial Completion.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 60 00
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 MATERIALS AND EQUIPMENT

- A. Material and equipment shall be of the manufacturer, model, and type specified. Substitute materials and equipment approved prior to bidding, in accord with the Instructions to Bidders, are incorporated into this Project Manual as Addenda.

1.02 MATERIALS AND EQUIPMENT OF ACCEPTABLE MANUFACTURER

- A. An item of material or equipment may be used in place of an item which is specified by manufacturer and model number and type by conforming to all of the following provisions:
 - 1. The item is manufactured by one of the acceptable manufacturers listed in the Project Manual, Drawings, or Addenda.
 - 2. The item of material or equipment meets or exceeds the minimum qualities established by the specified item.
 - 3. The item is used throughout the project so that all items of material or equipment used in place of specified items are of the same make and type.
 - 4. The entire cost of all modifications which result from the use of items in place of specified items shall be borne by the Contractor who uses such items, at no additional cost to other Contractors or to the Owner.
- B. The Architect/Engineer has detailed and specified around a specific manufactured product for certain items. Although additional manufacturers are specified in Contract Documents, it is the Contractor's responsibility to coordinate the requirements of the product selected with all building components.

1.03 REPEATED FEATURES AND MATERIALS

- A. Repeated features and materials must be constructed alike, although detailed or indicated only once. Detail and ornament must continue throughout all moldings, bands, etc. Where items, devices and equipment are specified singular in number, the Specification shall apply to as many items, devices and pieces of equipment as are shown on the Drawings or required to complete the installation. Repeated items of equipment and materials shall be of the same manufacturer, model number and type.

1.04 WHEN BULKY MATERIALS AND EQUIPMENT ARE FURNISHED BY OTHERS

- A. The Prime (General) Contractor shall, upon receipt of notice in ample time, leave proper openings to permit the installation and properly close such openings afterwards.

1.05 WHEN EQUIPMENT IS FURNISHED BY OTHERS

- A. The Contractor shall use the manufacturer's detail drawings to establish roughing in dimensions and location of services. In case of conflict, the equipment detail drawings and dimensions shall be used, except where aesthetic or structural considerations make an adjustment necessary.

1.06 DISCREPANCIES

- A. In the event of discrepancies within the Drawings, within the Project Manual or between the Drawings and Project Manual, the discrepancies shall be brought to the attention of the Architect/Engineer immediately before proceeding with the affected work. The Architect/Engineer will make a written interpretation.
- B. If the Contractor fails to notify the Architect/Engineer of discrepancies and proceeds with the Work where discrepancies occur, such Work shall be considered done at the Contractor's risk. No excuse will thereafter be entertained for failure to carry out Work in a manner satisfactory to the Architect/Engineer.

1.07 STANDARDS

- A. Materials and processes for which standards have been adopted by ASTM, or other industry recognized organizations, shall conform to those standards. Methods shall be those recommended by the manufacturer of the material involved.

1.08 MEASUREMENTS

- A. Before ordering material and doing work, the Contractor shall verify measurements at the building and the site and be responsible for same. Extra compensation will not be allowed for differences between actual dimensions and measurements indicated on the Drawings. The Contractor shall submit differences to the Architect/Engineer.

1.09 CHASES, OPENINGS, INSERTS, ETC

- A. The General Contractor shall build into all new construction necessary chases, slots and openings required for his/her own or other contractor's work as shown on the Drawings or requested by other contractor's for their work. He/she shall cooperate with other contractors in the proper installation of sleeves, inserts, etc., furnished by the contractor or subcontractor concerned unless otherwise shown or specified.

1.10 CUTTING AND PATCHING

- A. Cutting, fitting and patching necessary to fit the several parts of this or other contractor's work together, or cutting, fitting, and patching of existing construction and new work in place shall be the expense of the contractor concerned. Each contractor shall determine and be responsible for proper location and character of all inserts, holes, chases, and other openings in new and existing construction, and give the other interested contractors proper notification with regard to same.
- B. Cutting, fitting, repairing, patching, etc., required whether it be in existing construction, new work in place or executing the initial installation, must be done by craftsmen skilled in their respective trades. Repair cut surfaces to match adjacent surfaces.

1.11 SUBSTITUTIONS

- A. Mill tests, chemical analysis, manufacturer's specifications, and such other information as is available shall be submitted as proof of quality when presenting substitute materials for Owner's approval. If the Contractor proposes the construction method other than that shown or specified, complete drawings and engineering notes shall accompany the request. The Contractor shall reimburse the Architect for architectural and engineering service furnished, time required for checking the proposed change, and drafting time required for preparing as built drawings made necessary by substitutions.

1.12 STABILITY

- A. Members shall be rigid and securely anchored. Members subject to vibration or wracking shall be attached with through bolts or cinch bolts. Connections shall be adequate to withstand all strains to which they normally would be subjected.

1.13 TRUENESS

- A. Surfaces and joints of all materials fabricated on or off the site into a single article or composition, or into an assembly of units, shall be uniform, true, plumb, level, properly curved or pitched as required and free from defects and blemishes.

1.14 COORDINATION

- A. The Contractor shall coordinate his/her work with that of the other contractors and shall cooperate with them to the fullest extent. He/she shall order all materials promptly so that they will be available when needed and not delay the installation of items by other contractors.

1.15 THE PRIME (GENERAL) CONTRACTOR

- A. The Prime (General) Contractor shall give ample notice of his/her and other contractor's intended operations including current progress schedules, directing their activities on the job to assure orderly procedures with the interests of the Owner's obligations to the public in mind.

Lewis Central High School
Entry Addition

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 78 00
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 CLEANING

- A. When the project is completed, the General Contractor shall clean all site and building areas affected by this work, removing all rubbish and excess materials, no matter by whom it is left. Dust accumulations shall be totally removed from all interior surfaces. See General Conditions and individual Specification Sections for further clean-up requirements.

1.02 SUBMITTALS

- A. The following submittals shall accompany the Contractor's final Application for Payment. Submittals shall be submitted in duplicate unless otherwise specified in the Sections indicated.
1. 01 29 00 Contractor's Affidavit of Payment of Debts and Claims
 2. 01 29 00 Certification of Unemployment Compensation Contributions
 3. 01 29 00 Contractor's Affidavit of Release of Liens (AIA Document G706A, latest edition)
 4. 01 29 00 Individual Releases of Waivers of Liens from Subcontractors and Suppliers
 5. 01 29 00 Consent of Surety of Final Payment (AIA Document G707, latest edition)
 6. 07 19 00 Water Repellent Warranty
 7. 07 42 13.23 Metal Wall Panel Warranty
 8. 07 53 23 EPDM Roofing System Warranty
 9. 07 62 00 Sheet Metal Flashing and Trim Warranty
 10. 07 92 00 Silicone Joint Sealer Warranty
 11. 08 14 16 Flush Wood Door Warranty
 12. 08 43 13 Aluminum Frame and Door Warranty
 13. 08 71 00 Finish Hardware Warranty
 14. 08 80 00 Glazing Warranty
 15. 10 11 00 Visual Display Boards Warranty
 16. 12 24 00 Window Shades Warranty
 17. Divisions 21 thru 28 Various Mechanical and Electrical Warranties as noted

1.03 INSPECTION CERTIFICATES

- A. Inspection certificates issued by regulatory agencies shall be submitted to the Architect/Engineer before final payment.

1.04 TESTING REPORTS

- A. Testing reports shall be submitted to the Architect/Engineer before final payment, and shall include the following:
1. Performance Tests
 2. Water System Disinfection Reports
 3. Air Balancing Reports

1.05 COORDINATE

- A. Coordinate with requirements of Commissioning as outlined in various sections throughout the project manual.

1.06 RECEIPTS FOR TESTING COSTS

- A. Receipt for testing costs as specified in Section 01 40 00, Quality Control Services, shall be submitted to the Architect/Engineer before final payment.

1.07 PROJECT RECORD DRAWINGS

- A. Project Record Drawings shall be delivered to the Architect/Engineer before final payment in accordance with the General Conditions of the Contract. Record drawings shall be a copy of

the Contract Drawings, properly marked to reflect changes made during construction, and with undamaged edges.

- B. These drawings shall be the Contractor's separate field set on which he/she has accurately marked changes that were made during construction.

1.08 OPERATION AND MAINTENANCE MANUALS AND REPAIR KITS

- A. Operation and Maintenance Manuals and Repair kits shall be submitted to the Architect/Engineer in duplicate before final payment or earlier when specified. Data to be included is as follows:
 - 1. Water Repellent Maintenance Data
 - 2. Roofing Maintenance Data
 - 3. Hardware Maintenance Data
 - 4. Acoustic Ceiling Tile Maintenance Data
 - 5. Carpet Maintenance Data and Repair Kits
 - 6. Visual Display Board Maintenance Data and Kits
 - 7. Mechanical and Electrical Operating and Maintenance Data, Parts Lists, Lubrication Schedules, Diagrams and Accessory Schedules
- B. Operation and Maintenance Manuals shall be bound in plastic or vinyl-covered 3-ring binders (Submit one copy). The binders shall be large enough to accommodate all materials and shall be marked with tabs to identify the contents. In addition to the hard copies Operation and Maintenance Manuals shall also be submitted in PDF form by approved external storage media or digital file transfer.

1.09 INSTRUCTIONS FOR THE OWNER

- A. On completion of the project, the Contractor shall demonstrate the proper operation and maintenance procedures for all mechanical, electrical and operating general construction items prior to final acceptance by the Owner. Such demonstration sessions shall be video-recorded by the Contractor at his/her expense. One copy of each video-recording shall be in DVD format, and turned over to the Owner.

1.10 EXTRA STOCK

- A. Extra Stock shall be delivered to the Owner before final payment, and shall include the following:
 - 1. Paint
 - 2. Carpet
 - 3. Tile
 - 4. Vinyl Base
 - 5. Acoustical Ceiling Tile
 - 6. Cubicle Curtains
 - 7. Mechanical/Electrical Items as may be noted in Divisions 22 thru 28 and on the Drawings

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS

**SECTION 02 41 00
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 78 00 - Closeout Submittals: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

- A. Pre-Demolition Conference:
 - 1. Once the ceilings have been removed, prior to any demolition related to any walls and/or structural items, the General Contractor shall hold a Pre-Demolition Conference with the General Contractor, Demolition Sub-Contractor, Architect, Structural Engineer and Owner to review limits of demolition and the Contractor's proposed means and methods to perform the work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Not Used.

PART 3 EXECUTION

3.01 DEMOLITION

- A. Refer to Drawings for scope of demolition.
- B. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. The Contractor shall thoroughly review the site, the building, and the Bidding Documents before submittal of bids in order to determine the scope of the demolition involved.

- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- F. Protect existing structures and other elements to remain in place and not removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- G. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- H. Hazardous Materials:
 - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
 - 2. If the Contractor discovers material which he/she suspects may contain asbestos, he/she shall immediately notify the Owner and cease work in close proximity to the suspected asbestos containing material. The Owner will then arrange for the testing and removal of the asbestos material. If time delays are encountered because of required asbestos removal work, the schedule shall be adjusted accordingly by Change Order.
- I. Remove building materials regardless of how they are constructed. Components shall be removed as follows:
 - 1. Demolish masonry walls in small sections.
 - 2. Remove structural steel and wood framing, etc. by individual pieces and lower carefully.
 - 3. Completely remove floor slabs, pavement and walks regardless of depth below the surface. Under new paving and walk areas, abandoned utilities shall be removed to a depth of at least 3-feet below finished grade.
 - 4. Remove materials where shown or required.
 - 5. Remove area of walks, drives, curbs, rubbish, junk, and miscellaneous items.
 - 6. Where paving, slabs and curbs are removed next to paving, slabs and curbs scheduled to remain, the paving, slabs and curbs shall be saw-cut to provide a straight edge.
 - 7. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors and framing.

- J. The Contractor shall be responsible for providing all necessary temporary shoring and supports as required during removal of existing walls, floors, and other structural items and until final structural replacement items are in place. He/she shall be responsible for damage to existing facilities which are scheduled to remain caused by his/her demolition operations. The Architect/Engineer will not be responsible for problems/accidents which occur because of the Contractor's failure to thoroughly inspect the structure and review the drawings of the existing building before removing such items. A copy of the Owner's drawings of the existing building will be made available for review at the Owner's office prior to receipt of bids and during construction of the project. These drawings may be helpful to the Contractor in determining the sequence or methods of removal for certain items. The Contractor shall be responsible for verifying the accuracy of such existing drawings before making decisions regarding demolition based upon them.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 - 1. Verify construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 - 1. Provide, erect, and maintain temporary 1-hour fire-rated partitions to separate areas of the building under construction from areas occupied by the Owner. Coordinate the locations of these walls with the local Authority having Jurisdiction to meet egress requirements.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. The following items shall be carefully removed by the Contractor and delivered to the Owner at a location designated by the Owner:
 - a. Other items as may be noted on the Drawings.
 - 3. Items to be removed and reinstalled by the Contractor shall be as follows:
 - a. Existing Office Furnishings as noted on the Drawings.
 - b. Existing Office Casework as noted on the Drawings.

DIVISION 03 – CONCRETE

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

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.
 - 3. Concrete reinforcement

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Qualification Data: For installer, manufacturer, and testing agency.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates
- F. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Semirigid joint filler.
 - 11. Joint-filler strips.
 - 12. Repair materials.
- G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- H. Field quality-control test and inspection reports.
- I. Laboratory test reports for concrete materials and mix design tests in accordance with ACI 318 Chapter 5 requirements for laboratory trial batch method of "field experience method".

- J. Shop Drawings: Submit shop drawings for reinforcement detailing fabrication, bending and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. 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."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Plain-Steel Wire: ASTM A 82, galvanized.

2.02 REINFORCEMENT ACCESSORIES

- A. 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," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I or Type II
 - a. Cement is to have alkalinity of .6% or less.
 2. Fly Ash: ASTM C 618, Class C.
 - a. Limit the use of fly ash as follows:
 - 1) Fly ash shall not be used in slabs unless specifically directed by the finishing contractor.
 - 2) If the use of fly ash in slabs is elected, do not exceed 15% of cement content by weight with 1:1 replacement ratio.
 - 3) For all other concrete members do not exceed 30% of cement content by weight with 1:1 replacement ratio.
 3. Blended Hydraulic Cement ASTM C565, Type IL, Type IP.
 - a. Type IP at structural stoops to match Sidewalk Paving.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S.
1. Maximum Coarse-Aggregate Size: **3/4 inch** nominal or NDOR 47B.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.04 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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.

2.05 FLOOR AND SLAB TREATMENTS

- A. Under slab Vapor Barrier: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited. The vapor barrier shall have the following characteristics
1. Permeance shall be less than 0.01 Perms [grains/(ft² *hr * in.Hg)] per ASTM E1745.
 2. Strength: ASTM E 1745, Class A
 3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor barrier.
 4. Manufacturers:
 - (a) Fortifiber Building Systems Group;
 - (b) Insulation Solutions, Inc;
 - (c) Interplast Group

- (d) Stego Industries, LLC;
- (e) Raven Industries, Inc;
- (f) Reef Industries, Inc;
- (g) Substitutions: See Section 016000 - Product Requirements.

2.06 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.07 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.08 CONCRETE MIXTURES, GENERAL

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

- D. Mix designs to provide normal weight concrete which meet compressive required by the drawings. Use air entrained concrete for all concrete unless otherwise indicated. The maximum water cement ratios are to be as follows:
 - 1. 4000 psi 28 day compressive strength; a maximum water cement ratio of .50
 - 2. 3500 psi 28 day compressive strength; a maximum water cement ratio of .53
 - 3. If submittals do not meet the requirements of ACI 318 Chapter 5, the following criteria shall be met:
 - a. 4000 psi 28 day compressive strength; a maximum water cement ratio of .48
 - b. 3500 psi 28 day compressive strength; a maximum water cement ratio of .50
 - 4. Addition of Water on Site: Water may be added to the concrete on site for adjustment of slump only to the limit of the specified water/cement ratio. In no case may the water/cement ratio be exceeded. Concrete supplier shall indicate in the mix design submittals the maximum amount of water per yard that can be added on site
- E. Air entrain all concrete except slabs, or unless otherwise noted. Total air content to be 5 to 7 percent as determined by ASTM C173..
- F. Up to 15% fly ash can be substituted for cement in slab concrete mixes with Architect's approval of mix design.
- G. Up to 30% fly ash can be substituted for cement in footing concrete mixes with Architect's approval of mix design.

2.09 FABRICATING REINFORCEMENT

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

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, 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.
- B. Project-Site Mixing: Is not allowed unless approved by engineer of record.

PART 3 EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, 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.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- K. Granular Course: Place 3 ½" granular fill and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus ¾ inch (19 mm) before installing vapor barrier.
 - 1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.02 EMBEDDED ITEMS

- 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.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISI's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of slabs, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.05 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.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 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 will 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.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.06 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to amount approved by mix designs.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.07 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. Select types of slab finishes required from remaining paragraphs. Coordinate finishes selected with finish schedule or indicate location of each finish on Drawings.
- C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
 1. Apply scratch finish to surfaces indicated.
- D. 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 indicated to receive trowel finish..
- E. 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 indicated, 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.
- F. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

3.08 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for conformance to specified tolerances.
- B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
 1. Typical: F(F) of 35; F(L) of 24.
 2. Locations with thin-bed porcelain tile installations when a cementitious bonding material will be used, including large and heavy tile mortar: F(F) of 50; F(L) of 35

- C. At thin-bed porcelain tile installations when a cementitious bonding material will be used, including large and heavy tile mortar: maximum allowable variation in the tile substrate is 1/8" in 10' (3mm in 3m) from the required plane, with no more than 1/16" variation in 24" (1.5mm variation in 600mm) when measured from the high points in the surface.
- D. Measure F(F) and F(L) in accordance with ASTM E1155, within 8 hours after the final trowling operation; report both composite overall values and local values for each measured section.
- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.09 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

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 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. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. 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 with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 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.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will 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 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches (50 mm)** deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 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.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a **No. 16 (1.18-mm)** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/2 inch (13 mm)** in any dimension in solid concrete, but not less than **1 inch (25 mm)** in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of **0.01 inch (0.25 mm)** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch (6 mm)** to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes **1 inch (25 mm)** or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a **3/4-inch (19-mm)** clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes **1 inch (25 mm)** or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
- 1). Testing Frequency: Obtain at least one composite sample for each **100 cu. yd. (76 cu. m)** or fraction thereof of each concrete mixture placed each day.
 1. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is **40 deg F (4.4 deg C)** and below and when **80 deg F (27 deg C)** and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
- b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than **500 psi (3.4 MPa)**.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to **ASTM E 1155 (ASTM E 1155M)** within 24 hours of finishing.

END OF SECTION

- c. Certain Communications equipment including, but not limited to, intercom phones and video intercoms as noted on the Drawings.
 - d. Certain Audio Visual equipment as noted on the Drawings.
 - e. Existing Refrigerator.
 - f. Existing Cot.
 - g. Existing Fire E
 - h. Certain ATC Pads and Grid.
 - i. Existing Bell and Plaque as noted on the Drawings.
 - j. Other items so noted on the Drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
- 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. 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.
- F. Protect existing work to remain.
- 1. Prevent movement of structure. Provide shoring and bracing as required.
 - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Materials shall not be stored on the site for sale, nor shall the Contractor conduct any sale on the site. The Owner reserves the right to remove any materials scheduled for demolition prior to the scheduled time of removal and to retain such materials as their property.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 03 32 20
CONCRETE FLOOR UNDERLAYMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Self-leveling concrete underlayment as indicated on the Drawings – See Sheet A1-1 for locations.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 REFERENCES

- A. ACI 302.1R - Guide to Concrete Floor and Slab Construction.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each product, including information on compatibility of different products and limitations.
- C. Furnish data, laboratory test reports and materials certificates as specified in the Section 03 31 00, "Concrete Work."

1.06 QUALITY ASSURANCE

- A. Installer's Qualifications shall be by an applicator authorized by the manufacturer using manufacturer's approved mixing and pumping equipment for the installation of the specified product.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered in their original, unopened packages and protected from exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

1.08 FIELD CONDITIONS

- A. Before, during and after installation of gypsum cementitious underlayment, building interior shall be enclosed and maintained at a temperature above 50 degrees F (10 degrees C).
- B. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section. Install quickly if substrate is warm and follow warm weather instructions available from the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Self-Leveling Floor Underlayment:
 - 1. ARDEX Americas; ARDEX Feather Finish: www.ardexamericas.com.
 - 2. Maxxon Corp., Level-Right Self-Leveling Floor Underlayment: www.maxxon.com.
- B. Sand Aggregate: Washed masonry or plaster sand, 1/8-inch or less particle size.
- C. Water: Potable and free of impurities.
- D. Subfloor Primer: As required by the manufacturer.

2.02 MIX DESIGNS

- A. General: Mix proportions and methods shall be in strict accordance with product manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Apply materials in accordance with manufacturer's instructions.
- B. General: Subfloor shall be structurally sound. Clean subfloor to remove all mud, oil, grease and other contaminating material prior to the installation of the underlayment.
- C. Leak Prevention: Fill all cracks and voids with quick setting patching or caulking material where leakage of underlayment could occur.
- D. Primer: Prime subfloor using the floor primer complying with manufacturer's printed instructions. Priming instructions may vary according to type of substrate. Apply multiple coats where required by the manufacturer.
- E. Mixing: Comply with manufacturer's printed instructions.
- F. Application of Self-Leveling Concrete Underlayment shall not begin until the building is enclosed, including windows, doors and other fenestration. Install after drywall installation.
- G. Application: Comply with manufacturer's printed instructions. Place Self-Leveling Concrete Underlayment over concrete from a maximum of 3-inches thick to featheredge as required in conjunction with grinding of the existing concrete floor to create a level surface with no more than 1/4" variation in height over a 10'-0" run. Spread and screed underlayment to a smooth surface. Except at required joints, place underlayment as continuously as possible until application is complete so that no product slurry is placed against underlayment that has obtained its initial set.
 - 1. Comply with the Floor Flatness and Levelness Values as specified in 03 30 00 - Cast-in-Place Concrete:
 - a. Under Carpeting: F(F) of 25; F(L) of 20.
 - b. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25.
- H. Drying: Provide continuous ventilation and adequate heat. Provide mechanical ventilation if required by the manufacturer. To test for dryness, tape a 24-inch by 24-inch section of plastic to the surface of the underlayment. After 48 to 72 hours, if no condensation occurs, the underlayment shall be considered moisture free.

3.02 QUALITY CONTROL

- A. Slump Test: At least one set of 3 molded cube samples shall be taken from each day's pour during the underlayment application. Cubes shall be tested recommended by the manufacturer's recommendation in accord with ASTM C109/C109M. Test results shall be available to Architect upon request from applicator.
- B. Protection: During construction, place temporary protection over the underlayment where subject to heavy wheeled or concentrated loads.

END OF SECTION

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast concrete sills and cap as detailed on the Drawings.
- B. Supports, anchors, and attachments.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Masonry accessories including drip edge.
- B. Section 07 19 00 - Water Repellents.
- C. Section 07 92 00 - Joint Sealants: Sealing perimeter and intermediate joints.
- D. Section 09 99 99 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- F. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- I. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- M. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.
- N. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).
- O. PCI MNL-122 - Architectural Precast Concrete; 2007.
- P. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
- Q. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

- C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Conduct field verifications of conditions as required to provide precast units sized to fit openings with typical 3/8-inch joints.
- D. Samples: Submit two samples, 12 by 12 inch in size, illustrating surface finish, color and texture.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Firm having at least 5 years of experience in production of precast concrete of the type required.
 - 2. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.

1.06 MOCK-UPS

- A. Provide a mock-up sample of each Architectural Precast color for Owner/Architect review and approval.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, warping, staining and other physical damage and so that markings are visible.
- B. Handling: Lift and support precast units only from support points.
- C. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.
- D. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Precast Concrete:
 - 1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www.pci.org/#sle.

2.02 PRECAST UNITS, GENERAL

- A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.
 - 1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.
 - a. Backup Mix: Same aggregate-cement ratio as face mix; achieve 28 day compressive strength of 5000 psi.
 - b. For all non-vertical exterior surfaces, water absorption shall not exceed 5 to 6 percent by weight, except between 3 to 4 percent for sloping surfaces (sills).
 - 2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
 - 3. Calculate structural properties of units in accordance with ACI CODE-318.
 - 4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.03 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
- B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.

- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected or stainless steel protected.

2.04 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal or Type III - High Early Strength Portland type.
 - 1. Cement for all precast units shall be a mixture of "white" cement and pigment to match sample in the Architect's office.
- B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.
- C. Aggregate shall be consistent and equal quality gradation and color throughout the Project and shall match the aggregate in the sample at Architect's office.
- D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 - 1. Color(s): To match existing.
- E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- F. Air Entrainment Admixture: ASTM C260/C260M.

2.05 SUPPORT DEVICES

- A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
 - 1. Clean surfaces of rust, scale, grease, and foreign matter.
- B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563/A563M nuts and matching washers.

2.06 FABRICATION

- A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.
- B. Maintain plant records and quality control program during production of precast units. Make records available upon request.
- C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
 - 1. Forms to be used are to be determined by the fabricator. Forms may be of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.
- D. Maintain consistent quality during manufacture.
- E. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
- F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.
- G. Place recessed flashing reglets continuous and straight.
- H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

2.07 ACCESSORIES

- A. Drip Edge: Specified in Section 04 20 00 - Unit Masonry

2.08 SOURCE QUALITY CONTROL

- A. Provide testing and analysis of concrete mix.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 ERECTION

- A. Erect units without damage to shape or finish. Replace or repair damaged panels.
- B. Erect units level and plumb within allowable tolerances.
- C. Align and maintain uniform horizontal and vertical joints as erection progresses.
- D. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.
- E. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.
- F. Anchor units in final position by bolting, welding, grouting or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.
- G. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.
- H. At welded connections apply rust-inhibitive coating on damaged areas, same as shop-applied material. Use galvanized repair coating on galvanized surfaces.

3.03 REPAIR

- A. Repair of damaged units shall be done by a representative of the manufacturer to the Architect/Engineer's satisfaction. Limitations as to the amount of patching which will be permitted is subject to acceptance of the Architect. Precast which cannot be repaired to the satisfaction of the Architect shall be removed and replaced.
- B. In addition to above, in-place precast units may be rejected for any one of the following:
 - 1. Exceeding specified installation tolerances.
 - 2. Damaged during construction operations.
 - 3. Exposed-to-view surfaces which develop surface deficiencies.
 - 4. Other defects as listed in PCI MNL-117.

3.04 CLEANING AND SEALING

- A. Clean exposed facings to remove dirt and stains which may be on units after erection and completion of joint treatments. Wash and rinse in accordance with precast manufacturer's recommendations. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes which could change the character of exposed concrete finishes. When units are clean and dry, and all building sealant application is complete, all precast items shall be protected with water repellent as specified in Section 07 19 00.

END OF SECTION

DIVISION 04 – MASONRY

**SECTION 04 20 00
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Loose steel lintels and Fabricated steel items.
- B. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.
- C. Section 07 27 00 - Air Barriers: Air barriers applied to exterior face of backing sheathing or unit masonry substrate.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- E. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- G. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.
- H. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
- I. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- J. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.
- K. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
- L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
- O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

- Q. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- R. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).
- S. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- T. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- U. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- V. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- W. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Masonry Conference: Prior to the installation of masonry and associated work, and after approval of required job mock-up, the General Contractor shall arrange a Pre-masonry conference at the site at a pre-arranged time approved by the Architect/Engineer. The conference shall include in attendance the masonry subcontractor and his/her jobsite foreperson, and the Architect/Engineer. The Contractor shall record discussions and agreements that are made, which are not specifically addressed in the Contract Documents, and shall furnish a copy to all involved participants.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit two samples of facing brick and mortar units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. All work shall comply with the latest standards of the Brick Institute of America (BIA) and Portland Cement Association (PCA).
- B. The Brick Manufacturers shall closely coordinate with the Architect/Engineer to assure that the brick on the sample panels match the panels available for review at the office of the Architect/Engineer.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

<u>Course Aggregate</u>	<u>4-Hour</u>	<u>3-Hour</u>	<u>2-Hour</u>	<u>1-Hour</u>
Expanded Slag or Domic	4.7	4.0	3.2	2.1
Expanded Clay or Shale	5.7	4.8	3.8	2.6
Limestone, Cinders, Unexpanded Slag	5.9	5.0	4.0	2.7
Calcareous Gravel	6.2	5.3	4.2	2.8
Siliceous Gravel	6.7	5.7	4.5	3.0

1.07 MOCK-UPS

- A. Construct a masonry wall as a mock-up panel sized 6 feet long by 4 feet high; include weep holes, mortar, accessories, structural backup, sill mock-up, flashings (with lap joint, corner, and end dam), wall insulation, and a properly caulked control joint in mock-up.

- B. Locate mock-up on site in location directed by the Architect, on a pallet so that the pallet can be moved about the site as required.
- C. All sample mock-ups to be saved until the end of project. This includes rejected and approved samples. When directed, demolish mock-up and remove from site.
- D. Masonry work shall not progress until the cleaned down and dried sample panel is approved by the Architect/Engineer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Masonry units shall be delivered, unloaded and handled in a manner to adequately protect exposed corners, edges and faces from chipping, cracking and other damage. Such chipped and otherwise damaged units shall not be utilized in exposed wall areas, but may be selected for utilization in concealed wall areas, if damaged characteristics are minor and do not affect the structural integrity of the wall.
- B. Brick masonry units shall be inspected by the distributor or manufacturer to insure color match with the approved sample panel at the jobsite prior to installation within the wall. Units not matching the approved sample shall not be placed in exposed wall areas.
- C. Delivery of mortar materials other than aggregate and water shall be in sealed and labeled packages.
- D. Do not order colored mortar for brickwork until the sample panel has been approved at the job site.
- E. Masonry units shall be stored off the ground on pallets or in some manner that will prevent absorption of moisture from the ground and the soiling of masonry units. Concrete masonry units shall be protected from becoming wet from rain, snow and capillary action. All masonry units shall be so protected when the temperature is below 40F.
- F. Reinforcing shall be stored off the ground and shall be free of loose rust and other coatings that will reduce bond.
- G. General storage of materials shall be in a manner to prevent deterioration and intrusion of foreign material. Material that has become unsuitable for good construction shall not be used and shall be immediately removed from the site.

1.09 JOB CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at the end of each day's work. Extend cover a minimum of 24-inches down both sides and hold cover securely in place. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24-inches down face next to unconstructed wythe and hold cover in place.
- B. Environmental Conditions: During cold and hot weather, masonry materials shall be stored, erected, and protected to meet the requirements of the Brick Institute of America Technical Note 1 Revised dated June, 2006, Technical Note 11A Revised dated September 1988, and National Concrete Masonry Association TEK 3-1C dated 2002.
- C. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost of by freezing conditions. Comply to cold-weather construction requirement contained in ACI 530.1/ASCE 6/TMS 602. Comply with the following requirements:
 - 1. Construction: When the ambient temperature is within the limits indicated, use the following procedures:
 - a. 40-32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
 - b. 32-25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 70 and 120 deg F. Maintain mortar above freezing until used in masonry. Maintain grout temperature above 70 deg F at time of placement.

- c. 25-20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 70 and 120 deg F. Maintain mortar above freezing until used in masonry. Maintain grout temperature above 70 deg F at time of placement. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.
 - d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 70 and 120 deg F. Maintain mortar above freezing until used in masonry. Maintain grout temperature above 70 deg F at time of placement. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.
- 2. Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
 - a. 40-25 deg F: Cover masonry with a weather-resistive membrane for 48 hours after construction.
 - b. 25-20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mph.
 - c. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.
- 3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above, but not less than 7 days after completion of cleaning.
- D. Do not lay masonry units which are wet or frozen.
- E. Remove ice and snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
- F. Remove all masonry determined to be damaged by freezing conditions.
- G. Hot Weather Requirements: Protect unit masonry work when temperatures and humidity conditions produce excessive evaporation of water. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above. Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, end and jamb blocks, bond beams, and other detailed conditions.
 - a. Provide reinforced concrete masonry lintels fabricated from precast load-bearing units.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 Mpa).
 - b. Weight Classification: All units shall be manufactured with standard weight aggregate. (125 lbs. per cu. ft. or more, oven dry weight of concrete.)
 - c. Exposed Faces: Manufacturer's standard color and texture unless otherwise indicated.
 - 4. Nonloadbearing Units: ASTM C129.

2.02 BRICK UNITS

- A. Facing Brick: ASTM C216, Type FBX, Grade SW.
 - 1. Color and texture to match Architect's sample. A brick panel will be required for the approval of the brick provided.

2. Color and texture:
 - a. Basis of Design: Glen-Gery / Sioux City Brick.
 - 1) Color: Butternut Velour.
3. Actual size: Modular - 3 5/8 x 2 1/4 x 7 5/8 inches.
4. Special and solid shapes of facing brick, as required, shall be furnished. Solid shapes shall be furnished for locations where holes in brick would otherwise be exposed. All exposed surfaces of special bricks shall be finished unless noted otherwise.
5. Compressive strength: 2500 psi, measured in accordance with ASTM C67.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
 1. Pre-mixed with retarder additives, not allowed.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.
- F. Air-entraining add-mixtures shall not be used. Air content shall not exceed 8-percent.
- G. Anti-Freeze Compounds: Not permitted.
- H. Calcium chloride shall not be used in mortar.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 1. Heckman Building Products, Inc.; Product - 213 with 282 Masonry Ties.
 2. Hohmann & Barnard, Inc; HB 213 Veneer Anchor: www.h-b.com/#sle.
 3. WIRE-BOND; RJ-711 www.wirebond.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 1. Type: Ladder.
 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to 16 CFR 1201 Class B.
 3. Size: 0.1875 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
 1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- E. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.
- F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 3. Vertical adjustment: Not less than 3-1/2 inches.

- G. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.05 FLASHINGS

- A. Thru-Wall Flashing:
1. At cavity wall construction, build flashing into masonry construction as indicated on the Drawings.
 2. At tops of exterior steel beams and channels which support masonry, install thru-wall flashing.
 3. Care shall be taken not to puncture flashing material and to keep completely cavity free of mortar droppings. Joints shall be avoided to the maximum extent possible, but where they occur they shall be lapped a minimum of 6-inches. Turn thru-wall flashing up at ends of openings in masonry walls to form end dams, or provide pre-formed end dams in accord with BIA-Tech Note No. 7. Gaps in thru-wall flashing will not be acceptable.
- B. Metal Flashing Materials:
1. Copper Flashing: ASTM B370, 060 soft annealed; 20 oz/sq ft thick; natural finish.
 2. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.
- C. Combination Asphaltic Flashing Materials - Copper:
1. Copper/Asphalt Flashing: 5 oz/sq ft copper sheet coated with elastic asphalt compound on both sides.
 - a. Manufacturers:
 - 1) Advanced Building Products, Inc; Copper Fabric Flashing: www.advancedbuildingproducts.com/#sle.
 - 2) Hohmann & Barnard, Inc: www.h-b.com/#sle.
 - 3) WIRE-BOND: www.wirebond.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- D. Membrane Asphaltic Flashing Materials:
1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 40 mils (0.040 inch) minimum total thickness; 8 mil cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.
 - a. Manufacturers:
 - 1) Advanced Building Products, Inc; Strip-N-Flash: www.advancedbuildingproducts.com/#sle.
 - 2) Carlisle Coating and Waterproofing Inc.; Product - CCW 705 Membrane.
 - 3) GCP Applied Technologies; Perm-A-Barrier Wall Membrane: www.gcpat.com.
 - 4) Heckmann Building Products, Inc: www.heckmannbuildingprods.com/#sle.
 - 5) York Flashings; York Seal: www.yorkflashings.com/#sle.
 - 6) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Flashing Mastic:
 - 1) GCP Applied Technologies; Bituthene 3000: www.gcpat.com.
 - 2) Carlisle Coating and Waterproofing Inc.; Product - CCW 704 Mastic.
- E. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 - b. York Manufacturing, Inc: www.yorkmfg.com/#sle.
- F. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- G. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives. Provide vertical leg on interior side.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc; DP Standard Drip Plate: www.h-b.com/#sle.
 - b. Illinois Product Corp.; Product - IPCO Stainless.

2.06 ACCESSORIES

- A. Compressible Fillers:
 - 1. Compressible filler to be used in masonry expansion joints (3/4-inch or wider) behind caulking and backer rod shall be "Sonoflex F" manufactured by Sonneborn Contech, Inc. Thickness shall be as required to fill the joint in an uncompressed state.
 - 2. Compressible fillers to be used at exterior masonry control joints shall be preformed "Neo-Seal IV" as manufactured by Williams Products, Inc.
 - 3. Compressible filler to be used where masonry walls abut or surround concealed columns, shall be 5008-3 Column Boxboard manufactured by Williams Products Company. Thickness shall be 1/2-inch unless noted otherwise on the Drawings.
- B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 - 1. Provide .8-inch thick mortar net where the cavity is less than 1-inch wide and provide 2-inch thick mortar net where the cavity is 2-inches or greater in width.
 - 2. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:
 - 1) Mortar Net Solutions: www.mortarnet.com/#sle.
 - 2) Hohmann & Barnard, Inc.; Product - Mortar Trap.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt used as a bond breaker at control joints in concrete block at exterior walls.
- D. Cavity Vents:
 - 1. Type: Molded PVC grilles, insect resistant.
 - 2. Size: Standard (3/8" x 3 3/8" x 2 1/2").
 - 3. Color(s): To match mortar color of wall.
 - 4. Manufacturers:
 - a. Hohmann & Barnard, Inc; QV-Quadro-Vent: www.h-b.com/#sle.
 - b. Mortar Net Solutions: www.mortarnet.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 5. Color: Clear.
- E. Metal lath shall be 2.5-pound galvanized steel diamond mesh lath, and shall be installed to close off bottom of cores which are to be filled with grout.
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, loadbearing masonry: Type S.
 - 3. Exterior, non-loadbearing masonry: Type S.
 - 4. Interior, loadbearing masonry: Type S.
 - 5. Interior, non-loadbearing masonry: Type N (Type S may be used at the Contractor's option).
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- D. Grout for Reinforced Masonry: shall be concrete with sand-gravel aggregate and with a minimum 28-day compressive strength of 3000 psi. Grout for cores of reinforced masonry shall have a slump of 8 inches to 10 inches as tested according to ASTM C143/C143M. Grout shall

have a minimum cement content of 658 lbs. per cubic yard. Where required, grout shall be plastic, suitable for pumping without separation of constituents

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

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

3.04 GENERAL

- A. Cutting of masonry units shall be avoided if possible. If cutting of exposed brick and concrete masonry units is necessary, it shall be done with a carborundum wheel, with all junctions and joints carefully and accurately fitted. No piece shorter than 4-inches shall be used at any vertical corner or jamb unless shown otherwise on the Drawings.
- B. Distribution of Brick: Tenders distributing brick to bricklayers shall take from 3 separate cubes on an alternating basis, to improve the evenness of the blend within the finished walls. This requirement will be strictly enforced.
- C. Wetting of Masonry Units: Brick having absorption rates (according to ASTM C 67) in excess of 30 grams/sq. in./minute shall be wetted from 3 to 4 hours before laying. All units shall be uniformly wetted and nearly saturated so the absorption rate does not exceed the above amount, but shall be surface dry without free water on surfaces when laid in the wall. During freezing weather, units that require wetting shall be sprinkled with warm water just before laying. (For units with surface temperatures above 32 degrees F, wet with water heated to above 70 degrees F. For units with surface temperatures below 32 degrees F, wet with water heated to above 130 degrees F.)
- D. Do not wet concrete masonry units.
- E. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets.
- F. Laying Up Masonry: Masonry shall be laid up true and plumb, with special units (corners, jamb blocks, headers, fillers, closers, fitters, etc.) as required to form corners, returns, openings, and offsets, and maintain a proper bond throughout the length of wall. Masonry walls shown on the Drawings as extending to the structure shall be laid up tight against or held free of beams, upper floor slabs, joists and roof deck, according to the following schedule or as shown on the Drawings.
 - 1. Exterior Walls: Lay up tight against beams, joists, and bottom of roof deck lowest corrugations unless noted otherwise on the Drawings. (It will not be necessary to fill in between steel deck corrugations with grout). Under Section 07 21 00, the Insulation Subcontractor shall fill voids between deck corrugations at exterior wall where the deck ribs are perpendicular to the wall.
 - 2. Interior Non-Bearing Walls: Hold 3/8-inch clear of all beams, joists, and upper floor slabs unless noted otherwise on the Drawings. Hold 3/8-inch clear and install backer rod and caulk where abutting exposed concrete and steel beam members in finished rooms unless noted otherwise. (Backer rod and caulk included under Section 07 9200. It will not be necessary to fill in between deck corrugations with grout.)

- G. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.
- H. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each days' work. Cover partially complete structures when work is not in progress. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.

3.05 COURSING

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

3.06 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints. Bed webs in mortar starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8-inch joints.
- E. Remove excess mortar and mortar smears as work progresses.
- F. Interlock intersections and external corners.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Cut mortar joints flush where walls are concealed by other finish materials, walls are concealed in chases or above ceilings, resilient base is scheduled, cavity insulation vapor barrier adhesive is applied, or bitumen dampproofing is applied.
- J. Collar (vertical longitudinal) joints between facing and backing wythes or solid back-up material, except cavities, shall be completely filled with mortar by back parging either the facing or backing wythe and shoving units tight.
- K. Staining: Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately grout and mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
- L. Protect sills, ledges and projections from droppings of mortar.
- M. Isolate masonry partitions from vertical structural framing members with a control joint.

- N. Cavity Protection: Cover cavities at all times when the walls are not being worked on to assure proper protection of the insulation from moisture and sunlight (at masonry cavity walls) and to provide proper protection for the insulating sheathing (at brick veneer walls).

3.07 TOOLING AND POINTING

- A. Tooling and Pointing: Joints shall be struck flush and after mortar has partially set but is still sufficiently plastic to bond, joints shall be tooled with a tool which compacts mortar and presses excess mortar out of the joint rather than dragging it out. All joints shall be made with a straight, clean line. Exercise special care to avoid getting mortar on faces of brick which will be exposed.
- B. Rake joints back 3/4-inch at interior control joints in preparation for backer rod and caulking to be installed under Section 07 92 00.
- C. Pointing:
 - 1. Joints which are not tight at the time of tooling shall be raked out, pointed, and then tooled
 - 2. During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings, and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealing compounds.

3.08 WEEPS/CAVITY VENTS

- A. Install weeps in veneer walls at 16 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.09 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.10 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 24 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 16 inches vertically.

3.11 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.12 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.

3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.13 MASONRY WORK ADJACENT TO STRUCTURAL MEMBERS

- A. Anchoring Masonry to Structural Members: Provide an open space not less than 1/2-inch in width between masonry and structural members, unless otherwise shown. Keep open space free of mortar and other rigid materials. Place continuous compressible filler at all column sides adjacent to masonry construction as detailed on the Drawings maintaining the total space completely free of mortar and debris. Also place compressible fillers where non-bearing masonry abuts beam, joists or deck and at other locations shown on the Drawings or specified earlier in this Section.

3.14 LINTELS

- A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 1. Shoring: Wood shoring or other approved means of support shall provide a level platform of proper elevation while lintels are being built in place. Shoring shall be kept in place for a minimum of 7 days, or until the lintel has gained sufficient strength to support loads.
 2. Mortar Bedding: Units shall be laid end to end, with full mortar coverage on all abutting edges; the joints shall be shoved tight. Provide a minimum of 8-inches of bearing, unless shown otherwise of the Drawings. Lintel shall be set in a full bed of mortar.
 3. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
 4. Place and consolidate grout fill without displacing reinforcing.

3.15 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

3.16 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Form expansion joint as detailed on drawings to form continuous vertical breaks from top to bottom of wall junctures. Expansion joints shall be straight and plumb, uniform in width, and totally filled with expansion joint filler as specified and other materials shown on the Drawings. Place expansion joint flashing lengths into wall as erected at locations indicated on the Drawings. Overlap lengths minimum of 4-inches in direction of flow.
- D. See Section 07 92 00 - Joint Sealants.

3.17 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, window frames, anchor bolts, plates, and sleeves and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 1. Fill space between hollow metal frames and masonry solidly with mortar of Portland cement/sand grout mixed to be as stiff as possible without interfering with proper workability and solid filling of jambs. Additives and mixtures which could cause internal rusting in frames shall be strictly prohibited.

- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.18 MISCELLANEOUS MASONRY INSTALLATION REQUIREMENTS

- A. Bond Beams: Construct bond beams at the top of all concrete masonry unit walls, unless shown on the Drawings. Unless otherwise indicated, bond beams shall be reinforced with two No. 5 bars. Bond beams shall be bedded, reinforced and grouted the same as masonry lintels.
- B. Openings and chases for heating, plumbing, and electrical ducts, pipes and conduits shall be built into masonry walls. Cutting of units to accommodate work of others shall be performed by masonry mechanics. Chases shall be kept free from mortar and debris.
- C. Fill cores of concrete masonry units of each course, as they are laid up, with sand at special sound isolation walls and partitions noted on the Drawings to receive sand fill. Protect top of unfinished walls and partitions to prevent sand from becoming moist.
- D. Installation of Steel Lintels and Other Built-In Structural Steel: Lintels and bearing plates shall be set on full beds of grout, as shown on the Drawings, leveled and at correct elevation.
- E. Install bond breaker at locations as shown on the Drawings in relation to other construction to allow separation for required movements.
- F. Install reglets and nailers for sheet metal flashing and other related work where shown or required to be built into the work.
- G. Miscellaneous Grouting: Unless otherwise shown on the Drawings, fill cores of concrete masonry units solid with grout at pilasters and piers, at 2 courses below bearing plates, at beam and lintel bearing and where required to secure anchors and bolts, grout fill all jambs at metal frames, and elsewhere as shown on the Drawings. Also, the cores shall be grouted full at courses which support at least 4 courses of concrete masonry units and roof loads, if the face shells of this lower course do not line up with the face shells of the course immediately above. Install metal lath in horizontal joint below cores to be filled solid with grout.
- H. Do not apply concentrated loads for at least 3 days after completion of erection of masonry walls and columns.

3.19 REPAIR AND POINTING OF MASONRY

- A. Remove and replace masonry units which are loose, chipped, broken, stained and otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings, and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

3.20 TOLERANCES

- A. Tolerances shall meet or exceed those recommended by the Brick Institute of America.

3.21 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.

3.22 PROTECTION

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

END OF SECTION

DIVISION 05 – METALS

**SECTION 05 1200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Steel Decking" for field installation of shear connectors.

1.03 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Indicate location of vent holes required in galvanized steel.
- C. Welding certificates.
- D. Qualification Data: For installer, fabricator, and testing agency.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Shop primers.
 - 4. Nonshrink grout.
- F. Source quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabricator shall specialize in performing steel fabrication with a minimum of 10 years of documented experience, and all welding is completed by AWS certified welders. The fabricator shall qualify welding procedures and welding operators in accordance with AWS Qualification requirements.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."

3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members or Specification for Load and Resistance Factor Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.07 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Weight Class: Standard.
 2. Finish: Black, except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: **ASTM A 325**, Type 1, heavy hex steel structural bolts; **ASTM A 563** heavy hex carbon-steel nuts; and **ASTM F 436** hardened carbon-steel washers.
 1. Finish: Plain.
- B. High-Strength Bolts, Nuts, and Washers: **ASTM A 490**, Type 1, heavy hex steel structural bolts; **ASTM A 563** heavy hex carbon-steel nuts; and **ASTM F 436** hardened carbon-steel washers, plain.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 50.
 1. Configuration: Straight.
 2. Nuts: **ASTM A 563** heavy hex carbon steel.
 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 4. Washers: **ASTM F 436** hardened carbon steel.
 5. Finish: Plain.

- E. Headed Anchor Rods: ASTM F 1554, Grade 50, straight.
 - 1. Nuts: **ASTM A 563** heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: **ASTM F 436** hardened carbon steel.
 - 4. Finish: Plain.
- F. Threaded Rods: **ASTM A 307, Grade A.**
 - 1. Nuts: **ASTM A 563** heavy hex carbon steel.
 - 2. Washers: **ASTM F 436** hardened ASTM A 36/A 36M carbon steel.
- G. Finish: Plain.

2.03 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time capable of developing a minimum compressive strength of 7,000 psi at 28 days..

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 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 unless noted otherwise.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.07 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**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to receive sprayed fire-resistive materials.
 - 4. 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 dry film thickness of not less than **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than **1.5 mils**.

2.08 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M. Galvanize all steel with exterior exposure, unless noted otherwise.
 - 1. Install vent holes as required for the galvanizing process. Vent holes shall be installed in hidden locations.
 - 2. Fill vent holes which will be exposed to view and grind smooth after galvanizing.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 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 base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cur. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.04 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 unless noted otherwise..
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 REPAIRS AND PROTECTION

Lewis Central High School
Entry Addition

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

**SECTION 05 3100
STEEL DECKING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Non-Composite floor deck.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
 - 2. Division 05 Section "Structural Steel Framing" for shop-and field-welded shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 09 painting Sections for repair painting of primed deck.

1.03 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.

1.04 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.;The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.

- l. Valley Joist; Division of EBSCO Industries, Inc.
- m. Verco Manufacturing Co.
- n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.02 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS) Grade 33/230, with G60 galvanized coating.
 - 2. Color: Manufacturer's standard.
 - 3. Deck Profile: As indicated.
 - 4. Profile Depth: As indicated.
 - 5. Design Uncoated-Steel Thickness: As indicated.
 - 6. Span Condition: Three or more continuous spans or as indicated in the drawings.
 - 7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.03 NON-COMPOSITE FORM DECK

- A. Metal Form Deck: Ribbed sheet steel:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS) Grade 33/230, with G60 galvanized coating.
 - 2. Minimum Metal Thickness as indicated in the drawings
 - 3. Nominal Height: As indicated in the drawings.
 - 4. Profile: As indicated in the drawings.
 - 5. Formed Sheet Width: As indicated in the drawings.
 - 6. Side Joints: Lapped, welded or lapped and mechanically fastened as indicated in the drawings.
 - 7. End Joints: Lapped, welded.
 - 8. Span Condition: Two or more continuous spans or as indicated in the drawings.

2.04 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, **No. 10 (4.8-mm)** minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of **33,000 psi (230 MPa)**, not less than **0.0359-inch (0.91-mm)** design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of **33,000 psi (230 MPa)**, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plate: Single-piece steel sheet, **0.0747 inch (1.90 mm)** thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than **1-1/2 inches (38 mm)** long, and as follows:
1. Weld Diameter: **5/8 inch (16 mm)** nominal.
 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or **18 inches (450 mm)**, and as follows:
1. Mechanically fasten with self-drilling, **No. 10 (4.8-mm-)** diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**, with end joints as follows:
1. End Joints: lapped **2 inches (51 mm)** minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than **12 inches (305 mm)** apart with at least one fastener at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: **5/8 inch**, nominal.
 - 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or **as indicated**, and as follows:
 - 1. Mechanically fasten with self-drilling, **No. 10** diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of **1-1/2-inch-** long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [**1-1/2 inches**], with end joints as follows:
 - 1. End Joints: Lapped or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at **14 inches** apart in both directions, within **9 inches** of walls at ends, and not more than **12 inches** from walls at sides, unless otherwise indicated. Coordinate with architectural requirements.

3.05 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior wall framing.

1.02 RELATED SECTIONS

- A. Section 053100 - Steel Decking.
- B. Section 072100 - Thermal Insulation: Insulation within framing members.
- C. Section 079005 - Joint Sealers.
- D. Section 092116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

1.03 REFERENCES

- A. AISI SG-973 - Cold-Formed Steel Design Manual; American Iron and Steel Institute; 1996.
- B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2003.
- C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2000.
- D. ASTM A 570/A 570M - Standard Specification for Structural Steel, Sheet and Strip, Carbon, Hot-Rolled; 1998.
- E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2003.
- F. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2004.
- G. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2003.
- H. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2000.
- I. AWS D1.1 - Structural Welding Code - Steel; American Welding Society; 2004.
- J. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 1998.
- K. MFMA (GU) - Guidelines for the Use of Metal Framing; Metal Framing Manufacturers Association; current edition.
- L. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2000).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum 5 years of experience.

1.06 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated on the drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. Marino-Ware; Product ____: www.marinoware.com.
 - 2. MiTek Industries, Inc.; Product ____: www.mii.com.
 - 3. Unimast, Inc.; Product ____.
 - 4. Dietrick.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING MATERIALS

- A. Studs and Track: ASTM C 955; studs formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage and depth: As required to meet specified performance levels.
 - 2. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.
 - 3. Provide components fabricated from ASTM A 1008/A 1008M, Designation SS steel.

2.03 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A 153/A 153M.
- B. Anchorage Devices: Power actuated.
- C. Welding: In conformance with AWS D1.1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and in accordance with ASTM C1007.
- B. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joints 4 inches and seal.
- C. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- D. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- F. Install exterior studs, and load bearing studs full length in one piece. Install studs tight to framing members above without deflection tracks, unless noted otherwise. Splicing of studs is not permitted.

- G. Install exterior, and load bearing studs, brace, and reinforce to develop full strength and achieve design requirements. Maximum spacing of stud bridging is 4'-0 oc.
- H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- I. Install intermediate studs above and below openings to align with wall stud spacing.
- J. Provide deflection allowance in stud track, directly below horizontal building framing at interior non-load bearing framing, and where indicated.
- K. Attach cross studs to studs for attachment of fixtures anchored to walls.
- L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- M. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 09 90 00 - Painting: Painting of exterior lintels.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
- I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- N. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.05 QUALITY ASSURANCE

- A. Field Measurement: Take field measurements prior to preparation of shop drawings and fabrication, where possible.

- B. Shop Fabrications: Fabricate, fit, and assemble miscellaneous metal items in the shop. Work that cannot be permanently shop-assembled shall be completely assembled, marked, and disassembled before shipment to ensure proper assembly in the field.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. General: For metal work which will be exposed to view, use only materials which are smooth and free of all surface blemishes.
- B. Steel Sections: ASTM A36/A36M.
- C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- D. Plates: ASTM A283/A283M.
- E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- F. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Bolts, Nuts, and Washers: Stainless steel.

2.03 MATERIALS - FASTENERS

- A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
- B. Provide bolts and fastening devices as required to set miscellaneous and ornamental metal items in place.

2.04 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds at exterior locations.
 - 1. Miscellaneous metal items exposed on the interior shall be intermittently welded, ground smooth, and filled with sanded body putty; or at the Contractor's option, they may be continuously welded and ground smooth.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to a 1/32-inch radius. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work with exposed faces flat, smooth and free of deformation and distortion.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Cut, reinforce, drill and tap miscellaneous metal work as required to receive hardware and similar items.

- H. Weather Exposure: Fabricate joints which will be exposed to the weather in a manner to exclude water and/or provide weep holes where water may accumulate through condensation or other means.

2.05 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and masonry; prime paint finish.
- B. Steel Angles: Provided for metal deck support at all roof openings greater than 12-inches by 12-inches in size. Angles shall extend to adjacent joists and shall be installed on all 4 sides except where openings are immediately adjacent to joists. Angles shall be 3-inch by 3-inch by 1/4-inch unless noted otherwise on the Drawings.
- C. Lintels: As detailed; prime paint finish.
 - 1. Lintels shall have a minimum 8-inch bearing unless otherwise noted.
 - 2. All surfaces of exterior lintels shall be prepared and hot-dipped galvanized after fabrication.
- D. Aluminum break metal enclosures – see Architectural Drawings. Note that these enclosures shall have no exposed seams.

2.06 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: Two coats.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FINISHES - ALUMINUM

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Preservative treated wood materials.
- D. Fire retardant treated wood materials.
- E. Concealed wood blocking, nailers, and supports.
- F. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2012 (Reaffirmed 2021).
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- C. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.
- D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- F. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021.
- G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.
- H. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2022.
- I. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.
- J. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- K. PS 1 - Structural Plywood; 2023.
- L. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- M. PS 20 - American Softwood Lumber Standard; 2025.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on each type of process and factory-fabricated product.
- C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.
- D. Research/Evaluation Reports: For the following, showing compliance with the building code in effect for the Project:
 - 1. Power-driven fasteners.
 - 2. Powder-actuated fasteners.
 - 3. Expansion anchors
 - 4. Metal framing anchors.

1.05 QUALITY ASSURANCE

- A. New Products: Only new lumber shall be utilized throughout the project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Where nominal sizes are indicated, provide actual sizes required by PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
 - 5. Treated wood will not be allowed, except at sill plate conditions.

2.02 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. For items of dimension lumber size, provide Construction, Stud or No. 2 grade SPF lumber with 19 percent maximum moisture content.
 - 2. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
 - a. Spruce-pine-fir (south) or Spruce-pine-fir, Construction or No. 2 Common grade; NELMA, NLGA, WCLIB, or WWPA.

2.03 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: S-dry (19 percent maximum).
- C. Surfacing: S4S.
- D. Grade: No. 1, 1 Common, or Select.

2.04 CONSTRUCTION PANELS

- A. Wall Sheathing: PS 2 type.
 - 1. Bond Classification: Exterior.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: 24.
 - 4. Performance Category: 3/4 PERF CAT.
 - 5. Edge Profile: Square edge.

- B. Wall Sheathing: See Section 09 21 16.
- C. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-C, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in an area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.
- B. Nails, Brads, and Staples: ASTM F1667 .
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 .
- F. Bolts: Steel bolts complying with ASTM A307 , Grade A, Property Class 4.6; with ASTM A563 Hex nuts and, where indicated, flat washers.
- G. Headed Anchor Bolts at Sill Plates: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594 , Alloy Group 1 or 2.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six (6) times the load imposed when installed in unit masonry assemblies and equal to four (4) times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633 , Class FeZn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.06 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alpine Engineered Products, Inc.
 - 2. Cleveland Steel Specialty Co.
 - 3. Simpson Strong-Tie Co., Inc.
 - 4. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by the manufacturer that meet or exceed those indicated. The manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.

2.07 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Fire Retardant Treatment:
 1. Interior Type A: AWWA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
 2. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing.
 - c. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.
- B. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. CABO NER-272 for power-driven fasteners.
 2. Published requirements of metal framing anchor manufacturer.
 3. Table 2304.9.1, "Fastening Schedule", in the 2006 International Building Code.
 4. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view of will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; pre-drill as required.
 5. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Grab bars.
 - 4. Toilet accessories.
 - 5. Wall-mounted door stops.
 - 6. Cubical curtain tracks.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.07 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

END OF SECTION

**SECTION 06 20 00
FINISH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 08 14 16 - Flush Wood Doors.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Samples: Submit two samples of each type of finish wood, 1 x 12 inches in size illustrating wood grain and specified finish.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

2.02 LUMBER MATERIALS

- A. Hardwood Lumber: Red Oak species, plain sawn, maximum moisture content of 6 percent; with vertical grain No. 1 Common Grade.
- B. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.org.

2.03 SHEET MATERIALS

- A. Particleboard (PART. BD.): ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
- B. Medium Density Fiberboard (MDF): ANSI A208.2 Composed primarily of cellulosic fibers and a bonding system cured under heat and pressure.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.

- B. Lumber for Shimming and Blocking: Softwood lumber of indicated species.
- C. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting.
Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Millwork.
- B. Specially fabricated cabinet units.
- C. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. BHMA A156.9 - Cabinet Hardware; 2020.
- B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Samples: Submit the following samples to the Architect/Engineer in accord with 01 30 00 - Administrative Requirements.
 - 1. Solid Wood: With or for transparent finish; set of 3 pieces 6-inches by 12-inches by 3/4-inch, finish S4S.
 - 2. Plastic Laminate: One piece of each specified; 2-inches by 2-1/2-inches minimum.
 - 3. Cabinet Liner: One of each specified; 6-inches by 6-inches.
 - 4. Hardware: Pulls; one of each specified.

1.05 QUALITY ASSURANCE

- A. Quality Standards: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), Eighth Edition, Version 1.0, 2003, Section 1600, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Do not deliver casework until painting, wet work, and similar operations, which could damage or deteriorate woodwork, have been completed in installation areas.
- C. Scheduling: Fabricator shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install interior finish carpentry until required temperature and relative humidity conditions have been stabilized and will be maintained in installation areas.
- D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 LUMBER - GENERAL

- A. Factory-mark each piece of lumber and plywood with grading agency identification information; except omit marking from surfaces to receive transparent finish.
- B. Cabinets shall be constructed per Section 400 of AWI Quality Standards, 1997 edition, and shall be Custom Grade overlay construction (without reveals) for plastic laminate and wood casework unless indicated otherwise.
- C. Softwood Moisture Content: Softwood shall be seasoned lumber having a moisture content from time of manufacture until time of installation not greater than the values required by the applicable grading rules of the appropriate grading and inspecting agency.
- D. Hardwood Moisture Content: Hardwood shall be kiln dried lumber having a moisture content from time of manufacture until time of installation within the ranges required in the Architectural Woodwork Institute "Quality Standards".
- E. Wood Moisture Content: Provide kiln-dried lumber with an average moisture content range of 6-percent to 11-percent for interior work. Lumber at time of installation shall not exceed 5-percent to 10-percent for interior wood (except pressure treated wood).
- F. Lumber for Painted Finish: At Contractor's option, use pieces which are either glued-up lumber or made of solid lumber stock.
- G. Hardwood Edges: All exposed hardwood edges shall be eased slightly to approximately a 1/32-inch radius unless noted otherwise. Exercise care to avoid pre-easing edges which will abut other ease edges at unmitered corners.

2.02 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Wood Veneer Faced Cabinet:
 - 1. Exposed Surfaces (transparent finish): HPVA HP-1 Grade A, Red Oak, plain sliced, random-matched.
 - 2. Semi-Exposed Surfaces (painted finish): HPVA HP-1 Grade B, yellow birch, plain sliced, random-matched.
 - 3. Concealed Surfaces (drawer bodies, transparent finish): red oak, poplar, or natural yellow birch.
- C. Plastic Laminate Faced Cabinets: Custom grade.

2.03 WOOD-BASED COMPONENTS

- A. Concealed miscellaneous solid wood for blocking, furring, nailers and similar applications as required shall be Standard or Better, any species, unless designated otherwise on the Drawings.
- B. Hardboard: shall be tempered.
 - 1. Thickness: 1/4-inch thick unless noted otherwise.
 - 2. Manufacturers:
 - a. Boise Cascade; www.bc.com.
 - b. Georgia-Pacific; www.gp.com.
 - c. Masonite Corporation; www.masonite.com.
- C. Particle Board:
 - 1. Density: 45-48 pounds per cubic foot.
 - 2. Thickness: 3/4-inch, unless otherwise shown or specified.
 - 3. Manufacturers:
 - a. Georgia-Pacific; www.gp.com.
 - b. Weyerhaeuser Company; www.weyerhaeuser.com

- D. Cabinet Liner for use on cabinet interiors where shown on the Drawings and specified hereinafter shall be of balanced panel construction composed of 9 to 11 mils thick thermosetting polyester over-laminated to both faces of particleboard substrate as previously specified, and shall be Plusswood. Melamine or 1/32-inch plastic laminate may be used at the Contractor's option, with Architect's approval.

2.04 LAMINATE MATERIALS

- A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- B. Thickness of plastic laminate shall be 1/16-inch where applied to countertops, backsplashes and endsplashes, and 1/32-inch elsewhere.
- C. Exposed tops less than 72-inches above the floor, ends, backs, fronts, doors, drawer fronts, knee spaces, face rails, open shelving, countertops, file cabinet openings and other locations specified or shown on the Drawings shall receive plastic laminate and shall be balanced with plastic laminate cabinet liner at semi-exposed locations and backer sheet at concealed locations.
- D. Plastic laminate placement shall be as shown on the Drawings and as listed in Section 09 99 90 - Color Schedule.
- E. Interior surfaces of cabinet doors, unless noted otherwise, shall be the same plastic laminate as on the door exteriors.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by AWI/AWMAC to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Thickness: 3mm.
 2. Color: As selected by Architect from manufacturer's standard range.
 3. Manufacturers:
 - a. Doellken North America; www.doellken.com.
 - b. Rehau; www.rehau.com.
- C. Sealant, for sealing between wall surfaces and splashes or countertops, shall be one of the following:
1. Dow Corning Corp.; 999, clear.
 2. General Electric Co.; SCC-1201, clear.
- D. Sealer for hardboard and drawer bodies shall be clear satin varnish (2 coats) manufactured by any of the approved manufacturers listed in Section 09 99 90 - Color Schedule.
- E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- F. Nails: Select material, type, size, and finish required for each use.

Stock up to 1/2-inch thick	4d finishing or casing nails
Stock 1/2- to 3/4-inch thick	6d finishing or casing nails
Stock 3/4- to 1-inch thick	8d finishing or casing nails
Stock 1- to 1-1/4-inch thick	16d finishing or casing nails

- G. Grommets: Standard plastic grommets for cut-outs, in color Metallic Silver 23.
1. Manufacturer:
 - a. Doug Mockett & Company; Model No. EDP.
- H. Solid Colored Cork (CC-1):
1. Manufacturer: Walltalkers by Koroseal.
 2. Size: 1/4-inch thick.

3. Provide Tac-Wall Aluminum J-Trim around perimeter of solid colored cork, as noted on Drawings.

2.06 MISCELLANEOUS REQUIREMENTS

- A. All surfaces including countertops and backsplashes receiving plastic laminate shall be balanced with plastic laminate where exposed, or plastic laminate backer sheet where not exposed.
- B. Where architectural casework abut walls and ceilings, provide a maximum 3/4-inch scribe to match adjacent plastic laminate or hardwood. Hold face of scribe back 1-1/4-inch from the outer face of doors.
- C. All shelving shall be 1-inch thick material, with edging as specified above.
- D. Cabinets that hold equipment and those which do not extend to the floor shall be fabricated by gluing and screwing all joints and additional means necessary to provide extra strong joints to carry the load.
- E. Drawers shall be 1/2-inch solid hardwood assembled with lock-shoulder corner joint or full furniture dovetail joints. Bottom shall be 1/4-inch thick tempered Duron fully captured, except at file drawers (where file followers are specified) the bottom shall be 1/2-inch thick plywood fully captured, with 1/4-inch tempered hardboard layer on top of drawer bottom to bring it up flush with the file follower. Drawers shall be shop-sealed with 2 coats of sanding sealer prior to installation of drawer hardware.

2.07 HARDWARE

- A. Hardware: BHMA A156.9, types as scheduled for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, brushed chrome finish, for nominal 1 inch spacing adjustments.
 1. Product No. 346 NP manufactured by K & V or equal.
 2. Provide 4 clips per shelf.
 3. Pin fits into 1/4-inch holes.
- C. Countertop Brackets: Shall be equal to 2.0" Concealed Brackets manufactured by A&M Hardware, Inc. in color Black and sized for countertop depth - install prior to drywall installation.
- D. Drawer and Door Pulls: Pulls for doors shall be placed vertically and on drawers shall be placed horizontally, and shall be 4-inch wire pull conforming to ADA Standards for Accessible Design, US26D finish, unless noted otherwise below. Provide 2 pulls on drawer fronts exceeding 30-inches in width and one pull for each door and each drawer 30-inches in width or less. Samples shall be submitted to the Architect for approval.
- E. Cabinet Locks: steel with brushed chrome finish.
 1. Furnish 2 keys for each room. Each room shall be keyed differently from each other.
 2. Master key all locks and furnish 5 master keys.
 3. Door Locks: BHMA A156.11, E07121, National Lock No. M4-7054 (verify with owner).
 4. Drawer Locks: BHMA 156.11, E07041, National Lock No. M4-7054 (verify with owner).
- F. Door Catches: Magnetic.
 1. One per door less than 48-inches in height and 2 per door 48-inches in height or over. Catches shall be the manufacturers standard. Samples shall be submitted to the Architect/Engineer for approval. Finish shall be chrome or almond that matches liner.
- G. Automatic Door Catches for inactive leaf of locked pairs of doors:
 1. Spring changing bolts will not be accepted.
 2. Manufacturer:
 - a. H.B. Ives; Elbow Catch #2, heavy duty or approved equal.
- H. Drawer Slides:
 1. Type: Full extension.

2. Mounting: Side mounted.
3. Manufacturers:
 - a. For all drawers over 8-inches high, and for all drawers wider than 24-inches:
 - 1) Accuride International, Inc; Model 3640: www accuride.com/#sle.
 - b. Drawer slides for all other drawers:
 - 1) Blum 430E.
 - c. Manufacturer's standard glides are acceptable on standard drawers as long as the following minimum requirements are met:
 - 1) 100-pound rating
 - 2) epoxy coating
 - 3) in-stop/out/stop, out keeper
 - 4) nylon ball-bearing rollers
 - 5) side away adjustable cam
 - d. Substitutions: See Front End Documents.
- I. Hinges: Concealed (fully mortised) self-closing type, with plastic caps.
 1. Manufacturers:
 - a. Grass America Inc; Model No. 1203: www grassusa.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Doors 48-inches or less: 1-pair.
 3. Doors 48- to 72-inches: 1-1/2 pair.
 4. Doors over 72-inches: 2 pair.
 5. Provide Grass clear plastic bumper pads in the same quantity as the hinges.

2.08 FABRICATION

- A. General: Architectural Casework shall conform to the design and details shown on the Drawings and shall meet the requirements for cabinets as defined in Section 400 of the Architectural Woodwork Institute Quality Standards.
- B. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements, verify dimensions, and review equipment shop drawings as required for an accurate fit.
- C. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings. However, items shall be fabricated in largest units possible, with minimal field joints and assembly. Proposed field joint locations shall be shown on the shop drawings.
- D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- G. Inner faces of doors and inner faces of finished ends shall be plastic laminate or hardwood plywood as shown on the Drawings.
- H. Concealed and semi-exposed framing shall be of soft wood.
- I. Where finished end or base cabinet has side splash shown, the end and splash shall be one-piece 3/4-inch thick particleboard with plastic laminate at all exposed faces, and hardwood edging (size as shown of the Drawings).
- J. Provide cutouts for plumbing fixtures, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

3.03 ADJUSTING

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

**SECTION 07 05 53
FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting: Paint finish.

1.03 REFERNECE STANDARDS

- A. ICC (IBC) - International Building Code; 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.
- D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
- B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.
- C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 91 23 for products.
- D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

- A. See Section 09 90 00 for substrate preparation for painted markings.

3.03 INSTALLATION

- A. Locate markings as required by ICC (IBC).
- B. Install adhered markings in accordance with manufacturer's instructions.
- C. Install applied markings in accordance with Section 09 90 00.
- D. Install neatly, with horizontal edges level.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

**SECTION 07 11 13
BITUMINOUS DAMPPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.
 - 1. At structural steel columns and base plates where concealed by concrete and extending below grade.
 - 2. At other similar locations as may be shown on the Drawings at steel surfaces.
- B. Protection boards.
- C. Drainage panels.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 REFERENCE STANDARDS

- A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).
- B. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013, with Editorial Revision (2019).
- C. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.

1.05 QUALITY ASSURANCE

- A. General: For each type of work, obtain primary materials from a single manufacturer, to the greatest extent possible. Provide secondary materials only as recommended by the manufacturer of the primary materials.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

- A. Temperature and Weather: Unless otherwise permitted by the dampproofing manufacturer's recommendations, dampproofing shall not be applied when temperatures are below 50-degrees F, during rainy weather, when rain is forecast within 24 hours, or when freezing temperatures are forecast within 12 hours.
- B. Protect dampproofing from rain and moisture during initial set.
- C. Protect other work from spillage of dampproofing materials and prevent materials from penetrating and clogging drains and conductors.
- D. Scheduling: Do not proceed with dampproofing work until blocking, nailers, piping, conduit and other projections through the substrate have been installed, and parging placed and cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.

2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
 3. VOC Content: Not more than permitted by local, State, and federal regulations.
 4. Applied Thickness: 1/16 inch, minimum, wet film.
 5. Products:
 - a. Sika Corporation; Sikalastic 315: www.usa.sika.com.
 - b. W. R. Meadows, Inc; Sealmastic Emulsion Type II (brush/spray-grade): www.wrmeadows.com/#sle.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 ACCESSORIES

- A. Drainage Panel: 1/4-inch thick formed plastic, hollowed sandwich.
- B. Protection Board: Rigid insulation; see Section 07 21 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

- A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of work.
- B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.
- C. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- D. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- E. Apply bitumen by brush or spray application.
- F. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal per coat to a minimum dry-film thickness of not less than 30 mils. Dampproofing shall be applied evenly to form a continuous unbroken film, free from pinholes so that surfaces present a uniform black appearance..
- G. Extend vertical dampproofing 12-inches onto intersecting walls and footings, but do not extend onto surfaces which will be exposed to view when the project is completed.
- H. Seal items watertight with mastic, that project through dampproofing surface.
- I. Backfilling: Unless a longer curing time is recommended by the dampproofing material manufacturer, backfilling shall be executed at least 24 hours and not more than 7 days after dampproofing work is complete. Care shall be taken during backfilling as not to rupture, damage, or displace the dampproofing.

- J. Place drainage panel directly over dampproofing, butt joints, and position to ensure downward drainage.
- K. Place protection board over drainage panel, butt joints, and adhere with mastic.
- L. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

**SECTION 07 19 00
WATER REPELLENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellents applied to exterior architectural precast concrete surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 03 45 00 - Precast Architectural Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience
- B. Single Source Responsibility: Both water-repellent coating and graffiti-resistant coating to be by the same manufacturer. Where both coatings are applied to the same surface, apply within the time limit specified by the coating manufacturer.
 - 1. When both water repellent and graffiti-resistant coatings are applied to the same surface, be sure only manufacturers that provide both types of coatings are specified and that their products are compatible with each other.

1.06 MOCK-UPS

- A. Apply water repellent according to the rates and methods recommended by the manufacturer to half of the approved precast concrete unit mock-ups. Water repellent work shall not proceed until the sample applications have been approved by the Owner and Architect.

1.07 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.
- C. Follow the manufacturer's printed instructions relative to other application limitations and specific requirements of temperature and wall dryness before masonry surface application begins.
- D. Sequencing: Application of water repellent shall not proceed until all caulking, painting and sealing has been applied.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Water Repellent: Submit 2 copies of a warranty, signed by the manufacturer, describing an agreement to furnish new water repellent material at no cost to the Owner for wall areas which become non-water-repellent due to a deterioration of the original application within a period of 5 years following the completion of the water repellent work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acrylic Water Repellents:
 - 1. BASF Construction Chemicals; MasterProtect Series:
www.buildingsystems.basf.com/#sle.
- B. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
 - 1. PROSOCO, Inc; Sure Klean Weather Seal Blok-Guard & Graffiti Control:
www.prosoco.com/#sle.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 - 2. Number of Coats: Two.
 - 3. VOC Content: Less than 20 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
 - 4. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
 - a. Manufacturers:
 - 1) PROSOCO, Inc; Sure Klean Weather Blok-Guard & Graffiti Control II:
www.prosoco.com/#sle.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- F. Scrub and rinse surfaces with water and let dry.
- G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

**SECTION 07 21 00
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and exterior wall behind brick and metal panel wall finish.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Masonry walls enclosing insulation.
- B. Section 07 21 19 - Foamed-In-Place Insulation.
- C. Section 07 27 00 - Air Barriers: Separate air barrier materials.
- D. Section 07 53 23 - EPDM Thermoset Single-Ply Roofing.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with the manufacturer's recommendations for handling, storage, and protection during installation.
- B. Do not expose plastic insulation to sunlight, except to the extent necessary for the period of installation and concealment.
- C. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to project site ahead of time. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

- A. Perimeter Insulation - Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578, where shown to be applied to the exterior face of exterior foundation walls shall be closed-cell extruded with integral high-density skin surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
 - 5. Board Size: 24 by 96 inch.
 - 6. Board Thickness: 2 inch.
 - 7. Manufacturers:

- a. Dow Chemical Company; STYROFOAM Square Edge: www.dow.com.
 - b. Owens Corning Corporation; Foamular 250 Square Edge: www.ocbuildingspec.com.
- B. Insulated Sheathing - Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578, shall be rigid, closed-cell with natural skin surfaces.
 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
 5. Board Size: 24 by 96 inch.
 6. Board Edges: Tongue-and-groove.
 7. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.
 8. Products:
 - a. Diversifoam Products; Certifoam 25 SE: www.diversifoam.com/#sle.
 - b. Owens Corning Corporation; Foamular 250 Extruded Polystyrene Rigid Foam Insulation: www.ocbuildingspec.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide.
- B. Insulation Fasteners: Appropriate for purpose intended.
 1. Length as required for thickness of insulation material and penetration of deck substrate.
- C. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
 1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for exterior wall cladding and metal wall panels.
 2. Depth: As required for thickness of insulation.
 3. Length: 6 inches for clips and 96 inches for girts.
 4. Spacing: 16 inches on center, vertically.
 5. Fasteners: As recommended by clip manufacturer.
 6. Products:
 - a. Advanced Architectural Products, LLC; SMARTci 1 in 1 System: www.GreenGirt.com/#sle.
 - b. Cascadia; www.cascadiacclip.com.
 - c. Cladiator; Slotted-Z FG: www.cladiator.com/#sle.
 - d. Strongwell; Stronggirt: www.strongwell.com.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 1. On the interior surface of exterior foundation walls where the exterior grade is at, or below, the interior floor elevations. Extend to a depth of 2'-8" below the interior floor elevation or 2'-0" below exterior grade, whichever is deeper.
 2. Other minor locations as may be shown on the Drawings.

- B. Apply with adhesive where temporary support is required before backfilling.
- C. Backfill carefully to prevent damage or displacement of insulation. When backfilling is completed, insulation shall be tight against the foundation walls or grade beams. In no case shall backfill material be allowed to be between the structure and the insulation.
- D. On vertical surfaces, set units in adhesive applied in accordance with the manufacturer's instructions. Use type of adhesive recommended by the manufacturer of the insulation.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.
- B. Install boards horizontally on walls.
 - 1. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Tape insulation board joints.

3.04 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS

- A. Install supports in accordance with manufacturer's installation instructions.
- B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.
- C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.
- D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 07 21 19
FOAMED-IN-PLACE INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In exterior framed walls.
 - 2. In exterior wall crevices.
 - 3. At junctions of dissimilar wall and roof materials.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, and preparation requirements.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection as required by ABAA QAP.
- D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.
- B. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
 - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
 - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 MOCK-UPS

- A. Install one representative area of insulation (approximately 14 feet long by 14 feet high); include insulation wall construction, window and frame, and door frame in mock-up.
- B. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518. The thickness shall meet R-13.
 - 2. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 3. Manufacturers:
 - a. BASF Corporation; SPRAYTITE 178: www.spf.basf.com/#sle.
 - b. Certainteed; CertiaSpray Closed Cell Foam: www.certainteed.com.
 - c. Demilec LLC; HEATLOK HFO High Lift: www.demilec.com/#sle.
 - d. Dow: www.dow.com.
 - e. Johns Manville; JM Corbond IV Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete before insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to achieve a thermal resistance R-value of 13 minimum.
- D. Patch damaged areas.
- E. At exterior stud walls with structural steel beams, fill the cavity between the steel and the exterior sheathing full. Coordinate with General Contractor to drill openings in and patch portions of the exterior sheathing board, as required, to provide access to fill the cavity full.
- F. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- G. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 27 00
AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air barriers.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Water resistant barrier under exterior cladding.
- B. Section 06 10 00 - Rough Carpentry: Air barrier under exterior cladding.

1.03 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, limitations, and description for protection, surface preparation, and application.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.
- F. Testing agency qualification statement.

1.05 QUALITY ASSURANCE

- A. Contractor requirements:
 - 1. Knowledgeable in the proper use and handling of specified products.
 - 2. Employ skilled installers who are experienced and knowledgeable in air and water-resistive barrier application, and familiar with the requirements of the specified work.
 - 3. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with the manufacturer's published instructions.
- B. Project Meeting: Convene a pre-application meeting before the start of installation of fluid-applied membrane air barrier. Require attendance of parties directly affecting work of this section, including the Contractor, Architect, and product representative. Review Mock-Up procedures.

1.06 MOCK-UPS

- A. Prior to overall installation, apply air and water-resistive barrier system to mock-up wall, verify details for overall installation. Demonstrate tie-ins with adjoining construction and other termination conditions.
 - 1. Install air and water-resistive barrier mock-ups in field on assemblies constructed of unit masonry. Use the manufacturer's written application instructions.

2. Mock-ups must remain available for inspection, testing and approval throughout the project.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their original sealed containers bearing manufacturer's name and identification of product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90 degrees F (32 degrees C). Store away from direct sunlight.

1.08 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

- A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
 1. Air Barrier Coating:
 - a. Material: Acrylic.
 - b. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - c. Water Vapor Permeance: 25 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
 - d. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
 - e. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - f. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - g. Basis-of-Design Manufacturer:
 - 1) PROSOCO, Inc; R-GUARD Spray Wrap MVP: www.prosoco.com/r-guard/#sle.
 - h. Other Acceptable Manufacturers:
 - 1) Dow Chemical Company; DOWSIL DefendAir 200C: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - 2) Henry Company; Air-Bloc All Weather STPE: www.henry.com/#sle.
 - 3) Sto Corp; Sto Gold Coat: www.stocorp.com/#sle.
 - 4) W. R. Meadows, Inc; Air-Shield TMP: www.wrmeadows.com/#sle.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. System consists of self-adhesive glass fiber tape; a ready-mixed acrylic compound fill; and a ready-mixed flexible, acrylic coating to be applied to GWB or CMU backup.
 1. R-Guard GypPrime
 - a. Form: Milky blue liquid, mild odor
 - b. Specific Gravity: 1.01
 - c. pH: 8.5
 - d. Wt/Gal: 8.41 lbs
 - e. Total Solids: ASTM D2369 - 18 percent
 - f. VOC Content: Less than 100g/L
 - g. Flash Point: More than 212 degrees F (More than 93 degrees c)
 - h. Freeze Point: 32 degrees F (0 degrees C)
 2. R-Guard Joint and Seam Filler
 - a. Form: Pale Red, Gun grade sealant
 - b. Specific Gravity: 1.4 to 1.5
 - c. pH: Not Applicable

- d. Wt/Gal: 11.8 lbs
- e. Total Solids: 99 percent
- f. VOC Content: Max 100 g/L
- g. Flash Point: No data
- h. Freeze Point: No data
- 3. R-Guard Liquid-Applied Flashing Membrane - Fast Flash
 - a. Form: Brick Red, Gun grade sealant
 - b. Specific Gravity: 1.45 to 1.60
 - c. pH: Not Applicable
 - d. Wt/Gal: 12.5 lbs
 - e. Total Solids: 99 percent
 - f. VOC Content: 30 g/L
 - g. Flash Point: No data
 - h. Freeze Point: No data
- 4. R-Guard Fill
 - a. Form: Dark red viscous liquid, mild odor
 - b. Specific Gravity: More than 1.0
 - c. pH: 7.5 - 10.5
 - d. Wt/Gal: 11.9 lbs
 - e. Total Solids: ASTM D2369 - 83 percent
 - f. VOC Content: Less than 100 g/L
 - g. Flash Point: More than 200 degrees F (More than 93 degrees C)
 - h. Freeze Point: 32 degrees F (0 degrees C)
- 5. R-Guard Spray Wrap MVP
 - a. Form: Batter like, semi-gel liquid pink color
 - b. Specific Gravity: More than 1.4
 - c. pH: 8.5 - 9.5
 - d. Wt/Gal: 11.69 lbs
 - e. Total Solids: ASTM D2369 - 63-68 percent
 - f. VOC Content: Less than 18 g/L
 - g. Flash Point: not applicable
 - h. Freeze Point: 32 degrees F (0 degrees C)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect people, vehicles, property, plants and all surfaces not designated to receive treatment from the product, splash and wind drift.
- B. Remove projections, protruding fasteners, dirt, and loose or foreign matter that might interfere with proper installation.
- C. Ensure that sheathing is properly installed with ends, corners and edges properly fastened with mechanical fasteners set flush with sheathing and spotted with joint and seam filler and fastened back into solid backing.
- D. Joints should be struck flush with the surface of the CMU.
- E. Fill small voids and cracks up to 1/8-inch with fill specified above. For voids and cracks greater than 1/8-inch and up to 1/4-inch, use paintable acrylic latex caulk tooled flush.

- F. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Fluid-Applied Coatings or Membranes:
 - 1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
 - 2. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.
 - 3. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.
- E. Openings and Penetrations in Exterior Air Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
 - 4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
 - 1. Provide testing and inspection required by ABAA QAP.
 - 2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
 - 3. Cooperate with ABAA testing agency.
 - 4. Allow access to air barrier work areas and staging.
 - 5. Do not cover air barrier work until tested, inspected, and accepted.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 42 13.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior curtain wall system consisting of formed metal composite material (MCM) sheet, framing, secondary supports, and anchors to structure.
- B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.
- B. Section 07 21 00 - Thermal Insulation: Support for cladding and continuous insulation.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- D. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).
- G. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
 - 1. Require attendance by the installer and relevant sub-contractors.
 - 2. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
 - 3. Review procedures for protection of work and other construction.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Fabrication instructions and recommendations.

4. Specimen warranty for finish, as specified herein.
- C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 1. Physical characteristics of components shown on shop drawings.
 2. Storage and handling requirements and recommendations.
 3. Installation instructions and recommendations.
 4. Specimen warranty for wall system, as specified herein.
- D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 1. Indicate panel numbering system.
 2. Differentiate between shop and field fabrication.
 3. Indicate substrates and adjacent work with which the wall system must be coordinated.
 4. Include large-scale details of anchorages and connecting elements.
 5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
 6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- E. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.
- F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.
- G. Installer's qualification statement.
- H. Maintenance Data: Care of finishes and warranty requirements.

1.06 QUALITY ASSURANCE

- A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
 1. With not less than five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified in this section.
 1. With minimum three years of experience.
 2. Approved by wall panel system manufacturer.

1.07 MOCK-UPS

- A. Provide a mock-up for evaluation of fabrication workmanship.
- B. Locate where directed.
- C. Provide specified finish on panels.
- D. Mock-up may remain as part of work. Mock-up may be incorporated into final construction upon Owner's approval.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
 1. Protect finishes by applying heavy-duty removable plastic film during production.
 2. Package for protection against transportation damage.
 3. Provide markings to identify components consistently with drawings.

4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 1. Store in well-ventilated space out of direct sunlight.
 2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
 3. Store at a slope to ensure positive drainage of accumulated water.
 4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
 5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.09 FIELD CONDITIONS

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.10 WARRANTY

- A. Special Warranty: Provide 5-year warranty covering water tightness and integrity of seals of wall panels. Complete forms in Owner's name and register with warrantor.
- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wall Panel System Manufacturers:
 1. Petersen Aluminum Corporation; PAC-3000 CS: www.pac-clad.com/#sle.

2.02 WALL PANEL SYSTEM

- A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
 1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
 2. Provide panel jointing and weatherseal using a "wet", sealant-sealed system.
 3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

- A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

2.04 PANELS

- A. Panels: 1-inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
 1. Reinforce corners with riveted aluminum angles.
 2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
 3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
 4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.

5. Fabricate panels under controlled shop conditions.
6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
 - a. Make panel lines, breaks, curves, and angles sharp and true.
 - b. Keep plane surfaces free from warp or buckle.
 - c. Keep panel surfaces free of scratches or marks caused during fabrication.
8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

2.05 MATERIALS

- A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
 1. Overall Sheet Thickness: 0.157 inch, minimum (4 mm).
 2. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
 3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 4. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.
- B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
 1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
 2. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.06 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's standard line.

2.07 ACCESSORIES

- A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.
- B. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
 1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for metal wall panels.
 2. Fasteners: As recommended by clip manufacturer.
 3. See Section 07 21 00 - Thermal Insulation.
- C. Fasteners:
 1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
 2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 3. Bolts: Stainless steel.
 4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

- D. Closure Strips: EPDM rubber to match configuration of the covering.
- E. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.
- F. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine dimensions, tolerances, and interfaces with other work.
- B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
- C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.
- F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- G. Where joints are designed for field-applied sealant, seal joints completely with specified sealant.
- H. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - 1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
 - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
 - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
 - 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.
- J. Replace damaged products.
 - 1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
 - 2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.03 CLEANING

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

3.04 PROTECTION

- A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 53 23
EPDM THERMOSET SINGLE-PLY ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered roof system with ethylene propylene diene monomer (EPDM) roofing membrane.
- B. Insulation, flat and tapered.
- C. Deck sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 05 31 00 - Steel Decking.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashing and reglets.

1.03 REFERENCE STANDARDS

- A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- E. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
- F. FM (AG) - FM Approval Guide; Current Edition.
- G. FM DS 1-28 - Wind Design; 2016.
- H. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
 - 1. Product data indicating membrane materials, flashing materials, insulation, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.
- D. Samples: Submit samples of each product to be used.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Specimen Warranty: For approval.
- G. Warranty:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of this section:
 - 1. With minimum five years documented experience.
 - 2. Approved by membrane manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Protect products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.
- D. Keep Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.
- E. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.07 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above manufacturer's recommended maximum temperature.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
- F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 10 years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Exceptions NOT Permitted:
 - a. Damage due to roof traffic.
 - b. Damage due to wind of speed greater than 56 mph but less than 90 mph.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Carlisle SynTec; Sure-Seal: www.carlisle-syntec.com/#sle.
 - 1. Acceptable Manufacturers:
 - a. Elevate (formerly Firestone Building Products), www.holcimelevate.com.
 - b. Johns Manville - Commercial Roofing Systems: www.jm.com/#sle.

2.02 ROOFING APPLICATIONS

- A. EPDM Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Performance Requirements and Design Criteria:
 - 1. Roof Covering External Fire Resistance Classification: Class A when tested per UL 790.
 - 2. Wind Uplift:

- a. Designed to withstand wind uplift forces calculated with ASCE 7.
- b. Design Wind Speed: In accordance with local building code and authorities having jurisdiction (AHJ).
3. Insulation Thermal Resistance (R-Value): Provide R-Value over entire roof deck in accordance with local building code requirements.
4. Drainage: No standing water within 48 hours after precipitation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Single Source Responsibility: Provide and install products from single source.
- B. Membrane:
 1. Material: Ethylene propylene diene monomer (EPDM); ASTM D4637/D4637M, Type I (non-reinforced).
 2. Thickness: 60 mil, 0.060 inch, minimum.
 3. Sheet Width: Factory fabricated into largest sheets possible.
 4. Color: Black.
 5. Products:
 - a. Carlisle SynTec Systems; Sure-Seal.
- C. Seaming Materials: As recommended by membrane manufacturer.
- D. Membrane Fasteners: As recommended and approved by membrane manufacturer.
 1. Carlisle SynTec Systems; HP Term Bar Nail-In: 1-1/4 inch long expansion anchor with threaded drive pin.
 2. Carlisle SynTec Systems; HP Polymer Seam Plate: 2-inch diameter, barbed plastic fastening plate.
- E. Flexible Flashing Material: Same material as membrane.
- F. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

2.04 DECK SHEATHING AND COVER BOARDS

- A. Deck Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch thick.
 1. Product:
 - a. GP Dens-Deck, distributed by Carlisle SynTec Systems.
 - b. USG, UltraLight Coated Glass-Mat Roof Board
- B. Cover Board: Polyisocyanurate (ISO) thermal board, complying with ASTM C1289; Type II - Faced with dark coated-glass facer on one side and light coated-glass facer on other surface of core foam, Class 4 with thickness of 1/2 inch, and Grade 1 with 109 psi, maximum, compressive strength.
 1. Product: Carlisle SecurShield HD Polyiso.

2.05 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: ASTM C1289, Type II, Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam; Grade 2.
 1. Thickness: As indicated elsewhere.
 2. Size: 48 inches by 96 inches, nominal.
 3. R-value (LTTR): 30, minimum.
 - a. 5 1/2 inch Minimum Total Thickness: R-value 5.7, minimum per inch.
 4. Compressive Strength: 20 psi.
 5. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
 6. Product:
 - a. Carlisle Product matching the above specifications.
 - b. Acceptable Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone.

2.06 ACCESSORIES

- A. Roofing Expansion Joint Flashing: EPDM membrane. Provide roof expansion joints where indicated and as detailed on the Drawings.
 - 1. Materials:
 - a. Compressible tube: Sponge tubing for expansion joints shall be 1-inch diameter closed-cell sponge rubber tubing approved by the roofing manufacturer.
 - b. Compressible insulation with insulation retainer.
- B. Prefabricated Flashing Accessories:
 - 1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
 - a. Carlisle SynTec Systems; Sure-Seal (black) Pressure-Sensitive Inside/Outside Corner: 60 mil, 0.060 inch thick, 7 by 9 inches precut, uncured EPDM with 35 mil, 0.035 inch factory-applied tape.
 - b. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive Overlayment Strip: 40 mil, 0.040 inch thick, semi-cured EPDM laminated to 35 mil, 0.035 inch factory-applied tape.
 - c. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive Cured Cover Strip: 40 mil, 0.040 inch thick, cured EPDM laminated to 35 mil, 0.035 inch factory-applied tape.
 - d. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive T-Joint Covers: 40 mil, 0.040 inch thick, uncured EPDM laminated to 35 mil, 0.035 inch factory-applied tape.
 - e. Carlisle; Sure-Seal Elastoform Flashing: 60 mil, 0.060 inch thick, uncured EPDM membrane.
 - f. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive Elastoform Flashing: 60 mil, 0.060 inch thick, uncured EPDM laminated to 35 mil, 0.035 inch factory-applied tape.
 - 2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
 - a. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive Pipe Seals; with factory-applied tape on deck flange.
 - 3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
 - a. Carlisle SynTec Systems; Sure-Seal Pourable Sealant Pocket: 2 inches wide plastic support strip with factory-applied, adhesive-backed uncured EPDM flashing.
 - 4. Carlisle SynTec Systems; Sure-Seal Pressure-Sensitive Reinforced Universal Securement Strip (RUSS):
- C. Insulation Adhesive: Two component polyurethane, expanding foam.
- D. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self-adhering.
- E. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
 - 1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
 - 2. HP Fastener: Threaded, E-coat, square head fastener for insulation attachment to steel, wood plank, plywood or oriented strand board decks.
 - 3. Insulation Fastening Plate: 3-inch nominal diameter metal plate, for use with the appropriate fastener to attach insulation.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
 - 1. Carlisle SynTec Systems; Sure-Seal SecurTAPE: 3-inch or 6-inch wide splice tape.
 - 2. Carlisle SynTec Systems; 90-8-30A Bonding Adhesive: Synthetic rubber.
 - 3. Carlisle SynTec Systems; Sure-Seal/Sure-White One-Part Pourable Sealer: White, one-component, moisture curing, elastomeric polyether.
- G. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- H. Sealants: As recommended by membrane manufacturer.

1. Carlisle SynTec Systems; Water Cut-Off Mastic.
- I. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.
- J. Primer: Manufacturer's recommended product.
 1. Products:
 - a. Carlisle SynTec Systems; Sure-Seal HP-250 Primer.
- K. Edgings and Terminations: Manufacturer's standard edge and termination accessories.
 1. Wind Performance:
 - a. Membrane Pull-Off Resistance: 100 lb/ft, minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-1.
 - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-2.
 - c. Provide product listed in FM (AG) with at least FM 1-270 rating.
 2. Products: Snap-on gravel stop edge system.
 - a. Carlisle SynTec Systems; SecurEdge 200.
 3. Termination Bar.

PART 3 EXECUTION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.

- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.03 PREPARATION, GENERAL

- A. Clean substrate thoroughly prior to roof application.
- B. Do not begin work until other work that requires foot or equipment traffic on roof is complete.

3.04 METAL DECK PREPARATION

- A. Install deck sheathing on metal deck:
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 - 3. Tape joints.
- B. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual FM DS 1-28 recommendations and roofing manufacturer's instructions.
 - 1. Over entire roof area, fasten sheathing using six fasteners with washers per sheathing board.
 - 2. At roof perimeter to 4 feet in from edges, fasten sheathing using 6 fasteners with washers per board.

3.05 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.
- G. When substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

3.06 INSULATION APPLICATION

- A. Attachment of Insulation:
 - 1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions.
- B. Do not install wet, damaged, or warped insulation boards.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- F. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

- G. Tape joints of insulation in accordance with roofing and insulation manufacturers instructions.
- H. At roof drains, use factory-tapered boards to slope down to roof drains over 18 inches.
- I. Do not apply more insulation than can be completely waterproofed in the same day.

3.07 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
 - 3. Secure flashing to nailing strips at 4 inches on center.
- F. Install roofing expansion joints where indicated, and ensure joints are watertight.
- G. Coordinate installation of roof drains and sumps and related flashings, locate field splices away from low areas and roof drains, and lap upslope sheet over downslope sheet.
- H. Install walkway pads at areas of concentrated traffic as indicated on drawings, and space pad joints to permit drainage.
- I. Daily Seal: Install daily seal per manufacturer's instructions at the end of each workday. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.08 CLEANING

- A. Remove wrappings, empty containers, paper, and other debris from the roof daily. Dispose of debris in compliance with local, State, and Federal regulations.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

**SECTION 07 62 00
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products; 2018.
- F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene at project site before starting work of this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- B. Edge Securement. Metal edge flashing at low slope membrane roof areas shall be secured to comply with Section 1504.5 of the 2018 International Building Code and ANSI/SPRI/FM 4435/ES-1.
- C. Roofing Subcontractor shall be a firm with a minimum of 5 years experience in work related to the type of roofing system shown and specified. All sheet metal, roofing, roof insulation, and associated work shall be subcontracted to a single firm, with undivided responsibility for the specified performance of component parts (even though some components may be sub-subcontracted to others).
- D. Installer's Field Supervision: The Roofing Subcontractor must maintain a full-time, experienced supervisor/foreman on the jobsite during times that roofing work and associated roofing work (as described above) is in progress.

- E. Coordination: Roof deck, sheet metal, roof insulation, roofing materials, and methods of installations shall be coordinated to develop assemblies approved by the roofing, insulation, and flashing material manufacturers.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

- A. All flashing materials and installation shall be warranted to be leakproof and free of defects by the flashing subcontractor for a period of 2 years following the date of Substantial Completion. All prefinished sheet metal shall be warranted covering fade, chalking and film integrity for a non-prorated period of 20 years following the date of Substantial Completion. These warranties shall also be signed by the Prime Contractor and shall be submitted in duplicate.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Aluminum: ASTM B209 (ASTM B209M); 22 gauge, 0.0253 inch thick; mill finish.
 - 1. Clear Anodized Finish: AAMA 611, AA-M12C22A41, Class I, clear anodic coating not less than 0.7 mil, 0.0007 inch thick.

2.02 PREFINISHED ALUMINUM SHEETS

- A. Description: Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.
- B. Aluminum Sheet Substrates: ASTM B209/B209M, 3005 alloy, H12 or H14 temper.
- C. Superior Performance Organic Coating System: Comply with AAMA 2605 for aluminum preparation, pretreatment, primer and finish coat system; provide thermally cured 70-percent PVDF fluoropolymer systems; tested for weathering for 10 years with 5 delta units color change maximum.

2.03 PREPAINTED, METALLIC-COATED STEEL SHEETS

- A. Description: Factory-applied coatings applied to metallic-coated steel sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed, top side of sheet; washcoats on bottom, unexposed sheet side.
- B. Comply with ASTM A755/A755M.
- C. Metallic-Coated Steel Sheet Substrates:
 - 1. Zinc-Coated, Galvanized, Steel Sheets: Commercial steel sheets, galvanized by hot-dip process; comply with ASTM A653/A653M; coating designation G90.
- D. Substrate Preparation for Prefinishing: Clean and prepare substrate surfaces in accordance with coating manufacturer's recommendations for substrate type and application.
- E. Washcoats or Backercoats: Provide washcoats or backercoats in accordance with organic coating manufacturer's recommendations.
- F. Primer Coats: Provide basecoat primers in accordance with coating manufacturer's recommendations for substrate type, topcoat, and application.
- G. Superior Performance Organic Coating System: Provide thermally cured 70-percent PVDF fluoropolymer systems in accordance with AAMA 2605, tested for weathering for 10 years with 5 delta units maximum of color change.

2.04 FABRICATION - GENERAL

- A. General: Shop fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance and with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels as indicated. Provide uniform neat seams with minimum exposure of sealant.
- B. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant in compliance with industry standards.
- C. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- D. Form pieces in longest possible lengths.
- E. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- G. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

2.05 FABRICATION

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements.
- B. Protection: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- C. Fabrication of Perimeter Roof Edge Flashing:
 - 1. Form exposed roof edge flashing from 24 gauge prefinished sheet metal to the profiles shown on the Drawings in maximum 10-foot lengths. The height of the exposed face shall be as shown on the Drawings. Form 8-inch wide coverplates for joints to the same profile as the flashing and for installation over the roof edge flashing similar to Figure 2-5A of the SMACNA Manual.
 - 2. Form concealed continuous cleats from 22 gauge galvanized sheet metal to match the profile shown on the Drawings.
- D. Form counter flashing and receivers for lower roof intersections with upper walls from 28-gauge prefinished sheet metal similar to the profile shown in the SMACNA Manual, Figure 4-4A Alternate with vertical back dam, except crimp the vertical counterflashing to approximately at 3/4-inch bend to produce a spring clip action against the membrane roofing as shown on the Drawings. Form receivers and counterflashing in maximum 10-foot lengths. Where the upper walls are metal panel in lieu of brick, form the receiver to tuck up behind the air/moisture barrier at least 3-inches, or as otherwise required by the manufacturer.
- E. Form sealer pocket pans for roof penetrations, which are of other sectional shapes than round, from 24-gauge galvanized sheet metal as shown in the SMACNA Manual, Figure 4-17E, and as otherwise indicated on the Drawings and required by the roofing manufacturer.
- F. Form miscellaneous drawings from 24-gauge prefinished sheet metal as shown on the Drawings, and install with clips, cleats, or other fastenings as required.

2.06 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Nails: Shall be not less than No. 12 gauge, with large flat heads, diamond points, barbed shafts, and of sufficient length to penetrate substrate at least 7/8-inch. Nails shall have lead or

neoprene washers where heads are exposed to the weather. Nails shall be hot-dipped galvanized steel with ring shanks.

- C. Screws: Shall be No. 12 stainless steel, galvanized, bronze or brass round head wood or sheet metal screws of sufficient length to penetrate substrate 7/8-inch. Provide lead, bronze, or nylon expansion sleeves where screws are used to secure sheet metal to masonry or concrete. Neoprene or lead washers shall be provided where screws are exposed to the weather.
- D. Primer Type: Zinc chromate.
- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- G. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- H. Reglets: Units of type, material and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated. Form the 90 degree bent to receive sealant.
- I. Isolation Materials: Coatings and tapes, for isolation of dissimilar materials, shall meet the recommendations of the sheet metal manufacturer. Aluminum surfaces and dissimilar surfaces to be placed in contact with each other shall each be coated with paints as specified in Aluminum Construction Manual published by The Aluminum Association, latest edition.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.
- D. Coordination with Roofing Membrane Installation: Do not install roof edge flashings and cleats until the roofing membrane has been extended out over roof edges or up onto curbs as shown on the Drawings and specified in Section 07 53 23.
- E. Install underlayment where shown on the Drawings to substrate according to manufacturer's recommendations.

3.03 INSTALLATION

- A. Install work with lines and corners true and accurate in alignment. Install faces flat and free of buckles, excessive waves, and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on the concealed side of exposed edges. Joints at corners shall be sealed and designed to accommodate movement.
- B. SMACNA and Manufacturer's Details: Install work to meet the recommendations shown in the SMACNA Manual and the recommendations of the sheet metal manufacturer, except when otherwise shown or specified. In the event of a conflict between recommendations of SMACNA and the sheet metal manufacturer, the latter shall govern.
- C. Conceal fasteners and expansion provisions wherever possible in exposed work, and locate to minimize the possibility of leakage. Cover and seal work for a watertight installation. Provide cleat-type anchorages for metal flashing and trim wherever practical, arranged to relieve stresses resulting from building movement and thermal expansion.
- D. Apply plastic cement compound between metal flashings and felt flashings.

- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Provide flanges, minimum 4-inches wide, for stripping in roofing.
- H. Provide for thermal expansion for items which exceed 10-feet in length
- I. Expansion joints shall be watertight, and shall be located as follows:
 - 1. Flashing and Trim. At 2-feet from corners and intersections and at 10-foot centers elsewhere.
- J. Overlaps shall be as follows:

Vertical surfaces and slopes steeper than 6 in 12	Minimum 3-inches
Slopes 6 in 12 or less	Minimum 6-inches
- K. Form drive-cleat sealed seams unless otherwise shown or specified.
- L. Installation of Receivers and Counterflashing: Fasten receivers to wood blocking or set into reglet lapping joints 4-inches minimum. Nail receivers to wood at 8-inch centers. Snap counterflashing into receiver and bend receiver down to form a straight line drip and compress the bottom edge of counterflashing back tightly against the roofing membrane. Slope counterflashing down near roof edges.
- M. Install sealer pocket pans with pourable sealer and as otherwise required by the roofing system materials suppliers.
- N. Install other miscellaneous sheet metal items as shown on the Drawings and as specified herein and in the SMACNA Manual to provide a neat, weathertight installation.
- O. Set splash pads under roof and canopy overflow outlets.

3.04 CLEANING AND PROTECTION

- A. Touch-up exposed surfaces which are visible or which might cause corrosion of metal or deterioration of finish with touch-up paint approved by the sheet metal manufacturer. Only minor scratches and fastening heads shall be touched-up. Other damaged material shall be replaced.
- B. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

**SECTION 07 84 00
FIRESTOPPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not.

1.02 RELATED REQUIREMENTS

- A. Section 07 05 53 - Fire and Smoke Assembly Identification.
- B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- H. FM 4991 - Approval Standard of Firestop Contractors; 2013.
- I. FM (AG) - FM Approval Guide; Current Edition.
- J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- L. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 2. Verification of minimum three years documented experience installing work of this type.
 3. Verification of at least five satisfactorily completed projects of comparable size and type.
 4. Licensed by local authorities having jurisdiction (AHJ).

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:
 1. 3M Fire Protection Products; CP 25WB: www.3m.com/firestop/#sle.
 - a. Accessories: MPS-2 and MMP-4S putty and other accessories as manufactured by 3M.
- B. Acceptable Firestopping Manufacturers:
 1. Hilti, Inc: www.us.hilti.com/#sle.
 2. Johns Manville: www.jm.com.
 3. RectorSeal, a CSW Industrials Company: www.rectorseal.com/firestop-solutions/#sle.
 4. Specified Technologies Inc: www.stifirestop.com/#sle.
 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 6. USG: www.usg.com.

2.02 MATERIALS

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- B. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping:
 1. Fire Ratings: Use system that is listed by FM (AG) or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated

assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

- B. Fire Safing Insulation:
 - 1. Mineral wool insulation for head of wall conditions, prefabricated to fit the trapezoidal flutes typical of metal deck.
 - a. Product: Thermafiber TopStop, Mineral Wood Insulation by Owens Corning or approved equal. See Section 01 60 00 - Materials & Methods.
 - 2. Mineral wood insulation for use at construction joints and penetrations.
 - a. Product: Thermafiber Safing, Mineral Wood Insulation by Owens Corning or approved equal. See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

**SECTION 07 92 00
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
 - 6. Certification by manufacturer indicating that product complies with specification requirements.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection. Samples shall be strips of actual caulking. Paper samples shall not be acceptable.
- D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- E. Executed warranty.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

- B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver sufficient samples to manufacturer for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - 6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide listed manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
 - 1. Urethane Sealants: Five years.
 - 2. Silicone Sealants: Twenty years.
- C. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

1.07 JOB CONDITIONS

- A. Weather and Temperature: Sealants shall be installed on dry days preferably with temperatures between 40F and 55F, but in no case shall sealants be installed when temperatures are below 40F or above 90F.
- B. Protection: Special care shall be exercised to prevent damage to adjacent work during installation of sealants.
- C. Sequencing:
 - 1. Install sealant adjacent to painted and stained surfaces before adjacent surfaces receive their final coat of paint or stain.
 - 2. Install sealants after brickwork and concrete is washed down and before water repellent treatment is applied.
 - 3. Caulking shall not begin until all samples have been approved and until a meeting has been held at the construction site between the Architect/Engineer and the caulking subcontractor to discuss miscellaneous caulking requirements and workmanship.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal the following joints:
 - 1) Wall expansion and control joints.
 - 2) Joints between doors, windows, and other frames or adjacent construction.
 - 3) Joints between different exposed materials.
 - 2. Interior Joints:
 - a. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - b. Seal the following joints:
 - 1) Joints between door frames and window frames and adjacent construction.
 - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.

- 3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
3. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with manufactured expansion joint cover assemblies or other sealing devices.
 - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
 - d. Joints where sealant installation is specified in other sections.
 - e. Joints between suspended ceilings and walls.
- B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
 2. Joints within and at perimeter of Exterior Insulation Finish System.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 3. Interior Expansion Joints at Exterior Walls.
- D. Interior Wet Areas: restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 3. Products:
 - a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
 - b. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: www.dow.com/#sle.
 - c. Pecora Corporation: www.pecora.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - e. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: White.
 2. Products:
 - a. Dow; Dowsil 786 Silicone Sealant: www.dow.com.
 - b. General Electric; Sanitary SCS1700 Sealant: www.siliconeforbuilding.com.
 - c. Tremco Commercial Sealants & Waterproofing; Tremsil 200: www.tremcosealants.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Products:
 - a. Pecora Corporation; Dynatrol II: www.pecora.com/#sle.
 - b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; Vulkem 116: www.tremcosealants.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; Dymeric 511: www.tremcosealants.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 35 percent, minimum.
 2. Products:
 - a. Pecora Corporation; NR-200 Urexpan: www.pecora.com.
 - b. Sika Corporation; Sikaflex-2c NS EZ Mix+: usa.sika.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; THC-900: www.tremcosealants.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use. Acoustical Sealant for use at penetrations through walls and at the tops of walls.
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Products:
 - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com/#sle.
 - b. Pecora Corporation; AC-20: www.pecora.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Products:
 - a. Sika Corporation; Sikaflex-2c SL: usa.sika.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Products:
 - a. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Uses M and A; multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent.
 2. Hardness Range: 30 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Products:
 - a. W. R. Meadows, Inc; Deck-O-Seal (pourable): www.wrmeadows.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.
 - 1. Profile: As required to match existing metal glazing cap requirements.
- C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
 - 1. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
 - 2. Products:
 - a. Tremco Commercial Sealants & Waterproofing; Spectrem Simple Seal:
www.tremcosealants.com/#sle.
- D. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- E. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- F. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- G. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

Lewis Central High School
Entry Addition

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

DIVISION 08 – OPENINGS

**SECTION 08 12 13
HOLLOW METAL FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 14 16 - Flush Wood Doors: Non-hollow metal door for hollow metal frames.
- B. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.
- C. Section 08 80 00 - Glazing: Glazed borrowed lites.
- D. Section 09 90 00 - Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- H. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
- L. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Supplier of Hollow Metal Frames shall be responsible for all coordination and preparation of hardware and wood and hollow metal doors and frames as they relate to each other.
- B. Hardware Templates: Templates shall be furnished to the fabricator by the hardware manufacturer. The fabricator shall drill and tap all holes, and make all cutouts and reinforcement in frames and doors to receive hardware in a neat and proper manner.

- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.
- B. Inspect hollow metal work upon delivery for damage or manufacturing defects. Minor damages and defects may be repaired provided items are equal in all respects to new work and acceptable to the Architect. Rejected work shall be replaced with new items.
- C. Delivery and Storage: Frames shall be shipped with angle spreaders at door opening bottoms. Frames shall be stored on the building site, in an upright position, under cover, on wood sills or floors, in a manner that will prevent rust or damage. Ventilate canvas or plastic covers to avoid humidity build-up.
- D. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Refer to Door and Frame Schedule on drawings for frame sizes, finishing, door hardware to be installed, and other variations, if any.
- B. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- C. Accessibility: Comply with ICC A117.1 and ADA Standards.
- D. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
- E. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- F. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.03 HOLLOW METAL DOOR FRAMES

- A. Frame Finish: Factory primed and field finished.
- B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
- C. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.04 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- B. Removable Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
- D. Touch up damaged factory finishes.

END OF SECTION

**SECTION 08 14 16
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 12 13 - Hollow Metal Frames.
- B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for other details.
- D. Samples: Submit two samples of door veneer, 6 inches by 6 inches in size illustrating wood grain, stain color, and sheen.
- E. Warranty, executed in Owner's name.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Wood doors shall not be delivered until the building or storage area is enclosed and sufficiently dry so that doors will not be damaged by excessive changes in moisture content.
- D. Identify each door as to type and location.
- E. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Krieger Specialty Products: www.kriegerproducts.com/#sle.
 - 2. Lynden Door: www.lyndendoor.com.
 - 3. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
 - 4. VT Industries, Inc: www.vtindustries.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

- A. Doors:

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at each location.
 2. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particle board core (PC) or structural composite lumber core (SCLC), plies and faces as indicated.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
1. Vertical Edges: Same species as face veneer.
- B. Facing Adhesive: Type II - water resistant.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
1. Provide solid blocks at locations required by WDMA for hardware reinforcement.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
1. Transparent:
 - a. System - TR-6, Catalyzed Polyurethane.
 - b. Stain: As selected by Architect - see Color Schedule in Section 09 99 90.
 - c. Sheen: Satin.
- B. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 12 13.
- B. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Fit door to frame for proper fit and machine for hardware using templates supplied by the Hardware Supplier.

- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- B. Section 08 80 00 - Glazing : Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. All frame details which will incorporate glazing shall be coordinated with the glass manufacturer to assure that all details, methods of frame weepage, materials and methods of installation are in accordance with the glass manufacturer's requirements.
- C. All hardware preparation, reinforcing and other requirements shall be coordinated with the hardware supplier to assure proper operation and fit of all doors and hardware items.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples of 4-inch long extrusions illustrating finished aluminum surface, glass, glazing materials.

- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 MOCK UP

- A. Install one representative aluminum frame condition for Owner/Architect approval prior to installing the remaining locations.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally-Broken (Exterior Aluminum Frames):
 - 1. Basis of Design: Kawneer North America; Trifab VG 451T: www.kawneer.com.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Center-Set Style, Not Thermally-Broken (Interior Aluminum Frames):
 - 1. Basis of Design: Kawneer North America; Trifab II 450.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Manko Window Systems, Inc: www.mankowindows.com/#sle.
 - 2. EFCO, a Pella Company; 402 (NT), 403 (T): www.efcocorp.com/#sle.
 - 3. Tubelite Inc.; T14000 Series: www.tubeliteinc.com.

2.02 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Glazing, Not Thermally-Broken (Interior Doors):
 - 1. Basis of Design: Kawneer North America; Model 500: www.kawneer.com.
 - 2. Thickness: 1-3/4 inches.
- B. Wide Stile, Insulating Glazing, Thermally-Broken (Exterior Doors):
 - 1. Basis of Design: Kawneer North America; Model 500T: www.kawneer.com.
 - 2. Thickness: 2-1/4 inches.
- C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. EFCO, a Pella Company: www.efcocorp.com/#sle.
 - 2. Manko Window Systems, Inc.: www.mankowindows.com.
 - 3. Tubelite Inc.: www.tubeliteinc.com.

2.03 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 3. Fabrication: To the greatest possible extent, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.
 - 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 9. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

2.04 PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
- B. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
- C. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
- D. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
- E. Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Manufacturer's standard blade-type stops.
- B. Glazing: See Section 08 80 00.
- C. Swing Doors: Glazed aluminum.
 - 1. Thickness: 1-3/4 inches at interior doors, 2 1/4 inches at exterior doors.
 - 2. Glazing Stops: Manufacturer's standard blade-type stops.
 - 3. Finish: Same as storefront.
- D. Closure plates and brake metal: Provide matching closure plates and brake metal at locations noted on the Drawings. Brake metal shall be 0.040-inch thick aluminum.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
 - 1. Do not use exposed fasteners except where unavoidable. Exposed fasteners shall match finish of frame members.
- C. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- D. Concealed Flashings: Galvanized steel, 26 gauge, 0.0179 inch minimum base metal thickness.
- E. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- F. Glazing Accessories: See Section 08 80 00.
- G. Caulking materials for internal frame joints, fasteners, etc., shall be of a color to most closely match the aluminum framing, and of the types recommended by the frame manufacturer. Caulking which is totally concealed may be of any color selected by the manufacturer.
- H. All caulking of frame perimeters shall comply with the requirements, materials and colors specified in Section 07 92 00, and shall be included under this Section.

2.07 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Color: As scheduled. See Section 09 99 90 - Color Schedule.

2.08 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Coordinate installation of security components at exterior doors. Coordinate as required with the door hardware supplier, the electrical sub-contractor and the Owner's security system provider. When there are electrical door hardware items being installed, the aluminum frame supplier shall provide boxes of the appropriate size to protect the hardware devices from damage and also to allow room for wire termination and installation of the electrified hardware items.
- C. Other Door Hardware: See Section 08 71 00.
- D. Weather-stripping:
 - 1. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.
 - 2. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
- E. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners
- F. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.

- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials. At points where members are attached to structure, use nylon or neoprene washers or other non-metallic materials for separation to allow for movement due to thermal range between aluminum unit and structure.
- E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- F. Provide thermal isolation where components penetrate or disrupt building insulation.
- G. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure to provide weathertight construction. Comply with requirements of the frame manufacturer regarding sealant types. Caulking at the perimeter of all frames where abutting adjacent materials shall be included in Section 07 9200.
- K. Drill frames and doors and install hardware items with bolted connections, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible. Check and adjust as required to maintain a tight fit against all weatherstripping.
- L. Install glass in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area. Test not less than 2% minimum of each window system. Field verify exact location of testing with Architect in the field.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3.05 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

Lewis Central High School
Entry Addition

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

**SECTION 08 71 00
FINISH HARDWARE**

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 08 12 13 - Hollow Metal Frames.
- B. Section 08 14 16 - Flush Wood Doors.
- C. Section 08 43 13 - Aluminum-Framed Storefronts.
- D. Section 28 00 00 - for Electrical requirements.

1.02 QUALITY ASSURANCE

- A. Supplier: The firm supplying hardware for this project shall employ a member of the American Society of Architectural Hardware Consultants, or a person of equivalent capability who is approved by the Architect. The Consultant shall be available during all phases of construction for consultation and technical assistance. The firms bidding on this project must understand all of the requirements of their jobsite work. If they aren't certified to perform all work associated with this contract then they need to make certain they make arraignments with people that are able to perform the technical aspects of this contract defined below.
 - 1. All door hardware low voltage wires provided and installed by the access control/security contractor.
 - 2. Door hardware power supplies provided by the door hardware subcontractor and installed by the electrician.
- B. Coordination with Steel Door and Frame Supplier: The hardware supplier shall coordinate all hardware items to be installed in or on steel doors and frames with the supplier of those items to assure proper fit, reinforcing and operation.
- C. Electrical System Rough-In: There is to be a coordination meeting set up by the General Contractor, with the Architect, the Owner's representative, the aluminum frame subcontractor, the electrician, the metal door/frame and hardware subcontractor as well as the access controls contractor to review all electrical products being installed and to make certain everyone understands their role in the process. This meeting needs to be held very early in the construction process, before any frames are installed, to eliminate any conflicts during the installation phase. The General Contractor shall keep meeting minutes and distribute copies to the above described.

1.03 SUBMITTALS

- A. Hardware Schedule: Submit hardware schedule to the Architect/Engineer in accord with the General Conditions and 01 30 00 - Administrative Requirements. The hardware schedule shall list the type, manufacturer's name and number, finish, size, function and location. All abbreviations and symbols used on the schedule shall be explained. Catalog cuts and information covering each item of hardware shall be attached to the hardware schedule. No hardware shall be ordered, or delivered to the job, until approval of the schedule has been received from the Architect. Approval of the schedule does not relieve the hardware supplier of fulfilling all terms of the specifications.
- B. Maintenance Manual: Supply 1 paper and 1 digital copy of installation instructions, maintenance instructions for each operating item, maintenance instructions for finishes, and parts manuals for all locksets, closers, exit devices and other operating devices to the Prime Contractor for inclusion in the overall project maintenance manual.
- C. Installation and Adjustment Tools: Supply 2 complete sets of all installation and adjustment tools for transmittal to the Owner by the Prime Contractor for each different style, type and series of lockset, latch, lock, exit device, closer or other adjustable hardware item provided and installed at this project.
- D. Keying Schedule: Verify keyway requirements and establish core mark, control, grand master, master, submaster divisions and individual passage keying requirements with the Owner's

representative. Verification shall include keying for miscellaneous locks on other items listed at the beginning of this Section. Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

1.04 SUBMITTAL SEQUENCE

- A. Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., steel and aluminum doors and frames) which are critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by builders of hardware, and other information essential to the coordinated review of hardware schedule.
- B. Steel and Aluminum Doors and Frames: Hardware for installation on steel and aluminum doors and frames is to be made to standard templates, and such templates, schedules and other pertinent information shall be delivered to the individual door and frame fabricators within 10 days after receipt of the approved finish hardware schedule. All steel and aluminum doors and frames shall be reinforced, drilled, and tapped by the fabricator for mortised hardware. Reinforcement for surface-applied hardware shall be by the fabricators. Drilling and tapping shall be done in the field by the hardware installer for surface applied hardware items.

1.05 PRODUCT HANDLING

- A. Packaging and Marking: Package hardware in individual containers on a set by set basis with set numbers which correspond to the approved hardware schedule. Each set shall contain each item of hardware required for that set including necessary screws, keys and installation instructions, and installation templates for spotting mortising tools. Two or more identical sets may be packaged in the same container. Mark each container clearly with hardware set numbers. All keys shall be tagged according to their corresponding locks and delivered to the Owner or his authorized representative as described hereinafter. All construction keys for new exterior locks shall be delivered to the Prime Contractor or his/her authorized representative.

1.06 TEMPLATES

- A. Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of finish hardware. Upon request, check the shop drawings of such other work, to confirm that adequate provisions are made for the proper installation of hardware.

PART 2 PRODUCTS

2.01 HARDWARE

- A. Finish Hardware shall be as hereinafter specified and scheduled. Provide additional items of hardware which are necessary to make a complete workable and workmanlike installation even though such items are not herein specifically scheduled. Such miscellaneous items shall be equal in quality and finish to items which are specified.
- B. Approved Products: Brands and models designated in this Section are intended to define the exact standards of quality, function and design required. Substitution in the brands noted as acceptable shall be equivalent in every respect. Substitutions, other than as below noted, will not be permitted unless given prior approval via addendum, as described in the Instructions to Bidders.

<u>ITEM</u>	<u>SPECIFIED</u>	<u>ACCEPTABLE</u>
Hinges	McKinney	Stanley
Continuous Hinges	Pemko	ABH
Locks	Corbin Russwin	No Substitutions
Exit Devices	Corbin Russwin	Precision
Electric Strikes	HES	No Substitutions
Closers	Norton	Stanley EHD9000
Flat Goods & Stops	Rockwood	Trimco
Power Transfers	Securitron	Precision

Wire Harnesses	McKinney	Stanley
Door Position Switches	Securitron	SDC

*PROVIDE 188S PERIMETER SMOKE GASKET AT ALL NEW FIRE/SMOKE RATED AND CORRIDOR DOORS.

- C. Continuous Hinges: All frames shall be properly reinforced per manufacturer's standards. Exterior hinges will be installed with the barrel of the hinge extended down to within 1/8" of the top of the threshold to prevent gaps in sealing the opening.
- D. Provide mounting brackets for door position switches as required at aluminum doors.

2.02 MISCELLANEOUS REQUIREMENTS

- A. All doors over 36-inches wide shall require 5-inch high butts. Doors shall be provided with 3 each 4 1/2" x 4 1/2" hinges. Provide 1 hinge for each 30" of door height.
- B. Mounting of Closers: Closers on all doors shall be mounted with sex bolts and finishing washers. Grommet nuts will not be acceptable. Provide all drop plates, spacers and mounting brackets to facilitate secure mounting to all door and frame conditions.
- C. Closers shall be of the parallel arm configuration where possible. Closer arms shall be heavy duty type for all closers.
- D. Door Silencers at Steel Frames: All steel frames shall receive Glynn Johnson GJ64 silencers as required. Provide 3 silencers on strike jambs of frames of single swing doors and 2 silencers on heads of frames of double-swing doors. At existing metal frames to remain, remove any existing silencers and provide new silencers as required. This latter requirement shall apply only to doors listed in the Schedule to receive a new hardware set; doors shown to have all existing hardware shall not require new silencers. Silencers shall also be provided at the tops in the metal frame door pocket enclosures at cross-corridor doors.
- E. Overhead Stops: Provide overhead stops wherever wall conditions will not allow use of standard wall stops.
- F. Deadstop Angles for closers and overhead stops shall be accurately determined to prevent doors from contacting adjoining walls or other doors while still affecting the hold-open point at the greatest possible angle.
- G. Provide cylinders and keys as required for the following equipment: (See those Specification Sections listed at this beginning of this Section).
- H. Note: Finish of all cylinders and keys shall be 626.

PART 3 EXECUTION

3.01 QUALITY CONTROL

- A. Pre-Installation Meeting: There is to be a coordination meeting set up by the General Contractor, with the Architect, the hardware installer, the Owner's representative and the hardware manufacturer to review all products being installed. This meeting needs to be held very early in the construction process, before any hardware is installed, to eliminate any conflicts during the installation phase. The General Contractor shall keep meeting minutes and distribute copies to above the described.
- B. Post-Installation Review: The General Contractor shall notify the Architect, Owner's representative and the hardware manufacturer upon completion of the hardware installation to review the work. The hardware manufacturer shall review and document the work and distribute copies to the above described.

3.02 HARDWARE LOCATIONS

- A. Hardware locations (height above finish floor) shall be in accordance with the Steel Door Institute Standards except for the following modifications:

Leversets/Latchsets 36-inches to centerline of strike

Exit Devices

35-3/4-inches (plus or minus) to centerline of
push pad, (center in door rail);
verify with Architect/Engineer.

3.03 INSTALLATION OF HARDWARE - GENERAL

- A. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- B. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- C. Drill, tap, and countersink units for surface applied hardware and other items which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards and manufacturer's recommendations.

3.04 INSTALLATION OF WEATHERSTRIPPING AND SEALS

- A. Provide metal fasteners of type which will not work loose as a result of normal door use, and which are compatible with metal of the stripping, and the frame or the door. Provide only smooth exposed fastener heads, which do not constitute a snagging hazard to clothing of building occupants.
- B. Set units plumb and level, accurately centered at optimum location for maintaining a permanent seal.
- C. Adjust doors, frames, and hardware, as necessary, to achieve proper operation of seals and stripping.

3.05 INSTALLATION OF THRESHOLDS

- A. On concrete, masonry, and similar substrates, install lead-shield anchors, accurately placed to receive machine screw anchors at locations pre-drilled and evenly spaced in threshold units (spaced not more than 12-inches o.c.).
- B. Screw thresholds to substrate with No. 10 or larger flat head machine screws, of the proper type and length of bronze or stainless steel which will provide for permanent anchorage and will not corrode in contact with threshold metal or shield anchor.
- C. At exterior doors, and elsewhere where scheduled, set thresholds in a bed of sealant as scheduled in Section 07 92 00 to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant and clean all adjacent surfaces.
- D. Set threshold units level and accurately aligned with outside edges of frames and door bottom edge, and at proper elevation for door operation and full and positive seal to threshold stop. Shim, if necessary, for full continuous support of threshold at each edge and intermediate legs, if any. Use non-corrosive shims of metal or plastic (no wood), set in adhesive or otherwise anchored against dislocation from impact of traffic upon threshold.

3.06 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace any unit which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.07 HARDWARE

- A. See attached document.

END OF SECTION

Lewis Central High School
Entry Addition

Hardware Set 1 (Door # 100A, 100A.3)

1	Each	Continuous Hinge	KCFM_HD1 PT		PE
1	Each	Power Transfer	EL-CEPT	630	SU
1	Each	Exit Device	ED5200 EO MELR M92	630	RU
1	Each	Operator	by Section 087113		
1	Each	Actuator	by Section 087113		
1	Each	Wire Harness	QC-Cxxx (length required)		MK
1	Each	Door Position Switch	DPS-M-BK		SU
1	Each	Power Supply	by Access Control		

Threshold & Weatherproofing by Door Supplier.

Inside operator actuator always active and will electrically retract exit device latchbolt before initiating operator.

Loss of power or power being cut by emergency lockdown will release exit device latchbolts securing doors.

Egress free at all times by depressing exit device pushpad which will shunt door position switch.

Door position switch to monitor for propped door and unauthorized usage alert (schedule to be determined by owner).

Hardware Set 2 (Door # 100A.1)

1	Each	Continuous Hinge	KCFM_HD1 PT		PE
1	Each	Power Transfer	EL-CEPT	630	SU
1	Each	Exit Device	ED5200 K157ET C6 MELR M92	630	RU
1	Each	Pull	BF157 Mtg-Type 12	US32D	RO
1	Each	Operator	by Section 087113		
1	Each	Actuator	by Section 087113		
1	Each	Wire Harness	QC-Cxxx (length required)		MK
1	Each	Door Position Switch	DPS-M-BK		SU
1	Each	Card Reader	by Access Control		
1	Each	Video Intercom	Re-Use Existing		
2	Each	Push Button	by Access Control		
1	Each	Power Supply	by Access Control		

Threshold & Weatherproofing by Door Supplier.

Access control system to electrically retract exit device latchbolt, shunt door position switch and provide power to operator actuator during designated hours.

Video Intercom to allow visitors to signal staff of their presence, exit device latchbolt electrically retracted and operator actuator powered by signal from push button at Reception or SRO or from authorized phone allowing entry.

When locked, presenting a valid credential to card reader will electrically retract exit device latchbolt & shunt door position switch and provide power to operator actuator allowing entry.

Key override will manually retract exit device latchbolt allowing entry but door position switch is not shunted.

Loss of power or power being cut by emergency lockdown will release exit device latchbolt securing door and disable operator actuator.

Egress free at all times by depressing exit device pushpad which will shunt door position switch.

Door position switch to monitor for propped door and unauthorized usage alert (schedule to be determined by owner).

Hardware Set 3 (Door # 100A.4)

1	Each	Continuous Hinge	KCFM_HD1 PT		PE
1	Each	Power Transfer	EL-CEPT	630	SU
1	Each	Exit Device	ED5200 K157ET 6P MELR M92	630	RU
1	Each	Pull	BF157 Mtg-Type 12	US32D	RO
1	Each	Operator	by Section 087113		
1	Each	Actuator	by Section 087113		
1	Each	Wire Harness	QC-Cxxx (length required)		MK
1	Each	Door Position Switch	DPS-M-BK		SU
1	Each	Card Reader	by Access Control		
2	Each	Push Button	by Access Control		
1	Each	Power Supply	by Access Control		

Threshold & Weatherproofing by Door Supplier.

Access control system to electrically retract exit device latchbolt, shunt door position switch and provide power to operator actuator during designated hours.

Signal from push button at Reception or SRO or from authorized phone to electrically retract exit device latchbolt and provide power to operator actuator allowing entry.

When locked, presenting a valid credential to card reader will electrically retract exit device latchbolt & shunt door position switch and provide power to operator actuator allowing entry.

Key override will manually retract exit device latchbolt allowing entry but door position switch is not shunted.

Loss of power or power being cut by emergency lockdown will release exit device latchbolt securing door and disable operator actuator.

Egress free at all times by depressing exit device pushpad which will shunt door position switch.

Door position switch to monitor for propped door and unauthorized usage alert (schedule to be determined by owner).

Hardware Set 4 (Door # 104A)

1	Each	Continuous Hinge	KCFM_HD1 PT		PE
1	Each	Power Transfer	EL-CEPT	630	SU
1	Each	Exit Device	ED5200 K157ET C6 MELR M92	630	RU
1	Each	Pull	BF157 Mtg-Type 12	US32D	RO
1	Each	Closer	CPS7500 x 6890 x 6891	689	NO
1	Each	Wire Harness	QC-Cxxx (length required)		MK
1	Each	Door Position Switch	DPS-M-BK		SU
1	Each	Card Reader	by Access Control		
1	Each	Power Supply	by Access Control		

Threshold & Weatherproofing by Door Supplier.

Presenting a valid credential to card reader will electrically retract exit device latchbolt and shunt door position switch allowing entry.

Key override will manually retract exit device latchbolt allowing entry but door position switch is not shunted.

Loss of power or power being cut by emergency lockdown will release exit device latchbolt securing door.

Egress free at all times by depressing exit device pushpad which will shunt door position switch.

Door position switch to monitor for propped door and unauthorized usage alert (schedule to be determined by owner).

Hardware Set 5 (Door # 102, 102A)

1	Each	Lock	CLX3362 NZD	626	RU
1	Each	Electric Strike	8300C	630	HS
2	Each	Card Reader	by Access Control		
1	Each	Push Button	by Access Control		
1	Each	Power Supply	by Access Control		

Balance of Hardware Existing.

G.C. to modify existing door and frame as required for new lock and electric strike.

Signal from push button at Reception or from authorized phone to release electric strike allowing passage into corridors.

Lever on Reception side to in locked position at all times.

During school hours lever on Corridor side to be unlocked by key allowing free entry to Reception.

After school hours lever on Corridor side to be locked by key securing Reception.

When locked, presenting a valid credential to card reader either side will release electric strike allowing passage.

Loss of power or power being cut by emergency lockdown will leave electric strike closed securing door.

Hardware Set 6 (Door # 103, 105, 106, 107, 108, 110, 114, 118A)

3	Each	Hinge	TA2714 5" x 4 ½"	US26D	MK
1	Each	Lock	CLX3351 NZD	626	RU
1	Each	Wall Stop	409	US32D	RO

Hardware Set 7 (Door # 110B)

3	Each	Hinge	TA2714 4 ½" x 4 ½"	US26D	MK
1	Each	Privacy	CLX3320 NZD	626	RU
1	Each	Wall Stop	409	US32D	RO

Hardware Set 8 (Door # 111, 116, 130)

Existing Hardware to Remain.

SECTION 08 71 13
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Product requirements for certain door hardware, supplementing specifications in Section 08 71 00.
- B. Power operators.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware: General administrative and installation requirements applicable to this Section.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors; 2019.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

PART 2 PRODUCTS

2.01 POWER OPERATORS

- A. Power Operators: Low energy type, surface mounted; capable of controlling door up to 350 pounds; operating as a mechanical closer when power is not available; complying with BHMA A156.19, ADA Standards and ICC A117.1.
 - 1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic component for proper operation and switching.
 - a. Run wiring through door frames and provide external access for manual shut off of unit.
 - 2. Provide time delay option for normal cycle.
 - 3. When operating as a closer, provide operating forces complying with BHMA A156.19, ADA Standards and ICC A117.1.
 - 4. Provide delay switches for motor activation, exit device latch retraction interfacing and hold open times; hold open times to be adjustable from one second to multiple seconds duration.
 - 5. Degree of powered swing adjustable from 80 degrees to 110 degrees.
 - 6. Integral obstruction detection for closing and opening cycle.
 - 7. Adjustable built in stop, set from 80 degrees maximum to 180 degrees manual swing.
 - 8. When in "blow open" operation for smoke ventilation, keep operator in the open position when power is lost.
 - 9. Boost-to-close selectable by on/off switch.
 - 10. Inside vestibules, provide adjustable sequencing input for operation of two or more units.
 - 11. Manufacturers:
 - a. Basis of Design Manufacturers:
 - 1) Stanley Magic Door, Inc.; Product – Magic Access for interior doors.
 - 2) Stanley Magic Door, Inc.; Product – Magic Force (power close) for exterior door.
 - b. Acceptable Manufacturers:
 - 1) ASSA ABLOY Entrance Solutions: www.besam-usa.com/#sle.
 - 2) Horton Automatics: www.hortondoors.com/#sle.
 - 3) LCN, an Allegion brand: www.allegion.com/us/#sle.
 - c. Provide products of a single manufacturer.
- B. Actuators: Proximity access reader with adjustable range.
 - 1. Provide an actuator on each side of each door having a low energy power operator.
 - a. Provide frame mounted press switch at exterior doors.
 - 2. Size actuators to fit inside and fully cover a standard single mount electrical box.

3. Locate actuators in accordance with ICC A117.1 and ADA Standards.
 4. Material: Stainless steel.
 5. Basis of Design:
 - a. Stanley Magic Switch MS11 (stainless steel touchless actuator) to be provided.
 - b. Provide same manufacturer as power operators.
 - c. Acceptable Manufacturers as listed above.
- C. Signage: Provide signage in accordance with BHMA A156.19.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.
- B. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
- C. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

- A. Install in accordance with Hardware Schedule and manufacturer's written instructions.
- B. See Section 08 71 00 for additional requirements.

3.03 ADJUSTING

- A. Adjust door equipment for correct function and smooth operation.

END OF SECTION

**SECTION 08 80 00
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 12 13 - Hollow Metal Frames: Glazed borrowed lites.
- C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- E. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- J. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.

1.05 COORDINATION

- A. The glazing subcontractor shall coordinate his/her requirements with the steel frame subcontractors to assure that frames are provided with required bite, edge, and face clearance.

1.06 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: All areas of glazing shall comply with all applicable codes, including but not limited to the International Building Code, Edition as noted in the Drawings. In case of conflict between that regulation and these Drawings and Specifications, the requirements of the regulatory agency shall govern.
- B. Glass Standards: Glass installations shall meet the requirements of ASTM C1036. Heat-treated glass shall meet the requirements of ASTM C1048. Safety glass shall meet the requirements of Standard CPSC 16 CFR 1201.
- C. Glass material containing bubbles, scratches, or other glass shall be removed immediately upon notice.
- D. Manufacturer's Label: Each piece of glass shall bear the manufacturer's label.

1.07 STORAGE AND HANDLING

- A. Stack glazing sheets at 5 to 7 degrees from vertical. Separate sheets with interweaving of protection paper and cushion top and bottom edges with felt. Cover to protect material from wind-blown water or run-off, but provide for ventilation and circulation of cool, dry air. Maintain temperature above dew point. Protect glazing material from welding, sandblasting, and other potentially damaging operations before and after installation.
- B. Handle glazing sheets to prevent damage to edges and corners.

1.08 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Warranty on Hermetic Seals: Provide insulating glass manufacturer's written warranty, agreeing to, within specified warranty period, furnish FOB project site, replacement units for insulating glass units which have defective hermetic seals (excluding that due to glass breakage); defined to include intrusion of moisture or dirt, internal condensation at temperatures above -20F, and other visual evidence of seal failure or performance failure; provided manufacturer's instructions for handling, installation, protection, and maintenance have been adhered to during warranty period. If this warranty is not honored by the glass manufacturer because of defective installation procedures or other actions of the glazing subcontractor, that subcontractor shall be liable for the terms of that warranty for a period of 5 years after the date of Substantial Completion.
- C. Warranty period is 10 years after seal date permanently imprinted on unit, but not less than 9 years after date of Substantial Completion.
- D. All glass shall be warranted for 10 years against breakage due to defects in materials, workmanship or installation with all such glass immediately removed and replaced with matching new material at no additional cost to the Owner upon notification by the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 2. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 3. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category II impact test requirements.
 2. Ionoplast Interlayer: 0.090 inch thick, minimum.

2.03 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 3. Insulite Glass Co.: www.insuliteglass.com.
 4. ITI Glass: www.itiglass.com.
 5. Oldcastle Building Envelope: www.obe.com.
 6. Pilkington North America Inc: www.pilkington.com/na/#sle. Pilkington North America Inc: www.pilkington.com/na/#sle.
 7. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.
 8. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- B. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Spacer Color: Aluminum.
 4. Edge Seal:
 - a. Single-Sealed System: Provide silicone sealant as seal applied around perimeter.
 5. Color: Grey.
 6. Purge interpane space with dry air, hermetically sealed.
- C. Type TTIG - Tinted Tempered Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick.
 - a. Tint: Gray.
 - 1) Basis of Design: Vitro Graylite 2 - to match existing.
 - b. Coating: Self-cleaning type, on #1 surface.
 - c. Coating: Low-E (solar control type), on #2 surface.
 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value) 20 percent, maximum.
 7. Visible Light Transmittance (VLT): 44 percent, nominal.
 8. Solar Heat Gain Coefficient (SHGC): .27, nominal.

2.04 GLAZING UNITS

- A. Type CTG - Clear Tempered Glass: Non-fire-rated.
 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 2. Glass Type: Fully tempered safety glass as specified.
 3. Tint: Clear.
 4. Thickness: 1/4 inch.

- B. Type SCTLG - Security Clear Tempered Laminated Glass.
 - 1. Applications: Locations as indicated on drawings.
 - 2. Thickness: 9/16 inch.
 - 3. Outer Lite: Tempered glass.
 - 4. Inside Lite: Tempered glass.
 - 5. Manufacturers:
 - a. SentryGlas: www.sentryglas.com.

2.05 GLAZING SEALANTS

- A. Glazing Sealant for the exterior perimeter of all glass panes where they abut frame members (unless recommended otherwise by the glass manufacturer) shall be the following type and manufacturer:
 - 1. General Electric Company; SCS2000 SilPruf.
- B. Other glazing sealants shall be of the type and manufacture recommended by the glazing manufacturer for the type of glass and application.
- C. Sealant Backer Rod: To be compressible continuous length rod stock of closed cell polyethylene foam for use as back-up of butt joint sealants as shown on the Drawings. Color shall be manufacturer's standard. Backer rod shall be of the diameter as recommended by the Fabricator/Installer and shall be one of the following or as otherwise recommended by the Fabricator/Installer:
 - 1. BASF; MasterSeal 920: www.basf.com.
 - 2. W.R. Meadows, Inc.; Kool-Rod: www.wrmeadows.com.
- D. Joint Primer/Sealer: To be the type of joint/sealer recommended by the sealant manufacturer for the joint surfaces to be primed, bonded, and sealed.

2.06 ACCESSORIES

- A. Setting Blocks: Neoprene or EPDM, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene or EPDM, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.
- F. Two Way Communication Window Speak-Thru: No-draft speak-thru allowing audible transmission in glazing.
 - 1. Location: Pass-thru window as indicated on the Drawings.
 - 2. Size: 5 inch diameter.
 - 3. Material: Stainless Steel.
 - 4. Basis of Design:
 - a. Covenant Security Equipment: CSE-QS-NV: www.coventsecurityequipment.com.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 STANDARDS AND PERFORMANCE

- A. Watertight and airtight window and door installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating doors), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- B. Protect all glass from edge damage during handling and installation, and subsequent operation of glazed components of the work. During installation, discard units with significant edge damage or other imperfections.
- C. Glazing channel dimensions as shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerance. Adjust as required by job conditions at time of installation.
- D. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual," except where more stringent requirements are indicated.
- E. Install insulating glass units to comply with recommendations by Sealed Insulating Glass Manufacturers Association, except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

3.03 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.
- D. Coordinate with painter to assure that all metal frames have received their first coat of paint before glazing is started.

3.04 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.
- F. Continuous glazing tape shall be installed at both faces of all glass. Exterior glazing shall be sealed at the full perimeter of each pane with silicone sealant where the glass abuts the metal frames.
- G. Make silicone joints where interior glass abuts glass and wall materials without frames.
- H. Install setting blocks of proper size and spacing, for glass sizes larger than 50 united inches, except where pre-shimmed tapes are used for glazing. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

- I. Install tempered glass sheets in frame openings with manufacturer's identification seal placed in the lower right hand corner of each lite opening.
- J. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- K. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

3.05 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

DIVISION 09 – FINISHES

**SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 27 00 - Air Barriers: Air- and water-resistive barrier over sheathing.
- D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- I. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- J. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- K. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- L. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).
- M. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

- N. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- O. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- P. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- Q. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- R. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- S. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- T. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
- U. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
- V. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- W. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- X. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).
- Y. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- Z. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- AA. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- BB. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
- CC. SSMA - Steel Stud Manufacturers Association; Current Edition.
- DD. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
 - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate special details associated with fireproofing.

1.05 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where gypsum wallboard systems with fire-resistance ratings are indicated or are required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested for fire resistance per ASTM E119 by a testing and inspection agency acceptable to authorities having jurisdiction. Products used in the assembly shall carry a classification label from a testing laboratory acceptable to the authority having jurisdiction.
- B. Allowable Tolerances: On faces of work exposed in occupied spaces, including stairwells (if any), limit offsets between planes of board faces to 1/8-inch, and limit variations from plumb and location (including warp and bow) not to exceed 1/4-inch in 8'-0".

- C. Install gypsum board on walls, partitions and furring to within 1/8-inch of floor to provide full backing for resilient base.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Gypsum wallboard shall not be delivered to the project site until immediately before application is to begin. All gypsum drywall materials shall be delivered in original packages, containers or bundles bearing brand name and identification nomenclature.
- B. Storage: Gypsum wallboard boards shall be stored inside under cover and stacked flat in a manner to keep material flat, dry, protected from weather, direct sunlight, surface contamination, traffic or other construction damage. Other materials and accessories shall remain in their original wrappings or containers, sorted flat and protected from damage or bending until ready for actual use.
- C. Handling: Handle gypsum boards in a manner to prevent damage to edges, ends and surfaces. Damaged gypsum boards and accessories shall not be incorporated within the work and shall be immediately removed from the site.
- D. Store metal products to prevent corrosion in accordance with AISI "Code of Standard Practice".

1.07 JOB CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during, and after application of gypsum board.
- B. Temperature: When outside temperatures are below 55F, maintain continuous interior temperature in the range of 55F to 70F for minimum period of 48 hours prior to, during, and following application of gypsum board, joint and finishing treatment materials or bonding of adhesives.
- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent drying too rapidly.
- D. Protection: Protect all adjacent surfaces and work by suitable means from splatter or overspray from texture surface application.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.
 - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. MBA Building Supplies, Inc.: www.mbastuds.com.
 - 3. MarinoWARE: www.marinoware.com/#sle.
 - 4. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
- C. Structural Steel Framing for Application of Gypsum Board: See Section 05 40 00.
- D. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.

1. Framing and Suspension Materials: When 20-gauge and 25-gauge materials are specified below, they shall be fabricated from commercial quality galvanized steel with a minimum yield point of 33,000 psi. 20-gauge material shall have a design thickness of .0312-inch and the 25-gauge material shall have a design thickness of .0188-inch as defined by SSMA (Steel Stud Manufacturers Association).
2. Studs: C-shaped with flat or formed webs consisting of 25-gauge and 20-gauge galvanized steel, 1-5/8 inch, 3-5/8 inch, 4 inch, and 6 inch screw type studs and track or as otherwise may be indicated on the Drawings.
 - a. 25-gauge studs shall be used throughout, except 20-gauge shall be used at the following locations:
 - 1) All interior studs that are over 12-feet total height.
 - 2) All 4-inch and 6-inch interior studs.
 - 3) All interior studs which support wall-mounted cabinets and plumbing fixtures.
3. Runners: 20-gauge galvanized U shaped, sized to match studs with 1-1/2-inch minimum legs placed at the top of all walls abutting structural members above as indicated on the Drawings.
4. Ceiling Channels: C-shaped.
5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch fabricated from 0.021-inch hot dipped galvanized steel.
6. Furring Members: Zee-shaped sections, minimum depth of 2 inches.
- E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
- F. Non-structural Framing Accessories:
 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
- G. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
- H. Fastenings Shall be as Follows:

Studs to track	3/8-inch drywall, type S, pan head screws
Track to masonry	1/4-inch diameter hooked anchor bolts
Track to concrete floor and furring studs and channel to masonry	Cartridge driven studs or concrete nails
Track to metal deck	Self-tapping screws (toggle bolts required to hang heavy bulkheads in tension)

2.03 SUSPENSION SYSTEM

- A. Grid Suspension System: ASTM C645 , manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
- B. Wire for Hangers and Ties: ASTM A641/A641M , soft, Class 1 zinc coated (galvanized).
 1. Hanger Wire: No. 11 gauge galvanized wire.
 2. Tie Wire: No. 16 gauge galvanized wire.

- C. Runner Channels: 20 gauge galvanized channels. Size shall be 1-1/2-inches deep by 19/32-inch wide. Also, provide 25-gauge studs for ceiling/bulkhead suspension where shown on the Drawings.
- D. Furring Channels: 25 gauge electrogalvanized steel.
 - 1. Products:
 - a. Same manufacturers as other framing materials.
- E. Furring Channel Clips: For clipping to furring channels shall be of galvanized wire and of the same manufacturer as the furring channels.
- F. At the Contractor's Option: In lieu of the above specified tie wire, runner channels, furring channels and furring channel clips, provide pre-engineered suspension system including main tees and cross channels manufactured by United States Gypsum Company, or equal system by any other manufacturer listed above, or Drywall Grid System or Shortspan Drywall Grid (as appropriate to the location as manufactured by Armstrong).

2.04 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
 - 5. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 - 3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 - 4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - b. Mold resistant board is required at the interior face of all exterior walls as noted on Sheet A0-0.
 - 5. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 6. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - 7. Paper-Faced Products:
 - a. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
 - b. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 8. Mold-Resistant, Paper-Faced Products:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Gypsum Board: www.goldbondbuilding.com/#sle.
 - 9. Glass Mat Faced Products:
 - a. USG Corporation; Sheetrock Brand Glass-Mat Panels Mold Tough Regular 5/8 in. (15.9 mm): www.usg.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Backing Board For Wall Tile Areas:

1. Application: Horizontal surfaces behind where wall tile is shown or scheduled (see Wall Types) to be installed over stud walls.
 - a. Provide cement based backer board at wet walls.
 - b. Provide gypsum based backer board at no-wet walls.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch.
 - b. Products:
 - 1) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
 - 2) USG Corporation; Fiberock Brand Aqua-Tough AR Interior Panels Regular 5/8 in. (15.9 mm): www.usg.com/#sle.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Core Type: Regular.
 4. Regular Board Thickness: 5/8 inch.
 5. Edges: Square.
 6. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com/#sle.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com/#sle.
 - d. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 3 1/2 to 6 inches.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Air Barrier: See Section 07 27 00.
- D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2) Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - 3) USG Corporation: www.usg.com.
 2. Corner Beads at High Traffic Areas: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) Pittcon Industries Inc.; SO-HSN-90 High Strength Corner:
 - 2) USG Corporation: www.usg.com.
 3. Bullnose Corner Beads: 3/4 inch radius.
 - a. Products:
 - 1) ClarkDietrich: www.clarkdietrich.com
 - 2) Phillips Manufacturing Co: www.phillipsmfg.com/#sle.

- 3) USG Corporation: www.usg.com.
- 4. Expansion Joints:
 - a. Type: 1/4-inch by 7/16-inch deep V-shaped metal with factory-installed protective tape.
 - b. Products:
 - 1) ClarkDietrick; 093 Zinc Control Joint (ZNCJ): www.clarkdietrich.com.
 - 2) Phillips Manufacturing Co; 093 Expansion Control Joint: www.phillipsmfg.com/#sle.
 - 3) USG Corporation: www.usg.com.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- H. Screws shall be 1-inch, Type S, drywall screws for securing gypsum board to metal studs and 1-1/4-inch, Type W drywall screws for securing gypsum board to wood furring. Longer screws, as recommended by the gypsum board manufacturer, shall be utilized to secure the exposed layer of gypsum board to the framing and suspension systems through the concealed layer at double layer walls, ceilings and bulkheads, and to attach and secure accessories. Provide other screws as recommended by the manufacturer for attachment of tile backer board to metal studs.
- I. Fasteners for Glass-Mat Gypsum Sheathing Board: 1-5/8" (41 mm), No. 8 (4.2 mm diameter) wafer-head steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B117.
- J. Nails for Attachment to Wood Members: ASTM C514.
- K. Adhesive for direct lamination of gypsum board panels at double layer walls, ceilings and bulkheads, and direct lamination of gypsum board to other substrates shall be selected as recommended by the gypsum board manufacturer for the specific applications and as approved by the Architect/Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated below.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Hanger wires shall be spaced at 4-foot centers along runner channels, or closer spacing if recommended by the materials manufacturer, and shall be located 6-inches from ends. Adjust to a closer spacing if required to provide secure anchorage for double layer ceilings.
 - 4. Runner channels shall be spaced at 4-foot centers, and shall be within 6-inches of parallel walls or ceiling boundaries. Lap runner channels 12-inches and tie near each end with double loops of tie wire. Substitute 25 gauge studs where shown on the Drawings. Studs

used for ceiling suspension system shall be spaced at 16-inches on center unless noted otherwise.

5. Furring channels shall be placed at right angles to runner channels and spaced at 16-inch centers. Fasten to runner channel with clips on alternate sides of runner channels. Lap furring channels 6-inches at splices and tie near ends with double loops of tie wire.
 6. Under the contractor's option as previously described, in lieu of the runner channels and furring channels specified above, install hanger wires, main tees and cross channels as recommended by the materials manufacturer.
- C. Studs: Space studs at 16 inches on center.
1. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
 2. Align track at floor, top of masonry walls, frames and overhead structure as indicated on the Drawings. Secure base track at 24-inch centers and at ends with power-driven fasteners as specified above. Head track to be held within the down turn legs of special formed 20-gauged galvanized steel slip runner track welded or secured to bottom side of structure above for lateral support with deflection allowance of 1/2-inch or as indicated on the Drawings. Bulkhead or other similar construction which is to be hung under tension shall have head track secured to structure at 16-inch centers minimum. Butt weld or splice track at joints.
 3. Set studs at partition ends, corners, and intersections, at jambs of openings and at 16-inch centers in between unless shown otherwise on Drawings. Seat studs squarely into track and plumb or align. Secure studs to track as required.
 4. If the partition is of such height that the studs must be spliced, do so by installing 2 horizontal runner channels back-to-back (one for the top of the lower wall and one for the bottom of the upper wall). Fasten the runner channels to each other and then install 3-5/8-inch metal stud diagonal knee braces at 8-foot maximum centers from on face of the studs to the structure.
 5. Install horizontal stiffener channels through studs at cut-out locations at maximum 6-foot centers in partitions which do not have GWB installed in both faces.
 6. Install knee braces for metal frames and for walls which terminate above the ceiling as required to provide lateral support.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking for support of:
1. Framed openings.
 2. Wall-mounted cabinets.
 3. Plumbing fixtures.
 4. Toilet accessories.
 5. Wall-mounted door hardware.
 6. Other items as indicated

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board of maximum practical length with long dimensions at right angles to furring, cross channels, and studs, with ends and edges occurring over firm bearing.
- C. Double-Layer Non-Rated: The finish layer shall be installed with screws spaced as specified above, and with adhesive as recommended by the manufacturer. All joints of the second (finish) layer shall be staggered for a minimum of 16-inches from the joints of the base layer. All screws for the finish layer shall be driven through the base layer into the framing above.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 1. Seal joints, cut edges, and holes with water-resistant sealant.
 2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- G. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
 1. Seal joints, cut edges, and holes with water-resistant sealant.
- H. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- I. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- J. Openings: End joints may occur not closer than 8-inches from either side of openings in walls. No joint shall align with edges of openings, and joints above openings shall be centered over openings.
- K. Fastenings: Panels shall be held in firm contact with the support member while the nails and screws are being driven. Fastenings shall proceed from the central portion of the board toward ends and edges. Fastenings shall proceed from the central portion of the board toward ends and edges. Fastenings shall be driven home with the heads slightly below the surface of the board. Care shall be taken to avoid breaking the paper face. Improperly driven fastenings shall be removed. Space screws at 15-inch centers and locate 3/8-inch to 1/2-inch from edges of panels. At double layer walls and bulkheads, install finish layer with longer screws and adhesive as noted above for ceilings.
- L. Checking Fasteners: After installation, pound on walls and ceilings to detect loose fastenings and push on board adjacent to fasteners to see if there is movement. If loose fasteners are detected, drive them tight. Whenever fastenings have punctured paper, hold board tight against framing and install another fastener properly, approximately 1-1/2-inches from fastener head which punctured paper, and remove faulty fastener. When fastenings wallboard to second side of a partition, check the opposite side for fasteners loosened by pounding and drive them tight again.

3.05 GROUT

- A. Grout all hollow metal door frames which occur in stud walls by spot-grouting at the jamb anchor clips prior to inserting the gypsum board into the frame. Grout tightly to assure solid anchorage of the frames. Do not fill metal jambs full of grout. Spot grouting will not be required at metal frames that have jamb anchors welded to the frames.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long and in continuous lengths with fasteners spaced at 6-inch centers.
- B. Casing Beads: Casing beads shall be applied to all exposed edges and ends of gypsum wallboard, and wherever indicated on the Drawings with nails at 6-inch centers.
- C. Aluminum Corners and Bullnose Terminations: Shall be placed where shown on the Drawings in continuous jointless lengths and screw secured to metal stud framing at 6-inch centers to a true and straight alignment. Install ceiling trim in coordination with finish ceiling trim installation.
- D. Corner Beads: Install at external corners, using longest practical lengths.

3.07 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated in the Drawings.
 - 2. Level 4: Walls and ceilings to receive eggshell paint finish, flat paint finish, or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Ceiling plenum areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Taping: A uniformly thin layer of joint compound, approximately 4-inches wide, shall be applied over the joint. Tape shall be centered over the joint and embedded into the compound, leaving sufficient joint compound under the tape to provide proper bond. Wall angles, corners, returns and inside corner angles shall be reinforced with tape to conform to the angle and embedded into the compound. Taping and finishing shall be required for all below ceiling line exposed joints, and all joints behind tackwall surfaces. Taping only without finishing will be required for all fire rated partitions above the ceiling line, and for all gypsum board which covers steel structure members at return air plenum.
 - 2. Joint compound combinations to be utilized at gypsum board locations shall be as follows (note: use portland based product at cement board locations):
 - a. Embedding and First Coat: Ready-mixed or job-mixed, drying-type, all-purpose or taping compound.
 - b. Fill (Second) Coat: Ready-mixed or job-mixed, drying-type, all-purpose or topping compound.
 - c. Finish (Third) Coat: Ready-mixed or job-mixed, drying-type, all-purpose or topping compound.
 - 3. Finishing Corners: All inside corners shall be coated with at least one coat of joint compound or topping compound with the edges feathered out. Flanges of wallboard corner bead shall be concealed by at least 2 coats of compound. The first coat shall be

joint compound, and the second coat may be joint compound or topping compound feathered out approximately 9-inches on both sides of the exposed metal nose.

4. Finish Nail or Screw Heads and Dimples: Apply three coats of joint compound or taping compound to all exposed gypsum board surfaces below the ceiling, and concealed behind tackwall locations. This may be applied as each coat is applied to the joints. Allow 24 hours drying time between coats, sanding between if necessary. Caution shall be used to avoid roughing of wallboard paper.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

**SECTION 09 30 00
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Metal trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 90 05 - Joint Sealers.
- B. Section 09 21 16 - Gypsum Board Assemblies: Installation of tile backer board.
- C. Section 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. Coordinate with Architect.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Submit samples of each type and color of tile, base, trim and grout color required to the Architect/Engineer.
- D. Manufacturer's Certification: Tile shall be Quality Certified by the Tile Council of America, Inc., to equal or exceed the standard grade requirements of TCA 137.1. The Certification Mark of the Tile Council of America shall appear on each label or carton of tile.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 4 square feet of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Installer Qualifications: Company specializing in performing tile installation, with minimum of 10 years of documented experience, and must submit 3 project references where like kind specified tile has been installed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in original containers with seals unbroken and labels intact until the time of use.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.

- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.
- C. Protect work from environmental conditions and construction activities during and after installation in accordance with manufacturer's printed recommendations.

PART 2 PRODUCTS

2.01 TILE

- A. Porcelain Tile Type (PT-1):
 - 1. Through-body Colored Porcelain, Style Portofino manufactured by Portobello America and distributed by Jaeckle; Megan Zuerlein, megan.zuerlein@jaeckledistributors.com.
 - 2. Size: 12x24 inch.
 - 3. Tile shall meet or exceed ANSI 137.1.
 - 4. Grout joint of 1/8" is recommended.
- B. Ceramic Tile Type CT-1 & CT-2: ANSI A137.1, and as follows:
 - 1. Glazed Ceramic Tile, Style Watercolor manufactured and distributed by Jaeckle; Megan Zuerlein, Megan.Zuerlein@jaeckledistributors.com.
 - 2. Size: 4 x 16 inch.
 - 3. Edges: Square.
 - 4. Surface Finish: Glossy.

2.02 TRIM AND ACCESSORIES

- A. Metal Trim: Satin natural anodized extruded aluminum, dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Metal Edge Trim for edges of porcelain tile floors not abutting walls shall be Schiene by Schluter Systems or clear satin aluminum angles as shown on the Drawings or otherwise required. Depths of aluminum extrusions or angles shall be as required for depth of the tile and setting bed.
 - 2. Metal Edge Trim at all vertical outside corners of porcelain wall tile and base tile shall be Quadec by Schluter Systems. Use longest lengths available to avoid multiple pieces per corner. When piecing lengths together is necessary, edges touching each other shall be smooth, factory edges to ensure tight seam.
 - 3. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Genesis APS International: www.genesis-aps.com/#sle.
 - c. Genotek: www.genotek.com

2.03 SETTING PRODUCTS SYSTEM WARRANTY

- A. Provide 5 Year System Warranty from manufacturer of waterproofing/anti-fracture membrane, mortar, grout, and sealant. Contractor must use only products called for under manufacturer's warranty and install per manufacturer's instructions.

2.04 MORTAR MATERIALS

- A. Manufacturers:
 - 1. Laticrete International, Inc.: www.laticrete.com
 - 2. Bonsal American, Inc: www.prospec.com
 - 3. Bostik Inc, Hydroment Products: www.bostik-us.com.
 - 4. Custom Building Products: www.custombuildingproducts.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Basis of Design Thinset: 253 Gold manufactured by Laticrete International, Inc.

2.05 GROUTS

- A. Manufacturers:
 - 1. Laticrete International, Inc: www.laticrete.com.
 - 2. Bonsal American, Inc: www.prospec.com.

3. Bostik Inc: www.bostik-us.com.
 4. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
 5. Custom Building Products: www.custombuildingproducts.com.
 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Typical Grout: Permacolor by Laticrete International, Inc.
1. Color(s): As specified in Section 09 99 90 - Color Schedule.
 2. ANSI A118.7 polymer modified cement grout.
- C. Epoxy Grout for Restroom Floor Tile and Shower Tile: SpectraLoc Pro by Laticrete International, Inc. Use this same grout for corresponding base tile in these areas.
1. Color(s): As specified in Section 09 99 90 - Color Schedule.
 2. ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane at showers: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/8 inch gap, minimum; comply with ANSI A118.12.
 2. Fluid or Trowel Applied Type:
 - a. Products:
 - 1) LATICRETE International, Inc; LATICRETE HYDRO BAN:
www.laticrete.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated on the drawings. Do not interrupt tile pattern through openings. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Layout tile work and center tile fields in both directions in each space on each wall area. Adjust to minimize tile cutting. Maintain 1/8-inch joints at porcelain tile, unless recommended otherwise by tile manufacturer(s).
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

- E. Install metal trim in accordance with manufacturer's instructions.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints. Use epoxy grout at floors and base in restrooms. Grout tile according to the grout manufacturer's printed instructions.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 CLEANING

- A. Clean tile and grout surfaces per manufacturers' recommended procedures.

3.05 PROTECTION

- A. Do not permit traffic over finished floor surface for 3 days after installation.
- B. When recommended by the tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors.
- C. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear.
- D. Prior to final inspection, remove protective coverings and rinse protective cleaner from surfaces.

END OF SECTION

**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.
- B. Section 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
- D. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 6" by 6" inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches long, of suspension system main runner and perimeter molding.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Provide one additional unopened carton of each type and size of acoustical tiles on the project.

1.06 QUALITY ASSURANCE

- A. Subcontract the installation of acoustical ceilings to an experienced firm which is acceptable to the manufacturer of the acoustical units and suspension system.
- B. Warranty: Provide manufacturer's minimum 15 year system warranty for all acoustical ceiling tile and grid against sagging, shrinking and delamination, and resistance to the growth of mold / mildew and bacteria.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Material shall be delivered to the project in the original packages, with seals unbroken and with the manufacturer's name and brand stamped clearly thereon. No seconds or remnants shall be used. No materials shall be delivered or stored in the building until all glazing has been

completed and all exterior openings closed in. All wet work, including concrete, masonry, plastering, etc., shall be completed and dried out.

1.08 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation, or as required in Manufacturer's Installation Instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. USG: www.usg.com/#sle.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tile Type ATC-1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
 - 1. Size: 24 x 24 inches.
 - 2. Thickness: 5/8 inches.
 - 3. Composition: Wet Formed Mineral Fiber.
 - 4. Light Reflectance: 83-85 percent, determined in accordance with ASTM E1264.
 - 5. NRC: .55 determined as specified in ASTM E 1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 7. Edge: Reveal.
 - 8. Color:
 - a. ATC-1: White.
 - 9. Surface Pattern: Nondirectional Fine Texture.
 - 10. Products:
 - a. Certainteed, Baroque Mineral Fiber, PBT-154 (verify to match existing ATC).

2.03 SUSPENSION SYSTEM(S)

- A. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required. Sections shall be thickness and strength to support the ceiling assembly indicated on the Drawings, with a maximum deflection of 1/360 of the span. Size attachment devices for 5 times the design load indicated in ASTM C 635, Table 1, direct hung.
- B. Exposed Steel Suspension System [for all ATC]: Formed galvanized steel, commercial quality cold rolled; intermediate-duty, minimum.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: White Enamel Painted.
 - 4. Product shall be one of the following:
 - a. Prelude XL Exposed Tee by Armstrong.
 - b. 15/16" EZ Stab Classic System by Certainteed.
 - c. Donn Brand DX by USG.

2.04 ACCESSORIES

- A. Support Channels: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

- C. Hanging Wires: No. 12 gauge galvanized wire unless heavier gauge is recommended by the manufacturer for the loads specified.
- D. Accessories: Provide prefinished 15/16-inch by 15/16-inch by 0.20 gauge hemmed edge wall angle molding and corners. All accessories shall be pre-finished to match Tee Grid System finish. Provide hold-down clips where indicated, and other special accessories as required for a complete installation. Accessories shall be supplied by the same manufacturer as the grid system.
- E. At locations where suspended ceiling matches the adjacent bulkhead or soffit elevation, provide: Reveal Edge Wall Angle, Product No. 1461.01 - 3/4" reveal molding by Rockfon or equal.
- F. Perimeter Moldings: .
 - 1. Perimeter Trim: Provide 4-inch and 6-inch extruded aluminum perimeter trim at ATC clouds and height difference between ATC and upper ceiling, field verify. See locations on Reflected Ceiling Plan. Perimeter trim shall be equivalent to Axiom Classic Straight by Armstrong. Color shall be Silver Grey (SG).
- G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work. Notify the Contractor and the Architect in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.
- B. Verify that layout of hangers will not interfere with the location of the electrical fixtures, and other items which penetrate ceiling. Examine the Electrical and Mechanical Drawings to coordinate this work. Examine the Reflected Ceiling Plan and various ceiling edge treatment details on the Drawings for exact coordination of relationships to the various building lines, surfaces and conditions.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M and ASTM C 636/C 636M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Install suspension system with hanger support coming from building structure only. Install hangers by looping and wire-tying directly to structures or with concrete nails or drive pins into solid structure members, toggles into hollow areas, or eye screws as appropriate to comply with ASTM C 636. Attachment to ducts, conduit and other similar support will not be permitted. Space hangers not more than 4-feet on center as recommended by grid manufacturer along each member. Extra hanger wires shall be required as recommended by the grid manufacturer where grilles and troffers are installed parallel to main runners.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Do not eccentrically load system or induce rotation of runners.
- I. Install edge moldings, corners, special corners, reveal moldings and 2-inch by 2-inch expansion wall angles of the type indicated to coordinate with the grid system at edges of each acoustical

ceiling area as noted on the reflected ceiling plan, and at locations where edge of units would otherwise be exposed after completion of work. Secure wall angle molding to building construction by fastening through holes made not more than 3-inches from end of molding and 6-inches on center. All moldings shall be standard wall angle moldings specified except where shown otherwise on the Drawings.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
- F. Install hold-down clips on each panel where noted on the Drawings and in areas where required by governing regulations for fire-resistance ratings. Space as recommended by the panel manufacturer, unless otherwise indicated or required. Comply with fire rating requirements.
- G. Upon completion of the installation, all soiled, deformed, discolored and otherwise damaged tile surfaces shall be cleaned or replaced. Completed acoustical ceiling system installation shall neither be altered nor disturbed by any other trade without specific prior approval from the Prime Contractor and Ceiling Subcontractor. Prior to Substantial Completion, the total acoustical ceiling system installation shall be inspected by the Contractor, adjusting all units and accessories for complete and proper placement and alignment. All soiled and otherwise damaged acoustic tile units and accessories shall be replaced with new items if minor finish damage cannot be successfully cleaned or repaired to original condition status completely free of damage or soil evidence to the satisfaction of the Architect/Engineer.

END OF SECTION

**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient tile flooring.
- C. Resilient base.
- D. Resilient stair accessories.
- E. Installation accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2023.
- B. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans, floor patterns, and location of transition strips.
- D. Verification Samples: Submit two samples, 2 by 2 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Materials and Methods, for additional provisions.
 - 2. Extra Flooring Material: 12 square feet of each type and color.
 - 3. Extra Wall Base: 10 linear feet of each type and color.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F, or as recommended by manufacturers of resilient flooring products.
- D. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Composition Tile (VCT): Homogeneous, with color extending throughout thickness.
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc; Standard Excelon: www.armstrong.com/#sle.
 - 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 3. Size: 12 by 12 inch.

4. Thickness: 0.125 inch.
5. Color: see Color Schedule Section 09 99 90.

2.02 RESILIENT BASE

- A. Vinyl Base: (VB) ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.
 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Height: 4 inch.
 3. Thickness: 0.125 inch.
 4. Finish: Satin.
 5. Length: Roll.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: ES.
 1. Manufacturers:
 - a. [Johnsonite, a Tarkett Company <> : www.johnsonite.com/#sle].
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Carpet to VCT Flooring: Tarkett-Johnsonite, cta-xx-c
 3. VCT Flooring to Concrete: Tarkett-Johnsonite, RRS-XX-C.
 4. Carpet to Concrete: Tarkett-Johnsonite, CTA-XX-J.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. Final waxing, where required, will be by the Owner.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 09 68 00
CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 09 65 00 - Resilient Flooring nt Flooring.
- C. 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.
- C. CRI (GLC) - Green Label Testing Program - Approved Product Categories for Carpet; Carpet and Rug Institute; Current Edition.
- D. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Scaled drawings indicating products, seaming plan, installation method of carpet tile, direction of carpet , and location of edge moldings and edge bindings .
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, and method of installation.
- D. Shop Drawings: Indicate carpet location, installation method, direction of carpet tile , and location of edge moldings.
- E. Samples: Submit two samples 12 x 12 inch in size illustrating color and pattern for each carpet material specified. Or submit two full tile samples for each carpet tile specified.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Two copies of the manufacturer's recommended maintenance data
 - 2. Extra Carpet: Provide 3% of each type, color, and pattern installed. Extra carpet shall be new, clean, unused carpet material in full factory width, carefully wrapped, sealed and identified as to carpet type designation, as extra stock for each manufacturer, pattern, color and dye lot. Extra carpet shall be provided immediately before installation begins, and shall be of the same dye lot of that which is installed.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet with minimum three years experience and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Deliver carpet to jobsite in the original mill wrappings with each roll having its register number properly marked on each bale. Each pattern, type and color of carpet shall be of the same dye lot.

- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- D. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

- A. **Carpet Tile : CPT-1,2**
 - 1. Product: Shifted States Collection, Interpret manufactured by Interface.
 - 2. Size: 19.7" x 19.7" nominal.
 - 3. Pile Thickness: 0.121 inches.
 - 4. Construction: Tufted Pattern Loop.
 - 5. Gauge: 1/10 inch.
 - 6. Stitches: 11.4 per inch.
 - 7. Tufted Yarn Weight: 19 oz/sq yd.
 - 8. Dye Method: 100% Solution Dyed.
 - 9. Fiber Type: 100% Recycled Content Nylon
 - 10. Backing Material: Glasbac.
 - 11. Installation Method: Monolithic.
- B. **Carpet Tile : CPT-3**
 - 1. Product: Obex - CutX manufactured by Milliken.
 - 2. Tile Size: 39.4" x 39.4" nominal.
 - 3. Total Thickness: 0.5 inch.
 - 4. Construction: Tufted, Cut Pile - Walk-Off Tile.
 - 5. Gauge: 5/32 inch.
 - 6. Stitches: 9.5 per inch.
 - 7. Face Weight: 24 oz/sq yd.
 - 8. Fiber Type: Encore® SD (with recycled content).
 - 9. Dye Method: PrintWorks Precision Dye.
 - 10. Backing Material: PVC-Free WellBAC Comfort Plus Cushion.
 - 11. Installation Method: Monolithic.

2.02 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.
- B. Edge Strips and Transitions: See Resilient Flooring, Section 09 6500, color as selected.
- C. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Inspect all carpet upon receiving shipment and advise Architect in writing of any condition or defects deemed unacceptable for installation.
- B. Verify that sub-floor surfaces are clean and dry and in a condition satisfactory to the Carpet Subcontractor. The Carpet Subcontractor shall notify the General Contractor, in writing, with copies to the Architect, of conditions which will prevent him/her from producing satisfactory finished work. The installation of carpet shall be an indication of his/her acceptance of the substrates, and he/she will automatically assume the responsibility for any unacceptable finished work caused by substrate conditions. Under this Section 09 68 00, the Carpet Subcontractor shall be responsible for installing fill at depressions, holes, cracks and minor variations, and to transition where adjacent to porcelain tile.
- C. Vacuum substrate immediately prior to carpet installation, and remove all substances which would interfere with the installation or be harmful to the work.

- D. Verify that concrete sub-floor surfaces are dry enough and ready for adhesive installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710. If test results are not within the adhesive manufacturer's specified limits for moisture emission rate and alkalinity, contact adhesive manufacturer for their recommended products to achieve appropriate levels.

3.02 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet in accordance with manufacturer's instructions and CRI Carpet Installation Standard.
- C. Lay out carpet per drawings.
 - 1. Locate change of color or pattern between rooms under door centerline or as shown on drawings.
- D. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.
- E. Extend carpet under open-bottom and raised-bottom obstructions and under removable flanges of obstructions. Extend carpet into closets, knee spaces and alcoves of rooms indicated to be carpeted. Extend carpet under movable furniture and equipment unless otherwise indicated.

3.03 CARPET TILE

- A. Install in accordance with manufacturer's written instructions for the specified carpet.
- B. Bond all modular carpet securely to the substrate in a full bed of "releasable" adhesive, and with self-adhesive backing where specified.
- C. Install in a grid pattern, tightly fitting carpet tiles to each other and to all vertical surfaces. Follow manufacturer's printed instructions regarding maintaining squareness and tightness of the installation.
- D. Carpet tiles less than half-size will not be allowed except where the configuration of the room will not permit larger size tiles. Avoid use of cut tiles in doorways and other high traffic areas to the maximum extent possible.
- E. Damaged, defective, wrinkled or shrunken modular carpet tiles, or carpet stained by adhesives shall be removed and replaced.

3.04 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces with a beater-type vacuum cleaner.
- C. Remove all loose pieces of face yarn with sharp scissors.

END OF SECTION

**SECTION 09 90 00
PAINTING**

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 09 99 90 - Color Schedule.

1.02 DESCRIPTION OF WORK

- A. EXTENT of painting work is shown on Drawings and schedules, and as herein specified.
- B. THE WORK INCLUDES painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.
- C. "PAINT" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

1.03 WORK NOT INCLUDED

- A. SHOP PRIMING. Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work and similar items. The same applies for shop-fabricated or factory-built mechanical and electrical equipment and accessories. See list of items later in this Section. However, the presence of a shop-applied primer shall not reduce the number of coats required to be applied in the field as specified under the Paint and Stain Schedule later in this Section. Touch-up of primer on structural and miscellaneous steel items damaged or abraded shall be accomplished under Sections 05 12 00 and 05 50 00. Touch-up of primer on metal doors and frames damaged or abraded surfaces shall be accomplished under Section 08 12 13. The painter shall notify the Contractor if such repair has not been done prior to his/her application of the first coat of paint.
- B. PREFINISHED ITEMS. Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) toilet enclosures, acoustic materials, finished mechanical and electrical equipment including cabinet unit heaters, light fixtures, switchgear and distribution cabinets. See list of items later in this Section.
- C. CONCEALED SURFACES. Unless otherwise indicated, painting is not required on surfaces such as walls and ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces and duct shafts. See list of items later in this Section.
- D. FINISHED METAL SURFACES. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated. See list of items later in this Section.
- E. OPERATING PARTS AND LABELS. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated.
- F. Do not paint over code-required labels, such as Underwriters' Laboratories and Factory Mutual, and equipment identification, performance rating, name, and nomenclature plates.
- G. OMIT PAINT, STAIN AND/OR FINISHING AS NOTED for the following items:
1. Fire alarm panels (prefinished)
 2. Fire extinguisher cabinets
 3. Flashings, gutters and downspouts (prefinished)
 4. Toilet compartments (prefinished)

1.04 QUALITY ASSURANCE

- A. ACCEPTABLE MANUFACTURERS are as follows:
1. Benjamin Moore and Company
 2. Diamond Vogel Paints (Vogel Paint Manufacturing Company)
 3. ICI Paints

4. Iowa Paint Manufacturing Company, Inc.
 5. Pittsburgh Paints, PPG Industries, Inc.
 6. Pratt and Lambert, Inc.
 7. The Sherwin-Williams Company
 8. Tnemec Company, Inc. (only on products as specified below)
- B. PRE-PAINTING CONFERENCE. Prior to the start of painting and after approval of required shop drawings and samples, the General Contractor shall arrange a Pre-painting Conference at the project site at a pre-arranged time approved by the Architect/Engineer. The conference shall include in attendance the painting subcontractor and his/her jobsite foreperson. The contractor shall record discussions and agreements that are made which are not specifically addressed in the Contract Documents, and shall furnish a copy to all involved participants.

1.05 SUBMITTALS

- A. MANUFACTURER'S DATA. Submit copies to the Architect/Engineer in accord with the General Conditions and the Front End Documents of the manufacturers' printed specifications and data sheets for each type of paint and other finishing materials proposed to be utilized. These submittals shall be for each paint system (designated PS herein) specified.
- B. SAMPLES. Submit 3 samples of each type of finish and color to the Architect/Engineer in accord with the General Conditions and the Front End Documents. Stain samples of ST-1 shall be submitted on 8-inch long piece of wood, matching species and cut specified. Paint samples shall be submitted on 8-1/2-inch by 11-inch Mead Mark I cover paper, coated one side, with paint sprayed or applied with a foam rubber roller. Front of paint samples shall show the paint manufacturer and the trade name of the proposed paint.
- C. EXTRA STOCK. The Painting Contractor shall furnish the Owner with one gallon of **EACH COLOR IN EACH PAINT SYSTEM**, sealed and unused, which are used on this project, together with explanation of what each paint system is used for and mixing formula attached thereto. The Painting Contractor shall furnish 2 copies of the mixing formula information to the Prime Contractor in addition to the instructions attached to paint containers for inclusion with the Owner's maintenance manuals.

1.06 DELIVERY, STORAGE AND PROTECTION

- A. DELIVERY AND STORAGE OF MATERIALS. All paints, varnishes, enamels, lacquers, stains, and similar materials must be delivered in the original containers with seals unbroken. All containers must also include the following information:
1. Name of title of material
 2. Federal Specification numbers if applicable
 3. Manufacturer's stock number and date of manufacture
 4. Manufacturer's name
 5. Contents by volume, for major pigment and vehicle constituents
 6. Thinning instructions
 7. Application instructions
 8. Color name and number
- B. STORE MATERIALS in a single place designated by the Prime Contractor and approved by the Owner and Architect/Engineer. Such storage place shall be kept neat and clean, and all damage thereto or to its surroundings shall be returned to the original or intended condition. Oil rags, waste, etc. shall be removed from the building every night, and every precaution taken to avoid the danger of fire.

1.07 JOB CONDITIONS

- A. TEMPERATURE. Surface temperature shall be maintained at a minimum of 50F during application and drying of paints and finishes. Exterior surfaces shall not be painted or finished during rainy or frosty weather nor when they are exposed to a hot sun. See manufacturer's printed instructions for more specific requirements.

- B. PROTECTION. Adjacent work, building finishes and surfaces together with manufactured casework and similar items shall be totally protected with masking tape, drop cloths or other suitable coverings. Manufactured casework, millwork, cabinetwork, food service equipment and similar items shall not be utilized for any construction related purpose or utilized as work surface, scaffolding, plank supports or in any way walked upon.
- C. SEQUENCING. Frames and doors shall be given their first coat of paint and stain/varnish before glass is installed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. MATERIALS. The Contractor shall have the option of using materials and finishes manufactured by any one of the manufacturers previously listed. Materials used throughout shall be the products of one manufacturer only and shall be first line and top grade materials produced by the manufacturer selected. The mentioning of a specific brand name is done to establish a minimum acceptable standard or quality desired. Actual materials are listed in the Schedule of Finishes. In the case where Tnemec products are specified hereinafter, the above substitution policy for other listed products shall not apply, and only the specified Tnemec products will be acceptable.

PART 3 EXECUTION

3.01 INSPECTION

- A. CONDITION OF SURFACES. The Painting Contractor shall examine all surfaces which are scheduled to receive paint, stain, varnish, or other coatings, and report in writing to the Prime Contractor with copy to the Architect/Engineer, any surfaces which cannot be put into proper condition for finishing by customer cleaning, sanding, puttying, or other similar preparation operations. Application of the first coat shall constitute acceptance of surfaces as fit and proper to receive finish.

3.02 PREPARATION

- A. GENERAL. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
- B. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted. Following completion of painting of each space or area, reinstall removed items.
- C. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- D. CEMENTITIOUS MATERIALS. Prepare cementitious surfaces of concrete, concrete block and cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.
- E. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed direction.
- F. WOOD. Wood surfaces to be painted shall be cleaned of dirt, oil, or other foreign substances. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat, where finish is paint or enamel.
- G. Wood surfaces to be stained shall be finish sanded to 150 grit or equal, and dusted off.
- H. After application of first coat, putty nail holes, cracks, etc., with putty of a color to match that of the finish. Bring putty flush to the adjoining surface. Sandpaper smooth when dried.

- I. FERROUS METALS. Clean ferrous surfaces which are not galvanized or shop-coated, with S.S.P.C. SP 6 Commercial Blast.
- J. GALVANIZED METAL. Clean and treat chemically with a compound designed for this purpose, such as "Lithoform", "Stibley", or "Solfo Metallic Coat", abrasive blast, or scarify to a uniform finish in accordance with the paint manufacturer's instructions.
- K. ALUMINUM (where specified to be painted). Thoroughly clean using solvents recommended by the paint manufacturer. Scuff sand surface to provide tooth for bonding.

3.03 APPLICATION

- A. GENERAL. All materials shall be applied in accordance with the paint manufacturer's printed instructions, using applicators and techniques best suited for substrate and type of material being applied. Apply all materials under adequate illumination, spread evenly, and flow on smoothly without runs or sags. All coats must be thoroughly dry before applying succeeding coats. The number of coats specified shall not be reduced, even if the item to be painted has been factory primed. Apply materials to provide total color and sheen uniformity on all surfaces.
- B. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind all permanently-fixed equipment and furniture with prime coat only before final installation of equipment.
- C. SPRAY APPLICATION OF PAINTS will be permitted on wall surfaces and on exposed metal deck, steel joists, and exposed structural roof system areas provided the application is by airless-type spray equipment, and provided the application by spray is followed by a roller on wall surfaces. Roller shall thoroughly work paint into pores for complete surface coverage. Conventional paint spray equipment will be permitted on metal door frames, metal doors, and other metal fabrications. Sprayed surfaces shall be smooth, free of imperfections, and paint runs, and shall be completely covered by each coat.
- D. UNDERCOATS OF PAINT AND ENAMEL shall be of the approximate color as the final coat, except primers for accent colors may be white or off-white if recommended by the paint manufacturer to bring out the color depth of the finish color. Between coats, sand enamel finish applied to metal or wood with fine sand paper, clean and tack to produce an even, smooth finish.
- E. STAINING AND VARNISHING. Cover surfaces to be stained with a uniform coat and wipe off if required. Between coats, sand varnish finish applied to wood with fine sandpaper, clean and tack to produce an even, smooth finish.
- F. FACTORY-PRIMED AND MILL-PRIMED SURFACES. Use the materials specified in every case for such surfaces and use in accord with the manufacturer's directions for the first or priming coat.
- G. NONFERROUS METALS. Copper, bronze, chromium plate, nickel, stainless steel, aluminum, and Monel metal shall not be painted or finished except as otherwise specified.
- H. GENERAL. Paint all exposed ductwork, piping structural members and decking in all finished spaces. Color to match adjacent wall or ceiling unless noted otherwise.

3.04 FIELD QUALITY CONTROL

- A. FIRST COAT INSPECTION. When a coat of material has been applied, the Painting Subcontractor shall inform the Architect/Engineer so that the work may be inspected and approved. Credit for succeeding coats will not be given unless the preceding coat has been so examined and approved.

3.05 ADJUSTING AND CLEANING

- A. CLEAN ADJACENT AND OTHER SURFACES which are smeared or splattered as a result of the painting. Use a knife blade to clean paint out of control joints in plaster or gypsum board, using care not to scratch or otherwise damage finished surfaces.

3.06 PROTECTION

- A. PROTECT WORK OF OTHER TRADES, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- C. Do not paint telecommunications cables. Coordinate paint and cable installation schedule with the telecommunications contractor. Protect cabling from direct painting or over-spray. Cables which have been painted are void of the manufacturer's warranty and will be replaced at this contractor's expense.
- D. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 PAINT AND STAIN SCHEDULE

A. INTERIOR WORK

- 1. FERROUS METAL (Other items, i.e., metal doors, frames, etc.)
 - a. 1 coat
 - 1) Sherwin Williams, Pro Industrial Pro-Cryl Primer
OR Tnemec, Series 115 at 2.5-3.0 mils
 - b. 2 coats
 - 1) Sherwin Williams, Pro Industrial High Performance Acylic Semi-Gloss
OR Tnemec, Series 1029 Enduratone
- 2. GYPSUM BOARD (CEILINGS)
 - a. 1 coat
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Primer
 - b. 2 coats
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Flat B30 Series
- 3. GYPSUM BOARD (WALLS)
 - a. 1 coat
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Primer
 - b. 2 coats
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Eg Shell B20 Series
- 4. WOOD AND PLYWOOD (PAINTED)
 - a. 1 coat
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Primer
 - b. 2 coats
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Semi-Gloss B31 Series
- 5. CONCRETE MASONRY
 - a. 1 coat
 - 1) Sherwin Williams, PrepRite Interior/Exterior Latex Block Filler
 - b. 2 coats
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Eg Shell B20-260 Series
- 6. EXISTING GYPSUM BOARD, PLASTER, CONCRETE AND CONCRETE MASONRY (previously painted)
 - a. 2 coats
 - 1) Sherwin Williams, ProMar 200 Zero VOC Interior Latex Eg Shell B20-2600
- 7. EXISTING FERROUS METAL (previously painted)
 - a. 2 coats
 - 1) Sherwin Williams, Pro Industrial High Performance Acylic Semi-Gloss
OR Tnemec, Series 1029 Enduratone

8. MECHANICAL AND ELECTRICAL ITEMS. New registers, grilles, steel-incased heating units, heating and water pipes, sprinkler piping, electrical conduits, outlet boxes, and panelboard fronts exposed in a finished room (except in Rooms at the Mezzanine / Clerestory level) shall be painted as specified for Metal Work or as specified or required for the surface to be painted. Color shall match color of adjacent wall or ceiling surfaces.
9. INSIDE OF NEW DUCTWORK AND PLENUM SPACES exposed to view through registers and grilles shall receive one coat of flat black paint.

3.08 PAINT AND STAIN LOCATION SCHEDULE

- A. THE FOLLOWING LIST of items requiring paint or stain contains the major areas of finish required. The Contractor shall verify the color and type of finish with the Architect/Engineer for any items which obviously require finish but for which a color is not listed hereinafter.
- B. EXTERIOR COLOR PLACEMENT
 1. Hollow metal doors and frames, including interior surfaces, unless noted otherwise
As noted on Door and Frame Schedule.
- C. INTERIOR COLOR PLACEMENT
 1. Hollow metal doors and frames: As noted on Door and Frame Schedule.
 2. GWB ceilings: As noted on Room Finish Schedule
 3. GWB bulkheads: P-3, U.N.O., see Drawings.
 4. Electrical panels and access doors: Match adjacent wall and ceiling surfaces.
 5. Handrails, guardrails, brackets and supports: As noted on Drawings.
 6. Metal reveals in GWB: Match adjacent wall surface.

END OF SECTION

SECTION 09 99 90
COLOR SCHEDULE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This section covers color selections of paint and other building finishes and components which are specified in other Sections. Color is considered of prime importance for all aspects of this Project. Obtain colors for items not specifically noted herein from applicable Sections or Architect.
- B. Colors selected are those of the brand specified. Colors of items proposed as substitutes shall match those specified subject to approval of Architect.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Materials to be used and installation thereof are specified in other Sections of this Specification.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INTERIOR COLOR SCHEDULE

- A. Manufactured Casework (Section 12 35 30) and Architectural Wood Casework (Section 06 41 00)
 - 1. Plastic Laminate
 - a. PL-1, color: Formica - Natural Oak 346-58 (matching existing - wood casework).
 - b. PL-2, color: Formica - DecoMetal, M4511 Aluminum Crush II (metal accent).
 - 2. Melamine/Cabinet Liner
 - a. ML-1, Panolam, color: White.
 - 3. PVC Edge Materials
 - a. PVC-1, color: to match PL-1, 15/16" x 3mm thick (used with PL-1).
 - 4. Solid Surface Material
 - a. SSM-1, color: Wilsonart - Brooklyn Concrete 9219GS (countertops & window sills).
 - 5. Colored Cork
 - a. CC-1, color: Koroseal - Walltalkers, Earthen 08.
- B. Flush Wood Doors (Section 08 14 16)
 - 1. Door Stain, color: ST-1.
- C. Tile Work (Section 09 30 00)
 - 1. Porcelain Tile
 - a. PT-1, color: Jaeckle, Portobello America - Portofino, Twilight, 12"x24" (RR floor).
 - 2. Ceramic Tile
 - a. CT-1, color: Jaeckle - Watercolor, Linen, Glossy, 4"x16" (RR wall field - white).
 - b. CT-2, color: Jaeckle - Watercolor, Denim, Glossy, 4"x16" (RR wall accent - blue).
 - 3. Grout
 - a. GRT-1, color: Laticrete - 45 Raven (used with PT-1).
 - b. GRT-2, color: Laticrete - 78 Sterling Silver (used with CT-1,2).
- D. Acoustical Ceilings (Section 09 51 00)
 - 1. Acoustic Tile Ceiling
 - a. ATC-1, color: Standard White (typical).
 - 1) Provide Perimeter Trim where noted on Drawings.
- E. Resilient Flooring (Section 09 65 00)
 - 1. Vinyl Composition Tile
 - a. VCT-1, color: Armstrong - Imperial Texture, Standard Excelon, Blue Cloud 51933 (white).
 - b. VCT-2, color: Armstrong - Imperial Texture, Standard Excelon, Genetian Blue 51946 (blue).

Lewis Central High School
Entry Addition

- 2. Vinyl Base
 - a. VB-1, color: Johnsonite - 29 Moon Rock WG.
 - b. VB-2, color: Johnsonite - to match existing in ISS 117.
- 3. Flooring Accessories
 - a. Edge Strip, ES-1, color: Johnsonite - to match VB-1.
- F. Carpeting (Section 09 68 13)
 - 1. Carpet
 - a. CPT-1, color: Interface - Shifted States, Interpret, Lead, 19.7" x 19.7" (grey).
 - b. CPT-2, color: Interface - Shifted States, Interpret, Denim, 19.7" x 19.7" (blue).
 - c. CPT-3, color: Milliken - Obex, CutX/Fizz, 27 Grey, 39.4" x 39.4" (walk-off).
- G. Painting and Coating (Section 09 90 00)
 - 1. Paint Color
 - a. P-1, color: Sherwin Williams - SW7647 Crushed Ice (typical walls).
 - b. P-2, color: Sherwin Williams - SW7018 Dovetail (hollow metal).
 - c. P-3, color: Sherwin Williams - SW7757 High Reflective White (gwb ceilings - white).
 - d. P-4, color: Sherwin Williams - SW9177 Salty Dog (dark blue accent).
 - e. P-5, color: Sherwin Williams - SW6523 Denim (light blue accent).
 - f. P-6, color: Sherwin Williams - to match existing walls in ISS 117.
 - 2. Stain Color
 - a. ST-1, color: to match existing wood doors.
- H. Visual Display Units (Section 10 11 00)
 - 1. Markerboard color: white.
 - 2. Trim and Frame color: Claridge Class II clear anodized finish
- I. Cubicle Curtains and Track (Section 10 21 23)
 - 1. Cubicle and Shower Curtain, color: Maharam - Prose, 511503, 007 Flight.
- J. Wall and Door Protection (Section 10 26 00)
 - 1. Corner Guards
 - a. CG-1, color: CS Acrovyn - Solid Color PET, Driftwood (off-white).
 - b. CG-2, color: CS Acrovyn - Solid Color PET, Naval Blue (blue).
- K. Window Shades (Section 12 24 00)
 - 1. Manual Shade, color: MechoShade - Soho, 1% openness, 1100 Series, 1113 Mercer.
 - 2. Fascia, color: clear anodized.

3.02 EXTERIOR COLOR SCHEDULE

- A. Metal Wall Panels (Section 07 42 13.23)
 - 1. MP, color: Petersen Aluminum Corporation, PAC-3000 CS; Color: Anodic Clear.
- B. Sheet Metal Flashing and Trim (Section 07 62 00)
 - 1. Flashing, color: Clear Anodized Finish.
- C. Aluminum-Framed Storefronts (Section 08 43 13)
 - 1. Color: Clear Anodized.

END OF SECTION

DIVISION 10 – SPECIALTIES

**SECTION 10 11 00
VISUAL DISPLAY UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Markerboards.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

- A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, tackboard, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.
- D. Samples: Submit color charts for selection of color and texture of markerboard and tackboard.
- E. Test Reports: Show compliance to specified surface burning characteristics requirements.
- F. Manufacturer's printed installation instructions.
- G. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

- A. See Front End Documents for additional warranty requirements.
- B. Provide Life of Building warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Claridge Products and Equipment, Inc; LCS Markerboards:
www.claridgeproducts.com/#sle (contact: Jennifer Shoemaker,
www.maynardinteriors.com)
2. Polyvision Corporation (Nelson Adams); Fixed Markerboards: www.polyvision.com/#sle.
3. Substitutions: See Section 01 60 00 - Materials and Methods.

2.02 VISUAL DISPLAY UNITS

- A. Markerboards (MB): Porcelain enamel on steel, laminated to core, magnetic surface.
 1. Color: White.
 2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch (minimum thickness).
 3. Core: MDF, 7/16 inch thick, laminated to face sheet.
 4. Backing: Aluminum sheet, laminated to core.
 5. Height: 48 inches.
 6. Length: As indicated on drawings.
 7. Frame Profile: Provide one of the following:
 - a. Claridge Series 1.
 - b. Polyvision Traditional Plus Series.
 8. Frame Finish: satin clear.
 9. Accessories: Provide chalk tray.

2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Aluminum Sheet Backing: 27 gauge, 0.014 inch thick.

2.04 ACCESSORIES

- A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- B. Chalk Tray: Aluminum, molded ends, concealed fasteners, same finish as frame. Chalk tray shall be equal to Claridge Series 1 chalk tray.
- C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

3.04 SCHEDULE

- A. Markerboards and/or Tackboards shall be centered, horizontally, on the wall each is being installed on, unless noted otherwise on the Drawings.
- A. Mounting Height: shall be at 3'-0" Above Finished Floor, unless noted otherwise on the Drawings. This dimension shall be the elevation from the bottom of each board.

END OF SECTION

**SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dimensional letter signage.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Samples: Submit two samples of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.
- C. Store tape adhesive at a normal room temperature of 68 to 72 degrees F.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Dimensional Letter Signs:
 - 1. A.R.K. Ramos: www.arkramos.com/#sle.
 - 2. Gemini Incorporated: www.geminisignproducts.com.
 - 3. Latitude Sigange + Design: www.latitudedesignage.com.
 - 4. L & H Sign Company Inc.: www.lhsigns.com.

2.02 DIMENSIONAL LETTERS

- A. Applications: Building identification. Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style and size.
 - 1. Use individual metal letters.
 - 2. Mounting Location: Exterior as indicated on drawings.
- B. Exterior Metal Letters:

Lewis Central High School
Entry Addition

1. Material: Aluminum casting.
 2. Letter Height: 16 inches for name Name. See Drawing Sheet A2-1.
 3. Text and Typeface:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Case: Upper case only.
 4. Finish: Baked enamel.
 5. Color: As selected.
 6. Mounting: Furnished with threaded studs for flush mounting on masonry .
- C. Interior Dimensional Letter:
1. Material: Satin aluminum-faced laminate. Sides finished to match laminate.
 2. Color: Clear Anodized
 3. Font: Arial, uppercase.
 4. Size: As shown on the Drawings.
 5. Mounting: Manufacturer's standard appropriate to suit substrate.
 6. Location: At Reception 102 Desk, text shall say the following: "LEWIS CENTRAL HIGH SCHOOL".
 - a. Architect to verify text with Owner.

2.03 NON-TACTILE SIGNAGE MEDIA

- A. Vinyl Street Address at Front Entry
1. See Building Elevation for placement
 2. 4-digit - 6" high Arial font
 3. Color: Light Grey, easily visible from street.

2.04 ACCESSORIES

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

**SECTION 10 21 23
CUBICLE CURTAINS AND TRACK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended overhead curtain track and guides.
- B. Surface mounted overhead curtain track and guides.
- C. Cubicle curtains.
- D. Shower curtains.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Track supports above ceiling.
- B. Section 06 10 00 - Rough Carpentry: Blocking and supports for track.
- C. Section 09 51 00 - Acoustical Ceilings: Suspended ceiling system to support track.
- D. Section 09 99 90 - Color Schedule.
- E. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Shower curtain rod.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for curtain fabric characteristics.
- C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- D. Samples: Submit two fabric samples, 12 by 12 inch in size illustrating fabric color.
- E. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carriers: Ten.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept curtain materials on site and inspect for damage.
- B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cubicle Track and Curtains:
 - 1. A. R. Nelson Co: www.arnelson.com/#sle.
 - 2. C/S General Cubicle: www.c-sgroup.com/cubicle-track-curtains/#sle.
 - 3. Imperial Fastener Co., Inc: www.imperialfastener.com/#sle.
 - 4. Inpro: www.inprocorp.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

- A. Track: Extruded aluminum sections; one piece per cubicle track run; box channel profile.
 - 1. Profile: Channel.

2. Mounting: Surface.
 3. Structural Performance: Capable of supporting vertical test load of 50 lbs without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
 4. Track End Stop and splicers and all other necessary fittings and hardware for a complete installation: To fit track section.
 - a. At locations of Acoustic Ceiling Tile; all track shall be surface mounted according to manufacturer's recommendations.
 - b. At locations of Drywall; all track shall be recessed according to manufacturer's recommendations.
 5. Track Bends: Minimum 12 inch radius; fabricated without deformation of track section or impeding movement of carriers.
 6. Suspension Rods: Tubular aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
 7. Escutcheons: Where suspension rod meets finished ceiling or structure, provide escutcheons to match rod finish.
 8. Finish on Exposed Surfaces: satin anodized finish.
- B. Curtain Carriers: Nylon roller to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; one carrier for each 6 lineal inches of fabric width.
- C. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

- A. Cubicle Curtains and Shower Curtain (outer fabric):
1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
 3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk, manufactured by Maharam.
 4. Curtain: Color as selected and noted in Color Schedule, Section 09 99 90.
- B. Shower Curtain (inner liner):
1. Vinyl, translucent curtain to match size of outer fabric.
 - a. Super Bio Stat Vinyl manufactured by Inpro.
- C. Shower Curtain Rings:
1. Stainless Steel Slide Bead Rings suitable for 1" diameter curtain rod manufactured by Inpro. Coordinate quantity with shower curtains.
- D. Curtain Fabrication:
1. Cubicle Curtain: Manufacture of one piece, sized 20 percent wider than track length. Terminate curtain 16 inches from floor.
 2. Shower Curtains: Manufacture of one piece, sized 20 percent wider than rod length. Shower curtain and inner liner shall be full length (from rod to floor) with open mesh at top.
 3. Open Mesh Cloth: Shall be include at top 24 inches of curtains for room air circulation. Mesh shall be banded with curtain fabric.
 4. Curtain Heading: Triple thickness 2 inches wide, with metal grommet holes for carriers 6 inches on center, double fold bottom hem 2 inches wide. Lock stitch seams in two rows. Turn seam edges and lock stitch.
 5. Provide fabric curtain tie backs, 3 inches wide by 19 inches long.
 6. Curtain shall be moveable from both front and back ends.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

- B. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. See Section 05 50 00 for track supports above ceiling.
- C. See Section 06 10 00 for track supports above ceiling.
- D. Suspend track from ceiling system.
- E. Install end cap and stop device.
- F. Install curtains on carriers ensuring smooth operation.

END OF SECTION

**SECTION 10 26 00
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.
- B. Section 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 6 inches long.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has previously installed wall surface protection systems similar in material, design, and extent to the systems indicated for this Project.
- B. Manufacturer Qualifications: Firm experienced in manufacturing wall surface protection system components that are similar to those required for this Project and that have a record of successful in-service performance.
- C. Single Source Responsibility: Obtain each color, grade finish and type of wall surface protection system component from a single source with resources to provided products of consistent quality in appearance and physical properties without delaying progress of the Work.
- D. Design Criteria: The Drawings indicate the size, profile and dimensional requirements of wall surface protection system components required and are based on the specific types and models indicated. Wall surface protection system components by other manufacturers may be considered provided color options are acceptable and deviations in dimensions and profiles are

minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards (CG):
 - 1. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Corner Guards: www.c-sgroup.com/#sle.
 - 2. Inpro; G2-160 High Impact Corner Guards: www.inprocorp.com/#sle.
 - 3. Manufacturer must be able to match colors specified.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted (CG):
 - 1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
 - 2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 3. Width of Wings: 2 inches.
 - 4. Corner: 1/4 inch radius.
 - 5. Color: As noted in 09 99 90 Color Schedule.
 - 6. Corner Angle: 90 degree.
 - 7. Length: One piece, as indicated on Drawings.
 - 8. Provide preformed color matching top and bottom caps.
 - 9. Manufacturer:
 - a. Construction Specialties, Inc; SSM-20an: www.c-sgroup.com/#sle.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

- B. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Install wall surface protection units plumb, level and true to line without distortions. Do not use materials with chips, cracks, voids, stains or other defect that might be visible in the finished work.
- C. Position corner guard 4 inches above finished floor to height as indicated on the Drawings.

3.03 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

**SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- C. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com.
 - 3. Bobrick Washroom Equipment Co., Inc.: www.Bobrick.com.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Surface-Mounted Toilet Accessories - General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with full-length stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Recessed Toilet Accessories - General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when closed.
- D. Stamped Names and Labels: On exposed faces of toilet accessory units are not permitted, except where otherwise indicated; unobtrusive labels on surfaces not exposed to view are acceptable.
- E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys for each accessory to Owner.
- F. Stainless Steel Sheet: ASTM A666, Type 304.
- G. Mirror Glass: Tempered safety glass, ASTM C1048; and 6ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required or stainless steel.
 - 1. Mirror shall be secured to hanger(s) with concealed Philips head locking screws located in bottom of frame.
- H. Fasteners, Screws, and Bolts: Shall be of the same material as accessory unit or of galvanized steel where concealed; tamper-proof.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 PREPARATION

- A. Deliver inserts, anchorages, and rough-in frames to site for timely installation.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated. Verify all heights and locations with Owner and Architect in the field.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.
- B. Protective coverings shall remain in place until all construction is complete.

3.05 SCHEDULE

- A. Model numbers specified are Bobrick Washroom Equipment Company, Inc. numbers to establish standard of quality; equivalent products by one of the specified manufacturers will be accepted.

<u>Item #</u>	<u>Model #</u>	<u>Item</u>	<u>Item Description</u>
Grab Bars	B-6806		
GB-1		36" Grab Bar	
GB-2		42" Grab Bar	
GB-3		18" Grab Bar	
GB-4		Shower Grab Bar	
MR-1	B-290	Mirror-Tempered Glass	24x36
NDL-1	B-254	Sanitary Napkin Disposal	Surface Mount
RH-1	B-76727	Robe Hook	Double Hook
CR-1	B-6107	Shower Curtain Rod	Heavy Duty
FSS-1	B-5191	Shower Seat	ADA Shower Accessory
TD-1	Towel Dispenser		Owner Provided, Contractor Installed
SD-1	Soap Dispenser		Owner Provided, Contractor Installed
PH-1	Paper Holder		Owner Provided, Contractor Installed

END OF SECTION

DIVISION 11 – NOT USED

DIVISION 12 – FURNISHINGS

**SECTION 12 24 00
WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 09 21 16 - Gypsum Board Assemblies: Substrate for window shade systems.
- C. Section 09 51 00 - Acoustical Ceilings: Shade pockets, pocket closures and accessories.
- D. Section

1.03 REFERENCE STANDARDS

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- B. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- E. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
 - 1. Compliance with ANSI/WCMA A100.0-2022 Standard for Window Covering Products.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum ten years of experience with shading systems of similar size and type.
 - 1. Factory training and demonstrated experience.
- C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: Twenty-five years.
 - 3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Manually Operated Roller Shades:
 - 1. Basis of Design:
 - a. MechoShade Systems LLC; Mecho/5 Manual Shade System:
www.mechoshade.com/#sle.
 - b. Or approved equivalent by Draper Inc or SWF Contract.

2.02 ROLLER SHADE TYPES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Interior Manual Roller Shades: MechoShade System LLC; Mecho/5 System
 - 1. Drop Position: Regular.
 - 2. Mounting: Ceiling mounted within window pocket.
 - a. Field verify existing conditions for mounting.
 - 3. Size: As indicated on Drawings.
 - 4. Hembars: Designed to maintain bottom of shade straight and flat.
 - 5. Solar Shade cloths:
 - a. Fabric: Soho 1% openness.
 - b. Color: See Color Schedule - Section 09 99 90.
 - 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
 - a. **Chain Retainer / Tensioner: Chain tensioning device complying with ANSI/WPCA A100.0-2022.**

2.03 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 - 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade Band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.
 - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.04 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- C. Manufacturer may recommend the use of extra heavy hem bars to ensure flatness and tracking of shade. All information and recommendations must be properly communicated by the dealer/installer to architect and general contractor. Dealer will be responsible for changes in hem type.

2.05 COMPONENTS

- A. Access and Material Requirements:
 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
 2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
 3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

2.06 ACCESSORIES

- A. Fascia:
 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 2. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 3. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
 4. Notching of Fascia for manual chain shall not be acceptable.
 5. Fascia:
 - a. See Color Schedule - Section 09 99 90.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- C. Installation Tolerances:
 - 1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch.
 - 2. Maximum Offset From Level: 1/16 inch.
- D. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller
- F. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.05 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

**SECTION 12 35 30
MANUFACTURED CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Casework units.
- B. Casework hardware.
- C. Casework countertops.

1.02 RELATED REQUIREMENTS

- A. Section 09 99 90 - Color Schedule.

1.03 REFERENCE STANDARDS

- A. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2020 (ANSI/BHMA A156.9).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product data on components such as drawer slides, door/drawer pulls, hinges, catches, locks, and shelf clips.
- C. Shop Drawings: Indicate casework locations, large scale plans, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.
- D. Samples: Submit 2 samples and technical data for each of the following: cabinet body laminated board, cabinet interior liner, PVC edge banding, pulls, shelf clips, hinges and plastic laminates to the Architect.

1.05 QUALITY ASSURANCE

- A. Quality Standards: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute AWI.
- B. Softwood Lumber Standard: Comply with PS 20, American Softwood Lumber Standard, and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
- C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.
- D. Hardwood Plywood Standard: Comply with PS 51.
- E. Glued-Up Lumber Standard: Comply with PS 56.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufactured Casework:
 - 1. Calmar Manufacturing Company, Inc.; Product Tru-Built System Two Flush Overlay Construction.
 - 2. Designer Woods, equivalent product
 - 3. Holt Woodworking, equivalent product
 - 4. Kay Dee Company, equivalent product
 - 5. Maloney, Inc. Cabinets, equivalent product
 - 6. Moorman Custom Cabinets, equivalent product
 - 7. Stevens Industries, Inc.; Product Casemaster 2100 T-Mold Overlay.
 - 8. TMI Systems Designs Corporation; Product Trimline 7000 Series.
 - 9. Case System Laminate Casework; Product Case System I.

2.02 COMPONENTS

- A. Plastic Laminate and Liners:
 - 1. Exposed cabinet doors, drawer fronts, face/apron rails/blank panels, ends, backs, fronts, shelves, end standards, countertops, splashbacks, appliance and file openings, cabinet top surfaces less than 72 inches above the floor and other locations specified or shown on the Drawings shall receive plastic laminate and shall be balanced with plastic laminate cabinet liner at semi-exposed locations and backer sheet at concealed locations.
 - 2. Plastic Laminate shall be specified in Section 09 00 90.
 - 3. Plastic Laminate placement shall be as indicated on the Drawings. Linear pattern of laminate on **doors and drawers shall run vertically, unless noted otherwise on Drawings.**
 - 4. Cabinet interiors shall be satin finish polyester laminated, both sides particleboard as manufactured by Panolam, or color matching melamine laminate (balanced) or plastic laminate (balanced) (Casework Subcontractor to have the option).
- B. Edge Banding:
 - 1. Plastic Laminate covered doors, drawer fronts, ends and exposed edges shall be PVC flat 3mm thick edge manufactured by Doellken Woodtape and/or Rehau as noted in Section 09 99 90, machine applied with waterproof hot-melt adhesive.
 - 2. Non-exposed cabinet body ends and shelves shall be flat PVC 3mm thick edge banding manufactured by Doellken Woodtape and/or Rehau as noted in Section 09 99 90. Color shall match the polyester liner.
- C. Countertops:
 - 1. All countertops and backsplashes shall extend over all bases and knee spaces in continuous length utilizing maximum plastic laminate sheet sizes available for minimum seams and joints. Seams and loose joint placements, when necessary, shall not be located near sink locations.
 - 2. Countertops shall be 1-1/4-inch thick. Provide 3/4-inch thick by 4-inch thick high self-edged backsplashes or as otherwise shown, where countertops abut walls or other finishes construction, and at other locations as specified or noted elsewhere.
 - 3. Countertops and backsplashes shall be laminated with high pressure horizontal grade plastic laminate or solid surfacing material. See drawings for material location.
 - 4. Solid Surfacing Countertops & Window Sills: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - a. Flat Sheet Thickness: 1/2 inch, minimum.
 - b. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

- 1) Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - d. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.
 - e. Fabricate in accordance with manufacturer's standard requirements.
- D. Drawers:
1. Sides, Back and Subfront shall be particleboard, minimum of 1/2" thick, laminated with thermalfused melamine. Back and subfront doweled and glued into sides. Dowels fluted, with chamfered ends and a minimum diameter of 8mm. Top edge banded with 3mm PVC edging.
- E. Wood Materials:
1. Concealed Miscellaneous Solid Wood for blocking, furring, nailers and similar applications as required shall be Standard or Better, any species, unless designated otherwise on the Drawings.
 2. Hardboard shall be tempered, 1/4-inch thick unless noted otherwise, and manufactured by one of the following:
 - a. Boise Cascade
 - b. Georgia-Pacific
 - c. Masonite Corporation
 3. Particleboard shall have a density of 45 to 48 pounds per cubic foot, and shall be manufactured by Georgia Pacific or Weyerhaeuser Company. Unless otherwise shown or specified, thickness shall be 3/4-inch.
- F. Miscellaneous:
1. All Shelving shall be 1-inch thick material.

2.03 HARDWARE

- A. Drawer and Door Pulls: Pulls for doors shall be placed vertically and on drawers shall be placed horizontally, and shall be 4-inch wire pull conforming to ADA Standards for Accessible Design, US26D finish, unless noted otherwise below. Provide 2 pulls on drawer fronts exceeding 30-inches in width and one pull for each door and each drawer 30-inches in width or less. Samples shall be submitted to the Architect for approval.
- B. Drawer Slides: Shall be Blum 430E, or manufacturer's standard drawer glides are acceptable on standard drawers as long as the following minimum requirements are met:
1. 100-pound rating, full extension, side mount
 2. Epoxy coating
 3. In-Stop/Out/Stop, Out Keeper
 4. Nylon ball-bearing rollers
 5. Side away adjustable cam
 6. Drawer slides for all drawers 8-inches high and higher, and for all drawers exceeding 30-inches in width shall be manufactured by Accuride, Model 3640
- C. Hinges: Shall be "Institutional Option," (heavy-duty, semi-adjustable, five-knuckle, fixed-pin, hospital tip, 270-degree swing, full wrap-around hinges with minimum of 8 screw attachment). Hinge finish shall be US26D, dull chrome. Provide one pair of hinges for each door to 48-inches in height, and one and one-half pair of hinges for doors 48-inches in height or over. Concealed "European" Hinges are not acceptable.
- D. Automatic Door Catches: Shall be used for inactive leaf of locked pairs of doors and shall be Ives elbow catch #2, heavy duty, as manufactured by H.B. Ives, or approved equal. Spring chain bolts will not be accepted.
- E. Door Catches: Shall be 2 bar magnetic surface applied one per door less than 48-inches in height and 3 bar surface applied magnetic 2 per door 48-inches in height and over, and shall be the manufacturers standard. Finish shall match the liner.

- F. Adjustable Shelf Hardware: Shall be recessed steel standards similar to K&V No. 255 with 256 shelf clips, 4 per shelf, or multiple drilled cabinet ends with hole spacing of not more than 2-inches on centers with nickel-plated steel, pin type, with an integral bearing plate which has a cast-in edge to help retain the shelf when loaded, 4 per shelf. Pin fits into 5 mm holes.
- G. Grommets: Standard plastic grommets for cut-outs, in color Metallic Silver 23.
 - 1. Manufacturer:
 - a. Doug Mockett & Company; Model No. EDP.
- H. Lock Keying:
 - 1. All Manufactured Casework shall be keyed alike within each room, unless noted otherwise. Each room shall be keyed differently from each other.
 - 2. Furnish 2 keys for each room.
 - 3. Master key all locks and furnish 5 master keys.
 - 4. Door Locks: BHMA A156.11, E07121, National Lock No. M4-7054 (verify with owner).
 - 5. Drawer Locks: BHMA 156.11, E07041, National Lock No. M4-7054 (verify with owner).
- I. Chain Stops:
 - 1. Provide on hinged doors adjacent to walls, cabinets and countertops of greater depth. Determine length and position chain for attachment to cabinet frame and door to prevent door and door pull from contacting adjacent surface.
- J. Miscellaneous Fastenings: Screws, toggle bolts, expansion bolts, and other miscellaneous fastenings shall be used as required to securely fasten Manufactured Casework items in place. Jointry of casework components shall be in compliance with AWI standards.

2.04 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- C. Fabricate each unit to be rigid and not dependent on building structure for rigidity.
- D. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.
- F. Provide cutouts for plumbing fixtures, appliances, and fixtures and fittings. Prime paint contact surfaces of cut edges.
- G. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting. Where Manufactured Casework abuts walls and ceilings, provide a maximum 3/4-inch scribe to match adjacent plastic laminate. Hold face of scribe back 1-1/4-inch from the outer face of doors. Manufactured Casework manufacturers shall field verify all dimensions including heights of bulkheads.
- H. Wall cleats supporting countertops at walls shall be 3/4-inch by 2-inch paint grade hardwood. Recess back from face of countertop 4-inches unless noted otherwise on the Drawings. Paint to match wall. All loose joints and field joints shall be joined with hardwood splines and loose joint (or concealed) fasteners.
- I. Provide sealant, for sealing between wall surfaces and splashes or countertops, shall be one of the following:
 - 1. Dow Corning Corporation - 999, Clear
 - 2. General Electric Company - SCC-1201, Clear
- J. Sealer for the edges at all cutout holes shall be two coats of a clear waterproof varnish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing.

3.02 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Set casework items plumb and square, securely anchored to building structure.
- C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Use filler strips; not additional overlay trim for this purpose.
- D. Close ends of units, back splashes, shelves and bases.
- E. Wall Cabinet Mounting Height shall be 84-inches from the top of the cabinet to the floor, unless otherwise noted.

3.03 ADJUSTING

- A. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.04 CLEANING

- A. Clean casework, countertops, shelves, and hardware.

3.05 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.

3.06 SCHEDULE - ITEMIZED SPECIFICATIONS

- A. See Manufactured Casework elevations for heights, widths, and depths.

B. BASE CABINET UNITS

- 1. Item B1: DOOR ONLY BASE CABINET
 - a. 2-hinged doors
 - b. 1-adjustable shelf
 - c. Locked where shown
- 2. Item B2: FILE DRAWERS
 - a. 3-drawers
 - b. Includes hanging file system in bottom drawer
 - c. Legal size
 - d. Locked where shown
- 3. Item B3: LATERAL FILE DRAWERS
 - a. 2-lateral file drawers - letter size
 - b. Include hanging file system
 - c. Provide Lock
- 4. Item B4: DOOR ONLY SINK CABINET
 - a. 2-hinged doors with attached toe-kick
 - b. No finished bottom inside cabinet (for ice machine drain inside cabinet)
 - c. Blank apron at top
 - d. Locked where shown
- 5. Item B5: DOOR/DRAWER BASE CABINET
 - a. 1-hinged door
 - b. 1-drawer
 - c. 1-adjustable shelf
 - d. Locked where shown

C. WALL CABINET UNITS

- 1. Item W1: WALL DOOR ONLY CABINET
 - a. 2-solid hinged doors

- b. See elevations for number of adjustable shelves
 - c. Locked where shown
- 2. Item W2: WALL DOOR ONLY CABINET
 - a. 1-hinged door
 - b. See elevations for number of adjustable shelves
 - c. Locked where shown

D. TALL CABINET UNITS

- 1. Item T1: TALL STORAGE CABINET
 - a. 2-hinged doors
 - b. 5-adjustable shelves
 - c. Vertical divider where wider than 36"
 - d. Locked where shown
- 2. Item T2: TALL WARDROBE / DOOR CABINET
 - a. 2-hinged doors with vertical divider down the middle
 - b. Side One:
 - 1) 1-adjustable shelf
 - 2) 1-stationary clothes rod below shelf
 - c. Side Two:
 - 1) 5-adjustable shelves
 - d. Locked where shown

END OF SECTION

DIVISION 13 – NOT USED

DIVISION 14 – NOT USED

DIVISION 21 – FIRE SUPPRESSION

**SECTION 21 04 00
COMMON REQUIREMENTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the general requirements of these specifications and shall apply to all phases of the work specified, shown on the drawings, or required to provide for complete installation of all systems for this project.
- B. This Section includes the following basic materials and methods to complement other Division 21 Sections.

1.02 SCOPE

- A. The entire building shall have fire protection sprinkler system installed to meet the requirements of the NFPA codes, State Fire Marshal's office, Owner's approving insurance agency and all Authorities Having Jurisdiction.
- B. Contractor shall coordinate the locations of all ceiling mounted sprinkler heads to avoid any and all interference with all other trades.
- C. If conflicts do occur such that lights, ducts, diffusers, grilles, or ceiling systems cannot be installed in their required locations due to sprinkler piping interference, the piping shall be relocated or rerouted at no additional expense to the project.
- D. Contractor shall maintain an adequate supply of extra piping, fittings, and necessary tools to make field modifications without delay.
- E. An approved sprinkler shop drawing does not preclude rerouting if so ordered by the Architect.

1.03 WARRANTIES

- A. Warrant all materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.
- B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.
- C. Repair or replace, at no additional cost to the Owner, any item which may become defective within the warrant period.
- D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Owner.
- E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.
- F. The repair of faulty workmanship shall be considered to be included in the contract.

1.04 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.05 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.
- D. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.06 DEFINITIONS

- A. The following definitions shall apply throughout the contract documents:
 - 1. Architect: Architect or Engineer
 - 2. Code: All applicable national, state and local code
 - 3. Mechanical: All plumbing, HVAC, & fire protection work required by the Contract Documents
 - 4. Electrical: All electrical and fire alarm work required by the Contract Documents
 - 5. Contractor: Any Contractor performing work required by the Contract Documents
 - 6. Indicated: Noted, scheduled or specified
 - 7. Selected: Selected by the Architect or Engineer
 - 8. Provide: Furnish, install, connect and tested complete and ready for use
 - 9. Furnish: Supply and deliver to the site ready for installation
 - 10. Install: Install complete, per Contract Documents and manufacturer's requirements.
 - 11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
 - 12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
 - 13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and in parking garages.
 - 14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
 - 15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
 - 16. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
 - 17. Damp Locations: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.
 - a. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.
 - 18. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.07 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols shown on the plans.

1.08 ABBREVIATIONS

- A. Refer to abbreviations list shown on the Drawings.
- B. The following abbreviations apply throughout the Contract Documents:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. ADA: Americans with Disabilities Act
 - 3. AHJ: Authority Having Jurisdiction
 - 4. AMCA: Air Moving Council of America
 - 5. ANSI: American National Standards Institute
 - 6. ARI: American Refrigeration Institute
 - 7. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
 - 8. ASME: American Society of Mechanical Engineers
 - 9. ASTM Specification: Standard specifications of the American Society for Testing Materials
 - 10. CPVC: Chlorinated polyvinyl chloride plastic.
 - 11. CR: Chlorosulfonated polyethylene synthetic rubber.
 - 12. EPDM: Ethylene propylene diene terpolymer rubber.
 - 13. FM: Factory Mutual Engineering Corporation
 - 14. IRI: Industrial Risk Insurers
 - 15. NEC: National Electrical Code, latest edition
 - 16. NEMA: National Electrical Manufacturers Association
 - 17. NFPA: National Fire Protection Association
 - 18. NP: Nylon plastic.
 - 19. NPS: Nominal Pipe Size
 - 20. PE: Polyethylene plastic.
 - 21. PVC: Polyvinyl chloride plastic.
 - 22. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
 - 23. UL or Underwriters: Underwriters Laboratories, Inc.

1.09 CODES

- A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.
- B. All work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
 - 1. International Building Code (IBC)
 - 2. International Fire Code (IFC)
 - 3. International Energy Conservation Code (IECC)
 - 4. International Fuel Gas Code (IFGC)
 - 5. International Plumbing Code (IPC)
 - 6. International Mechanical Code (IMC)
 - 7. Safety and Health Regulations for Construction
 - 8. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards
 - 9. National Electrical Code (NEC)
 - 10. National Fire Protection Association (NFPA)
 - 11. American Gas Association (AGA)
 - 12. Underwriters' Laboratories, Inc. (UL)
 - 13. National Electrical Safety Code (NESC)
 - 14. All applicable national, state and local codes and amendments.

1.10 PERMITS

- A. The Contractors shall familiarize themselves with all requirements regarding all permits, fees, etc., and shall comply with them.

- B. All permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.
- C. All utilities shall be installed in accordance with the local rules and regulations and all charges shall be paid by the Contractor.

1.11 CODE COMPLIANCE

- A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that shown on the drawings shall not be substituted.
- B. Where the National Electrical Code or applicable codes require controllers to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment.

1.12 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
 - 1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
 - 2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
 - 3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
 - 4. Acceptable Equivalent Substitutions: Acceptable equivalent substitutions are products of manufactures other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
 - a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
 - b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - c. The Contractor providing the substitution shall bear the total cost of all changes due to substitutions. These costs may include additional compensation to the Architect for redesign and evaluation services, increased cost of work by the Owner or other Contractors, and similar considerations.
 - 5. Performance Requirements: Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.
 - 6. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.
- C. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
- D. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.13 SUBMITTALS

- A. Shop Drawings, Product Data and Samples:
 - 1. Other section in the Project Manual shall be adhered to if more stringent than the following paragraphs.

2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect for review.
3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.
5. The shop drawing submittals shall be numbered consecutively under Specification Section 210400. The submittal subject shall clearly summarize the area or system being issued for review.
6. The product data submittal ID shall be numbered consecutively under the applicable Project Manual section, ending with the revision number. The submittal subject shall be the product data description.
 - a. For example, the first revision of the second submittal for product data specified in section 211300 shall have an ID of '211300-002-1'.
7. Submittals for products not listed in the Project Manual shall reference the respective contract document.
8. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
 - a. Shop drawings and product data shall be in original searchable PDF format.
9. Where samples are required, submit one (1) sample of each required item.
10. Shop drawings are drawings, diagrams, schedules and other data specifically prepared for this project by the Contractor, Manufacturer, Supplier, or Distributor to illustrate some portion of the work. Shop Drawings shall also detail fabrication and installation for metal and wood supports and anchorage for fire protection materials and equipment.
 - a. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 - b. Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals.
 - c. Indicate installation, layout, weights, volumes, mounting and support details, and piping connections.
 - d. Hydraulic calculations associated with the shop drawings shall be packaged in the same submittal.
 - e. Submit final shop drawings to Authorities Having Jurisdiction for approval.
11. Shop drawings shall include a completed and signed Owner's Information Certificate as required by NFPA. This certificate shall also be included with the documents issued to the AHJ for approval.
12. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
13. Samples are physical examples furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate materials, equipment or workmanship and to establish the standards by which the work will be performed.
14. All submittals shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. All equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.
15. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect.
16. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.

17. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data or samples.
 18. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect's review of those drawings.
- B. Coordination Drawings: Detail major elements, components, and systems of fire protection equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Drawings shall include the following:
1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - a. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - b. Equipment and accessory service connections and support details.
 2. Sprinklers shall be referred on the drawings with the Sprinkler Identification Number (SIN) or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
 - a. Exterior wall and foundation penetrations.
 - b. Fire-rated wall and floor penetrations.
 3. Sizes and location of required concrete pads and bases.
 4. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 5. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 6. Reflected ceiling plans to coordinate and integrate installation of fire protection devices with air outlets and inlets, light fixtures, communication system components, and other ceiling-mounted items.
 7. All Contractors are required to provide information concerning their part of the work needed to develop the coordination drawings.
 8. Drawings shall contain all of the following that are applicable:
 - a. Fire sprinklers and piping
 - b. Ductwork, equipment, and terminal devices (showing access and service requirements).
 - c. Plumbing
 - d. Structure and general construction
 - e. HVAC piping
 - f. Bus duct
 - g. Recessed light fixtures
 - h. Electrical conduit 2 inches and larger
 - i. Cable tray
 - j. Wet vacuum system
 - k. Other areas indicated by the Contractor that involve congestion
 9. Complete drawings after submitting product data on items included in coordination drawings.
- C. Approved Fire Protection Drawings:
1. Working plans and hydraulic calculations, prepared according to NFPA, that have been reviewed and approved by all authorities having jurisdiction and Owner's insurance carrier.
- D. The Subcontractor shall provide fire-hydrant flow test as a basis for hydraulically calculated systems. Testing shall be conducted at a location representative of the actual future system(s) supply and be no more than 12 months old at date of submission. The flow test report shall have, as a minimum, the following:
1. Contractor's name and contact information.
 2. Project name.

3. Date, time and location of flow test.
 4. Static pressure (psi).
 5. Residual pressure (psi).
 6. Water flow measurement (gpm).
 7. Elevation of hydrant(s) tested (feet above sea level).
- E. Operation and Maintenance Manuals:
1. Prepare electronic operation and maintenance manuals for the equipment furnished.
 2. The manual shall be in original searchable PDF format with equipment organized by specification section. Bookmarking shall be provided in the PDF for each specification section and piece of equipment.
 3. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than 30 days prior to substantial completion of the project.
 4. Manuals not meeting the requirements of this section may be rejected by the Architect.
 5. Manual shall include, but shall not be limited to, the following:
 - a. A cover page including:
 - 1) Project name and address
 - 2) Division of work covered by the manual
 - 3) Name, address and telephone number of Contractor and all Sub-Contractors including night or emergency numbers
 - b. A Complete Index. Contractor may submit the index to the Architect for review prior to submittal of complete manuals if desired.
 - c. Manufacturer's equipment product data, O&M manuals and parts lists identified by the equipment mark used in the contract drawings.
 - d. Names, Addresses and Telephone Numbers. This list shall include the manufacturer and local representative who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the manual.
 - e. Startup, Operation and Shutdown Procedures. Provide a written description of procedures for startup, operation and shutdown of each fire protection item or system. This description shall include motors to start, valves to open, etc., in proper sequence, and the location of switches, starters, pushbuttons and valves.
Description shall include item references or labels used in the contract documents unless otherwise instructed in advance by the Owner.
 - f. Seasonal Changeover Procedure. Provide a written description of the procedure for necessary seasonable changeover from heating to cooling and vice versa.
 - g. Equipment Accessory Schedule. Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required and the manufacturer of all renewable items.
 - h. Lubrication Schedule. Provide a chart listing each piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication.
 - i. Emergency Procedures. Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
 - j. One copy of all shop drawings.
 - k. Signed letters of certification of inspection and similar information.
 - l. All manufacturers' warranty information.
 - m. Provide documentation that training was performed for each item specified to include Owner training. Include name of Owner's representative(s) present, date and time of training.
 - n. Normal Maintenance Schedule. Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days and yearly.
 - o. Provide documentation that Extra Materials were received by the Owner for each section requiring Extra Materials.

- p. Motor List. The list shall indicate motor location, equipment served (using labels indicated on drawings), horsepower, electrical characteristics, motor type, and rpm. Motors less than 1/2 horsepower need not be included.
- F. Division 21 Specific Submittals
 - 1. Product Data For the following:
 - a. Transition fittings.
 - b. Dielectric fittings.
 - c. Mechanical sleeve seals.
 - d. Escutcheons.
 - e. Pipe flashing hood.
 - f. Access doors.
 - 2. Welding certificates.
 - 3. Coordination Drawings: For access panel and door locations.

1.14 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner's designated personnel.
- B. Operation and Maintenance Manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall be scheduled at the convenience of the Owner. A minimum of 8 hours of training shall be provided.
- D. Training shall include instructions on the following:
 - 1. Startup and shutdown procedures
 - 2. Seasonal changeover
 - 3. Periodic maintenance
 - 4. Emergency operation
 - 5. Safety
- E. In addition to the instructions required above, wherever possible perform the operations being described in order to fully illustrate system operation.
- F. At the completion of training, turn over to the Owner all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.

1.15 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel".
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Each individual Fire Protection component (including fire sprinklers, piping, couplings, fittings, valves and accessories) shall be supplied by one manufacturer and shall be UL listed .

1.16 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.17 COORDINATION

- A. Drawings, plans, schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.
- B. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- C. Arrange for spaces, chases, slots, and openings in building structure during progress of construction to allow for system installations.
- D. Coordinate arrangement, mounting, and support of equipment.
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
- E. Coordinate routing of all piping in open and exposed areas with light fixture locations. Where piping will be installed at or below the mounting height of lights, piping shall not pass directly below or within a proximity that will create an obstruction to the required light pattern. Deviations and/or conflicts discovered in the field shall be resolved, to owner/architect/engineer satisfaction, at no additional cost to the project.
- F. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- G. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- H. Coordinate service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing water, gas, electrical power and other services.
- I. Coordinate location of access panels and doors for items that are concealed by finished surfaces.
- J. Coordinate testing of items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.18 STRUCTURAL COORDINATION

- A. Where pipes are routed vertically through shafts, the Subcontractor shall furnish and install all necessary miscellaneous structural members to support the loads imposed by the risers.
- B. In cases where the Contractor determines that superimposed loads such as suspended or floor mounted fire protection, mechanical, electrical, plumbing system or equipment exist which exceed design loads indicated on structural contract documents, Contractor shall submit load data to Design Professionals for review prior to proceeding with work.
- C. Distribute the maximum load hung from any structural member for fire protection, mechanical, electrical, plumbing, ductwork, piping, etc. over the member's tributary area in a way that the design superimposed dead loads listed in structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required achieving the allowable load distribution.
- D. Connections of systems designed by Contractor's engineer such as, but not limited to fire protection, mechanical, electrical, plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the

supporting structural members. Contractor is responsible for furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

- E. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.

PART 2 PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules and/or notes with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 EQUIPMENT SHORT CIRCUIT CURRENT RATING

- A. Where the National Electrical Code or applicable codes require equipment to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment. Acceptable methods of complying with this requirement are as follows:
 - 1. Provide SCCR rating at the equipment that meets or exceeds the available short circuit current at the switchboard or panelboard where the equipment circuit originates.
 - 2. Provide calculations, based on the available short circuit current at the switchboard or panelboard where the equipment circuit originates, that document the actual short circuit current available at the equipment. The SCCR rating of the equipment shall meet or exceed this calculated value.

2.03 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.04 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.05 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.06 PIPE AND PIPE FITTINGS

- A. Refer to individual piping Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
 - 1. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
 - 2. Pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.
 - 3. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

2.07 JOINING MATERIALS

- A. Refer to individual piping sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- I. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- J. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 1. Sleeve: ASTM A 126, Class B, gray iron.
 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 3. Gaskets: Rubber.
 4. Bolts and Nuts: AWWA C111.
 5. Finish: Enamel paint.

2.08 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 4. Aboveground Pressure Piping: Pipe fitting.

2.09 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion. Dielectric unions shall not be used.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 1. Manufacturers:
 - a. Central Plastics Co.
 - b. Watts Industries, Inc.; Water Products Div.

- E. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Central Plastics Co.
 - 2. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.
 - 1. Manufacturers:
 - a. Grinnell Corp.; Grinnell Supply Sales Co.
 - b. Victaulic Co. of America.

2.10 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Mechanical Sleeve Seals
 - a. Calipo, Inc.
 - b. Flexicraft Pipesseal.
 - c. GPT, an EnPro Industries Company.
 - d. Metraflex Co.
 - e. Shamrock Crete-Sleeve.
 - f. Thunderline/Link-Seal/
 - 2. Manufactured Sleeves:
 - a. Pipe Shields.
 - b. Proset.
 - c. Shamrock Crete-Sleeve.
- B. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Plastic. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.12 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.13 SEALANTS AND FIRESTOPPING

- A. Manufacturers:
 - 1. Sealants:
 - a. Dow Corning
 - b. Pecora
 - c. Sonneborn
 - d. Tremco
 - 2. Firestopping Materials and Systems:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. 3M Fire Protection Products: www.3m.com/firestop.
 - c. Hilti, Inc: www.us.hilti.com.
 - d. Nelson FireStop Products: www.nelsonfirestop.com.
 - e. Specified Technologies, Inc: www.stifirestop.com.
 - f. Tremstop Fyre-Sil Sealant - Tremco Sealants & Coatings
- B. Silicone Sealant: Single component, air curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected.
- C. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- E. Joint Backing: ANSI/ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width.
- F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- G. Firestopping Materials and Systems:
 - 1. Subject to compliance with the requirements of Division 07 Fire and Smoke Protection.

2.14 ACCESS DOORS

- A. Manufacturers:
 - 1. Access Doors:
 - a. J. L. Industries
 - b. Karp Associates, Inc.
 - c. Larsons Mfg. Co.

- d. Milcor, Inc.
 - e. Miller Limited Partnership
 - f. Nystrom, Inc.
- B. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated.

2.15 ELECTRICAL WIRE

- A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.
- B. All wiring running exposed in return air plenums shall be plenum-rated cable for fire and smoke spread.

2.16 LOW VOLTAGE CONTROL WIRE AND CABLE

- A. 24 VAC, and General Purpose Cabling:
- 1. Cable shall consist of copper conductors not less than #18 AWG stranded.
 - 2. Cable shall be two- or three-conductor twisted cable with a drain wire.
 - 3. Cable shall have a 100 percent overall shield.
 - 4. Cable shall be plenum rated.
 - 5. Cable shall meet or exceed NEC voltage rating of 300 volts.
 - 6. Cable shall be NEC type CMP.
 - 7. Cable shall meet or exceed UL temperature rating of +60 deg C.
 - 8. Cable shall be labeled at a minimum of every 18 inches with the system manufacturer's name and the type of signal carried within the cable, i.e., analog input, analog output, binary input, binary output, 24 VAC.
- B. Approved Manufacturers: Windy City Wire, Southwest Wire, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Fabrication, erection, and installation of the complete system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.
- B. Check all areas and surfaces where equipment or materials are to be installed and report any unsatisfactory conditions before starting work.
- C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the fire protection work.
- D. Equipment and systems shall be installed in accordance with manufacturer's instructions, requirements, or recommendations.
- E. Coordinate location of fire sprinkler piping and heads with all trades prior to finalization of shop drawings and hydraulic calculations.
- F. See architectural reflected ceiling plans for locations of all ceiling mounted devices.
- G. Do not run fire sprinkler piping above electrical panels or in code required clearance spaces. Coordinate with electrical, plumbing and mechanical contractors.
- H. Coordinate shut down of existing fire service with Owner's representative.
- I. All work shall comply with NFPA and the local AHJ (Authorities Having Jurisdiction), and Owner's insurance carrier.
- J. Where any area of a building is subject to freezing and the temperatures cannot be reliably maintained at or above 40 degrees F, fire protection shall be installed in a way that is protected from freezing.

3.02 DELIVERY AND STORAGE OF MATERIALS

- A. Take provisions for the delivery and safe storage of materials and shall make the required arrangements with other Contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.
- C. All items subject to cold weather damage shall be protected by covering, insulating, or storing in a heated space.

3.03 COOPERATION WITH OTHER CONTRACTORS

- A. Perform the work in conformance with the construction called for by other trades and afford other Contractors reasonable opportunity for the execution of their work.
- B. Properly connect and coordinate the work with the work of other Contractors at such time and in such a manner as not to delay or interfere with their work.
- C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.
- D. Promptly report to the Architect any delay or difficulties encountered in the installation of the fire protection work which might prevent prompt and proper installation of work required from other trades.

3.04 COORDINATION OF WORK

- A. The list below is the precedence of assigned work items for space priority in descending order. Items not listed shall have the same precedence as similar items.
 - 1. In areas with finished ceilings: Reflected ceiling with all light fixtures, access above light fixtures required for maintenance, sprinkler head locations, and all ceiling fixtures and devices.
 - 2. Space designed for future utility placement.
 - 3. Gravity flow plumbing waste, roof drainage, and other systems that rely upon gravity for flow.
 - 4. Ductwork and appurtenances, except that external bracing shall be relocated to accommodate local interference.
 - 5. In open and exposed areas: Exposed and surface mounted light fixtures and signs.
 - 6. Fire sprinkler piping.
 - 7. Bus duct.
 - 8. Cable tray with access identification 8 inches horizontal to 6 inches above tray.
 - 9. Electrical conduit over 2 inches in diameter.
 - 10. HVAC piping except for pressurized domestic water piping.
 - 11. Refrigerant safety relief piping.
 - 12. Plumbing vents.
 - 13. Electrical conduit under 2 inches in diameter.
- B. Plan all work so it proceeds with a minimum of interference with other trades.
- C. It shall also be the responsibility of the Contractor to inform the General Contractor of all openings required in the building construction for the installation of the fire protection work.
- D. The Contractor shall cooperate with all other contractors in furnishing material and information, in proper sequence, for the correct location of all sleeves, inserts, foundations, wiring, etc.
- E. Provisions shall be made for all special frames, openings, and sleeves as required.
- F. The Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.05 ELECTRICAL WIRING

- A. Install wiring in accordance with National Electric Code, ANSI/NFPA 70.

- B. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures. For concealed and accessible areas, plenum-rated wiring and cabling may be used.
- C. Class 2 wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.
- D. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.
- E. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.
- F. Control panels shall be mounted on vibration-free walls or freestanding structural supports. Panels shall be located as indicated or approved by the Owner's Representative.
- G. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.
- H. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

3.06 CONTROL WIRING

- A. Provide all incidental control wiring required to make the equipment or systems fully operational. Coordinate with equipment manufacture incidental wiring requirements.
- B. Incidental control wiring includes but not limited to:
 - 1. Pushbutton Stations and Emergency Stop Switches
 - 2. Remote Monitoring and Control Panels (Provided by Equipment Manufacturers)
 - 3. Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters

3.07 LAYING OUT WORK

- A. Carefully lay out all work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings.
- B. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance, and code-required clearances from the structure or other equipment and systems.
- C. Provide offsets and elevation changes in piping and conduit as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- D. The layout shall not cause problems of operation, maintenance, or clearance for items installed by other Contractors.
- E. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.
- F. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect prior to installation and shall request clarification.
- G. Failure to properly coordinate and lay out the work will require correction by the Contractors at their own expense.

3.08 DATA AND MEASUREMENTS

- A. Drawings are diagrammatic or schematic. Do not scale drawings.
- B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.

- C. Obtain exact locations, measurements, levels, etc., at the site and shall adapt their work to actual conditions.
- D. Examine the general construction, mechanical, electrical, and other applicable drawings and the Specifications.
- E. Only architectural drawings, structural drawings, and site measurements may be utilized in calculations.
- F. Layout and coordinate all work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.

3.09 POSITION OF DEVICES

- A. Locate devices mounted on finished surfaces with regard to paneling, furring, trim, etc. Where several devices occur in a room, they shall be symmetrically arranged as reviewed by the Architect.
- B. Devices improperly located or installed shall be repaired, replaced or relocated at the Contractor's expense.
- C. Devices shall be set plumb or horizontal and shall extend to the finished surface of the wall, ceiling, or floor without projecting beyond the surface.
- D. Devices shown on wood trim, cases, or other fixtures shall be installed symmetrically and, where necessary, shall be set with the long dimension of the plate horizontal.
- E. Coordinate their respective devices so as not to destroy the aesthetic effect of the surface in which the devices are mounted.
- F. Coordinate the locations of all items with work furnished by other trades to avoid interference.
- G. If the required coordination is not done, the outlets or devices shall be removed and relocated if so directed by the Architect and the damaged surfaces repaired at the Contractor's expense.
- H. Devices shall be installed at the height noted or required by code. All heights of devices are measured from finished floor to centerline of device.

3.10 PROTECTION OF APPARATUS

- A. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment, and installations from damage of any kind.
- B. Failure to provide such protection to the satisfaction of the Architect shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.11 ACCESS TO EQUIPMENT

- A. All motors, valves, control devices, specialties, etc., shall be located to provide for easy access for operation, repair and maintenance; if concealed, access doors shall be provided.
- B. Access doors required for access to equipment requiring inspection or service shall be provided.
- C. Provide all access doors not already furnished by other Contractors but which are required for access to fire protection equipment.
- D. Doors shall be 12 inches by 12 inches unless shown otherwise.
- E. Person access doors shall be 18 inches by 18 inches minimum.

3.12 WORK IN EXISTING BUILDINGS

- A. General: All work in the existing building, indicated on the drawings or specified herein, shall be executed with a minimum amount of interference with the normal activities of the occupants of the building.
- B. All work shall be scheduled in advance with the Owner and shall not proceed without the Owner's written approval.

- C. Utilities: Utilities shall not be interrupted without the Owner's prior written approval regarding the time and duration of such interruptions.
 - 1. Utilities to existing facilities shall not be disconnected until new or temporary facilities are installed except for short periods of interruption which are necessary for the performance of the new work and which are approved by the Owner.
- D. Fire Alarm System: The existing fire alarm system shall remain functional throughout construction.
 - 1. As a minimum, the existing degree of protection shall be maintained for all areas.
 - 2. All required outages shall be coordinated with the Owner and the Fire Marshal.
- E. Welding: The Owner shall be notified before starting welding or cutting.
 - 1. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc.
 - 2. Welding or cutting with an open flame or arc shall be stopped not less than one hour before leaving the premises.
- F. Noisy Operations: Noisy operations such as those involving use of air hammers, etc., in demolition, or cutting of openings shall be scheduled with the Owner.
- G. Occupancy:
 - 1. The Owner will continue to occupy the building and carry on normal activity. Each Contractor shall protect the occupied areas from dust, smoke, etc., by a method reviewed by the Architect.
- H. Owner's Right to Direct Work: The Owner shall have the right to direct the places of beginning work, its prosecution, and the manner in which all work under this contract is to be conducted, insofar as may be necessary to secure the safe and proper progress and quality of the work.
- I. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.
- J. Cutting and Patching:
 - 1. Each Contractor shall be responsible for all cutting and patching required for the work.
 - 2. Patching shall be done by persons skilled in the trade involved and shall be prepared to receive paint.
 - 3. Openings through floors may be drilled up to 1 inch but shall be core drilled over 1 inch.
 - 4. Whenever the building surfaces (walls, floors, etc.) and openings are modified, removed and/or replaced to accommodate the new work or to introduce into or remove items from the building, such surfaces or openings shall be carefully reinstalled in conformance with the applicable code to protect the integrity of the building.
- K. Existing Piping or Equipment:
 - 1. If any existing piping or equipment is encountered which would interfere with the proper installation of new work, it shall be removed or relocated as required or as directed by the Architect.
 - 2. Where existing work is to be modified, it shall be done in conformance with these specifications.
 - 3. Materials used shall be the same as for new work unless otherwise specified.

3.13 SEALING OF EXTERIOR OPENINGS

- A. Openings around pipes, conduits, etc., in exterior walls above grade shall be sealed with polyurethane sealant.
- B. Preparation:
 - 1. Clean and prepare joints in accordance with manufacturer's instructions.
 - 2. Remove loose materials and foreign matter which might impair adhesion of sealant.
 - 3. Verify that joint backing and release tapes are compatible with sealant.
 - 4. Perform preparation in accordance with ASTM C804 for solvent release sealants.

5. Protect elements surrounding the work of this Section from damage or disfiguration.
- C. Installation:
 1. Perform installation in accordance with ASTM C804 for solvent release sealants.
 2. Install sealant in accordance with manufacturer's instructions.
 3. Measure joint dimensions and size materials to achieve required width/depth ratios.
 4. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
 5. Install bond breaker where joint backing is not used.
 6. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
 7. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
 8. Tool joints concave.

3.14 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install as described below, unless individual Sections specify otherwise. Individual Sections specify unique installation requirements.
- B. General Locations and Arrangements:
 1. Drawing plans, schematics, and diagrams indicate general, diagrammatic location and arrangement of systems.
 2. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 3. Install systems as indicated, unless deviations to layout are approved on Coordination Drawings.
 4. Provide offsets and elevation changes in piping and conduit as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
 5. Refer to architectural reflected ceiling plans for exact diffuser, register, grille, and ceiling mounted device locations.
 6. Do not run piping above electrical panels or in code required clearance spaces.
 7. Coordinate location of piping with electrical cable tray. Provide a minimum of 6" of clear access above cable tray for installation of cables.
 8. Install all horizontal piping in mechanical rooms at a minimum of 7'-6" above finished floor.
 9. Install all wall mounted equipment at a minimum 7'-0" above finished floor or as required for service per manufacturers' recommendations.
 10. Install exposed interior and exterior piping at right angles or parallel to building walls.
 - a. Diagonal runs are prohibited, unless otherwise indicated.
 11. Conceal piping in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted, except in mechanical rooms or service areas.
 12. Install piping free of sags or bends with ample space between piping to permit proper insulation applications if necessary.
 13. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building unless otherwise indicated.
 - a. Allow sufficient space above ceiling panels to allow for ceiling panel removal.
 14. Install piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment.
 - a. Install expansion loops or compensators where indicated.
 15. Do not use ceiling support system to bear weight of devices or systems unless ceiling support system is certified as suitable to do so.
 16. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.
- C. Contractor is responsible for any cutting and patching needed for installation. Patching must match existing.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Locate groups of pipes parallel to each other, spaced to permit insulation and valve servicing.

- F. Install fittings for changes in direction and branch connections.
- G. Keep all pipe and equipment openings closed during construction except when actual work is being performed on that item or system.
- H. Piping branch takeoffs shall be fabricated using standard manufactured welding or threaded or grooved tees.
- I. Leaking pipe joints shall be remade using new materials.
- J. Drill and deburr all openings which are made after erection of the piping system.
 - 1. Joints in steel pipe 2 inches and smaller shall be threaded in accordance with ANSI B1.1.
 - 2. Ream threaded ends to remove burrs and restore full inside diameter.
 - 3. Utilize pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint.
 - 4. Tighten joints to leave not more than three threads exposed.
- K. Pipe joints and steel pipe larger than 2 inches shall be welded in accordance with ASME Code for Pressure Piping B31.
- L. Flanges on steel pipe larger than 2 inches shall be welded in accordance with ASME B31. Clean flange faces and install gaskets.
 - 1. Tighten bolts to torques specified by the manufacturer of the flange and flange bolts to provide uniform compression of gaskets.
- M. Joints in non-ferrous pipe shall be brazed or soldered.
 - 1. Braze joints in accordance with ANSI B31.9 or B31.5.
 - 2. Thoroughly clean tube surface and inside surface of the fitting using emery cloth. Clean tube and fittings and apply flux.
 - 3. Flux shall not be used for cleaning tube and fitting surfaces.
- N. Joints for other piping systems are specified within the respective piping system specifications.
- O. Install couplings according to manufacturer's written instructions.
- P. Piping Penetrations:
 - 1. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - a. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
 - b. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - c. Piping in Utility Areas: Cast brass or stamped steel with set-screw or spring clips.
- Q. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exceptions:
 - 1) Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2) Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 3) Extend sleeves 2" above finished floor level where pipe clamps rest on the sleeve.
 - 2. Build sleeves into new walls and slabs as work progresses.
 - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe or 16 Gauge Welded Sleeves: For pipes penetrating fire-rated walls.
 - b. Steel, 22 Gauge, Sheet-Metal Sleeves: For pipes penetrating non-fire-rated walls.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

- d. Sleeves set in concrete floor construction, which do not support piping shall be at least 16 gauge galvanized steel.
 - e. Sleeves set in concrete floor construction supporting riser piping shall be standard weight steel pipe. Sleeves supporting riser piping larger than 6" shall have three (3) 6" long reinforcing rods welded radially at 120° spacing to the sleeve and shall be installed with the rods embedded in the concrete slab. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. Install steel pipe for sleeves smaller than 6 inches in diameter. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials in accordance with manufacturer's written instructions and applicable codes. Refer to Division 7 Section - Firestopping for materials.
 - f. Sleeves supporting riser piping larger than 6" shall have three (3) 6" long reinforcing rods welded radially at 120° spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
 - 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
 - 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials in accordance with manufacturer's written instructions and applicable codes. Refer to Division 7 Section - Firestopping for materials.
- U. Verify final equipment locations for roughing-in of all systems.
- V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.15 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual", Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook".
 - 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 - 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
 - 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

3.16 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire protection materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.17 TESTING AND TEST REPORTS

- A. Upon completion of the work, the entire system shall be tested and proven for capacity of equipment, balance of system and proper operation of controls.
 - 1. Motors shall be checked for overload.
 - 2. Lubricate moving parts and clean or replace filters.
 - 3. Test piping systems per applicable codes and standards.
 - 4. Submit three (3) copies of all tests to the Architect for review prior to date of substantial completion.
 - 5. Equipment and systems discrepancies shall be corrected prior to final acceptance.

END OF SECTION

**SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Above ground piping and fittings.
- B. Mechanical couplings.
- C. Pipe hangers and supports.
- D. Pressure gauges.
- E. Documentation cabinet.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Provide manufacturer's catalog information. Indicate material selections being provided, listing and ratings.
 - 2. Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals.
 - 3. Submit product data to Authorities Having Jurisdiction for approval when required by the local code. Submit proof of approval to the Architect/Engineer.
- B. Project Record Documents: Record actual locations of components and tag numbering.
- C. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
 - 2. Installer shall receive training provided by the respective manufacturer to qualify for installing mechanical pressed fitting systems.
- C. Conform to UL (DIR) requirements.
- D. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Each individual Fire Protection component (including fire sprinklers, couplings, fittings, valves and accessories) shall be supplied by one manufacturer and shall be UL listed .
- F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- B. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, or ASTM A795 Schedule 40, black.
 - 1. All piping shall have a Corrosion Resistance Ratio (CRR) greater than or equal to 1.00.
 - 2. All piping used in dry sprinkler systems, preaction sprinkler systems, and dry standpipe systems shall be Schedule 40 black steel.
 - 3. All piping installed where system pressure exceeds 300 psi shall be ASTM A 53 Schedule 40 Grade B seamless.
 - 4. Steel Fittings: ASME B16.5 steel flanges and fittings or ASME B16.11 forged steel socket welded and threaded.
 - 5. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 6. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 - 7. Ductile Iron Threaded Fittings: Shall be listed for fire protection use and be manufactured to the dimensional standards of ASME B16.3.
 - 8. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.
 - 9. Mechanical tee type branch and sprinkler fittings where outlets are strapped over a cut hole with a gasket O-ring are not allowed.
- B. Copper Tube: ASTM B75/B75M or ASTM B88 (ASTM B88M), H58 drawn temper.
 - 1. Type: Type M (C).
 - 2. Fittings: ASME B16.18, cast copper alloy solder joint, pressure type.
 - 3. Joints: AWS A5.8M/A5.8 Classification BCuP-3 or BCuP-4 copper/silver braze.
- C. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, standard thickness.
 - 2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene-butadiene rubber gasket.
- D. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- E. Flexible Sprinkler Head Connections:
 - 1. Manufacturers
 - a. Viking
 - b. Easy Flex
 - c. Victaulic Company; Vic-Flex: www.victaulic.com.
 - d. Gateway Tubing
 - e. Flexhead Industries
 - f. Flex Drop
 - g. SprinkFLEX
 - h. Reliable Sprinkler
 - 2. Flexible sprinkler head connections shall have materials suitable for system fluid. Connections shall be rated for 175 psi minimum working pressure.
 - 3. Braided stainless steel flexible hose with minimum 1" outside diameter.
 - 4. Provide 1" inlet nipple for connection to sprinkler main, outlet reducer fitting for straight outlet, EPDM seal, slip nut, preassembled with sprinkler head, zinc plated steel support bar and bracket for connection to ceiling system.

2.03 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring or Carbon steel, adjustable steel band hanger.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable steel band hanger.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

- D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- F. Vertical Support: Steel riser clamp. Riser clamps shall rest on sleeves.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- I. Hanger rods installed in exposed, unconditioned areas such as parking garages shall be galvanized or zinc plated.
- J. Hanger rods installed in conditioned concealed spaces may be black.
- K. Hanger rods and fasteners shall be sized, spaced, and installed as recommended by the manufacturer for the service intended and per NFPA 13 and 14 requirements.
- L. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners. The Subcontractor shall submit fastener details to the base building Structural Engineer for review and approval prior to submission to the Engineer. Fasteners shall meet NFPA 13 and 14 requirements and be UL listed .
 - 1. Top Beam Clamps: Complying with ICC-ES SP-58.
 - 2. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 3. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 4. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 5. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 6. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - 7. Other Types: As required.

2.04 MECHANICAL COUPLINGS

- A. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig.
 - 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
 - 4. Housing Coating: Factory applied orange enamel.
 - 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 - 6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.
 - 7. Provide stops for direct stab installation without field assembly.

2.05 PRESSURE GAUGES

- A. Manufacturers:
 - 1. AGF Manufacturing: www.agfmfg.com/#sle.
 - 2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 - 4. Omega Engineering, Inc: www.omega.com/#sle.
 - 5. Winters Instruments: www.winters.com/#sle.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.
 - 2. Diameter: 4-1/2 inch.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Display in psi.
 - 5. Range: As appropriate for system pressure (0 psi - 175 psi)

2.06 DOCUMENTATION CABINET

- A. Provide a steel document storage cabinet located adjacent to system riser.

- B. The cabinet shall include paper copies of all the fire protection drawings, calculations and signs.
- C. The cabinet shall include electronic copies of all the fire protection drawings, calculations and signs.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Protection of Piping Against Freezing in accordance with NFPA requirements:
 - 1. Where portions of systems are subject to freezing and temperatures cannot reliably be maintained at or above 40°F (4°C), systems shall be installed as a dry or preaction system.
- B. Piping in finished portions of the building, except in mechanical equipment rooms, stairwells or where otherwise indicated on the Drawings shall be concealed.
- C. Route piping in orderly manner, plumb and parallel to building structure. Run all pipe straight and true. Springing or forcing piping into place will not be permitted. Install piping in such a manner as to prevent strain on the equipment..
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- H. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 6. Where trapeze hangers are constructed, the all-thread rods supporting the trapeze member shall not extend more than 1" below the assembly.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- I. Structural Considerations:
 - 1. Do not penetrate building structural members unless indicated.

- J. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.
- K. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

3.04 FLEXIBLE SPRINKLER HEAD CONNECTIONS

- A. Install flexible sprinkler drops per manufacturer's recommendations for maximum number of bends and minimum inside bend radius.

END OF SECTION

**SECTION 21 13 00
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System design, installation, and certification.
- B. Fire department connections.

1.02 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products.
- B. NFPA 1963 - Standard for Fire Hose Connections.
- C. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS

- A. Specification Compliance Review.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop drawings and hydraulic calculations shall be submitted under Specification Section 210400 and follow the requirements documented there.
- D. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.
- F. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
 - 1. Sprinklers shall be referred on the drawings with the sprinkler identification number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.04 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Comply with UL (DIR) requirements.
- C. Designer Qualifications: Individual person employed full-time by the water-based fire protection system contractor who meets the following requirements:
 - 1. Designs the system under direct supervision of a Professional Fire Protection Engineer experienced in design of this type of work and is licensed in the State in which the Project is located.
 - 2. Is currently certified by the National Institute for Certification in Engineering Technologies (NICET) at a Level III or Level IV in fire protection engineering technology, automatic sprinkler layout, or another nationally recognized certification in an automatic sprinkler system layout recognized by the State Fire Marshal.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- F. Equipment and Components: Provide products that bear UL label or marking.

- G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.
- H. Each individual Fire Protection component (including fire sprinklers, valves and accessories) shall be supplied by one manufacturer and shall be UL listed .
- I. All castings used for valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Comply with the NFPA 13 Hazard Classifications of Occupancies and Commodities, unless noted otherwise.
- C. Water Supply: Determine volume and pressure from current water flow test data.
 - 1. Revise design when test data available prior to submittals.
- D. Safety Factor: The hydraulic calculations shall show the automatic water supply can meet the required system flow and pressure demand.
- E. Interface system with building fire and smoke alarm system.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to system riser.

2.02 SPRINKLERS

- A. Sprinkler type and finish for typical locations are defined below. Supplemental information is also provided in the MEP and architectural drawings.
- B. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Enamel, color white .
 - 4. Escutcheon Plate Finish: Enamel, color white.
 - 5. Fusible Link: Glass bulb or fusible solder link type temperature rated for specific area hazard.
- C. Exposed Area Type: Upright type.
 - 1. Response Type: Quick.
 - 2. Finish: Brass.
 - 3. Fusible Link: Glass bulb or fusible solder link type temperature rated for specific area hazard.
- D. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Enamel, color white .
 - 4. Escutcheon Plate Finish: Enamel, color white .
 - 5. Fusible Link: Glass bulb or fusible solder link type temperature rated for specific area hazard.
- E. Dry Sprinklers: Recessed pendant or horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Enamel, color white .
 - 4. Escutcheon Plate Finish: Enamel, color white .

5. Fusible Link: Glass bulb or fusible solder link type temperature rated for specific area hazard.
- F. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
 1. Guards: Red finish.
- G. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss cast in the sprinkler body.

2.03 PIPING SPECIALTIES

- A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper with standard trimmings, including water and air pressure gauges, test by-pass and necessary piping, fittings and accessories required to achieve the following additional capabilities and features:
 1. Activate electric pressure alarm switch.
 2. Activate electric low air pressure trouble switch.
 3. Air Maintenance Device.
 4. Quick Opening Device when required to meet performance requirements of NFPA 13.
 5. Test and drain valve.
 6. Externally resettable.
 7. Replaceable internal components without removing valve from installed position.
- B. Air Release Valve:
 1. Automatic Air Release Valve
 - a. Furnish and install an air vent that is UL listed for use on wet fire sprinkler systems. The vent shall automatically release trapped air from the piping during system fill or as air migrates to the vent location over time. The vent shall automatically close when water reaches the device, and a retention pan or piped discharge to a drain shall be provided to capture and contain any incidental water.
 - b. The air vent shall have a minimum ½" NPT male connection to the sprinkler system and be furnished connected to a "y" type strainer. Furnish and install a ball valve to isolate the air vent from system pressure for replacement or strainer maintenance.
 - c. All components and fittings shall be brass.
 - d. The air vent valve shall be located at the high point on each fire sprinkler system as selected by the fire sprinkler designer to assure evacuation of trapped air in the piping.
 - e. The air vent shall be mounted in a vertical position with the manufacturer required clearance above the fire sprinkler main or branch line piping.
 - f. The air vent shall be located over areas without a ceiling, above a lay-in ceiling, or above an access panel.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Connections:
 1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
 - a. Body: Cast Brass with clappers.
 - b. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
 - c. Outlet: Bottom with pipe threads, 4 NPS.
 - d. Minimum Pressure Rating: 175 psig.
 - e. Finish: Chrome.
 - f. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
 - g. Manufacturers:
 - 1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com.
 - 2) Fire End & Croker Corporation: www.croker.com.

- 3) Potter Roemer Fire Pro: www.potterroemer.com.
- 4) Guardian Fire Equipment, Inc: www.guardianfire.com.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Install pipe runs to minimize obstruction to other work.
- D. Install piping in concealed spaces above finished ceilings.
- E. Install any dry lengths of drain piping sloped at a minimum 1/4" per 10'-0" of run from the drain valve to the point of discharge. Provide an auxiliary drain at any trapped low points on the drain piping.
- F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required, no closer than 6 inches from ceiling grid members.
- G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- H. Flush entire piping system of foreign matter.
- I. Install guards on sprinklers where subject to damage.
- J. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.
- K. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.
- L. Hydrostatically test entire system.
- M. Require test be witnessed by Fire Marshal.
- N. Fire Alarm Contractor shall connect all sprinkler devices to fire alarm control panel. All devices shall have a unique address.
- O. Fire sprinklers protecting unfinished shell spaces shall not be installed directly on the branch line serving the area. They shall be installed on 1" x 0'-4" arm overs, 1" x 1/2" bushings, or 1" sprigs to provide a 1" threaded outlet for future system adjustment.

3.02 SPECIAL SITUATIONS

- A. The following requirements reflect some of the special fire protection requirements included in this project, but may not represent all atypical arrangements that may be encountered. All NFPA and local jurisdictional requirements must be followed.
- B. All electrical rooms shall be provided with fire sprinkler protection unless specifically prohibited by building code.

3.03 FIELD QUALITY CONTROL

- A. Initial Inspections and Tests: All inspections, examinations and tests required by NFPA 13 and the authorities and/or agencies specified hereinbefore shall be arranged and paid for by the Subcontractor, as necessary to obtain complete and final acceptance of the system as installed. A means to perform these tests without hindering the system operation or creating a nuisance to the owner shall be provided, including any additional valves and piping necessary to do so. The certificates of inspection shall be furnished as Submittal Data.
- B. Periodic Inspection Service: After completion of the fire sprinkler systems and at the beginning of the warranty period the Subcontractor shall perform, without charge to the Owner, one inspection of the systems. Inspection shall be as per the applicable NFPA 25 sections, plus the following maintenance to be performed during the course of the inspection:
 - 1. Operation of all control valves.

2. Lubrication of operating stems of all interior valves.
3. Operation of electric alarms, supervisory panels, air compressors, alarm trip switches, flow switches, etc.
4. Lubrication of Fire Department hose connection inlet and fire hose valve threads.

C. Acceptance tests shall be witnessed by the Fire Marshal.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.05 PROTECTION AGAINST FREEZING

- A. Where any area of a building is subject to freezing and the temperatures cannot be reliably maintained at or above 40°F, the area shall be protected by a dry barrel fire sprinkler served from a wet fire sprinkler system or a dry fire sprinkler system.
- B. Building areas that may be subject to freezing include, but are not limited to:
 1. Entry vestibules.

3.06 SCHEDULES

- A. Occupancy hazard classifications based on NFPA guidelines, with area and sprinkler spacing and water density delivery based on NFPA 13 standards, unless modified below.
 1. Light Hazard: LH
 2. Ordinary Hazard, Group 1: OH1
 3. Ordinary Hazard, Group 2: OH2
 4. Extra Hazard, Group 1: EH1
 5. Extra Hazard, Group 2: EH2
 6. Pre-action: PA
- B. System Hazard Areas:
 1. Offices: LH
 2. Storage Closets/Rooms: OH1
 3. Lobbies/Corridors: LH
 4. ITEO, Microwave, Telecom and IDF: LH
 5. Restrooms/Locker Rooms: LH
 6. Worship Space: LH

END OF SECTION

DIVISION 22 - PLUMBING

**SECTION 22 04 00
COMMON REQUIREMENTS FOR PLUMBING**

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the general requirements of these specifications and shall apply to all phases of the work indicated or required to provide for complete installation of all systems for this project.
- B. This Section includes basic materials and methods to complement other Division 22 Sections.

1.02 WARRANTIES

- A. Warrant all materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.
- B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.
- C. Repair or replace, at no additional cost to the Owner, any item which may become defective within the warrant period.
- D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Owner.
- E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.
- F. The repair of faulty workmanship shall be considered to be included in the contract.

1.03 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.04 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.
- D. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.05 DEFINITIONS

- A. The following definitions shall apply throughout the contract documents:
 - 1. Architect: Architect or Engineer
 - 2. Code: All applicable national, state and local code

3. Mechanical: All plumbing, HVAC, & fire protection work required by the Contract Documents
4. Electrical: All electrical and fire alarm work required by the Contract Documents
5. Contractor: Any Contractor performing work required by the Contract Documents
6. Indicated: Shown on drawings, noted, scheduled or specified
7. Selected: Selected by the Architect or Engineer
8. Provide: Furnish, install, connect and tested complete and ready for use
9. Furnish: Supply and deliver to the site ready for installation
10. Install: Install complete, per Contract Documents and manufacturer's requirements.
11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and in parking garages.
14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
16. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
17. Damp Locations: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.
 - a. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.
18. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.06 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols shown on the plans.

1.07 ABBREVIATIONS

- A. Refer to abbreviations list shown on the Drawings.

1.08 CODES

- A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.
- B. All work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
 1. International Building Code (IBC)
 2. International Energy Conservation Code (IECC)
 3. International Fuel Gas Code (IFGC)
 4. International Plumbing Code (IPC)
 5. International Mechanical Code (IMC)
 6. Safety and Health Regulations for Construction
 7. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards

8. National Electrical Code (NEC)
9. National Fire Protection Association (NFPA)
10. Life Safety Code (NFPA 101)
11. American Gas Association (AGA)
12. Underwriters' Laboratories, Inc. (UL)
13. National Electrical Safety Code (NESC)
14. All applicable national, state and local codes and amendments.

1.09 PERMITS

- A. The Contractors shall familiarize themselves with all requirements regarding all permits, fees, etc., and shall comply with them.
- B. All permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.
- C. All utilities shall be installed in accordance with the local rules and regulations and all charges shall be paid by the Contractor.

1.10 CODE COMPLIANCE

- A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that shown on the drawings shall not be substituted.
- B. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.
- C. Where the National Electrical Code or applicable codes require controllers to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment.

1.11 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
 1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
 2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
 3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
 4. Acceptable Equivalent Substitutions: Acceptable equivalent substitutions are products of manufactures other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
 - a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
 - b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - c. The Contractor providing the substitution shall bear the total cost of all changes due to substitutions. These costs may include additional compensation to the Architect for redesign and evaluation services, increased cost of work by the Owner or other Contractors, and similar considerations.
 5. Performance Requirements: Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.

6. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.
- C. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
- D. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.12 SUBMITTALS

- A. Shop Drawings, Product Data and Samples:
 1. Other section in the Project Manual shall be adhered to if more stringent than the following paragraphs.
 2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect for review.
 3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
 4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.
 5. The shop drawing submittals shall be numbered consecutively under Specification Section 220400. The submittal subject shall clearly summarize the area or system being issued for review.
 6. Submittals not listed in the Project manual shall reference the respective contract document.
 7. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
 - a. Shop drawings and product data shall be in original searchable PDF format.
 8. Shop drawings are drawings, diagrams, schedules and other data specifically prepared for this project by the Contractor, Manufacturer, Supplier, or Distributor to illustrate some portion of the work. Shop Drawings shall also detail fabrication and installation for metal and wood supports and anchorage for plumbing materials and equipment.
 - a. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 9. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
 10. All submittals shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. All equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.
 11. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
 12. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data or samples.
 13. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect's review of those drawings.
 14. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been reviewed by the Architect. All such portions of the work shall be in accordance with reviewed submittals.

- B. Coordination Drawings: Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
1. Include the following:
 - a. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - b. Clearances for installing and maintaining insulation.
 - c. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - d. Equipment and accessory service connections and support details.
 - e. Exterior wall and foundation penetrations.
 - f. Fire-rated wall and floor penetrations.
 - g. Sizes and location of required concrete pads and bases.
 - h. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - i. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 - j. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, access doors or panels and other hanging or ceiling-mounted items.
 - k. All Contractors are required to provide information concerning their part of the work needed to develop the coordination drawings.
 - l. Coordination Drawing Content:
 - 1) Drawings shall contain all of the following that are applicable:
 - (a) Ductwork, equipment, and terminal devices (showing access and service requirements). Ductwork, equipment and terminal devices indicated in the coordination drawing content must be the same as that indicated in all submittals.
 - (b) Plumbing
 - (c) HVAC piping
 - (d) Recessed, surface mount, and exposed hanging light fixtures
 - (e) Electrical conduit 2 inches and larger
 - (f) Cable tray
 - (g) Fire sprinkler piping
 - (h) Structure and general construction
 - (i) Access doors and panels
 - (j) Other areas indicated by the Contractor that involve congestion
 - 2) Complete drawings after submitting product data on items included in coordination drawings.
- C. Operation and Maintenance Manuals:
1. Prepare electronic operation and maintenance manuals for the equipment furnished.
 2. The manual shall be in original searchable PDF format with equipment organized by specification section. Bookmarking shall be provided in the PDF for each specification section and piece of equipment.
 3. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than 30 days prior to substantial completion of the project.
 4. Manuals not meeting the requirements of this section may be rejected by the Architect.
 5. Manual shall include, but shall not be limited to, the following:
 - a. A cover page including:
 - 1) Project name and address
 - 2) Division of work covered by the manual

- 3) Name, address and telephone number of Contractor and all Sub-Contractors including night or emergency numbers
- b. A Complete Index. Contractor may submit the index to the Architect for review prior to submittal of complete manuals if desired.
- c. Manufacturer's equipment product data O&M manuals and parts lists identified by the equipment mark used in the contract drawings.
- d. Names, Addresses and Telephone Numbers. This list shall include the manufacturer and local representative who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the manual.
- e. Startup, Operation and Shutdown Procedures. Provide a written description of procedures for startup, operation and shutdown of each item or system. This description shall include motors to start, valves to open, etc., in proper sequence, and the location of switches, starters, pushbuttons and valves. Description shall include item references or labels used in the contract documents unless otherwise instructed in advance by the Owner.
- f. Seasonal Changeover Procedure. Provide a written description of the procedure for necessary seasonable changeover from heating to cooling and vice versa.
- g. Equipment Accessory Schedule. Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required and the manufacturer of all renewable items.
- h. One copy of all shop drawings.
- i. All manufacturers' warranty information.
- j. Provide documentation that training was performed for each item specified to include Owner training. Include name of Owner's representative(s) present, date and time of training.
- k. Normal Maintenance Schedule. Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days and yearly.

1.13 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner's designated personnel.
- B. Operation and Maintenance Manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall include instructions on the following:
 - 1. Startup and shutdown procedures
 - 2. Periodic maintenance
 - 3. Emergency operation
 - 4. Safety
- D. In addition to the instructions required above, wherever possible perform the operations being described in order to fully illustrate system operation.
- E. At the completion of training, turn over to the Owner all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.

1.14 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel".
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 COORDINATION

- A. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.
- B. Provide offsets and elevation changes in piping as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- C. Arrange for spaces, chases, slots, and openings in building structure during progress of construction to allow for system installations.
- D. Coordinate arrangement, mounting, and support of equipment.
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
- E. Coordinate routing of all piping in open and exposed areas with light fixture locations. Where piping will be installed at or below the mounting height of lights, piping shall not pass directly below or within a proximity that will create an obstruction to the required light pattern. Deviations and/or conflicts discovered in the field shall be resolved, to owner/architect/engineer satisfaction, at no additional cost to the project.
- F. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the installations that follow.
- G. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- H. Coordinate service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing water, gas, electrical power and other services.
- I. Coordinate location of access panels and doors for items that are concealed by finished surfaces.
- J. Coordinate testing of items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.17 STRUCTURAL COORDINATION

- A. In cases where the Contractor determines that superimposed loads such as suspended or floor mounted mechanical, electrical, plumbing system or equipment exist which exceed design loads indicated on structural contract documents, Contractor shall submit load data to Design Professionals for review prior to proceeding with work.
- B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, piping, etc. over the member's tributary area in a way that the design superimposed dead loads listed in structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required achieving the allowable load distribution.

- C. Connections of systems designed by Contractor's engineer such as, but not limited to mechanical, electrical, plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

PART 2 PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Specific Notes and/or Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.03 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.04 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.05 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast Brass Type: With set screw.
- D. Finish: Polished chrome-plated.
- E. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.06 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.07 SEALANTS AND FIRESTOPPING

- A. Manufacturers:
 - 1. Sealants:
 - a. Dow Corning
 - b. Pecora
 - c. Sonneborn
 - d. Tremco
 - 2. Firestopping Materials and Systems:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. 3M Fire Protection Products: www.3m.com/firestop.

- c. Hilti, Inc: www.us.hilti.com.
 - d. Nelson FireStop Products: www.nelsonfirestop.com.
 - e. Specified Technologies, Inc: www.stifirestop.com.
 - f. Tremstop Fyre-Sil Sealant - Tremco Sealants & Coatings
- B. Silicone Sealant: Single component, air curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected.
- C. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- E. Joint Backing: ANSI/ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width.
- F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- G. Firestopping Materials and Systems:
- 1. UL Listed products and assemblies.
 - 2. Subject to compliance with the requirements of Division 07 Fire and Smoke Protection.

2.08 ACCESS DOORS

- A. Manufacturers:
- 1. Access Doors:
 - a. J. L. Industries
 - b. Karp Associates, Inc.
 - c. Larsons Mfg. Co.
 - d. Milcor, Inc.
 - e. Miller Limited Partnership
 - f. Nystrom, Inc.
- B. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated.

2.09 ELECTRICAL WIRE

- A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.
- B. All wiring running exposed in return air plenums shall be plenum-rated cable for fire and smoke spread.

2.10 LOW VOLTAGE CONTROL WIRE AND CABLE

- A. Analog Input, Analog Output, Binary Input, Binary Output, 24 VAC, and General Purpose Cabling:
- 1. Cable shall consist of copper conductors not less than #18 AWG stranded.
 - 2. Cable shall be two- or three-conductor twisted cable with a drain wire.
 - 3. Cable shall have a 100 percent overall shield.
 - 4. Cable shall be plenum rated.
 - 5. Cable shall meet or exceed NEC voltage rating of 300 volts.
 - 6. Cable shall be NEC type CMP.
 - 7. Cable shall meet or exceed UL temperature rating of +60 deg C.

2.11 BACKFILL MATERIAL AND MIXES

- A. Earth Fill: Approved type of soil classified, in accordance with ASTM D2487, as GW, GP, GM, GC, SW, SP, SM. SC, ML or CL, and free of foreign substances, obtained from excavation on this project or other approved source, and having a plasticity index between 7.5 and 17.

- B. Granular Fill: Granular fill shall include clean, natural or prepared gravels, gravel-sand mixtures, sands or gravelly sands with little or no fines. A minimum of 95% shall be retained on a No. 200 sieve.
- C. Pea Gravel: Pea gravel shall consist of clean, hard, round particles of crushed stone, crushed or uncrushed gravel with the following gradation:

Sieve Size	Percent Passing
3/8 inch	85 - 95
#4	55 - 15
#8	0 - 2

- D. Crushed Rock: Crushed rock shall consist of clean, hard, particles of crushed limestone, dolomite, granite, quartzite, or other approved rock. It shall have a percentage of wear of not more than 45 and a percent loss of not more than 30 at the end of 16 cycles of the freezing and thawing test. Gradation for crushed rock shall be as follows:

Sieve Size	Percent Retained
1-1/2 inch	0
3/4 inch	5 - 35
3/8 inch	30 - 64
#10	70 - 90
#200	900 - 100

PART 3 EXECUTION

3.01 GENERAL

- A. Fabrication, erection, and installation of the complete system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.
- B. The Contractor shall check all areas and surfaces where plumbing equipment or materials are to be installed and report any unsatisfactory conditions before starting work.
- C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the plumbing work.
- D. Equipment and systems shall be installed in accordance with manufacturer's instructions, requirements, or recommendations.

3.02 DELIVERY AND STORAGE OF MATERIALS

- A. Take provisions for the delivery and safe storage of materials and shall make the required arrangements with other Contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.
- C. All items subject to cold weather damage shall be protected by covering, insulating, or storing in a heated space.

3.03 COOPERATION WITH OTHER CONTRACTORS

- A. Perform the work in conformance with the construction called for by other trades and afford other Contractors reasonable opportunity for the execution of their work.
- B. Properly connect and coordinate the work with the work of other Contractors at such time and in such a manner as not to delay or interfere with their work.
- C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.

- D. Promptly report to the Architect any delay or difficulties encountered in the installation of the plumbing work which might prevent prompt and proper installation of work required from other trades.

3.04 COORDINATION OF WORK

- A. The list below is the precedence of assigned work items for space priority in descending order. Items not listed shall have the same precedence as similar items:
 - 1. In areas with finished ceilings: Reflected ceiling with all light fixtures, access above light fixtures required for maintenance, sprinkler head locations, and all ceiling fixtures and devices.
 - 2. Gravity flow plumbing waste, roof drainage, and other systems that rely upon gravity for flow.
 - 3. Ductwork and appurtenances, except that external bracing shall be relocated to accommodate local interference.
 - 4. In open and exposed areas: Exposed and surface mounted light fixtures and signs.
 - 5. Fire sprinkler piping.
 - 6. Cable tray with access identification 8 inches horizontal to 6 inches above tray.
 - 7. Electrical conduit over 2 inches in diameter.
 - 8. HVAC piping except for pressurized domestic water piping.
 - 9. Plumbing vents.
 - 10. Electrical conduit under 2 inches in diameter.
- B. Plan all work so it proceeds with a minimum of interference with other trades.
- C. It shall also be the responsibility of the Contractor to inform the General Contractor of all openings required in the building construction for the installation of the plumbing work.
- D. The Contractor shall cooperate with all other contractors in furnishing material and information, in proper sequence, for the correct location of all sleeves, inserts, foundations, wiring, etc.
- E. Provisions shall be made for all special frames, openings, and sleeves as required.
- F. The Contractor shall pay for extra cutting and patching made necessary by their failure to properly direct such work at the correct time.

3.05 ELECTRICAL WIRING

- A. Install wiring in accordance with National Electrical Code and ANSI/NFPA 70.
- B. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures. For concealed and accessible areas, plenum-rated wiring and cabling may be used.
- C. Class 2 wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.
- D. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.
- E. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.
- F. Control panels shall be mounted on vibration-free walls or freestanding structural supports. Panels shall be located as indicated or approved by the Owner's Representative.
- G. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.
- H. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

3.06 CONTROL AND POWER WIRING

- A. Provide all incidental wiring required to make the fixtures, equipment or systems fully operational. Coordinate with equipment manufacture incidental power and control wiring requirements.

3.07 LAYING OUT WORK

- A. Carefully lay out all work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings.
- B. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance, and code-required clearances from the structure or other equipment and systems.
- C. Provide offsets and elevation changes in piping as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- D. The layout shall not cause problems of operation, maintenance, or clearance for items installed by other Contractors.
- E. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.
- F. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect prior to installation and shall request clarification.
- G. Failure to properly coordinate and lay out the work will require correction by the Contractors at their own expense.

3.08 DATA AND MEASUREMENTS

- A. Drawings are diagrammatic or schematic. Do not scale drawings.
- B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.
- C. Obtain exact locations, measurements, levels, etc., at the site and shall adapt their work to actual conditions.
- D. Examine the general construction, mechanical, electrical, and other applicable drawings and the Specifications.
- E. Only architectural drawings, structural drawings, and site measurements may be utilized in calculations.
- F. Layout and coordinate all work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.

3.09 POSITION OF DEVICES

- A. Locate devices mounted on finished surfaces with regard to paneling, furring, trim, etc. Where several devices occur in a room, they shall be symmetrically arranged as reviewed by the Architect.
- B. Devices improperly located or installed shall be repaired, replaced or relocated at the Contractor's expense.
- C. Devices shall be set plumb or horizontal and shall extend to the finished surface of the wall, ceiling, or floor without projecting beyond the surface.
- D. Devices shown on wood trim, cases, or other fixtures shall be installed symmetrically and, where necessary, shall be set with the long dimension of the plate horizontal.
- E. Coordinate their respective devices so as not to destroy the aesthetic effect of the surface in which the devices are mounted.
- F. Coordinate the locations of all plumbing items with work furnished by other trades to avoid interference.

- G. If the required coordination is not done, the outlets or devices shall be removed and relocated if so directed by the Architect and the damaged surfaces repaired at the Contractor's expense.
- H. Devices shall be installed at the height shown below unless otherwise noted. All heights of devices are measured from finished floor to centerline of device.
- I. Heights may be adjusted to correspond to nearest masonry course or as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.
 - 1. Control panels 48 inches.

3.10 PROTECTION OF APPARATUS

- A. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment, and installations from damage of any kind.
- B. Failure to provide such protection to the satisfaction of the Architect shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.11 ACCESS TO EQUIPMENT

- A. All motors, valves, control devices, specialties, etc., shall be located to provide for easy access for operation, repair and maintenance; if concealed, access doors shall be provided.
- B. Access doors required for access to equipment requiring inspection or service shall be provided.
- C. Provide all access doors not already furnished by other Contractors but which are required for access to plumbing equipment.
- D. Doors shall be 12 inches by 12 inches unless shown otherwise.
- E. Person access doors shall be 18 inches by 18 inches minimum.

3.12 EXAMINATION OF PREMISES

- A. Examine the premises and all conditions thereon and/or therein. The bid proposal shall take into consideration all such conditions which may affect the work under this contract.

3.13 ROADWAYS, CURBS, AND WALKS

- A. Use every possible precaution to prevent injuries to roadways, curbs, and walks on or adjacent to the site of the work.
- B. Any damage shall be repaired at the Contractor's own expense. This shall also include damage necessary for installation of the plumbing work.

3.14 WORK IN EXISTING BUILDINGS

- A. General: All work in the existing building, indicated on the drawings or specified herein, shall be executed with a minimum amount of interference with the normal activities of the occupants of the building.
- B. All work shall be scheduled in advance with the Owner and shall not proceed without the Owner's written approval.
- C. Utilities: Utilities shall not be interrupted without the Owner's prior written approval regarding the time and duration of such interruptions.
 - 1. Utilities to existing facilities shall not be disconnected until new or temporary facilities are installed except for short periods of interruption which are necessary for the performance of the new work and which are approved by the Owner.
- D. Storm water may be temporarily diverted to surface drainage provided such drainage is arranged to prevent flooding of structures, basements, and excavations for construction.
- E. Fire Alarm System: The existing fire alarm system shall remain functional throughout construction.
 - 1. As a minimum, the existing degree of protection shall be maintained for all areas.
 - 2. All required outages shall be coordinated with the Owner and the Fire Marshal.
- F. Welding: The Owner shall be notified before starting welding or cutting.

1. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc.
 2. Welding or cutting with an open flame or arc shall be stopped not less than one hour before leaving the premises.
- G. Noisy Operations: Noisy operations such as those involving use of air hammers, etc., in demolition, or cutting of openings shall be scheduled with the Owner.
- H. Occupancy:
1. The Owner will continue to occupy the building and carry on normal activity. Each Contractor shall protect the occupied areas from dust, smoke, etc., by a method reviewed by the Architect.
- I. Owner's Right to Direct Work: The Owner shall have the right to direct the places of beginning work, its prosecution, and the manner in which all work under this contract is to be conducted, insofar as may be necessary to secure the safe and proper progress and quality of the work.
- J. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.
- K. Cutting and Patching:
1. Each Contractor shall be responsible for all cutting and patching required for the work.
 2. Patching shall be done by persons skilled in the trade involved and shall be prepared to receive paint.
 3. Openings through floors may be drilled up to 1 inch but shall be core drilled over 1 inch.
 4. Whenever the building surfaces (walls, floors, etc.) and openings are modified, removed and/or replaced to accommodate the new work or to introduce into or remove items from the building, such surfaces or openings shall be carefully reinstalled in conformance with the applicable code to protect the integrity of the building.
- L. Existing Piping or Plumbing Equipment:
1. If any existing piping or plumbing equipment is encountered which would interfere with the proper installation of new work, it shall be removed or relocated as required or as directed by the Architect.
 2. Where existing work is to be modified, it shall be done in conformance with these specifications.
 3. Materials used shall be the same as for new work unless otherwise specified.

3.15 DEMOLITION REQUIREMENTS

- A. Information pertaining to the existing building has been obtained through the buildings original drawings where available. Report discrepancies to the architect/engineer prior to any demolition. Contractor shall field verify all existing conditions prior to commencing work.
- B. The Owner shall have the first right of salvage for all items being removed or demolished. If owner declines, the contractor shall remove from the premises and dispose of properly. Verify owner's intent prior to removal or demolition.
- C. Coordinate shut down of all utilities for demolition work with the owner.
- D. Coordinate demolition with the work of other trades. Provide temporary utilities as required to allow the work of other trades to proceed.
- E. Remove all plumbing fixtures and piping as indicated.
- F. Remove all items and systems as indicated.
- G. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 1. Piping to be removed: Remove portion of piping indicated to be removed and cap remaining piping with the same or compatible piping material.

2. Piping to be abandoned in place: Drain piping and cap with the same or compatible piping material.
 3. Equipment to be removed: Disconnect and cap services and remove equipment.
 4. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, and make equipment fully operational.
 5. Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to owner.
- H. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.16 INSULATION

- A. Continue pipe insulation through walls, floors, sleeves, hangers, and other penetrations.
- B. Insulate pipe fittings, joints, valves, unions, flanges, strainers, flexible connections and expansion joints with insulation of like material and thickness as adjoining pipe.
- C. Provide insulation jackets and/or covers as indicated.

3.17 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install as described below, unless individual Sections specify otherwise. Individual Sections specify unique installation requirements.
- B. Refer to The Plumbing Fixture Schedule for all plumbing piping connection sizes to all plumbing fixtures.
- C. Wall hydrants and downspout nozzles shall be installed between 18" and 24" above finished grade. Provide accessible shutoff valve located indoor for each wall hydrant.
- D. Piping in exterior building walls shall be located on the warm side of building insulation and vapor barrier. Building insulation shall run continuous between piping and exterior of building.
- E. PVC piping shall not be installed in return air plenums.
- F. General Locations and Arrangements:
 1. Drawing plans, schematics, and diagrams indicate general, diagrammatic location and arrangement of systems.
 2. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 3. Install systems as indicated, unless deviations to layout are approved on Coordination Drawings.
 4. Provide offsets and elevation changes in piping and conduit as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
 5. Refer to architectural exterior and interior elevations for wall mounted device locations.
 6. Do not run piping above electrical or telecom panels or in code required clearance spaces.
 7. Do not run piping and plumbing above or through information technology and data closets, IDF, and MDF rooms or associated riser rooms. Coordinate all routing with other trades.
 8. Coordinate location of piping with electrical cable tray. Provide a minimum of 6" of clear access above cable tray for installation of cables.
 9. Install all horizontal piping in mechanical rooms at a minimum of 7'-6" above finished floor.
 10. Install exposed interior and exterior piping at right angles or parallel to building walls.
 - a. Diagonal runs are prohibited, unless otherwise indicated.
 11. Conceal piping in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted, except in mechanical rooms or service areas.
 12. Install piping to allow application of insulation plus 1-inch clearance around insulation.

13. Pipe hangers for insulated pipe with vapor barrier jackets shall be installed around the outside of the insulation and a metal insulation support shield provided to prevent crushing of the insulation.
 14. Locate groups of pipes parallel to each other, spaced to permit insulation and valve servicing.
 15. Dielectric nipples or flange insulation kits shall be utilized for all dissimilar pipe connections. Dielectric unions will not be accepted.
 16. Install piping at indicated slope and as required by code.
 17. Provide components with pressure rating equal to or greater than system operating pressure.
 18. Install fittings for changes in direction and branch connections.
 19. Install piping free of sags or bends with ample space between piping to permit proper insulation applications.
 20. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building unless otherwise indicated.
 - a. Allow sufficient space above ceiling panels to allow for ceiling panel removal.
 21. Install piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment.
 - a. Provide expansion loops or compensators where indicated.
 22. Do not use ceiling support system to bear weight of devices or systems unless ceiling support system is certified as suitable to do so.
 23. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.
 24. Keep all pipe and equipment openings closed during construction except when actual work is being performed on that item or system.
 25. Leaking pipe joints shall be remade using new materials.
- G. Clean existing underground sanitary piping with cable and blade to first manhole prior to installation and connection of new piping.
- H. Provide wall- and floor mounted sewer cleanouts as required by code. Coordinate location in field.
- I. Locate plumbing vents through the roof at a minimum of 10'-0" away from all outdoor air intakes on HVAC equipment or operable windows.
- J. Terminate all natural gas flue vents a minimum of 2'-0" higher than any surface or equipment within 10'-0" or as required by code.
- K. Provide shut-off valves for water supply at all equipment items.
- L. Coordinate finish floor elevations to set floor drains and floor sinks.
- M. Saw cut and remove floor as required for installation of new piping.
- N. Contractor is responsible for any cutting and patching needed for plumbing installation. Patching must match existing.
- O. Verify final equipment locations for roughing-in of all systems.
- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.18 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom while maintaining accessible ladder access, if mounting heights are not indicated.
- B. Install equipment according to manufacturer's requirements and submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Provide access space around terminal units and heat pumps as required per manufacturers' recommendations. Do not route piping under terminal unit or heat pump.

- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- E. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components.
- F. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- G. Install equipment giving right of way to piping installed at required slope.
- H. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.19 EXCAVATION

- A. Perform excavation of every description and of whatever substances encountered, to the depths required or indicated on the drawings, in accordance with OSHA.
- B. During excavation, deposit material suitable for backfill in an orderly manner a sufficient distance from the excavation banks to avoid overloading and to prevent slides or cave-ins.
- C. Dispose of material unsuitable for backfill as directed by the Architect.
- D. Grade as necessary to prevent surface water from flowing into trenches or other excavations, and remove any water accumulating therein by pumping or by other acceptable method.
- E. Fill any excess excavation below the levels indicated for structures or raceways with sand, gravel or concrete.
- F. Unsuitable Material:
 - 1. Where the bottom of the trench is found to be unstable or to include ashes, cinders, any types of refuse, vegetable or other organic material, or large pieces or fragments of inorganic material, which in the judgment of the Architect should be removed, excavate and remove such unsuitable material to a minimum depth of 12 inches below the piping.
 - 2. Backfill the trench with selected bedding material and compact to provide uniform and continuous bearing for the piping.
 - 3. Dispose of the unsuitable material.
- G. Shoring Requirements:
 - 1. Perform shoring and sheeting that is required to protect the excavation and to safeguard employees in accordance with OSHA.
 - 2. Widen excavation to provide for space occupied by shoring and sheeting.
 - 3. Shoring shall meet the requirements of applicable codes and regulations.
- H. Dewatering:
 - 1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 2. Do not allow water to accumulate in excavations.
 - 3. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
 - 4. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 5. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas.
 - 6. Do not use trench excavations as temporary drainage ditches.

3.20 BACKFILL

- A. Do not backfill until required inspections are made and tests are performed for the specific utility.
- B. Backfill with the excavated materials specified for backfilling, consisting of earth, loam, sandy clay, sand and gravel or other materials, free from large clods of earth or stones.
- C. Do not use broken concrete as backfill materials.

- D. Do not backfill in freezing weather or with frozen material.
- E. Adjust the moisture content of the backfill material if required for proper compaction.
- F. Reopen any trenches improperly backfilled, or where settlement occurs, to the depth required for proper compaction, refill and compact to specified density.
- G. Compact backfill for structures to the specified density.
- H. During the backfilling of each exterior underground piping system, install continuous underground type plastic line markers.
 - 1. Locate markers directly over the buried piping at 12 inches to 18 inches below finished grade.
 - 2. Where multiple small piping are buried in common trenches and do not exceed an overall trench width of 16 inches, install a single line marker.
- I. Deposit suitable backfill material around the piping in 6-inch layers and thoroughly compact by hand, machine tamper, or other suitable equipment.
- J. Backfill to at least 90 percent of maximum density at optimum moisture content determined by ASTM D698 until the piping has a minimum cover of 2 feet.
- K. The moisture content of the soil at time of compaction shall be not more than 3 percent above or 3 percent below the optimum.
- L. Be careful not to disturb the piping.
- M. Carry backfilling on simultaneously on both sides of the piping to eliminate the possibility of lateral displacement.
- N. Return surface to original condition.

3.21 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.22 GROUTING

- A. Install nonmetallic, non-shrink, grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
 - 1. Clean surfaces that will come into contact with grout.
 - 2. Provide forms as required for placement of grout.
 - 3. Avoid air entrapment during placing of grout.
 - 4. Place grout, completely filling equipment bases.
 - 5. Place grout on concrete bases to provide smooth bearing surface for equipment.
 - 6. Place grout around anchors.
 - 7. Cure placed grout according to manufacturer's written instructions.

3.23 INCIDENTAL WORK

- A. The following incidental work shall be furnished by the designated contractor under the supervision of the Temperature Control Contractor:
 - 1. The Piping Contractor shall provide all necessary valved pressure taps, water, drain, and overflow connections and piping.
 - 2. The Piping Contractor shall provide all necessary piping connections required for flow devices, valve position indicators, etc.
 - 3. The Electrical Contractor shall provide power wiring to the variable frequency controller.

3.24 EQUIPMENT AND SYSTEM SOFTWARE INTERFACES TO THE BMCS

- A. Contractor shall coordinate with the BMCS Contractor to determine the points that are to be mapped from the equipment and systems to the BMCS. Contractor shall provide details of the

method of integration and the information to be transferred between the systems as part of the submittal package.

- B. Contractor shall provide the necessary software communication ports specifically for the interfacing of the systems to the BMCS.
- C. Contractor cannot document that the exact same interface has been performed between the selected BMCS and the equipment and/or system, then the interfaces shall be tested prior to installations at an offsite location. The equipment shall not be installed at the project location until all software interfaces to the BMCS have been successfully demonstrated or documented.
- D. Documentation regarding the software interfaces shall be provided in sufficient detail as to enable a person reasonably skilled in the writing of real time software applications to add/delete points mapped from one system to the other. The documentation shall include a detailed description of each protocol used and the model, version and firmware details of any protocol converter (gateway) that is used.
- E. Refer to BMCS specifications for coordination and testing requirements.

3.25 LUBRICATION, TESTING AND TEST REPORTS

- A. Upon completion of the work, the entire system shall be tested and proven for capacity of equipment, balance of system, proper operation of controls, and comfort of conditioned spaces.
 - 1. Prior to beginning systems testing, adjusting and balancing, replace all filter media with new media.
 - 2. Take air and water flow readings and submit copy of same to demonstrate proper flow according to the performances shown on the plans and noted in the specifications.
 - 3. Motors shall be checked for overload and belts adjusted.
 - a. Align pulleys and install belts according to manufacturer's written instructions.
 - b. Tension according to manufacturer's written instructions.
 - 4. Lubricate moving parts and clean or replace filters.
 - a. Run in all bearings and, after they are run in, drain and flush bearings and refill with a new oil charge.
 - b. Equipment shall be so arranged that tools (screwdrivers, wrenches, etc.) will not be required to make lubrication points accessible.
 - c. Extensions on grease or oil fittings shall be provided where required for access to lubricate.
 - 5. Test piping systems per applicable codes and standards.
 - 6. Submit copies of all tests to the Architect for review prior to date of substantial completion.
 - 7. Equipment and systems discrepancies shall be corrected prior to final acceptance.

END OF SECTION

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges.
- B. Thermometers.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- D. NSF 61 - Drinking Water System Components - Health Effects.

1.03 SUBMITTALS

- A. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.
- B. Project Record Documents: Record actual locations of components and instrumentation.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Pressure Gauges: One of each type and size.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Minimum Pressure Rating: 150 psig.
- B. Meters and Gages exposed to outdoor environment, water spray or wash shall be provided with weatherproofed cases.

2.02 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Ashcroft, Inc: www.ashcroft.com/#sle.
 - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 3. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 4. Ernst Gage Co.
 - 5. Moeller Instrument Co., Inc: www.moellerinstrument.com.
 - 6. Omega Engineering, Inc: www.omega.com.
 - 7. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
 - 8. Winters Instruments: www.winters.com/#sle.
 - 9. Marsh Bellofram.
 - 10. Miljoco.
 - 11. Terice, H.O. Co.
 - 12. Weiss Instruments, Inc.
 - 13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 14. WIKA Instrument Corporation.
- B. Pressure Gages: ASME B40.100, drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment.
 - 1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.
 - 2. Dial Text and Markings: Black color on white background with scaled psi units.
 - 3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.
 - 4. Scale: 150 Psi.

2.03 THERMOMETERS

- A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 3. Omega Engineering, Inc: www.omega.com.
 4. Terice, H.O. Co.
 5. Watts Water Technologies, Inc: www.watts.com/#sle.
 6. Weiss Instruments, LLC: www.weissinstruments.com/#sle.
 7. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
 8. Winters Instruments: www.winters.com/#sle.
- B. General:
1. Product Compliance: ASTM E1.
 2. Lens: Clear glass, except where stated.
 3. Accuracy: Two percent, when tested in accordance with ASTM E77, except where stated.
 4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.
- C. Thermometers - Adjustable Angle: 9 inch v-shape aluminum case with clear glass window scale, 3-1/2 inch NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.
- D. Thermometers - Dial Type:
1. Adjustable Angle: 5 inch diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch NPT stem.
- E. Thermometer Supports:
1. Manufacturers: Same as manufacturer of thermometer being used.
 2. Description: Pressure-tight, socket-type brass fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install pressure gauges as follows:
1. At Pumps: Place single gauge before strainer, suction side and discharge side.
 2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.
 3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.
- B. Install thermometers as follows:
1. Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
- C. Install thermometer sockets for all thermometers, controls system thermostat, transmitter, or sensor sockets.
- D. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
1. Pumps, 0 to 100 psi.
 2. Expansion tanks, 0 to 100 psi.
 3. Pressure reducing valves, 0 to 100 psi.
 4. Backflow preventers, 0 to 100 psi.
- B. Stem Type Thermometers, Location and Scale Range:
1. Domestic hot water supply and recirculation, 0 to 160 degrees F.
 2. Domestic cold water supply, 0 to 120 degrees F.
 3. Where shown on plans and details, 0 to 160 degrees F
- C. Thermometer Sockets, Location:

Lewis Central High School
Entry Addition

1. All thermometers

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ball valves.
- B. Butterfly valves.
- C. Check valves.

1.02 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.03 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End.
- G. ASME B31.9 - Building Services Piping.
- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
- I. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings.
- K. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
- M. AWWA C606 - Grooved and Shouldered Joints.
- N. MSS SP-45 - Drain and Bypass Connections.
- O. MSS SP-67 - Butterfly Valves.
- P. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends.
- Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service.
- R. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves.
- S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- T. NSF 61 - Drinking Water System Components - Health Effects.

- U. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.05 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. All Valve Types:
 - 1. Crane/Stockham Co.; Crane Valve Group: www.cranevalve.com.
 - 2. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - 3. Hammond Valve: www.hammondvalve.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
 - 5. Nibco, Inc: www.nibco.com.
 - 6. Watts: www.watts.com.
- B. Ball Valves:
 - 1. Apollo Flow Controls: www.apollovalves.com
 - 2. Conbraco Industries: www.apollovalves.com.
 - 3. Grinnell Products, a Tyco Business: www.grinnell.com.
 - 4. Jomar Valves, a division of Jomar Group: www.jomarvalve.com/#sle.
 - 5. Nibco, Inc: www.nibco.com.
 - 6. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
 - 7. Stockham: www.stockham.com.
 - 8. Tyco Flow Control: www.tycoflowcontrol.com.
 - 9. Uponor, Inc.: www.uponorpro.com.

10. Victaulic Company: www.victaulic.com.
 11. Viega LLC: www.viega.com/#sle.
 12. Watts: www.watts.com.
- C. Butterfly Valves:
1. DeZurick: www.dezurick.com.
 2. Grinnell Products, a Tyco Business: www.grinnell.com.
 3. Keystone Valves: www.keystonevalves.com.
 4. Tyco Flow Control: www.tycoflowcontrol.com.
 5. Victaulic Company: www.victaulic.com.
 6. Wheatley Valves: www.wheatleyhvac.com.
- D. Check Valves:
1. Apollo Flow Controls: www.apollovalves.com
 2. Grinnell Products, a Tyco Business: www.grinnell.com.
 3. Powell: www.powellvalves.com.
 4. Tyco Flow Control: www.tycoflowcontrol.com.
 5. Victaulic Company: www.victaulic.com.
 6. Wheatley Valves: www.wheatleyhvac.com.

2.02 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
1. Shutoff: Ball, butterfly, gate.
 2. Dead-End: Single-flange butterfly (lug) type.
 3. Throttling: Provide globe or ball.
 4. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control , metal or resilient seat check valves.
 - c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- E. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
 - a. 2 inch and Smaller: Threaded ends.
 - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - c. 5 inch and Larger: Grooved or flanged ends.
 - d. Grooved-End Steel Piping: Grooved.
 - e. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 2. Copper Tube:
 - a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - c. 5 inch and Larger: Grooved or flanged ends.
 - d. Grooved-End Copper Piping: Grooved.
 - e. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

- F. Domestic, Hot and Cold Water Valves:
 - 1. 2 inch and Smaller:
 - a. Bronze and Brass: Provide with solder-joint or mechanical press sealed ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Bronze Ball: Two piece, full port, brass or bronze with brass trim.
 - d. Copper Ball: Mechanical press sealed ends.
 - e. Bronze Swing Check: Class 125, bronze disc.
 - f. Bronze Gate: Class 125, NRS.
 - g. Bronze Globe: Class 125, bronze disc.
 - 2. 2-1/2 inch and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded, flanged, or mechanical press sealed ends.
 - b. Iron Ball: Class 150.
 - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
 - d. Iron Grooved-End Butterfly: 175 CWP.
 - e. Iron Swing Check: Class 125, metal seats.
 - f. Iron Swing Check with Closure Control: Class 125, lever and spring.
 - g. Iron Grooved-End Swing Check: 300 CWP.
 - h. Iron Center-Guided Check: Class 125, full lug, metal seat.
 - i. Iron Plate-Type Check: Class 125; single plate; metal seat.
 - j. Iron Gate: Class 125, NRS.
 - k. Iron Globe: Class 125.

2.03 GENERAL REQUIREMENTS

- A. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 - 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- B. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- C. Valve Sizes: Match upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: Quarter-turn valves 8 inch and larger.
 - 2. Handwheel: Valves other than quarter-turn types.
 - 3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
 - 4. Wrench: Plug valves with square heads.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Insulated Piping Valves: With 2 inch stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: Extended neck.
 - 4. Memory Stops: Fully adjustable after insulation is installed.
- F. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
 - 5. Grooved End Connections: AWWA C606.

- G. General ASME Compliance:
 - 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Solder-joint Connections: ASME B16.18.
 - 3. Building Services Piping Valves: ASME B31.9.
- H. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- I. Valve Bypass and Drain Connections: MSS SP-45.
- J. Source Limitations: Obtain each valve type from a single manufacturer.

2.04 BRASS, BALL VALVES

- A. Two Piece, Full Port and Regular Port with Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. WOG Rating: 600 psi.
 - 4. Vacuum Rating: 28.9 in-Hg.
 - 5. Body: Forged brass.
 - 6. Seats: PTFE.
 - 7. Stem: Brass.
 - 8. Ball: Chrome-plated brass.

2.05 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. WOG Rating: 600 psi.
 - 4. Body: Forged bronze or dezincified-brass alloy.
 - 5. Ends Connections: Pipe press, thread, or solder.
 - 6. Seats: PTFE or TFE.
 - 7. Stem: Bronze, blowout proof.
 - 8. Ball: Chrome plated brass.

2.06 STAINLESS STEEL, BALL VALVES

- A. Two Piece, Full Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. CWP Rating: 2,000 psi.
 - 4. Seats: PFTE.
 - 5. Stem: Stainless steel, blowout proof.
 - 6. Ball: Stainless steel, vented.
 - 7. End Connections: Threaded, press, or socket weld.
 - 8. Operator: Lockable handle.

2.07 IRON, BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
 - 1. Comply with MSS SP-72.
 - 2. CWP Rating: 200 psi.
 - 3. Body: ASTM A536 Grade 65-45-12, ductile iron.
 - 4. End Connections: Flanged or grooved.

5. Seats: PTFE, TFE, or Teflon.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Operator: Lever with locking handle.

2.08 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style; Bi-directional dead-end service without use of downstream flange:
 1. Class 125, or Class 150 flanges.
 2. Comply with MSS SP-67, Type I.
 3. Lug Style, Service Pressure Ratings:
 - a. 150 psi for sizes 14 to 24 inch.
 - b. 250 psi for sizes 2 to 12 inch.
 - c. Vacuum down to 29.9 in-Hg.
 4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
 5. Stem: One or two-piece stainless steel.
 6. Seat: EPDM.
 7. Disc: Aluminum-bronze.
 8. Operator: Lockable handle over direct-mount actuator base.

2.09 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psi.
 1. Comply with MSS SP-67, Type I.
 2. Body: Coated ductile iron.
 3. Stem: Two-piece stainless steel.
 4. Disc: Coated ductile iron.
 5. Disc Seal: EPDM.

2.10 BRONZE, LIFT CHECK VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
 1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
 2. CWP Rating: 200 psi.
 3. Design: Vertical flow.
 4. Body: Comply with ASTM B61 or ASTM B62, bronze.
 5. End Connections: Threaded or soldered.

2.11 BRONZE, SWING CHECK VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125: CWP Rating: 200 psig (1380 kPa).
 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 2. Design: Y-pattern, horizontal or vertical flow.
 3. Body: Bronze, ASTM B62.
 4. End Connections: Threaded or soldered.
 5. Disc: Bronze.

2.12 IRON, HORIZONTAL SWING CHECK VALVES

- A. Class 125:
 1. Pressure and Temperature Rating: MSS SP-71, Type I.
 2. Design: T-body style for clear or full waterways.

3. WOG Rating: 200 psi.
4. Body: ASTM A126, gray cast iron with bolted bonnet.
5. End Connections: Flanged.
6. Trim: Composition.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE or TFE.
9. Gasket: Asbestos free.

2.13 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125 with Lever and Spring-Closure Control.
 1. Comply with MSS SP-71, Type I.
 2. Description:
 - a. CWP Rating: 200 psi.
 - b. Design: Clear or full waterway.
 - c. Body: ASTM A126, gray iron with bolted bonnet.
 - d. Ends: Flanged as indicated.
 - e. Trim: Bronze.
 - f. Gasket: Asbestos free.
 - g. Closer Control: Factory installed, exterior lever, and weight.

2.14 IRON, GROOVED-END SWING CHECK VALVES

- A. Class 300:
 1. CWP Rating: 300 psi.
 2. Body: ASTM A536, Grade 65-45-12 ductile iron.
 3. Seal: EPDM or Nitrile.
 4. Disc: Ductile iron.
 5. Coating: Black, non-lead paint.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- D. Install check valves where necessary to maintain direction of flow as follows:
 1. Lift Check: Install with stem plumb and vertical.
 2. Swing Check: Install horizontal maintaining hinge pin level.
 3. Orient plate-type into horizontal or vertical position, between flanges.
- E. Provide chainwheels on operators for valves 4 inch and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.
- C. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
 - 1. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - 2. Detail proposed component identification data in terms of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - 3. Valve Data Format: Include id-number, location, function, and model number.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Nameplates:
 - 1. Heat exchangers, water heaters, and other heat transfer products.
 - 2. Control panels, transducers, and other related control equipment products.
 - 3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.
- B. Tags:
 - 1. Piping: 3/4 inch diameter and smaller.
 - 2. Manual operated and automated control valves.
- C. Pipe Markers: 3/4 inch diameter and higher.

2.02 MANUFACTURERS

- A. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
- B. Brady Corporation: www.bradycorp.com.
- C. Brimar Industries, Inc.: www.pipemarker.com.
- D. Champion America, Inc: www.Champion-America.com.
- E. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
- F. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
- G. Seton Identification Products: www.seton.com/aec.
- H. Substitutions: See Section 01 6000 - Product Requirements.

2.03 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

4. Nameplate Height: 1-1/2 inch.
5. Nameplate Material:
 - a. Flexible: Vinyl with adhesive backing per ASTM D709.

2.04 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.
- C. Valve Tag Schedule: In Valve and Equipment Schedule Binder

2.05 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of the fluid or system conveyed.
- C. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.
- E. Identification Scheme, ASME A13.1:
 1. Primary: External Pipe Diameter, Uninsulated or Insulated.
 - a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
 - b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
 - c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
 - d. 8 to 10 inches: Use 24 inch field-length with 2-1/2 inch text height.
 - e. Over 10 inches: Use 32 inch field-length with 3-1/2 inch text height.
 2. Secondary: Color scheme per fluid service.
 - a. Domestic Cold Water: White text on green background.
 - b. Domestic Hot Water: White text on green background.
 - c. Domestic Hot Water Return: White text on green background.
 - d. Storm: White text on green background.
 - e. Overflow: White text on green background.
 - f. Sanitary: White text on green background.
 - g. Plumbing Vent: White text on green background.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install tags in clear view and align with axis of piping
- B. Install plastic pipe markers in accordance with manufacturer's instructions.
- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Apply ASME A13.1 Pipe Marking Rules:
 1. Identify service and flow direction.
 2. Provide additional identification if the system is medium or high pressure when multiple pressure zones are being provided for the same system in the building.
 3. Place pipe marker adjacent to changes in direction.

4. Place pipe marker adjacent each valve port and flange end.
5. Place pipe marker at both sides of floor and wall penetrations.

3.03 TAGS

- A. Install tags with corrosion-resistant chain.
- B. Identify valves in main and branch piping with tags.
- C. Identify small devices such as in-line pumps with tags.
- D. Identify pipe 1 inch and smaller with tags.

3.04 PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete/around pipe in accordance with manufacturer's instructions.
- C. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction.
- D. All underground piping systems shall have a non-metallic warning tape, with appropriate warning, buried 24 inches above top of pipe.

3.05 NAME PLATES

- A. Install plastic name plates with adhesive backing.

3.06 VALVE AND EQUIPMENT SCHEDULE BINDER

- A. Provide 3-ring binder for all valve and equipment schedules with tabs and plastic page protectors for each system. Schedules to be on standard - size bond paper with following information:
 1. Valve Schedules:
 - a. Valve number
 - b. Piping system
 - c. System abbreviation (as shown on valve tag)
 - d. Location of valve (room or space)
 - e. Area served
 - f. Normal operating position (opened, closed, modulating)
 - g. Indicate emergency shutoff or similar special uses.
 2. Equipment Schedules:
 - a. Owners equipment label
 - b. Location
 - c. All data from manufacturer's equipment label including Model No., Serial No., Electrical data, etc.
 - d. Pump water flow and pressure
 - e. Motor data and measured amps at balancing
 3. As-Built Record Building Plans:
 - a. Indicate all valve and equipment locations
 - b. Provide in electronic format, .pdf or .dwg

3.07 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

END OF SECTION

**SECTION 22 07 19
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation.
- B. Glass fiber insulation.
- C. Jacketing and accessories.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.05 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Products shall be certified by UL GREENGUARD GOLD or Indoor Advantage Gold.
- F. Products shall be certified to meet or exceed UL Standard 2818 -2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings
- G. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

2.02 GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K Value: ASTM C177, 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
 - 1. Manufacturers:
 - a. Childers Products CP-127.
 - b. Foster Products 85-20/85-60.
 - c. Eagle Bridges - Marathon Industries, Inc.
 - 2. Shall meet ASTM C916 Type I/II
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on Glass wool.
- G. Fibrous Glass Fabric:
 - 1. Manufacturers:
 - a. Fosters Mast a Fab.
 - b. Childers Chil Glas #10.
 - 2. Cloth: Untreated; 9 oz/sq yd weight.
 - 3. Blanket: 1.0 pcf density.
 - 4. Weave: 5 by 5.
- H. Indoor Vapor Barrier Finish:
 - 1. Manufacturers:
 - a. Childers Products, Chil Out, CP-33.
 - b. Foster Products Vapor Out. 30-33.
 - c. Eagle Bridges - Marathon Industries, Inc.
 - 2. Cloth: Untreated; 9 oz/sq yd weight.
 - 3. Vinyl emulsion type acrylic, compatible with insulation, white color.
 - 4. Permeance shall be 0.07 perms or less at 45 mils dry tested by ASTM E96.
- I. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
 - 2. Armacell LLC: www.armacell.us/#sle.
 - 3. K-Flex USA LLC: www.kflexusa.com/#sle.
 - 4. RBX Corp.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. K Value: ASTM C177; 0.25 at 75 degrees F.
 - 2. Minimum Service Temperature: Minus 40 degrees F.
 - 3. Maximum Service Temperature: 220 degrees F.
 - 4. Moisture Vapor Permeability: 03 perm inch, when tested in accordance with ASTM E96/E96M.
 - 5. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
 - 1. Manufacturers:
 - a. Childers Products.
 - b. Foster Products.
 - c. Eagle Bridges - Marathon Industries, Inc.

2.04 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
 - 2. Covering Adhesive Mastic: Compatible with insulation.

2.05 ADA FIXTURE INSULATION

- A. Manufacturers:
 - 1. Truebro, Inc.
 - 2. Handi-Shield.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be any of the following:
 - a. Protective shield guards, comply with ANSI article 4.19.4 and CABO/ANSI 4.20.4, color shall be white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Coat all elbows, fittings, valves and flanges with vapor barrier mastic and reinforcing mesh. Finish with PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
- I. Inserts and Shields:

1. Application: Insulated piping 3/4 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Shield shall span an arc of 180 degrees.
 4. Match diameter of shield to OD of insulation.
 5. Shield dimensions shall not be less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 6. Insert Location: Between support shield and piping and under the finish jacket.
 7. Thermal-Hanger Insert Shields: Install according to manufacturer's written instructions.
- J. Insulated Piping: Attach hangers and supports to piping as follows:
1. Piping Operating Above Ambient Temperature:
 - a. Where piping is not supported on rollers or trapeze, hangers may project through insulation.
 - b. For straight runs of piping, at points of support more than 100 feet from elbow or anchor point, use roller type supports.
 - c. Where piping is supported on rollers or trapeze, support piping at outside diameter of insulation.
 - 1) NPS Smaller than 2: Provide MSS SP-58, Type 40, protective shield.
 - 2) NPS 2 1/2 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.
 2. Piping Operating Below Ambient Temperature: Support piping at outside diameter of insulation. Do not penetrate vapor barrier.
 - a. NPS Smaller than 2: Provide MSS SP-58, Type 40, protective shield.
 - b. NPS 2 1/2 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.
- K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

3.03 INSULATION AND JACKET SCHEDULE

- A. Insulation thickness listed below is based on the thermal conductivity performance of the material listed.
1. Provide insulation thickness based on 2015 International Energy Conservation Code minimum requirements.
 2. Alternative material thickness must be adjusted as required to provide equivalent conductivity performance.
 3. Alternative material substitution shall be reviewed by the Architect.
- B. Indoor Piping:
1. Domestic Cold Water:
 - a. All Pipe Sizes:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1 inch thick.
 2. Domestic Hot and Recirculated Hot Water:
 - a. 1-1/4-Inch and Smaller:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1 inch thick.
 - b. 1-1/2-Inch and Larger:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1-1/2 inches thick.
 3. Domestic Cold, Hot, and Hot Recirculating Water Buried in Masonry Walls:
 - a. Flexible elastomeric, 1/2 inch thick.
 4. Stormwater and Overflow:
 - a. All Pipe Sizes:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1/2 inch thick.
 5. Roof Drain and Overflow Drain Bodies:
 - a. All Pipe Sizes:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1/2 inch thick.

6. Plumbing Vents to 24 Inches Below Roof:
 - a. All Pipe Sizes:
 - 1) Glass-Fiber Pipe Insulation, Type I: 1/2 inch thick.
 7. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - a. All Pipe Sizes:
 - 1) Protective shield guards, comply with ANSI article 4.19.4 and CABO/ANSI 4.20.4, color shall be white.
 8. Condensate and Equipment Drain Water Below 60 Degrees F:
 - a. All Pipe Sizes:
 - 1) Glass-Fiber, Preformed Pipe, Type I: 1/2 inch thick.
- C. Indoor, Field Applied Jacket:
1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 2. If more than one material is listed, selection from materials is Contractor's option.
 3. Piping, Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor):
 - a. PVC: 20 mils thick.

END OF SECTION

**SECTION 22 10 05
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, above grade.
- D. Storm drainage piping, above grade.
- E. Equipment drains and overflows.
- F. Pipe flanges, unions, and couplings.
- G. Pipe sleeve-seal systems.
- H. Pressure reducing valves.
- I. Pressure relief valves.
- J. Strainers.

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. CPVC: Chlorinated polyvinyl chloride plastic.
- C. CR: Chlorosulfonated polyethylene synthetic rubber.
- D. EPDM: Ethylene-propylene-diene terpolymer rubber.
- E. Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per Safe Drinking Water Act as amended January 4th 2011 Section 1417.
- F. NBR: Acrylonitrile-butadiene rubber.
- G. PE: Polyethylene plastic.
- H. PP: Polypropylene plastic.
- I. PVC: Polyvinyl chloride plastic.

1.03 CODE AND PERMIT COMPLIANCE

- A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that shown on the Drawings shall not be substituted.
- B. Contractors shall familiarize themselves with all requirements as to permits, fees, etc., and shall comply. All permits, licenses, inspections, and arrangements required for the work shall be provided by the Contractors at their expense.
- C. All utilities shall be installed in accordance with utility company rules and regulations.
- D. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of piping systems. Wherever practical, install piping as indicated.

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Project Record Documents: Record actual locations of valves.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Valve Repacking Kits: One for each type and size of valve.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes and standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per Safe Drinking Water Act as amended January 4th 2011 Section 1417.
- D. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- E. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- F. Identify pipe with marking including manufacturer's registered trademark, country of origin, date of manufacture, size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- G. Hub and Spigot Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 74. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.
- H. Hubless Cast Iron pipe and fittings conform to ASTM A 888 or CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.
- I. Hubless Couplings shall be listed by NSF® International and conform to ASTM C 1540 for super duty or heavy duty couplings where indicated. Gaskets shall conform to ASTM C 564.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for installation of backflow prevention devices.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
- B. Cast Iron Pipe: ASTM A 888 or CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C 1540 heavy duty stainless steel clamp-and-shield assemblies with ASTM C 564 neoprene gaskets.

2.03 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C 1540 heavy duty stainless steel clamp-and-shield assemblies with ASTM C 564 neoprene gaskets.

2.04 SPECIAL FITTINGS - SANITARY WASTE AND VENT

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
- C. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
 - 3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, non toxic synthetic rubber sealing elements..

2.06 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
 - a. Manufacturers:
 - 1) Anvil International: www.anvilintl.com/#sle.
 - 2) Apollo Valves: www.apollovalves.com/#sle.
 - 3) FNW; Copper Press: www.fnw.com/#sle.
 - 4) Viega LLC: www.viega.com.
 - 5) Merit Brass Company: www.meritbrass.com.
- B. Stainless Steel Pipe: ASTM A269/A269M or A312, Grade TP304 alloy, Schedule 10 for up to 150 psi.
 - 1. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
 - 2. Fittings: Fittings may be roll grooved stainless steel compatible with piping and couplings.
 - 3. Rigid Mechanical Couplings for Grooved Joints:
 - a. Housing Material: Grade TP316 stainless steel or enamel coated ductile iron.

- b. Gasket Material: EPDM suitable for operating temperature range from minus 30°F (minus 34°C) to 230°F (110°C) or Grade "P" fluoroelastomer blend suitable for operating temperature range from 0°F (-18°C) to 180°F (82°C).
- c. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.
- d. Manufacturers:
 - 1) Apollo Valves: www.apollovalves.com/#sle.
 - 2) Viega LLC: www.viega.com.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C 1540 heavy duty stainless steel clamp-and-shield assemblies with ASTM C 564 neoprene gaskets.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 1 inch:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
 - 3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
 - 4. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
 - 5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - 6. Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.
- D. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 - 1. Couplings shall be two-piece, housing cast with offsetting angle-pattern bolt pads.
 - 2. Installation-Ready, for direct stab installation without field disassembly or loose parts.
 - 3. Designed to permit some angular deflection, contraction, and expansion.
 - 4. Couplings to be bolt pad to bolt pad assembly.
 - 5. Coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the proper use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to ensure best practices in grooved joint installations are being followed.
 - 6. Dimensions and Testing: In accordance with AWWA C606.
 - 7. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.

8. Gasket Material: Prelubricated, grade EHP, EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
9. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel, ASTM A449.
10. When pipe is field grooved, provide coupling manufacturer's grooving tools.
11. Manufacturers:
 - a. Anvil International: www.anvilintl.com/#sle.
 - b. Apollo Valves: www.apollovalves.com/#sle.
 - c. Victaulic Company: www.victaulic.com.
12. Grooved Copper Tube Fittings:
 - a. Fittings: ASME B16.22 wrought copper and ASTM B 75 (ASTM B 75M), copper tube or ASME B 16.18 and ASTM B 584, bronze casting.
 - b. Couplings: Rigid pattern, offsetting angle-pattern bolt pads.
13. Grooved Steel Pipe and Fittings:
 - a. Fittings: ASTM A 536, Grade 65-45-12 ductile iron; -ASTM A 53/A 53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings.
 - b. Rigid Type Couplings: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B3 1.1 and B31.9.
 - c. Flexible Type Couplings: Used in locations where vibration attenuation and stress relief are required. Use three flexible couplings in lieu of a flexible connector.
- E. No-Hub (Hubless) Couplings:
- F. Shielded, Heavy Duty No-Hub Couplings:
 1. Testing: In accordance with ASTM C1540 and FM 1680.
 2. Gasket Material: Neoprene complying with ASTM C564.
 3. Band Material: Stainless steel.
 4. Eyelet Material: Stainless steel.
- G. Pressed Fittings:
 1. Stainless Steel Pipe:
 - a. Stainless steel fitting shall conform to material and sizing requirements of ASTM A312 or ASTM A554.
 - b. Fittings must be NSF 61 and/or NSF 372 approved or certified when used for domestic water applications.
 - c. Sealing elements shall be EPDM or FKM, depending on application. Sealing elements shall be factory installed by the fitting manufacturer and include a feature that allows for leakage before the joint is pressed.
 2. Copper Tube:
 - a. Copper and copper alloy press fitting shall conform to material requirements of ASME B16.51 or IAPMO PS 117.
 - b. Fittings must be NSF 61 and/or NSF 372 approved or certified when used for domestic water applications.
 - c. Sealing elements shall be EPDM. Sealing elements shall be factory installed by the fitting manufacturer and include a feature that allows for leakage before the joint is pressed.
- H. Dielectric Connections: Waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.
 1. Dielectric unions shall not be used.
 2. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
 3. Insulating Material: Suitable for system fluid, pressure, and temperature.
 4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

- a. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
- 5. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
- 6. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.

2.09 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- D. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

2.10 PIPE SLEEVE-SEAL SYSTEMS

- A. Modular Mechanical Seals:
 - 1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
 - 2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 - 3. Size and select seal component materials in accordance to service requirements.
 - 4. Glass reinforced plastic pressure end plates.

2.11 BALANCING VALVES

- A. Maintained flow (gpm) as indicated.
- B. NSF/ANSI 61-G certified. Meets the NSF/ANSI Standard 372 for minimal lead content.
- C. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate.
- D. Construction: Class 125, brass, bronze or stainless steel body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- E. Manual Operated Y-Pattern Globe, Size 1/2 to 2 inch:
 - 1. Class 125, brass, bronze, or stainless steel body, multi-turn handwheel, memory stop, variable orifice, soldered connections, dual PT (hot and cold pressure-temperature) test ports for 300 psi, minus 4 to 250 deg F WOG service.
- F. Automatic Flow Limiting Cartridge, Size 3/4 inch:
 - 1. Class 125, brass, bronze, or stainless steel body, stainless steel cartridge, threaded connections with built-in union, dual PT (hot and cold pressure-temperature) test ports for 300 psi, 0.5 gpm WOG service.
- G. Automatic Flow Limiting Cartridge with Ball Valve, Size 1/2 to 1 inch:
 - 1. Class 125, brass or bronze body, stainless steel cartridge, leak-proof stem, threaded or soldered connections with built-in union, dual PT (hot and cold pressure-temperature) test ports for 300 psi, 0.25 to 1.5 gpm WOG service.
- H. Calibration: Control flow within five percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.12 PRESSURE REDUCING VALVES

- A. Lead free. The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight and be NSF 61 approved or certified.

- B. Pressure Rating: 150 psig or greater to meet the system working pressure at the installation location.
- C. 2 inch and Smaller:
 - 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union or grooved ends.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass, bronze, or stainless steel pilot piping and fittings.
 - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- D. Over 2 inch:
 - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged or grooved ends.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass, bronze, or stainless steel pilot piping and fittings.
 - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.13 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.14 STRAINERS

- A. Size 2 inch and Smaller:
 - 1. Threaded brass or copper body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 1-1/2 inch to 4 inch:
 - 1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever joining dissimilar metals.
 - 1. Dielectric unions are not allowed.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- L. Provide support for utility meters in accordance with requirements of utility companies.
- M. Install Y-pattern strainers for water on supply side of each control valve, water pressure reducing valve, solenoid valve, and pump. Provide NPS 3/4 nipple and ball valve with hose end and brass cap and chain in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Install water piping to ASME B31.9.
- Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- R. Mechanical Press Sealed Fittings: Press connections shall be made in accordance with the manufacturer's installation instructions. On-site training shall be performed by the manufacturer. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.
- S. Install cast iron pipe in accordance with the "Cast Iron Soil Pipe Handbook" latest edition, as published by the Cast Iron Soil Pipe Institute.
- T. Sleeve pipes passing through partitions, walls, and floors.
- U. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- V. Mechanically formed tees in copper pipe may be formed per ANSI A40 by workers certified after factory authorized training. Branch lines shall be formed with two dimple/depth stops in line with the run of the tube.
 - 1. Fabricate mechanically formed tees/outlets according to manufacturer's standard written procedure.
 - 2. Mechanically formed outlets shall have a collar with a height not less than three times the thickness of the branch tube wall.
 - 3. The branch shall be notched to conform to the inner curve of the run and shall be dimpled or otherwise impeded from penetrating the run pipe/tube to a depth that would obstruct the flow of fluid through the run pipe/tube.
 - 4. The branch tube shall also be dimpled or otherwise marked to indicate the location of the notches with respect to the run.
 - 5. Such marking shall be at a sufficient distance from the face of the joint to allow for a visual point of inspection after the joint is brazed.
 - 6. All joints constructed using this method shall be brazed.
- W. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.

2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
 3. Grooving tools shall be manufactured and supplied by the manufacturer of the couplings. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer's installation instructions.
 4. Factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.
 5. Flexible type couplings can be used in locations where vibration attenuation and stress relief are required. Use three flexible couplings in lieu of a flexible connector.
- X. Conceal all pipe in interior walls, piping chases, utility spaces, above ceilings or below grade or floors unless indicated to be exposed to view.
1. Do not install domestic water piping in exterior walls.
 2. Piping chases located on exterior walls shall be ventilated, by openings, to interior spaces.
- Y. Piping shall be installed so as to allow for maintenance and removal of ceiling mounted equipment, heat pump, terminal units, etc..
1. Verify and coordinate exact equipment locations and service requirements with Installing Contractor.
- Z. Provide cleanouts in sanitary and storm systems as required by code at each change of direction greater than 45 degrees at minimum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping at base of each vertical soil or waste stack 18 inches above finished floor elevation.
- AA. Provide double grade cleanouts on sanitary lines leaving the building. Locate cleanouts within the first 5 lineal feet from the building. Provide 4-inch concrete slab at each cleanout, minimum 18 inches by 18 inches, with top flush with grade.
- BB. Provide drainage and vent piping runouts to plumbing fixtures and drains with trap of required size.
- CC. Vent terminals (VTRs) shall penetrate roof a minimum of 6 feet from any fire wall.
- DD. PVC piping shall not be installed in return air plenums.
- EE. Install expansion joints on vertical risers as indicated and required by codes.
- FF. Install wall cleanout covers for concealed piping types as indicated and required by codes.
- GG. Install flashing flange and clamping device at each stack or vent passing through waterproof membranes.
- HH. Install vent flashing sleeves and stacks passing through roof. Secure over stack flashing in accordance with roofing manufacturer's requirements.
- II. Vent stacks shall terminate in accordance with applicable plumbing code or as follows:
1. At least 10 feet horizontally or 2 feet above doors, windows or other ventilating openings of the building or adjacent building.
 2. No closer than 2 feet under any roof gable.
 3. No closer than 2 feet from any wall extending above flat roof building.
 4. No closer than 6 feet from any fire wall.
 5. Minimum 7 feet above if roof is used for other purpose than weather protection (occupied).
- JJ. Provide sway bracing on no-hub piping as required by code.
- KK. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
 2. Support horizontal piping as indicated.
 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 8. Where trapeze hangers are constructed, the all-thread rods supporting the trapeze member shall not extend more than 1" below the assembly.
 9. Provide copper plated hangers and supports for copper piping.
 10. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 11. Provide hangers adjacent to motor driven equipment with vibration isolation.
 12. Support cast iron drainage piping at every joint.
 13. Storm and Sanitary Sewer Piping 5" and over with hubless couplings or hub and spigot joints: In addition to hangers provide bracing and joint restraints to prevent horizontal movement and separation. This shall be done at every branch opening, connection or change of direction by the use of braces, blocks, rodding, or other suitable means to prevent movement. Refer to CISPI 301 and 310 for illustrative details of restraint systems.
- LL. Pipe Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a watertight seal.
 6. Install in accordance with manufacturer's recommendations.
- MM. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 EQUIPMENT DRAINS AND OVERFLOW

- A. Piping material shall be suitable for type and temperature of drainage and location of equipment. Size piping per manufacturer's requirements and as indicated.
- B. Cooling coil condensate drainage shall be copper pipe. Condensate drain piping size (unless indicated otherwise):
1. Air Handling Units and Rooftop Units:
 - a. Less than 30 tons: 1 1/4"
 - b. 31 - 50 tons: 1 1/2"
 - c. 51 - 150 tons: 2"
 - d. 151 - 300 tons: 3"
 - e. 301 - 430 tons: 4"
 2. Terminal Cooling, Fan Coil, Blower Coil and Furnaces:
 - a. 0 - 5 tons: 3/4"
 - b. 6 - 20 tons: 1"
- C. Route drains and overflows to nearest floor drain unless shown otherwise. Slope piping to drain at 1/8 inch per foot.

3.05 CONNECTIONS TO EQUIPMENT AND FIXTURES

- A. Piping installation requirements are specified in other sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Extend piping and connect fixtures with water supplies, stops, risers, with traps, soil, waste, and vent piping as required by code and as indicated. Use size fittings required to match fixtures.

3.06 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe valves for throttling, bypass, or manual flow control services.
- E. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
- F. Provide spring-loaded check valves on discharge of water pumps.
- G. Provide balancing valves in water recirculating systems where indicated.

3.07 MECHANICAL GROOVED COUPLING REQUIREMENTS

- A. Grooving tools shall be manufactured and supplied by the manufacturer of the couplings. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer's installation instructions.
- B. Factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.

3.08 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated on the plans (if applicable) and slope to drain at minimum of 1/8 inch per foot slope.
- B. Kitchen Grease Waste Piping: Establish invert elevations within 1/2 inch vertically of location indicated on the plans (if applicable) and slope to drain at minimum of 1/4 inch per foot slope.
- C. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.09 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.10 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.11 FIELD QUALITY CONTROL

- A. Test and balance all flow control, reducing, regulating, temperature control and relief valves for required flow and pressures per manufacturer's requirements. Submit documented and witnessed test and balance results for review.
- B. Drainage Piping:
 - 1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - 3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 4. Test gravity drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - b. Leave new, altered, extended, or replaced pressurized drainage piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - c. Test Procedure: Test gravity drainage piping (except outside leaders) on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - d. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - e. Prepare reports for tests and required corrective action.
- C. Domestic Water Piping:
 - 1. Inspect domestic water piping as follows:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - c. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - d. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - e. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - f. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Test domestic water piping as follows:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Test Procedure: Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and required corrective action.

3.12 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

3.13 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inch to 1-1/4 inch:
 - 1) Maximum Hanger Spacing: 6.5 ft.
 - 2) Hanger Rod Diameter: 3/8 inches.
 - b. Pipe Size: 1-1/2 inch to 2 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
 - c. Pipe Size: 2-1/2 inch to 3 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
 - d. Pipe Size: 4 inch to 6 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.
 - e. Pipe Size: 8 inch to 12 inch:
 - 1) Maximum hanger spacing: 14 ft.
 - 2) Hanger Rod Diameter: 7/8 inch.
 - 2. Plastic Piping:
 - a. All Sizes:
 - 1) Per manufacturer's requirements.
 - 2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

**SECTION 22 10 06
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleanouts.
- B. Water hammer arrestors.
- C. Water mixing valves.
- D. Relief valves.
- E. Air vents.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Certificates: Certify that grease interceptors meet or exceed specified requirements.
- E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- F. Operation Data: Indicate frequency of treatment required for interceptors.
- G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Loose Keys for Outside Hose Bibbs: One.
 - 2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for installation of backflow prevention devices.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.03 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 2. Size: Same as connected drainage piping.
 - 3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.

4. Closure: Countersunk or raised-head, brass plug. (ASME A112.36.2M)
 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size. (ASME A112.36.2M)
- B. Metal Floor Cleanouts:
1. Standard: ASME A112.36.2M for adjustable housing cleanout.
 2. Size: Same as connected branch.
 3. Type: Adjustable housing.
 4. Body or Ferrule: Cast iron.
 5. Clamping Device: Not required.
 6. Outlet Connection: Spigot.
 7. Closure: Brass plug with straight threads and gasket.
 8. Adjustable Housing Material: Cast iron with set screws or other device.
 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, tile recess or carpet marker.
 10. Frame and Cover Shape: Square.
 11. Top Loading Classification: Medium Duty.
 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
1. Standard: ASME A112.36.2M. Include wall access.
 2. Size: Same as connected drainage piping.
 3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 4. Closure: Countersunk or raised-head, drilled-and-threaded plug.
 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.04 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors:
1. Stainless steel or copper construction, piston type sized in accordance with PDI-WH 201 and ASSE 1010, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.05 RELIEF VALVES

- A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.06 AIR VENTS

- A. General:
1. Pressure Rating: 125-psig minimum pressure rating at 140 degrees F.
 2. Mechanism and Seat: Stainless steel.
 3. Size: NPS 1/2 minimum inlet.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
- D. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur. Local code requirements on the type of backflow preventer or vacuum breaker shall be followed. Locations where potable water protection devices are required include, but are not limited to:
 - 1. Countertop appliances (coffee makers, ice machines, etc.).
 - 2. Fire protection systems.
 - 3. Flush valves.
 - 4. Hose bibbs (exterior and interior).
 - 5. Irrigation systems.
 - 6. Janitor rooms (mop sinks, service sinks, bed pan washer, etc.).
- F. Size and provide water hammer arresters in domestic water piping according to PDI-WH 201. Provide where quick closing valves are present including flush valves, standalone ice makers, laundry washing equipment and other sensor or electronic operated valves.
- G. At connections to mechanical systems or equipment, install pressure reducing valves, if required by equipment manufacturer, with inlet and outlet isolation valves, balance valve bypass and pressure gauge on valve outlet.
- H. Provide pressure reducing valves on water service wherever water service pressure exceeds 80 psig. Set pressure reducing valve to 80 psig maximum.
 - 1. Install pressure reducing valves with inlet and outlet shutoff valves and bypass with memory-stop balancing valve.
 - 2. Provide pressure gages on inlet and outlet of pressure reducing valves.
- I. Install balancing valves in locations where they can easily be adjusted.
- J. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet. Pipe in strict accordance with manufacturers' recommendations.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type unit recessed in or surface mounted on wall as specified.
- K. Install Y-pattern strainers for water on supply side of each control valve, water pressure reducing valve, solenoid valve, and pump. Provide NPS 3/4 nipple and ball valve with hose end and brass cap and chain in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- L. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs.
- M. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- N. Install shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finish locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- P. Install wall hydrants 18 to 36 inches above grade.

- Q. Install downspout nozzles 18 to 24 inches above grade.

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly, and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.03 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conventional plumbing fixtures and related components.
- B. Under-lavatory pipe supply covers.
- C. Fixture Carriers

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.
- C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- D. ASME A112.18.1 - Plumbing Supply Fittings.
- E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures.
- F. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures.
- G. ASME A112.19.2 - Ceramic Plumbing Fixtures.
- H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.
- I. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures.
- J. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
- K. ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device.
- L. ASME A112.19.15 - Bathtubs/Whirlpool Bathtubs with Pressure Sealed Doors.
- M. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices.
- N. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- O. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- P. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping.
- Q. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
- R. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- S. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer.
- T. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- V. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- W. IAPMO Z124 - Plastic Plumbing Fixtures.
- X. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- Y. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.
- Z. NEMA LD 3 - High-Pressure Decorative Laminates.
- AA. NSF 61 - Drinking Water System Components - Health Effects.
- BB. NSF 372 - Drinking Water System Components - Lead Content.

CC. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Faucet Washers: One set of each type and size.
 - 2. Extra Lavatory Supply Fittings: One set of each type and size.
 - 3. Extra Shower Heads: One of each type and size.
 - 4. Extra Toilet Seats: One of each type and size.
 - 5. Flush Valve Service Kits: One for each type and size.
 - 6. Extra Loose Keys for Outside Hose Bibbs: One.
 - 7. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on-site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 MAINTENANCE MATERIALS

- A. Furnish maintenance materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act," and Public Law 101-336, "American with Disabilities Act;" for fixtures for people with disabilities.

- G. Comply with "Reduction of Lead in Drinking Water Act", 2011, which defines "lead free" with regard to pipes, pipe fittings, plumbing fittings and fixtures.
- H. NSF/ANSI 372 - Drinking Water System Components – Lead Content
- I. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- J. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- K. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- L. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.
- M. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

2.03 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Fixture Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.04 MANUFACTURERS

- A. Plumbing Fixtures:
 - 1. American Standard, Inc.
 - a. Crane Plumbing
 - b. DXV
 - c. Eljer
 - d. Fiat
 - e. Safety Tubs
 - 2. Grohe America, Inc.
 - 3. Kohler Co.
 - 4. Sloan Commercial.
 - 5. Toto USA, Inc.
 - 6. Zurn Plumbing Products Group; Commercial.
- B. Stainless Steel Sinks:
 - 1. Elkay.
 - 2. Just.
 - 3. Kohler.
 - 4. Moen - Commercial.
- C. Faucets:
 - 1. American Standard.
 - 2. Brasscraft
 - 3. Chicago.
 - 4. Crane.
 - 5. Delta - Commercial.
 - 6. Eljer.
 - 7. Elkay.
 - 8. Hydrotek
 - 9. Kohler.
 - 10. MAC
 - 11. Moen - Commercial.
 - 12. Symmons
 - 13. T&S Brass.
 - 14. Wolverine Brass

15. Zurn Plumbing Products Group; Commercial.
- D. Shower Mixing Valves:
 1. American Standard.
 2. Crane.
 3. Delta - Commercial.
 4. Eljer.
 5. Grohe America, Inc.
 6. Kohler.
 7. Leonard.
 8. Lawler.
 9. Moen - Commercial
 10. Powers.
 11. Symmons.
 12. Zurn Plumbing Products Group; Commercial.
- E. Flushometers and Flushvalves:
 1. American Standard.
 2. Delaney.
 3. Gerber
 4. Hydrotek
 5. Moen - Commercial.
 6. Sloan.
 7. Toto.
 8. Zurn Plumbing Products Group; Commercial.
- F. Toilet Seats:
 1. American Standard
 2. Bemis.
 3. Beneke.
 4. Centoco.
 5. Comfort
 6. Church.
 7. Kohler.
 8. Zurn Plumbing Products Group; Commercial.
- G. Fixture Supports and Carriers:
 1. Grohe America, Inc.
 2. JOSAM Company: www.josam.com.
 3. Zurn Industries, Inc: www.zurn.com.
 4. J. R. Smith: www.jrsmith.com
 5. Ancon.
 6. Wade.
 7. Zurn Plumbing Products Group; Specification Drainage Operation.

2.05 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. General:
 1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 2. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
 3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASTM E84 for flame and smoke development.
 - b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
 - c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - d. Comply with ICC A117.1.

- e. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.
- f. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.
- g. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
- 4. Color: High gloss white.
- 5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
No cable ties allowed.

2.06 FIXTURE CARRIERS AND ACCESSORIES

- A. Lavatory and Sink Accessories:
 - 1. Chrome plated 17 gage brass tailpiece and P-trap with clean-out plug and arm with escutcheon.
 - 2. Offset waste with perforated open strainer.
 - 3. Screwdriver stops.
 - 4. Rigid supplies at wall mounted lavatories.
 - 5. Flexible supplies at counter mounted lavatories and sinks.
- B. Wall Hung Lavatory Carrier:
 - 1. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.
- C. Wall Hung Urinal Carriers:
 - 1. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.
- D. Wall Hung Water Closet Carriers:
 - 1. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, front and rear lugs for floor and wall attachment, threaded fixture studs with nuts and washers.
 - 2. Rated for minimum 500 lbs. duty.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops (as indicated), reducers, and escutcheons.
- C. Install components level and plumb, according to manufacturer's rough-in requirements.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.
- F. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- G. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- H. Attached all fixture carriers to building floor, wall or substrate with fasteners, bolts, washers, etc. of sizes and specifications as required by the fixture carrier manufacturer.
- I. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- J. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- K. Install wall-mounting fixtures with tubular waste piping attached to supports.
- L. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- M. Install counter-mounting fixtures in and attached to casework.
- N. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- O. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- P. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach. Coordinate flushometer height with grab bars.
- Q. Install toilet seats on water closets.
- R. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- S. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- T. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- V. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout.
- W. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
- X. Install shutoff valves in water-supply piping to emergency fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation.
- Y. Install thermometers in supply and outlet piping connections to water-tempering equipment.
- Z. Install mounting frames affixed to building construction and attached recessed water coolers to mounting frames, unless otherwise indicated.
- AA. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

3.04 CONNECTIONS TO EQUIPMENT AND FIXTURES

- A. Piping installation requirements are specified in other sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Extend piping and connect fixtures with water supplies, stops, risers, with traps, soil, waste, and vent piping as required by code and as indicated. Use size fittings required to match fixtures.

3.05 PLUMBING FIXTURES FURNISHED BY OTHERS

- A. Rough-in and install plumbing fixtures furnished by others or provided as components in casework, cabinetry or countertops.
- B. Provide supplies, stops, tailpieces and p-traps as required to complete installation.

- C. Provide faucets and accessories as indicated.

3.06 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

3.07 CONTROL WIRING

- A. Provide all incidental wiring required to make the fixtures, equipment or systems fully operational. Coordinate with equipment manufacture incidental power and control wiring requirements.
- B. Incidental wiring includes but not limited to:
 - 1. Plumbing Fixture power and control:
 - a. Faucets
 - b. Flush valves
 - c. Transformers
 - d. Flow switches
 - e. Alarms

3.08 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.09 ADJUSTING

3.10 CLEANING

- A. Clean plumbing fixtures and equipment.

3.11 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.12 SCHEDULES

- A. Fixture Heights: See architectural requirements for exact fixture mounting heights. Typical installation heights are included here for general reference.
 - 1. Water Closet:
 - a. Standard: 15 inches to top of bowl rim.
 - b. Accessible: 18 inches to top of seat.
 - 2. Water Closet Flush Valves:
 - a. Standard: 11 inches min. above bowl rim.
 - b. Recessed: 10 inches min. above bowl rim.
 - 3. Lavatory:
 - a. Standard: 31 inches to top of basin rim.
 - b. Accessible: 34 inches to top of basin rim.
 - 4. Shower Heads:
 - a. All: 78 inches to bottom of head.
- B. Fixture Rough-In and Connection: See the Plumbing Fixture Connection Schedule on the drawings for exact rough-in sizing. Typical sizing is included here for reference:
 - 1. Water Closet (Flush Valve Type):
 - a. Cold Water: 1 Inch.
 - b. Waste: 4 Inch.
 - c. Vent: 2 Inch.
 - 2. Lavatory:

Lewis Central High School
Entry Addition

- a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/4 Inch.
3. Sink:
- a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/4 Inch.
4. Shower:
- a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/4 Inch.

END OF SECTION

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

**SECTION 23 04 00
COMMON REQUIREMENTS FOR HVAC**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes basic materials and methods to complement other Division 23 Sections.

1.02 WARRANTIES

- A. Warrant all materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.
- B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.
- C. Repair or replace, at no additional cost to the Owner, any item which may become defective within the warrant period.
 - 1. Repair or replacement of compressorized equipment shall include a complete refrigerant charge.
- D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Owner.
- E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.
- F. The repair of faulty workmanship shall be considered to be included in the contract.

1.03 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.04 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.
- D. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.05 DEFINITIONS

- A. The following definitions shall apply throughout the contract documents:
 - 1. Architect: Architect or Engineer
 - 2. Code: All applicable national, state and local code
 - 3. Mechanical: All plumbing, HVAC, & fire protection work required by the Contract Documents

4. Electrical: All electrical and fire alarm work required by the Contract Documents
5. Contractor: Any Contractor performing work required by the Contract Documents
6. Indicated: Shown on drawings, noted, scheduled or specified
7. Selected: Selected by the Architect or Engineer
8. Provide: Furnish, install, connect and tested complete and ready for use
9. Furnish: Supply and deliver to the site ready for installation
10. Install: Install complete, per Contract Documents and manufacturer's requirements.
11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
16. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
17. Damp Locations: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.
 - a. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.
18. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.06 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols shown on the plans.

1.07 ABBREVIATIONS

- A. Refer to abbreviations list shown on the Drawings.

1.08 CODES

- A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.
- B. All work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
 1. International Building Code (IBC)
 2. International Fire Code (IFC)
 3. International Energy Conservation Code (IECC)
 4. International Fuel Gas Code (IFGC)
 5. International Plumbing Code (IPC)
 6. Uniform Plumbing Code (UPC)
 7. International Mechanical Code (IMC)
 8. Safety and Health Regulations for Construction
 9. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards
 10. National Electrical Code (NEC)

11. National Fire Protection Association (NFPA)
12. Life Safety Code (NFPA 101)
13. American Gas Association (AGA)
14. Underwriters' Laboratories, Inc. (UL)
15. National Electrical Safety Code (NESC)
16. All applicable national, state and local codes and amendments.

1.09 PERMITS

- A. The Contractors shall familiarize themselves with all requirements regarding all permits, fees, etc., and shall comply with them.
- B. All permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.
- C. All utilities shall be installed in accordance with the local rules and regulations and all charges shall be paid by the Contractor.

1.10 CODE COMPLIANCE

- A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that indicated shall not be substituted.
- B. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.
- C. Where the National Electrical Code or applicable codes require controllers to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment.

1.11 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
 1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
 2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
 3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
 4. Acceptable Equivalent Substitutions: Acceptable equivalent substitutions are products of manufactures other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
 - a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
 - b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - c. The Contractor providing the substitution shall bear the total cost of all changes due to substitutions. These costs may include additional compensation to the Architect for redesign and evaluation services, increased cost of work by the Owner or other Contractors, and similar considerations.
 - d. Performance Requirements: Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.

- e. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.
- f. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
- g. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.12 SUBMITTALS

- A. Shop Drawings, Product Data and Samples:
 - 1. Other section in the Project Manual shall be adhered to if more stringent than the following paragraphs.
 - 2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect for review.
 - 3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
 - 4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.
 - 5. Submittals shall be labeled indicating the specification number and title, shop drawing or product data description and the respective Part 2 paragraph and sub-paragraph numbers.
 - 6. Submittals not listed in the Project manual shall reference the respective contract document.
 - 7. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
 - a. Shop drawings and product data shall be in original searchable PDF format.
 - 8. Shop drawings are drawings, diagrams, schedules and other data specifically prepared for this project by the Contractor, Manufacturer, Supplier, or Distributor to illustrate some portion of the work. Shop Drawings shall also detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
 - a. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 - 9. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
 - 10. All submittals shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. All equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.
 - 11. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect.
 - 12. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
 - 13. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data or samples.
 - 14. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect's review of those drawings.

- B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
1. Include the following:
 - a. Actual equipment being provided. Refer to manufacturer's data for physical size, access and maintenance requirements. Provide all code required clearances.
 - b. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - c. Clearances for installing and maintaining insulation.
 - d. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - e. Equipment and accessory service connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Fire-rated wall and floor penetrations.
 - h. Sizes and location of required concrete pads and bases.
 - i. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - j. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 - k. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, access doors or pabels and other ceiling-mounted items.
 - l. All Contractors are required to provide information concerning their part of the work needed to develop the coordination drawings.
 - m. Drawings shall contain all of the following that are applicable:
 - 1) Ductwork, equipment, and terminal devices (showing access and service requirements). Ductwork, equipment and terminal devices indicated in the coordination drawing content must be the same as that indicated in all submittals.
 - 2) Plumbing
 - 3) HVAC piping
 - 4) Recessed light fixtures
 - 5) Electrical conduit 2 inches and larger
 - 6) Cable tray
 - 7) Fire sprinkler piping
 - 8) Structure and general construction
 - 9) Access doors and panels
 - 10) Other areas indicated by the Contractor that involve congestion
 - n. Complete drawings after submitting product data on items included in coordination drawings.
- C. Operation and Maintenance Manuals:
1. Prepare electronic operation and maintenance manuals for the equipment furnished.
 2. The manual shall be in original searchable PDF format with equipment organized by specification section. Bookmarking shall be provided in the PDF for each specification section and piece of equipment.
 3. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than 30 days prior to substantial completion of the project.
 4. Manuals not meeting the requirements of this section may be rejected by the Architect.
 5. Manual shall include, but shall not be limited to, the following:
 - a. A cover page including:
 - 1) Project name and address
 - 2) Division of work covered by the manual

- 3) Name, address and telephone number of Contractor and all Sub-Contractors including night or emergency numbers
- b. A Complete Index. Contractor may submit the index to the Architect for review prior to submittal of complete manuals if desired.
- c. Manufacturer's equipment product data O&M manuals and parts lists identified by the equipment mark used in the contract drawings.
- d. Names, Addresses and Telephone Numbers. This list shall include the manufacturer and local representative who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the manual.
- e. Startup, Operation and Shutdown Procedures. Provide a written description of procedures for startup, operation and shutdown of each item or system. This description shall include motors to start, valves to open, etc., in proper sequence, and the location of switches, starters, pushbuttons and valves. Description shall include item references or labels used in the contract documents unless otherwise instructed in advance by the Owner.
- f. Seasonal Changeover Procedure. Provide a written description of the procedure for necessary seasonable changeover from heating to cooling and vice versa.
- g. Equipment Accessory Schedule. Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required and the manufacturer of all renewable items.
- h. Lubrication Schedule. Provide a chart listing each piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication.
- i. Emergency Procedures. Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
- j. One copy of all shop drawings.
- k. Signed letters of certification of inspection and similar information.
- l. All manufacturers' warranty information.
- m. Provide documentation that training was performed for each item specified to include Owner training. Include name of Owner's representative(s) present, date and time of training.
- n. Normal Maintenance Schedule. Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days and yearly.
- o. Provide documentation that Extra Materials were received by the Owner for each section requiring Extra Materials.
- p. Motor List. The list shall indicate motor location, equipment served (using labels indicated on drawings), horsepower, electrical characteristics, motor type, and rpm. Motors less than 1/2 horsepower need not be included.

1.13 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner's designated personnel.
- B. Operation and Maintenance Manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall be scheduled at the convenience of the Owner. A minimum of 4 hours, per system, of training shall be provided.
- D. Training shall include instructions on the following:
 - 1. Startup and shutdown procedures
 - 2. Seasonal changeover
 - 3. Periodic maintenance
 - 4. Emergency operation
 - 5. Safety

- E. In addition to the instructions required above, wherever possible perform the operations being described in order to fully illustrate system operation.
- F. At the completion of training, turn over to the Owner all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.

1.14 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel".
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 COORDINATION

- A. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of systems. Wherever practical, install systems as indicated.
- B. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- C. Arrange for spaces, chases, slots, and openings in building structure during progress of construction to allow for system installations.
- D. Coordinate arrangement, mounting, and support of equipment.
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
- E. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- F. Sequence, coordinate, and integrate installing materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- G. Coordinate service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing water, gas, electrical power and other services.

- H. Coordinate location of access panels and doors for items that are concealed by finished surfaces.
- I. Coordinate testing of items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.17 STRUCTURAL COORDINATION

- A. In cases where the Contractor determines that superimposed loads such as suspended or floor mounted mechanical, electrical, plumbing system or equipment exist which exceed design loads indicated on structural contract documents, Contractor shall submit load data to Design Professionals for review prior to proceeding with work.
- B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, ductwork, piping, etc. over the member's tributary area in a way that the design superimposed dead loads listed in structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required achieving the allowable load distribution.
- C. Connections of systems designed by Contractor's engineer such as, but not limited to mechanical, electrical, plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for designing, furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.
- D. Coordinate locations of new fire suppression, plumbing and HVAC penetrations through existing structure and construction. Utilize all existing documentation of conditions for coordination. Verify penetrations utilizing GPR (Ground Penetrating Radar) as necessary to confirm penetration locations.

PART 2 - PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Specific Notes and/or Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 SHORT-CIRCUIT CURRENT RATING (SCCR) FOR EQUIPMENT AND ASSOCIATED CONTROL PANELS

- A. SCCR Compliance - Equipment manufacturers and suppliers shall provide a certified SCCR for all equipment and associated panels to be provided with equipment procured under these specifications. The certified SCCR rating shall be no less than the value of the available fault current at the switchboard or panel serving the equipment as indicated on the Division 26 Electrical Riser Diagrams. Manufacturer shall provide internal components that meet or exceed the SCCR rating required by these specifications. Manufacturer shall refer to the National Electrical Code (NEC), which is also known as NFPA 70, Article 100 for additional requirements
- B. Supplemental SCCR Compliance Data - At the manufactures option, they may calculate the available fault current at the specific equipment connection point. Manufacturer shall obtain feeder size, breaker type and length of feeder from the Division 26 contractor. All calculations shall be submitted as part of the equipment submittal for review by the engineer.
- C. Application of Labels - All equipment and control panels associated with equipment procured under these specifications shall have a permanently installed label provided by the manufacturer as a part of the equipment indicating the SCCR rating of the equipment. Labels shall comply with NEC Article 409 - Industrial Control Panels, and NEC Article 670 - Industrial Machinery.

2.03 CONTROL SYSTEM INTERFACES

- A. Equipment and systems shall be able to interface and integrate to BMCS systems and sequences via vendor protocols including, as a minimum, BACnet, LonTalk and Modbus.

2.04 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.05 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.06 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.07 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.08 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.09 SEALANTS AND FIRESTOPPING

- A. Manufacturers:
 - 1. Sealants:
 - a. Dow Corning
 - b. Pecora
 - c. Sonneborn
 - d. Tremco
 - 2. Firestopping Materials and Systems:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. 3M Fire Protection Products: www.3m.com/firestop.
 - c. Hilti, Inc: www.us.hilti.com.
 - d. Nelson FireStop Products: www.nelsonfirestop.com.
 - e. Specified Technologies, Inc: www.stifirestop.com.
 - f. Tremstop Fyre-Sil Sealant - Tremco Sealants & Coatings

- B. Silicone Sealant: Single component, air curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected.
- C. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- E. Joint Backing: ANSI/ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width.
- F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- G. Firestopping Materials and Systems:
 - 1. UL Listed products and assemblies.
 - 2. Subject to compliance with the requirements of Division 07.

2.10 ACCESS DOORS

- A. Manufacturers:
 - 1. Access Doors:
 - a. J. L. Industries
 - b. Karp Associates, Inc.
 - c. Larsons Mfg. Co.
 - d. Milcor, Inc.
 - e. Miller Limited Partnership
 - f. Nystrom, Inc.
- B. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated.

2.11 ELECTRICAL WIRE

- A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.
- B. All wiring running exposed in return air plenums shall be plenum-rated cable for fire and smoke spread.

2.12 LOW VOLTAGE CONTROL WIRE AND CABLE

- A. All wiring materials section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.
- B. Analog Input, Analog Output, Binary Input, Binary Output, 24 VAC, and General Purpose Cabling:
 - 1. Cable shall consist of copper conductors not less than #18 AWG stranded.
 - 2. Cable shall be two- or three-conductor twisted cable with a drain wire.
 - 3. Cable shall have a 100 percent overall shield.
 - 4. Cable shall be plenum rated.
 - 5. Cable shall meet or exceed NEC voltage rating of 300 volts.
 - 6. Cable shall be NEC type CMP.
 - 7. Cable shall meet or exceed UL temperature rating of +60 deg C.
- C. Primary and Secondary Communications Network Cabling:
 - 1. Cable shall be of type recommended by the DDC system manufacturer.
 - 2. Cable shall be shielded.
 - 3. Cable shall be plenum rated.
 - 4. Cable shall meet or exceed NEC voltage rating of 150 volts.
 - 5. Cable shall meet or exceed UL temperature rating of +60 deg C.

PART 3 - EXECUTION

3.01 GENERAL

- A. Fabrication, erection, and installation of the complete mechanical system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.
- B. The Contractor shall check all areas and surfaces where mechanical equipment or materials are to be installed and report any unsatisfactory conditions before starting work.
- C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the mechanical work.
- D. Equipment and systems shall be installed in accordance with manufacturer's instructions, requirements, or recommendations.

3.02 DELIVERY AND STORAGE OF MATERIALS

- A. Take provisions for the delivery and safe storage of materials and shall make the required arrangements with other Contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.
- C. Contractor shall be responsible for adequately protecting all supplies and equipment during cold weather.
- D. All items subject to cold weather damage shall be protected by covering, insulating, or storing in a heated space.

3.03 COOPERATION WITH OTHER CONTRACTORS

- A. Perform the work in conformance with the construction called for by other trades and afford other Contractors reasonable opportunity for the execution of their work.
- B. Properly connect and coordinate the mechanical work with the work of other Contractors at such time and in such a manner as not to delay or interfere with their work.
- C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.
- D. Promptly report to the Architect any delay or difficulties encountered in the installation of the mechanical work which might prevent prompt and proper installation of work required from other trades.
- E. Systems Test and Balance Contractors or personnel shall coordinate their work with the contractors who installed the systems being tested or balanced.
- F. The Temperature Control Contractor or personnel shall be present during systems test and balance.

3.04 COORDINATION OF WORK

- A. The list below is the precedence of assigned work items for space priority in descending order. Items not listed shall have the same precedence as similar items.
 - 1. Reflected ceiling with all light fixtures, access above light fixtures required for maintenance, sprinkler head locations, and all ceiling fixtures and devices.
 - 2. Space designed for future utility placement.
 - 3. Gravity flow plumbing waste, roof drainage, and other systems that rely upon gravity for flow.
 - 4. Ductwork and appurtenances, except that external bracing shall be relocated to accommodate local interference.
 - 5. Fire sprinkler piping.
 - 6. Cable tray with access identification 8 inches horizontal to 6 inches above tray.
 - 7. Electrical conduit over 2 inches in diameter.

8. HVAC piping except for pressurized domestic water piping.
 9. Plumbing vents.
 10. Electrical conduit under 2 inches in diameter.
- B. Plan all work so it proceeds with a minimum of interference with other trades.
 - C. It shall also be the responsibility of the Mechanical Contractor to inform the Contractor of all openings required in the building construction for the installation of the mechanical work.
 - D. The Contractor shall cooperate with all other contractors in furnishing material and information, in proper sequence, for the correct location of all sleeves, inserts, foundations, wiring, etc.
 - E. Provisions shall be made for all special frames, openings, and sleeves as required.
 - F. The Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.05 ELECTRICAL WIRING

- A. Install wiring in accordance with National Electric Code, ANSI/NFPA 70.
- B. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable. All wiring running exposed in air plenums shall be plenum cable.
- C. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures.
 1. For concealed and accessible areas, plenum-rated wiring and cabling may be used.
- D. Low voltage wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.
- E. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.
- F. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.
- G. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.
- H. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

3.06 CONTROL WIRING AND POWER CONNECTIONS

- A. Provide all incidental control power and wiring required to make the equipment or systems fully operational. Coordinate with equipment manufacture incidental wiring requirements.
- B. Unless indicted elsewhere, provide line voltage, 120VAC, 20 amp dedicated control power circuits and LAN outlet to each of the following and as indicated:
 1. BMCS Control panel, 1 circuit.
 2. Air handling Unit, 1 circuit.
 3. Boiler system, 4 circuits.
 4. Chiller system, 4 circuits.
 5. Air Terminal Unit Power supply transformer panel, 1 circuit per 20 terminal units.
 6. DDC Power supply and transformer panel. 1 circuit can power 30 terminal units.
 7. Coordinate required 120V power circuits and LAN outlets with Electrical Contractor.
- C. Incidental control wiring includes but not limited to:
 1. Air Handling Units:
 - a. Fans

- b. Damper Operators
 - c. Lights
 - d. UVC
 - e. Valve Operators
 - f. Humidifier
2. Boiler control system
3. Electric Duct Heaters
4. Energy Recovery, Make-up Units and Ventilators
5. Equipment Motors Starters
6. Fan Coil Units
7. Furnaces, Blower Coils, Water Source Heat Pumps, Air to Air Heat Pumps and Condensing Units
 - a. Provide 3/4 inch conduit with a minimum of eight distinctively colored or tagged #14 wires between units and remote panels or thermostats for control wiring
8. HVAC Controls (Including but not limited to):
 - a. Manufacturer's Packaged Control Systems
 - b. Control Relays
 - c. Fan Powered Air Terminal Units
 - d. Air Terminal Units
 - e. Control Dampers and Valves
 - f. Transmitters
9. Loose Motor Starters
10. Manual Multi-Speed Switches (Furnished as an Accessory to Mechanical Equipment)
11. Packaged Rooftop Units, Packaged Exhaust Fan and Make-Up Air Systems
 - a. Provide 3/4 inch conduit with a minimum of eight distinctively colored or tagged #14 wires between units and remote panels or thermostats for control wiring
12. Pushbutton Stations and Emergency Stop Switches
13. Pumps
14. Remote Monitoring and Control Panels (Provided by Equipment Manufacturers)
15. Smoke Dampers at Air Handling Units
16. Supply, Return and Exhaust Fans
17. Temporary Heating/Cooling Equipment
18. Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters
19. Variable Frequency Controls.

3.07 LAYING OUT WORK

- A. Carefully lay out all work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings.
- B. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance, and code-required clearances from the structure or other equipment and systems.
- C. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- D. The layout shall not cause problems of operation, maintenance, or clearance for items installed by other Contractors.
- E. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.
- F. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect prior to installation and shall request clarification.

- G. Failure to properly coordinate and lay out the work will require correction by the Contractors at their own expense.

3.08 DATA AND MEASUREMENTS

- A. Mechanical and electrical drawings are diagrammatic or schematic. Do not scale drawings.
- B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.
- C. Obtain exact locations, measurements, levels, etc., at the site and shall adapt their work to actual conditions.
- D. Examine the general construction, mechanical, electrical, and other applicable drawings and the Specifications.
- E. Only architectural drawings, structural drawings, and site measurements may be utilized in calculations.
- F. Layout and coordinate all work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.

3.09 POSITION OF DEVICES

- A. Locate devices mounted on finished surfaces with regard to paneling, furring, trim, etc. Where several devices occur in a room, they shall be symmetrically arranged as reviewed by the Architect.
- B. Devices improperly located or installed shall be repaired, replaced or relocated at the Contractor's expense.
- C. Devices shall be set plumb or horizontal and shall extend to the finished surface of the wall, ceiling, or floor without projecting beyond the surface.
- D. Devices shown on wood trim, cases, or other fixtures shall be installed symmetrically and, where necessary, shall be set with the long dimension of the plate horizontal.
- E. Coordinate their respective devices so as not to destroy the aesthetic effect of the surface in which the devices are mounted.
- F. Coordinate the locations of all mechanical items with work furnished by other trades to avoid interference.
- G. If the required coordination is not done, the outlets or devices shall be removed and relocated if so directed by the Architect and the damaged surfaces repaired at the Contractor's expense.
- H. Devices shall be installed at the height shown below unless otherwise noted. All heights of devices are measured from finished floor to centerline of device.
- I. Heights may be adjusted to correspond to nearest masonry course or as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.
 - 1. Temperature control panels: 60 inches
 - 2. Thermostats: 48 inches
 - 3. Carbon dioxide (CO2) sensors: 48 inches

3.10 PROTECTION OF APPARATUS

- A. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment, and installations from damage of any kind.
- B. Failure to provide such protection to the satisfaction of the Architect shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.11 ACCESS TO EQUIPMENT

- A. All motors, terminal boxes, valves, control devices, specialties, etc., shall be located to provide for easy access for operation, repair and maintenance; if concealed, access doors shall be provided.

- B. Access doors required for access to equipment requiring inspection or service shall be provided.
- C. Provide all access doors not already furnished by other Contractors but which are required for access to mechanical equipment.
- D. Doors shall be 12 inches by 12 inches unless shown otherwise.
- E. Person access doors shall be 18 inches by 18 inches minimum.

3.12 ROADWAYS, CURBS, AND WALKS

- A. Use every possible precaution to prevent injuries to roadways, curbs, and walks on or adjacent to the site of the work.
- B. Any damage shall be repaired at the Contractor's own expense. This shall also include damage necessary for installation of the mechanical work.

3.13 FRAMES

- A. Ducts passing through masonry walls shall be installed in steel angle iron frames and sleeves.
- B. All sleeves and frames shall be securely fastened to the walls. Provide for structural lintels in masonry wall openings.
- C. Ducts passing through openings in poured concrete walls and floors need not have frames.

3.14 FINISHED SURFACES PENETRATIONS

- A. All piping and ductwork penetrations of finished surfaces shall have escutcheons and/or closure plates.
- B. Openings shall be cut only as large as required for the installation, sleeves, and/or frames installed flush with finished surfaces and grouted in place.
- C. Surfaces around openings shall be left smooth and finished to match surrounding surface.
- D. Duct frames and pipe sleeves through floors in concealed locations and in unfinished spaces such as mechanical rooms, etc., shall extend 2 inches above finished floor level and shall be caulked watertight.
- E. All other sleeves shall extend approximately 1/4 inch above finished floor but shall allow placement of escutcheons.

3.15 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

- A. Subject to compliance with the requirements of Division 07.
- B. Provide proper sizing when providing sleeves or core-drilled holes to accommodate their work through penetrating items.
- C. All voids between sleeve or core-drilled hole and pipe passing through shall be firestopped to meet the requirements of ASTM E814.
- D. Install all materials complete, attached securely and permanently in place in accordance with manufacturers' printed directions.
- E. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- F. Do not cover installed firestopping until inspected by authority having jurisdiction.
- G. Install labeling required by code.

3.16 PIPING AND/OR DUCTWORK SYSTEMS - COMMON REQUIREMENTS

- A. General: Install as described below, unless individual Sections specify otherwise. Individual Sections specify unique installation requirements.
- B. General Locations and Arrangements:
 - 1. Drawing plans, schematics, and diagrams indicate general, diagrammatic location and arrangement of systems.

2. Indicated locations and arrangements were used to size pipe or ductwork and calculate friction loss, expansion, pump and fan sizing, and other design considerations.
3. Install systems as indicated, unless deviations to layout are approved on Coordination Drawings.
4. Provide offsets and elevation changes in ductwork, piping and conduit as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
5. Refer to architectural reflected ceiling plans for exact diffuser, register, grille, and ceiling mounted device locations.
6. Do not run ductwork and piping above electrical panels or in code required clearance spaces.
7. Do not run ductwork, piping, and plumbing above or through information technology and data closets, IDF, and MDF rooms. Coordinate all routing with other trades.
8. Coordinate location of ductwork and piping with electrical cable tray. Provide a minimum of 6" of clear access above cable tray for installation of cables.
9. Install all horizontal ductwork and piping in mechanical rooms at a minimum of 7'-6" above finished floor.
10. Install exposed interior and exterior piping and ductwork at right angles or parallel to building walls.
 - a. Diagonal runs are prohibited, unless otherwise indicated.
11. Conceal ductwork and piping in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted, except in mechanical rooms or service areas.
12. Install piping and ductwork to allow application of insulation plus 1-inch clearance around insulation.
13. Pipe hangers for insulated pipe with vapor barrier jackets shall be installed around the outside of the insulation and a metal insulation support shield provided to prevent crushing of the insulation.
14. Locate groups of pipes parallel to each other, spaced to permit insulation and valve servicing.
15. Dielectric nipples or flange insulation kits shall be utilized for all dissimilar pipe connections. Dielectric unions will not be accepted.
16. Install piping at indicated slope and as required by code.
17. Provide components with pressure rating equal to or greater than system operating pressure.
18. Install fittings for changes in direction and branch connections.
19. Install piping free of sags or bends with ample space between piping to permit proper insulation applications.
20. Install ductwork and piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building unless otherwise indicated.
 - a. Allow sufficient space above ceiling panels to allow for ceiling panel removal.
21. Install ductwork and piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment.
 - a. Provide expansion loops or compensators where indicated.
22. Do not use ceiling support system to bear weight of devices or systems unless ceiling support system is certified as suitable to do so.
23. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.
24. Keep all pipe, duct, and equipment openings closed during construction except when actual work is being performed on that item or system.
25. Leaking pipe and duct joints shall be remade using new materials.
26. Roof mounted piping, conduit and ductwork:
 - a. Coordinate all roof mounted support locations and loads with roofing contractor.
 - b. Space supports per all applicable codes and as indicated.

- c. Provide 18" minimum under pipe, duct and conduit, to allow for roof repair.
- 27. Piping Penetrations:
 - a. Provide pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1) Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
 - 2) Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
 - 3) Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4) Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
 - 5) Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
- C. Contractor is responsible for any cutting and patching needed for mechanical installation. Patching must match existing.
- D. Size and route refrigerant piping per manufacturers' recommendations.
- E. Verify final equipment locations for roughing-in of all systems.
- F. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.17 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to manufacturer's requirements and submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components.
- E. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- F. Install equipment giving right of way to piping installed at required slope.
- G. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.18 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.19 GROUTING

- A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
 - 1. Clean surfaces that will come into contact with grout.
 - 2. Provide forms as required for placement of grout.
 - 3. Avoid air entrapment during placing of grout.
 - 4. Place grout, completely filling equipment bases.
 - 5. Place grout on concrete bases to provide smooth bearing surface for equipment.
 - 6. Place grout around anchors.
 - 7. Cure placed grout according to manufacturer's written instructions.

3.20 INCIDENTAL WORK

- A. The following incidental work shall be furnished by the designated contractor under the supervision of the Temperature Control Contractor:
 - 1. The Piping Contractor shall install automatic valves and separable wells that are specified to be furnished by the Temperature Control Contractor.
 - 2. The Piping Contractor shall provide all necessary valved pressure taps, water, drain, and overflow connections and piping.
 - 3. The Piping Contractor shall provide all necessary piping connections required for flow devices, valve position indicators, etc.
 - 4. The Air Distribution Contractor shall install all automatic dampers furnished by the Temperature Control Contractor.
 - 5. The Air Distribution Contractor shall provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
 - 6. The Electrical Contractor shall provide power wiring to the variable frequency drives.
 - 7. The Air Distribution Contractor shall assemble multiple section automatic dampers, furnished by the Temperature Control Contractor, with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper actuators.
 - 8. The Air Distribution Contractor shall provide necessary sheet metal baffle plates to eliminate stratification while providing air volumes specified. Locate baffles by experimentation and affix and seal permanently in place only after stratification has been eliminated.
 - 9. The Air Distribution Contractor shall provide access doors or other approved means of access through ducts for service to control equipment.
 - 10. Supply and return air motorized smoke dampers shall be provided by the Air Distribution Contractor on all air handling units 15,000 cfm and larger, as required by NFPA 90A, and shall be controlled by the Temperature Control Contractor. Dampers shall close when fan stops and open when fan starts.

3.21 EQUIPMENT AND SYSTEM SOFTWARE INTERFACES TO THE BMCS

- A. Contractor shall coordinate with the BMCS Contractor to determine the points that are to be mapped from the equipment and systems to the BMCS. Contractor shall provide details of the method of integration and the information to be transferred between the systems as part of the submittal package.
- B. Contractor shall provide the necessary software communication ports specifically for the interfacing of the systems to the BMCS.
- C. Contractor cannot document that the exact same interface has been performed between the selected BMCS and the equipment and/or system, then the interfaces shall be tested prior to installations at an offsite location. The equipment shall not be installed at the project location until all software interfaces to the BMCS have been successfully demonstrated or documented.
- D. Documentation regarding the software interfaces shall be provided in sufficient detail as to enable a person reasonably skilled in the writing of real time software applications to add/delete points mapped from one system to the other. The documentation shall include a detailed description of each protocol used and the model, version and firmware details of any protocol converter (gateway) that is used.
- E. Refer to BMCS specifications for coordination and testing requirements.

3.22 LUBRICATION, TESTING AND TEST REPORTS

- A. Upon completion of the work, the entire system shall be tested and proven for capacity of equipment, balance of system, proper operation of controls, and comfort of conditioned spaces.
 - 1. Prior to beginning systems testing, adjusting and balancing, replace all filter media with new media.
 - 2. Test and balance procedures and documentation shall be in accordance with AABC, NEBB, or SMACNA unless indicated otherwise.

3. Take air and water flow readings and submit copy of same to demonstrate proper flow according to the performances shown on the plans and noted in the specifications.
4. Motors shall be checked for overload and belts adjusted.
 - a. Align pulleys and install belts according to manufacturer's written instructions.
 - b. Tension according to manufacturer's written instructions.
5. Lubricate moving parts and clean or replace filters.
 - a. Run in all bearings and, after they are run in, drain and flush bearings and refill with a new oil charge.
 - b. Equipment shall be so arranged that tools (screwdrivers, wrenches, etc.) will not be required to make lubrication points accessible.
 - c. Extensions on grease or oil fittings shall be provided where required for access to lubricate.
6. Smoke evacuation systems shall be tested in accordance with the requirements of the authority having jurisdiction and applicable codes and standards.
7. Test piping systems per applicable codes and standards.
8. Test ductwork systems per SMACNA and applicable codes and standards.
9. Submit all test reports to the Architect for review prior to date of substantial completion.
10. Equipment and systems discrepancies shall be corrected prior to final acceptance.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Angle valves.
- B. Globe valves.
- C. Ball valves.
- D. Check valves.
- E. Gate valves.

1.02 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.03 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End.
- G. ASME B31.1 - Power Piping.
- H. ASME B31.9 - Building Services Piping.
- I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
- J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
- K. AWWA C606 - Grooved and Shouldered Joints.
- L. MSS SP-45 - Drain and Bypass Connections.
- M. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves.
- N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.04 SUBMITTALS

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. All Valve Types:
 - 1. Crane/Stockham Co.; Crane Valve Group: www.cranvalve.com.
 - 2. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - 3. Hammond Valve: www.hammondvalve.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
 - 5. Nibco, Inc: www.nibco.com.
 - 6. Watts: www.watts.com.
- B. Gate, Globe and Angle Valves:
 - 1. Apollo Flow Controls: www.apollovalves.com
 - 2. Conbraco Industries: www.apollovalves.com.
 - 3. Tyco Flow Control: www.tycoflowcontrol.com.
 - 4. Powell: www.powellvalves.com.
 - 5. Victaulic Company[<>]: www.victaulic.com.
- C. Ball Valves:
 - 1. Apollo Flow Controls: www.apollovalves.com
 - 2. Conbraco Industries: www.apollovalves.com.
 - 3. Grinnell Products, a Tyco Business: www.grinnell.com.
 - 4. Tyco Flow Control: www.tycoflowcontrol.com.
 - 5. Victaulic Company: www.victaulic.com.
 - 6. Viega LLC: www.viega.us/#sle.
- D. Check Valves:
 - 1. Apollo Flow Controls: www.apollovalves.com
 - 2. Grinnell Products, a Tyco Business: www.grinnell.com.
 - 3. Powell: www.powellvalves.com.
 - 4. Tyco Flow Control: www.tycoflowcontrol.com.

5. Victaulic Company: www.victaulic.com.
6. Wheatley Valves: www.wheatleyhvac.com.

2.02 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
 1. Throttling (Hydronic): Ball, Globe, and Plug.
 2. Isolation (Shutoff): Butterfly, Gate, and Ball.
 3. Dead-End: Butterfly, single-flange (lug) type.
 4. Provide shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line.
 5. Provide throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
 6. Provide balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
 - a. Calibrated Balancing Valves and Automatic Flow-Control Valves shall not be used on equipment where pressure independent control valves are provided.
- D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- E. Required Valve End Connections for Non-Wafer Types:
 1. Steel Pipe:
 - a. Size 2 inch and Smaller: Threaded ends.
 2. Copper Tube:
 - a. Size 2 inch and Smaller: Threaded ends, except solder-joint valve-ends.
 3. Steam and Steam Condensate Pipe: Grooved ends not acceptable.
- F. Heating Hot Water Valves:
 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Angle: Bronze disc, Class 125.
 - c. Ball: Full port, two piece, brass trim.
 - d. Swing Check: Bronze disc, Class 125.
 - e. Gate: NRS, Class 125.
 - f. Globe: Bronze disc, Class 125.

2.03 GENERAL REQUIREMENTS

- A. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- B. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- C. Valve Sizes: Match upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 1. Handwheel: Valves other than quarter-turn types.
 2. Hand Lever: Quarter-turn valves 6 NPS and smaller.
- E. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
 1. Gate Valves: Rising stem.

2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: Extended neck.
 4. Memory Stops: Fully adjustable after insulation is installed.
- F. Memory Stops: Fully adjustable after insulation is installed.
- G. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
 4. Solder Joint Connections: ASME B16.18.
 5. Grooved End Connections: AWWA C606.
- H. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 2. Power Piping Valves: ASME B31.1.
 3. Building Services Piping Valves: ASME B31.9.
- I. Bronze Valves:
1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- J. Valve Bypass and Drain Connections: MSS SP-45.
- K. Source Limitations: Obtain each valve type from a single manufacturer.

2.04 BRONZE, ANGLE VALVES

- A. CWP Rating: Class 125: 200 psi and Class 150: 300 psi:
1. Comply with MSS SP-80, Type 1.
 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 3. Ends: Threaded.
 4. Stem: Bronze.
 5. Disc: Bronze, PTFE, or TFE.
 6. Packing: Asbestos free.
 7. Handwheel: Bronze or aluminum.

2.05 BRONZE, GLOBE VALVES

- A. CWP Rating: Class 125: 200 psi:
1. Comply with MSS SP-80, Type 1.
 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 3. Ends: Threaded or solder joint.
 4. Stem and Disc: Bronze or PTFE.
 5. Packing: Asbestos free.
 - a. Handwheel: Malleable iron.

2.06 BRASS, BALL VALVES

- A. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
 2. SWP Rating: 150 psi.
 3. WOG Rating: 600 psi.
 4. Vacuum Rating: 28.9 in-Hg.
 5. Body: Forged brass.
 6. Seats: PTFE or TFE.
 7. Stem: Stainless Steel.
 8. Ball: Stainless steel.
 9. Operator: Tee handle and stem extension.

2.07 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Bronze or Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. WOG Rating: 400 psi.
 - 4. Body: Forged bronze or dezincified-brass alloy.
 - 5. End Connections: Pipe thread or solder.
 - 6. Seats: PTFE.
 - 7. Stem: Bronze or brass.
 - 8. Ball: Chrome plated brass.
 - 9. Operator: Provide lockable handle and stem extension.

2.08 BRONZE, LIFT CHECK VALVES

- A. Class 125:
 - 1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
 - 2. CWP Rating: 200 psi.
 - 3. Design: Vertical flow.
 - 4. Body: Bronze.
 - 5. Ends: Threaded.
 - 6. Disc (Type 1): Bronze.
 - 7. Disc (Type 2): NBR or PTFE.

2.09 BRONZE, SWING CHECK VALVES

- A. Class 125:
 - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. WSP Rating: 200 psi.
 - 4. Body: Bronze, ASTM B62.
 - 5. End Connections: Threaded or soldered.
 - 6. Disc: Bronze.

2.10 BRONZE, GATE VALVES

- A. Non-Rising Stem (NRS) or Rising Stem (RS):
 - 1. Comply with MSS SP-80, Type I.
 - 2. Class 125: CWP Rating; 200 psi.
 - 3. Body Material: Bronze with integral seat and union-ring bonnet.
 - 4. Ends: Threaded or solder joint.
 - 5. Stem: Bronze.
 - 6. Disc: Solid wedge; bronze.
 - 7. Packing: Asbestos free.
 - 8. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- D. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Lift Check: Install with stem plumb and vertical.
 - 2. Swing Check: Install horizontal maintaining hinge pin level.
 - 3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.
- E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
- H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- K. FM (AG) - FM Approval Guide.
- L. MFMA-4 - Metal Framing Standards Publication.
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- N. UL (DIR) - Online Certifications Directory.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Strut Channel or Bracket Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.
- C. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch: 1/4 inch diameter.
 - c. Piping larger than 1 inch: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
- D. Steel Cable:
1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 - b. Elgen Manufacturing Company, Inc: www.elgenmfg.com.
- E. Cable Hanging System Kits:
1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation: www.eaton.com/.
 - b. Ductmate Industries, Inc: ductmate.com.
 - c. Gripple, Inc: www.gripple.com.
 - d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
 2. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb.
 3. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.
- F. Thermal Insulated Pipe Supports:
1. General Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.

- d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
- 2. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F.
 - c. Maximum Service Temperature: 180 degrees F.
 - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil.
- G. Pipe Supports:
 - 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 - 2. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 - 3. Operating Temperatures from 122 to 446 degrees F:
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
- H. Pipe Stanchions:
 - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 - 2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
 - 3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- I. Beam Clamps:
 - 1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
 - 2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
 - 3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
 - 4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
 - 5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
 - 6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
 - 7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
 - 8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- J. Riser Clamps:
 - 1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
 - 2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 - 3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 - 4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
 - 5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.
- K. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- L. Strut Clamps:
 - 1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

- M. Insulation Clamps:
 - 1. Two bolt-type clamps designed for installation under insulation.
 - 2. Material: Carbon steel with epoxy copper or zinc finish.
- N. Pipe Hangers:
 - 1. Split Ring Hangers:
 - a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
 - b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
 - c. Provide hanger rod and nuts of the same type and material for a given pipe run.
 - d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- O. Intermediate Pipe Guides:
 - 1. Pipe Diameter 6 inch and Smaller: Provide minimum clearance of 0.16 inch.
 - 2. Pipe Sizes 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
 - 3. Pipe Size 10 inch: 0.75 inch U-bolt.
 - 4. Pipe Sizes 12 to 16 inch: 0.875 inch U-bolt.
 - 5. Pipe Sizes 18 to 30 inch: 1 inch U-bolt.
 - 6. Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
- P. Pipe Alignment Guides:
 - 1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
 - 2. Pipe Sizes 10 inch and Larger: Roller type.
- Q. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- R. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
 - 1. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 - 4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- S. Pipe Shields for Insulated Piping:
 - 1. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
 - d. Minimum Service Temperature: Minus 40 degrees F.
 - e. Maximum Service Temperature: 178 degrees F.
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- T. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 4. Hollow Masonry: Use toggle bolts.
 - 5. Hollow Stud Walls: Use toggle bolts.
 - 6. Sheet Metal: Use sheet metal screws.

7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.
 - a. Use only threaded studs; do not use pins.
10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Pipe Hangers and Supports:
 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - a. Install and support non-metallic pipe and tubing in accordance with manufacturer's instructions.
 2. Support horizontal piping as scheduled.
 3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.
 5. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - a. Where trapeze hangers are constructed, the threaded rods supporting the trapeze member shall not extend more than 1" below assembly.
 8. Provide copper plated hangers and supports for copper piping.
 9. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 10. Steel Pipe Saddles:
 - a. Provide on all heating hot water piping, operating above 200 degrees F, 3" and larger.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

- H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- I. Where trapeze hangers are constructed, the threaded rods supporting the trapeze member shall not extend more than 1" below assembly.
- J. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- K. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- L. Secure fasteners according to manufacturer's recommended torque settings.
- M. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling Grid Markers.
- E. ASME A13.1 - Scheme for the Identification of Piping Systems.
- F. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.02 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Terminal Units: Stencilled painting.
- B. Dampers: Ceiling grid markers, where located above lay-in ceiling.
- C. Heat Transfer Equipment: Nameplates.
- D. Piping: Pipe markers.
- E. Small-sized Equipment: Tags.
- F. Valves: Tags and ceiling grid markers where located above lay-in ceiling.

2.02 MANUFACTURERS

- A. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
- B. Brady Corporation: www.bradycorp.com.
- C. Brimar Industries, Inc.: www.pipemarker.com.
- D. Champion America, Inc: www.Champion-America.com.
- E. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
- F. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
- G. Seton Identification Products: www.seton.com/aec.

2.03 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.04 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch octagonal.

- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch octagonal with smooth edges.
- C. Valve Tag Schedule: In Valve and Equipment Binder.

2.05 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.
- E. Color code as follows:
 - 1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
 - 2. Toxic and Corrosive Fluids: Orange with black letters.
 - 3. Compressed Air: Blue with white letters.

2.06 CEILING GRID MARKERS

- A. Marker Description: Self-adhering vinyl, 7/8 inch diameter, color coded.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosion-resistant mechanical fasteners.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units stencilled painting and valves with numbered tags.
- J. Locate ceiling grid markers to locate valves above T-bar type panel ceilings. Locate on grid closest to equipment.

3.03 TAGS

- A. Install tags with corrosion-resistant chain.

- B. Identify valves in main and branch piping with tags.
- C. Identify air terminal units coil valves with numbered tags.
- D. Tag automatic controls, instruments, and relays. Keep to control schematic.
- E. Identify small devices such as in-line pumps with tags.
- F. Identify pipe 1 inch and smaller with tags.

3.04 PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete/around pipe in accordance with manufacturer's instructions.
- C. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure and at each obstruction.
- D. All underground piping systems shall have a non-metallic warning tape, with appropriate warning, buried 24 inches above top of pipe.

3.05 NAME PLATES

- A. Install plastic name plates with stainless steel screws.
- B. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.
- C. Identify control panels and major control components outside panels with plastic nameplates.

3.06 VALVE AND EQUIPMENT SCHEDULE BINDER

- A. Provide 3-ring binder for all valve and equipment schedules with tabs and plastic page protectors for each system. Schedules to be on standard - size bond paper with following information:
 - 1. As-Built Record Building Plans:
 - a. Indicate all valve and equipment locations
 - b. Provide in electronic format, .pdf or .dwg

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems and components.
- B. Testing, adjustment, and balancing of hydronic systems and components.
- C. Testing, adjustment, and balancing of plumbing systems and components specified under Division 22.
- D. Measurement of final operating condition of HVAC systems.

1.02 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- M. TAB: Testing, adjusting, and balancing.
- N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- O. Test: A procedure to determine quantitative performance of systems or equipment.
- P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems.

- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.
- E. TABB - Testing, Adjusting, and Balancing Bureau.

1.04 SUBMITTALS

- A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 3. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified below and in Part 3.
 - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
 - 5. Include at least the following in the plan:
 - a. Preface: An explanation of the intended use of the control system.
 - b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - d. Identification and types of measurement instruments to be used and their most recent calibration date.
 - e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - f. Final test report forms to be used.
 - g. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - h. Expected problems and solutions, etc.
 - i. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
 - j. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
 - l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - n. Method of checking building static and exhaust fan and/or relief damper capacity.
 - o. Proposed selection points for sound measurements and sound measurement methods.
 - p. Methods for making coil or other system plant capacity measurements, if specified.
 - q. Time schedule for TAB work to be done in phases (by floor, etc.).
 - r. Description of TAB work for areas to be built out later, if any.
 - s. Time schedule for deferred or seasonal TAB work, if specified.

- t. False loading of systems to complete TAB work, if specified.
 - u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - v. Interstitial cavity differential pressure measurements and calculations, if specified.
 - w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
 - x. Procedures for formal progress reports, including scope and frequency.
 - y. Procedures for formal deficiency reports, including scope, frequency and distribution.
- B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Provide reports in electronic, word searchable, .pdf format binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.
 - k. Certification sheet signed and sealed by the certified testing and balancing engineer.
- C. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
- 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.
- D. Project Record Documents: Record actual locations of flow measuring stations, balancing dampers, balancing valves and rough setting, balancing dampers, and balancing dampers.
- E. As-Balanced Record Pump and Fan Curves: Record actual balanced points on the manufacture's submitted pump and fan curves.
- 1. Record system curves and actual RPM data for all fans.
 - 2. Record system curves, actual RPM and final impeller diameter for all pumps.
- F. Final Report Contents: In addition to certified field report data, include the following:
- 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

1.05 PROJECT CONDITIONS

- A. The entire TAB process shall be completed prior to Owner Occupancy.

1.06 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.07 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS

2.01 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. SMACNA (TAB).
 - 3. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
 - 16. Balancing dampers and devices are installed.
 - 17. Pressure/Temperature test fittings are installed on each pump.
- B. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory.
- C. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- D. Examine system and equipment test reports.
- E. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- G. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- I. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- J. Examine strainers for clean screens and proper perforations.
- K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine equipment for installation and for properly operating safety interlocks and controls.

- O. Examine automatic temperature control and building automation system components to verify the following:
 - 1. Check the sequence of operation of control devices are according to the Contract Documents..
 - 2. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 3. Dampers and valves are in the position indicated by the controller.
 - 4. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 5. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 6. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 7. Sensors are located to sense only the intended conditions.
 - 8. Controller set points are set at indicated values. Controllers are calibrated and commissioned. Record controller settings and note variances between set points and actual measurements.
 - 9. Changeover from heating to cooling mode occurs according to indicated values.
 - 10. Transmitter and controller locations and note conditions that would adversely affect control functions.
 - 11. Operation of limiting controllers (i.e., high- and low-temperature controllers).
 - 12. Free travel and proper operation of control devices such as damper and valve operators.
 - 13. Interaction of electrically operated switch transducers.
 - 14. Interaction of interlock and lockout systems.
 - 15. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
 - 16. Note operation of electric actuators using spring return for proper fail-safe operations.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.
- Q. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply and return systems.
- B. Outdoor and Exhaust Systems: Minimum shown on documents to plus 10 percent.
- C. Air Outlets and Inlets: Adjust individual devices to within plus 10 percent and minus 5 percent of design to space.
- D. Kitchen hood supply and exhaust: Minus 5 percent to plus 5 percent. Exhaust airflow shall exceed supply airflow.
- E. Hydronic Systems: Adjust to within plus or minus 5 percent of design.

3.05 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of

Environmental Systems", SMACNA's "HVAC Systems-Testing, Adjusting, and Balancing", and this Section.

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.06 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. Check and adjust systems approximately six months after final acceptance and submit report.

3.07 AIR SYSTEM PROCEDURE

- A. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- B. Check dampers for proper position to achieve desired airflow path.
- C. Check for airflow blockages.
- D. Check condensate drains for proper connections and functioning.
- E. Check for proper sealing of air-handling unit components.
- F. Check for proper sealing of air duct system.
- G. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- H. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- I. Measure air quantities at air inlets and outlets.
- J. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- K. Adjusting:
 - 1. After installation, adjust diffusers, registers, and grilles to air patterns indicated, as directed and as required to prevent drafts before starting air balancing.
 - 2. Adjust air patterns per manufactures recommendations based on installed conditions.

- L. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- M. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- N. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- O. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- P. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- Q. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- R. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- S. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- T. On fan powered terminal units, adjust air flow switches for proper operation.
- U. On electric heating coils, adjust system to provide required minimum airflow or downstream pressure differential to activate controls.
- V. Compensating for Diversity in Variable Volume Systems: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

3.08 HYDRONIC AND PLUMBING SYSTEM PROCEDURE

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check expansion tank liquid level.
 - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.
- C. Adjust water systems to provide required or design quantities.
- D. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

- E. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- F. Effect system balance with automatic control valves fully open to heat transfer elements.
- G. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- H. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.
- I. Set calibrated balancing valves, if installed, at calculated presettings.
- J. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- K. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- L. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- M. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- N. Measure the differential-pressure control valve settings existing at the conclusions of balancing.
- O. Balance variable volume systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.09 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.10 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Air Coils.
 - 2. Air Handling Units.
 - 3. Air Filters.
 - 4. Air Terminal Units.
 - 5. Air Inlets and Outlets.

3.11 MINIMUM DATA TO BE REPORTED

- A. Heating Coils:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Air flow, design and actual.
 - 6. Water flow, design and actual.

Lewis Central High School
Entry Addition

7. Water pressure drop, design and actual.
 8. Entering water temperature, design and actual.
 9. Leaving water temperature, design and actual.
 10. Entering air temperature, design and actual.
 11. Leaving air temperature, design and actual.
 12. Air pressure drop, design and actual.
- B. Air-Handling Unit:
1. Unit identification.
 2. Location.
 3. Make and type.
 4. Model number and unit size.
 5. Manufacturer's serial number.
 6. Unit arrangement and class.
 7. Discharge arrangement.
 8. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - g. Variable frequency controller position.
 9. Total airflow rate in cfm.
 10. Return air flow, specified and actual
 11. Outside air flow, specified and actual
 12. Total system static pressure in inches wg.
 13. Fan rpm.
 14. Discharge static pressure in inches wg.
 15. Filter static-pressure differential in inches wg.
 16. Outside-air damper position.
 17. Return-air damper position.
- C. Supply and Return Fans:
1. Unit identification.
 2. Location.
 3. Manufacturer.
 4. Model number.
 5. Serial number.
 6. Arrangement/Class/Discharge.
 7. Air flow, specified and actual.
 8. Total static pressure (total external), specified and actual.
 9. Inlet pressure.
 10. Discharge pressure.
 11. Sheave Make/Size/Bore.
 12. Number of Belts/Make/Size.
 13. Fan RPM.
- D. Return Air/Outside Air:
1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
 4. Design return air flow.
 5. Actual return air flow.
 6. Design outside air flow.

7. Actual outside air flow.
 8. Return air temperature.
 9. Outside air temperature.
 10. Required mixed air temperature.
 11. Actual mixed air temperature.
 12. Design outside/return air ratio.
 13. Actual outside/return air ratio.
- E. Exhaust Fans:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Fan RPM.
- F. Air Terminal Unit Data:
1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.
- G. Air Distribution Tests:
1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.
- H. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.12 ADDITIONAL TESTS AND INSPECTIONS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions. Make a total of three (3) inspections after occupancy of building to insure that satisfactory conditions are being maintained throughout and to satisfy any unusual conditions.

- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.
- C. Make an inspection in building during opposite season in which initial adjustments were made, and at that time make any necessary modifications to initial adjustment required to produce optimum operation of system components to produce proper conditions in each conditioned space. At time of opposite season checkout, Owner's representative shall be timely notified before any readings or adjustments.

END OF SECTION

**SECTION 23 07 13
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
- E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- F. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.02 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations. Show details for application of field-applied jackets.
- B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience and approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density, thickness, and appropriate ASTM standard designation.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Insulation products shall not contain asbestos, lead, mercury, mercury compounds, or formaldehyde.

- F. Products shall be certified by UL GREENGUARD GOLD or Indoor Advantage Gold.
- G. Products shall be certified to meet or exceed UL Standard 2818 -2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings
- H. Provide insulation thickness based on 2018 International Energy Conservation Code minimum requirements.
- I. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

1.06 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation; : www.jm.com.
 - 3. JP Lamborn Co: www.jpflex.com.
 - 4. Knauf Insulation: www.knaufinsulation.com.
 - 5. Manson Insulation, Inc.: www.mansoninsulation.com
 - 6. Owens Corning Corp; : www.owenscorning.com.
- B. Vapor Barrier Jacket:
 - 1. FSK: Kraft paper with glass fiber scrim yard and bonded to aluminized film; 0.0032 inch vinyl.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- C. Vapor Barrier Tape:
 - 1. Aluminized foil film, with pressure sensitive acrylic based adhesive, 3 inches wide, 6.5 mils thick, 58-ounce force/inch adhesion, 23 lbf/inch tensile strength. Service temperature -40 - 250 degree F.

1.07 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation; : www.jm.com.
 - 3. Knauf Insulation: www.knaufinsulation.com.
 - 4. Manson Insulation, Inc.: www.mansoninsulation.com
 - 5. Owens Corning Corporation: www.ocbuildingspec.com.
- B. Vapor Barrier Jacket:
 - 1. FSK: Kraft paper with glass fiber scrim yard and bonded to aluminized film; 0.0032 inch vinyl.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- C. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive, 3 inches wide, 6.5 mils thick, 90-ounce force/inch adhesion, 40 lbf/inch tensile strength.
- D. Indoor Vapor Barrier Finish:
 - 1. Manufacturers:
 - a. Fosters Model Vapor Out 30-33.
 - b. Childers Model Chil Out, CP-33.
 - 2. Cloth: Untreated; 9 oz/sq yd min. weight, glass fabric.
 - 3. Vinyl emulsion type acrylic, compatible with insulation, white color.

4. Characteristics: 0.07 perm water-vapor permeance per ASTM E96, Procedure B at 45 mil dry film thickness; -20 degrees F to +180 degrees F temperature range; solid content, 55 percent by volume and 68 percent by weight per ASTM D 1644; white color.

1.08 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 1. Aeroflex USA, Inc: www.aeroflexusa.com.
 2. Armacell LLC: www.armacell.us.
 3. K-Flex USA LLC: www.kflexusa.com.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 180 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

1.09 DUCT LINER

- A. Manufacturers:
 1. Aeroflex USA, Inc: www.aeroflexusa.com.
 2. Armacell LLC: www.armacell.us.
 3. CertainTeed Corporation: www.certainteed.com.
 4. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 5. Johns Manville: www.jm.com.
 6. Owens Corning Corporation: www.ocbuildingspec.com.
 7. RBX Corporation.
- B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 180 degrees F.
 3. Fungal Resistance: No growth when tested according to ASTM G21.
 4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
 5. Minimum Noise Reduction Coefficients:
 - a. 1/2 inch Thickness: 0.30.
 - b. 1 inch Thickness: 0.40.
 - c. 1-1/2 inches Thickness: 0.50.
 - d. 2 inch Thickness: 0.60.
 6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm when tested in accordance with ASTM C1071.
 7. Connection: Waterproof vapor barrier adhesive.
 8. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.
- C. Polyester Fiber Insulation:
 1. Insulation: Non-corrosive, incombustible, thermally bonded, polyester fiber complying with ASTM C1071; rigid board; impregnated surface with FSK facing and edges coated water based coating.
 - a. Thickness: 1 inch.
 - b. Zero VOCs: ASTM D5116.
 - c. Fungi Resistance: ASTM G21.
 - d. Apparent Thermal Conductivity: Maximum of .24 at 75 degrees F.
 - e. Service Temperature: Up to 250 degrees F.

- f. Rated Velocity on Coated Air Side for Air Erosion: 4000 fpm, minimum.
- g. Minimum Noise Reduction Coefficients:
 - 1) 1/2 inch Thickness: 0.30.
 - 2) 1 inch Thickness: 0.45.
 - 3) 1-1/2 inches Thickness: 0.60.
 - 4) 2 inch Thickness: 0.70.
- 2. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- 3. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that surfaces are clean, foreign material removed, and dry.

2.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets, with minimum installed R-value of 6.0.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Provide with or without standard vapor barrier jacket, with minimum installed R-value of 6.0.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
 - 6. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - b. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - c. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - 1) On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - 2) On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - 3) Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

- 4) Do not overcompress insulation during installation.
 - 5) Impale insulation over pins and attach speed washers.
 - 6) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - d. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - 1) Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - 2) Install vapor stops for ductwork and plenums operating below 50 degrees F at 18-foot intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness but not less than 3 inches.
 - e. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - f. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface.
 - g. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
7. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - b. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transition.
 - c. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - 1) On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - 2) On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - 3) Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - 4) Do not overcompress insulation during installation.
 - 5) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - d. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - 1) Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seals.

- 2) Install vapor stops for ductwork and plenums operating below 50 degrees F at 18-foot intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness but not less than 3 inches.
 - e. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows.
 - f. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.
 6. Lined ducts shall be fabricated to provide the net inside dimensions shown.
 7. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 8. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 9. Butt transverse joints without gaps and coat joint with adhesive.
 10. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 11. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
 12. Apply adhesive coating on all longitudinal seams.
 13. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.
 14. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.03 DUCT INSULATION

- A. Provide insulation thickness based on 2018 International Energy Conservation Code minimum requirements.
- B. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- C. Items Not Insulated:
 1. Fibrous-glass ducts.
 2. Metal ducts and plenums with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.

5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

2.04 INSULATION AND JACKET SCHEDULE

- A. Duct Liner
 1. Duct liner shall not be used on the following locations:
 - a. Ahead of any coil on all air distribution systems.
 - b. Within 20 feet downstream of a humidifier.
 - c. In any supply air duct system which serves laboratory spaces or any other area having special concerns for dust or airborne contaminants.
 2. Transfer Ducts, Sound Traps and Boots and as indicated: 1-inch liner.
 3. Fan Coil Units:
 - a. Supply Air: 1-inch liner 5 feet downstream.
 - b.
 4. Terminal Units:
 - a. Supply Air: 1-inch liner 5 feet downstream.
- B. Indoor Duct and Plenum
 1. Supply Air:
 - a. Concealed, supply-air duct insulation shall be any of the following:
 - 1) Glass-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
 - 2) Glass-Fiber Blanket: 2.2 inches thick and 0.75-lb/cu. ft. nominal density.
 - b. Concealed, supply-air plenum insulation shall be any of the following:
 - 1) Flexible Elastomeric: 1 inch thick.
 2. Return Air:
 - a. None.
 3. Exhaust Air:
 - a. Exhaust and Relief Ducts for a Distance of 36 Inches from Outside Wall/Roof:
 - 1) Glass fiber blanket, 1-1/2 inches thick nominal density.

**SECTION 23 07 19
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
- G. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
- I. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
- J. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
- K. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- L. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
- M. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- O. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.02 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.05 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Products shall be certified by UL GREENGUARD GOLD or Indoor Advantage Gold.
- F. Products shall be certified to meet or exceed UL Standard 2818 -2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings
- G. Provide insulation thickness based on 2018 International Energy Conservation Code minimum requirements.
- H. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

2.02 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/sle.
 - 5. Manson Insulation.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K Value: ASTM C177, 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
 - 1. Manufacturers:
 - a. Childers Products CP-127.
 - b. Foster Products 85-20/85-60.
 - c. Eagle Bridges - Marathon Industries, Inc.
 - 2. Shall meet ASTM C916 Type I/II
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
 - 1. Manufacturers:
 - a. Fosters Mast a Fab.
 - b. Childers Chil Glas #10.
 - 2. Cloth: Untreated; 9 oz/sq yd min. weight.
 - 3. Blanket: 1.0 pcf density.
 - 4. Weave: 5 by 5.
- H. Indoor Vapor Barrier Finish:

1. Manufacturers:
 - a. Childers Products, Chil Out, CP-33.
 - b. Foster Products Vapor Out. 30-33.
 - c. Eagle Bridges - Marathon Industries, Inc.
2. Cloth: Untreated; 9 oz/sq yd min. weight.
3. Vinyl emulsion type acrylic, compatible with insulation, white color.
4. Permeance shall be 0.07 perms or less at 45 mils dry tested by ASTM E96.

2.03 ACCESSORIES

- A. General Requirements:
 1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
 2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
 3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
 4. Supply materials that are asbestos free.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Coat all elbows, fittings, valves and flanges with vapor barrier mastic and reinforcing mesh. Finish with PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
- I. Inserts and Shields:
 1. Application: Insulated piping 3/4 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Shield shall span an arc of 180 degrees.
 4. Match diameter of shield to OD of insulation.

5. Shield dimensions shall not be less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 6. Insert location: Between support shield and piping and under the finish jacket.
 7. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 8. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
 9. Steel Pipe Saddles:
 - a. Provide on all steam and steam condensate piping 3" and larger.
 - b. Provide on all heating hot water piping, operating above 200 degrees F, 3" and larger.
 10. Thermal-Hanger Shield Inserts: Install according to manufacturer's written instructions.
- J. Insulated Piping: Attach hangers and supports to piping as follows:
1. Piping Operating Above Ambient Temperature:
 - a. Where piping is not supported on rollers or trapeze, hangers may project through insulation.
 - b. For straight runs of piping, at points of support more than 100 feet from elbow or anchor point, use roller type supports.
 - c. Where piping is supported on rollers or trapeze, support piping at outside diameter of insulation.
 - 1) NPS Smaller than 2: Provide MSS SP-58, Type 40, protective shield.
 - 2) NPS 2 1/2 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.
 2. Piping Operating Below Ambient Temperature: Support piping at outside diameter of insulation. Do not penetrate vapor barrier.
 - a. NPS Smaller than 2: Provide MSS SP-58, Type 40, protective shield.
 - b. NPS 2 1/2 and Larger: Provide thermal-hanger shield insert and weight-distribution plate.
- K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

3.03 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement.

Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.04 INSULATION AND JACKET SCHEDULE

- A. Insulation thickness listed below is based on the thermal conductivity performance of the material listed.
1. Alternative material thickness must be adjusted as required to provide equivalent conductivity performance.
 2. Alternative material substitution shall be reviewed by the Architect.
- B. Provide insulation thickness based on 2018 International Energy Conservation Code minimum requirements.
- C. Indoor Piping:
1. Heating Hot Water/Glycol Supply and Return, 200 Degrees F and below:
 - a. 1-1/4 Inches and Smaller:
 - 1) Glass Fiber, Preformed Pipe, Type I: 1 1/2 inches thick.
 - b. 1-1/2 Inches and Larger:
 - 1) Glass Fiber, Preformed Pipe, Type I: 2 inches thick.

- D. Indoor, Field Applied Jacket:
 - 1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

END OF SECTION

SECTION 23 09 13.13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Unitary Controllers
- B. Power Supplies and Transformers.
- C. Low Voltage Control Cable.
- D. Input/Output Sensors:
 - 1. Temperature sensors.
 - 2. Static pressure (air pressure) sensors.
 - 3. Equipment operation (current) sensors.
- E. Thermostats:
 - 1. Outdoor reset thermostats.
 - 2. Immersion thermostats.
 - 3. Airstream thermostats.
 - 4. Electric low limit duct thermostats.
 - 5. Electric high limit duct thermostats.
- F. Output Devices.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
 - 1. Manufacturer's printed data sheets for all control system components clearly identify data by component.
 - 2. General catalog sheets, including details of construction, ratings, and dimensions for each component.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
 - 1. Show complete details of interconnections between temperature control systems and control specified with equipment or systems.
 - 2. Provide valve schedules indicating size, type, design flow, valve capacity, pressure drop and CV value, identification, and part number.
 - 3. Provide dampers schedule indicating dimension and descriptions of blank-offs, installation location, arrangement, velocities, static pressure drop, damper features, identification, and part number.
 - 4. Control panel locations indicated on plans.
 - 5. Control panel interior layout drawings indicating the following:
 - a. Overall panel size.
 - b. Device locations and labeling within panel.
 - c. Spare and space locations.
 - d. Power supplies and transformers.
 - e. Wiring and cabling pathways.

6. Clearly note the proposed deviations from specified sequences and equipment, and substantiate with written explanation.
- D. Samples: Submit two of each type of room thermostat and cover.
- E. Design Data: Provide design data for sizing and selection of compressor.
- F. Manufacturer's Instructions: Provide for all manufactured components.
- G. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- H. Project Record and Closeout Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 1. Complete Index of Contents.
 2. Revise shop drawings to reflect actual installation and operating sequences.
 3. Red-mark "Record" control system drawings and then turn them over to the Owner's Representative.
 4. Provide directions for calibration, adjustment, and maintenance instructions for each type of component.
 5. Shop drawings of control system showing devices, interconnections between devices, and connections to items provided by others.
 6. Specifications data sheets on each device.
- I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 2. Extra Thermostats and Other Exposed Sensors: One of each type.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience approved by manufacturer.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1.07 MAINTENANCE SERVICE

- A. Provide service and maintenance of control system for two years from Date of Substantial Completion.
- B. Provide complete service of controls systems, including call backs. Make minimum of 8 complete normal inspections of approximately 40 hours total duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. As indicated.

2.02 EQUIPMENT - GENERAL

- A. Products Requiring Electrical and Control Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 GENERAL FOR UNITARY CONTROLLERS FOR COOLING AND HEATING TERMINAL UNITS

- A. Unitary Controllers (UC) shall be fully programmable controllers with operating sequences maintained in EEPROM or flash ROM. Customization of sequences of operation, operating parameters, control loop parameters, control constants, and schedules shall be changeable on-site by the subcontractor technician or Owner's representative. UC shall provide an interface via PIM to the field instrumentation and final control elements of the following types of equipment:
 - 1. One terminal unit.
 - 2. Up to three miscellaneous fans.
 - 3. One fan coil unit.
 - 4. Miscellaneous input monitoring.
- B. All other types of equipment and systems shall be controlled by panels meeting the requirements of DCP.
- C. Provide as part of the UC differential pressure transducers for the monitoring of the terminal unit primary air flowrate. The differential pressure transducer shall meet, at minimum, the requirements:
 - 1. Monitor the differential pressures generated by a multi-point averaging device located in the primary air duct. The terminal unit manufacturer shall provide the multi-point averaging sensors. Coordinate with the terminal unit manufacturer for range of pressure differential.
- D. The differential pressure sensors, where required for the equipment served, shall monitor the flowrates with an accuracy of + or - 5 percent with a the velocity pressure minimum of +/- 0.002 inch w.c. with a working pressure range of 0-2 inch w.c.. The BMCS subcontractor shall assist the Testing and Balancing subcontractor to calibrate each differential pressure sensor in the field following installation.
- E. Provide a wall mounted space temperature sensor for the monitoring of each equipment/terminal unit space temperature.
 - 1. The pressure differential transducers shall be on the UC. The terminal unit manufacturer as part of the factory installation shall provide tubing from these sensors to the multi-point averaging devices.
 - 2. Provide a one-micron filter on the pressure differential sensor if it monitors a moving air stream.
 - 3. If an automatic calibration program requires the automatic zeroing of the flow sensor and transducer, provide a coordinated sequence of operation that ensures the associated AHU is not operating during the automatic calibration procedure.

2.04 UNITARY CONTROLLERS - COOLING AND HEATING AIR TERMINAL UNITS

- A. Provide as part of the UC differential pressure transducers for the monitoring of the terminal unit primary air flowrate. The differential pressure transducer shall meet, at minimum, the requirements:
 - 1. Monitor the differential pressures generated by a multi-point averaging device located in the primary air duct. The terminal unit manufacturer shall provide the multi-point averaging sensors. Coordinate with the terminal unit manufacturer for range of pressure differential.
- B. Local Keypad and Display for each Controller:
 - 1. Use for interrogating and editing data.
 - 2. The pressure differential transducers shall be on the UC. The terminal unit manufacturer as part of the factory installation shall provide tubing from these sensors to the multi-point averaging devices.
 - 3. System security password prevents unauthorized use.

2.05 POWER SUPPLIES AND TRANSFORMERS

- A. DC Power Supplies:

- B. Each FPTU terminal unit shall have a UC meeting the above specified requirements for UC. The number and location of terminal units and air flowrates shall be as indicated on the Mechanical Drawings. The FPTU UC shall be fully programmable and shall not be application specific.
- C. The terminal unit manufacturer shall provide the following components for each fan powered terminal unit for interface and mounting of the UC:
 - 1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75 percent of the rated capacity of the power supply.
 - 2. Primary air dampers to be controlled by the UC.
 - 3. Input: 120 VAC +10 percent, 60 Hz.
 - 4. Output: 24 VDC.
 - 5. Enclosure to house the UC and associated components or suitable mounting brackets within the terminal unit enclosure.
 - 6. Multi-point averaging type flow sensor at the primary air inlet to the terminal unit.
 - 7. 24 VAC control transformer.
 - 8. 24 VAC contacts for each stage of electric heat.
 - 9. 0-10 Vdc fan flowrate and start/stop controller to the ECM motor.
 - 10. Line Regulation: +0.05 percent for 10 percent line change.
 - 11. Load Regulation: +0.05 percent for 50 percent load change.
 - 12. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
 - 13. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
 - 14. A power disconnect switch shall be provided next to the power supply.
- D. Transformers and Air Terminal Unit Power:
 - 1. Input frequency of 50/60 Hz.
 - 2. Internal circuit breaker.
 - 3. Foot Mounted
 - 4. Temperature range of 32 Deg. F. to 104 Deg. F.
 - 5. Sized to provide volts and amps as required for connected load.
 - 6. Input voltage shall be as required for the specific application.
 - 7. Transformers shall be panel mounted:
 - a. Panels located in mechanical or electrical rooms shall comply with NEMA 4 requirements.
 - b. Panels in other locations, including but not limited to occupied spaces, above ceilings, and plenum returns shall comply with NEMA 1 requirement.
 - c. Transformers and UPS can occupy the same panel enclosure.
 - d. Transformer panels cannot contain other BMCS compoenets unless properly shielded.
- E. DDC Power Supply Panel with Transformers:
 - 1. Transformer: 500 VA
 - 2. Over Current Protection: Circuit Breaker
 - 3. Primary: 480/277/240/120 VAC
 - 4. Frequency: 50/60 Hz
 - 5. Nominal Dimensions: 12" x 12" x 6"
 - 6. Approvals: Class 2 (UL Approved UL5085-3), UL916, UL508, C-UL, CE, RoHS
 - 7. Housing: NEMA1 Metal Enclosure, Plenum Rated
 - 8. Weight: 30.16 lbs.
 - 9. 5 Secondaries: 24 VAC, with LED Indicators
 - 10. 24 VAC ON/OFF: On / Off Switch & Breaker
 - 11. Input: 480/277/240/120 VAC, Finger-Safe Terminals
 - 12. Output: 5 Isolated, Floating 100 VA Class 2 24 Vac Terminals

13. Ambient Temperature Derating: 4A up to 40 degrees C; 3A up to 50 degrees C ; 2A up to 55 degrees C (When All 5 Outputs Operated Simultaneously)
 14. Standby Wattage: 48.5 W @ 120 VAC
 15. Full Load Primary Current: 4.6 A @ 120 VAC
 16. Basis of Design: Functional Devices, Inc. Model no.: PSH500A, Enclosed Power Supply
- F. Uninterruptable Emergency Power Supplies (UPS):
1. Output:
 - a. Output Power Capacity: 1920 Watts / 1920 VA
 - b. Max Configurable Power: 1980 Watts / 2200 VA
 - c. Nominal Output Voltage: 120V
 - d. Output Voltage Distortion: Less than 5%
 - e. Output Frequency (sync to mains): 50/60Hz +/- 3 Hz
 - f. Topology: Line Interactive
 - g. Waveform Type: Sine wave
 - h. Output Connections: (8) NEMA 5-15R, (2) NEMA 5-20R
 2. Input:
 - a. Nominal Input Voltage: 120V
 - b. Input Frequency: 50/60 Hz +/- 3 Hz (auto sensing)
 - c. Input Connections: NEMA 5-20P
 - d. Cord Length: 6 feet (1.83 meters)
 - e. Input voltage range for main operations: 82 - 144V
 - f. Input voltage adjustable range for mains operation: 75 - 154V
 3. Batteries & Runtime:
 - a. Battery Type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
 - b. Typical recharge time: 3 hour(s)
 4. Energy Use/Efficiency:
 - a.

<u>Load</u>	<u>Efficiency</u>
b. 25%	97.4%
c. 50%	98.2%
d. 75%	98.2%
e. 100%	98.1%
 5. Communications & Management:
 - a. Interface Port(s): (1) SmartSlot
 - b. Control panel: Multi-function LCD status and control console
 - c. Audible Alarm: Alarm when on battery : distinctive low battery alarm : configurable delays
 - d. Emergency Power Off (EPO)
 6. Surge Protection and Filtering:
 - a. Surge energy rating: 530 Joules
 - b. Filtering: Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449
 7. Environmental:
 - a. Operating Environment: 32 - 104 °F
 - b. Operating Relative Humidity: 0 - 95%
 - c. Operating Elevation: 0-10000 feet
 - d. Storage Temperature: 5 - 113 °F
 - e. Storage Relative Humidity: 0 - 95%
 - f. Storage Elevation: 0-50000 feet
 - g. Audible noise at 1 meter from surface of unit: 45.00 dBA
 - h. Online Thermal Dissipation: 275.00 BTU/h
 8. Conformance:
 - a. Regulatory Approvals: CSA, ENERGY STAR (USA), FCC Part 15 Class A, UL 1778

- b. Standard Warranty: 3 years repair or replace (excluding battery) and 2 year for battery, optional on-site warranties available, optional extended warranties available

2.06 LOW VOLTAGE CONTROL CABLE

- A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable.
- B. All wiring running exposed in air plenums shall be plenum cable.
- C. Analog Input, Analog Output, Binary Input, Binary Output, 24 VAC, and General Purpose Cabling:
 - 1. Cable shall consist of copper conductors not less than #18 AWG stranded.
 - 2. Cable shall be two- or three-conductor twisted cable with a drain wire.
 - 3. Cable shall have a 100 percent overall shield.
 - 4. Cable shall be plenum rated.
 - 5. Cable shall meet or exceed NEC voltage rating of 300 volts.
 - 6. Cable shall be NEC type CMP.
 - 7. Cable shall meet or exceed UL temperature rating of +60 deg C.
 - 8. Cable shall be labeled at a minimum of every 18 inches with the DDC system manufacturer's name and the type of signal carried within the cable, i.e., analog input, analog output, binary input, binary output, 24 VAC.
- D. Primary and Secondary Communications Network Cabling:
 - 1. Cable shall be of type recommended by the DDC system manufacturer.
 - 2. Cable shall be shielded.
 - 3. Cable shall be plenum rated.
 - 4. Cable shall meet or exceed NEC voltage rating of 150 volts.
 - 5. Cable shall meet or exceed UL temperature rating of +60 deg C.

2.07 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
 - 1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
 - 2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
 - 3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
 - 4. Temperature Sensing Device: Compatible with project DDC controllers.
 - 5. Performance Characteristics:
 - a. RTD:
 - 1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
 - 2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
 - 3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
 - 4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
 - 5) Range: Minus 40 degrees F through 220 degrees F minimum.
 - b. Thermistor:
 - 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
 - 2) Range: Minus 25 degrees F through 122 degrees F minimum.
 - 3) Heat Dissipation Constant: 2.7 mW per degree C.
 - c. Temperature Transmitter:
 - 1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
 - 2) Output: 4 to 20 mA.
 - d. Sensing Range:
 - 1) Provide limited range sensors if required to sense the range expected for a respective point.

- 2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
 - 3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
 - e. Wire Resistance:
 - 1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
 - 2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
 - f. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
 - g. Ceiling and Recessed Mount Temperature Sensors: Ceiling-mounted sensor in a low-profile housing.
 - h. Room Security Sensors: Stainless steel cover plate with insulated back and security screws.
 - i. Room Temperature Sensors User Adjustment with Occupancy Override:
 - 1) Construct for surface or wall box.
 - 2) Manual occupancy override and indication of occupancy status.
 - j. Insertion Elements:
 - 1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
 - 2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.
 - k. Duct Probe Temperature Sensors:
 - 1) Application: Air handling applications where the coil or duct area is less than 10 square feet, and the air is not affected by stratification.
 - 2) Sensor probe length shall be selected to provide the most representative reading from the sensed airstream.
 - 3) Duct Mounted Sensor Requirements:
 - (a) Sensor Type: Thermistor.
 - (b) Accuracy: ± 0.4 °F over a 32 to 158 °F range.
 - (c) Measurement Resolution: 0.1 °F.
 - (d) Enclosure Material: Stainless Steel.
 - l. Insertion Elements:
 - 1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
 - 2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.
- B. Static Pressure (Air Pressure) Sensors:
 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
 2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
 3. Accuracy: One percent of full scale with repeatability 0.3 percent.
 4. Output: 0 to 5 vdc with power at 12 to 28 vdc.
- C. Equipment Operation (Current) Sensors:
 1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
 2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
 3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

- D. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.
- E. Power Monitoring Sensors:
 - 1. Current measurement (amps) shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum five-amp signal, which will be converted to a 4-20 mA DDC-compatible signal for use by the facility management system.
 - 2. Current Transformer: A split core current transformer shall be provided to monitor motor amps.
 - a. Operating Frequency: 50-400 Hz.
 - b. Insulation: 0.6 kV class 10 kV BIL.
 - c. UL recognized.
 - d. Five-amp secondary.
 - e. Select current ratio as appropriate for application.
 - 3. Current Transducer: A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - a. 6X input over amp rating for AC inrushes of up to 120 amps.
 - b. Manufactured to UL 1244.
 - c. Accuracy: +0.5 percent, Ripple +1.0 percent.
 - d. Minimum Load Resistance: 30 kohms.
 - e. Input: 0-20 amps.
 - f. Output: 4-20 mA.
 - g. Transducer shall be powered by a 24 VDC regulated power supply (24 VDC + 5 percent).
- F. Air Filter Status Sensor:
 - 1. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for two amps at 120 VAC.
 - 2. A complete installation kit shall be provided, including static pressure tops, tubing, fittings, and air filters.
 - 3. Provide appropriate scale range and differential adjustment for intended service.
- G. Air Pressure Safety Sensor:
 - 1. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for two amps at 120 VAC.
 - 2. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
- H. Water Presence Sensor (Leak Detection Monitoring [Single Point]) - Water:
 - 1. Water leak detection monitors shall meet, at minimum, the following requirements:
 - a. Corrosion and abrasion resistant.
 - b. Adjustable height.
 - c. Configured for normally open or normally closed as required by the application.
 - d. Form C output relay.
 - e. Operating temperature range of -20 degrees F to 120 degrees F.

2.08 THERMOSTATS

- A. Outdoor Reset Thermostats:
 - 1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
 - 2. Scale range: Minus 10 to 70 degrees F.
- B. Immersion Thermostats:
 - 1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.
- C. Airstream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
 2. Averaging service remote bulb element: 7.5 feet.
- D. Electric Low Limit Duct Thermostats:
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
 2. Bulb length: Minimum 20 feet.
 3. Provide one thermostat for every 20 sq ft of coil surface.
 4. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
- E. Electric High Limit Duct Thermostats:
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,
 2. Bulb length: Minimum 20 feet.
 3. Provide one thermostat for every 20 sq ft of coil surface.
 4. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

2.09 OUTPUT DEVICES

- A. Control Relays:
1. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 2. Mounting bases shall be snap mount.
 3. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 4. Contacts shall be rated for 10 amps at 120 VAC.
 5. Relays shall have an integral indicator light and check button.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 27 26.
- C. Mount freeze protection thermostats using flanges and element holders.
- D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- E. Provide separable sockets for liquids and flanges for air bulb elements.
- F. Provide guards on thermostats in entrances.

- G. Provide insulated mounting bases on thermostats and other temperature sensing devices in the following locations:
 - 1. Exterior walls.
 - 2. Masonry/CMU walls.
 - 3. Interior walls that back up to mechanical/utility rooms and other non-conditioned spaces.
- H. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- I. Provide isolation (two position) dampers of parallel blade construction.
- J. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- K. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- L. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- M. Provide boxes, conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
 - 1. Provide boxes and conduit pathways (to ceiling spaces), for all wall mounted thermostats and sensors and wiring. Refer to Division 26.

3.03 SENSORS AND INPUT/OUTPUT DEVICES

- A. All input and output devices shall be installed per the manufacturer's recommendation.
- B. Building Differential Air Pressure Applications: Transmitter's exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
 - 1. Unless indicated otherwise, locate the exterior sensing tip near the building's main entrance.
 - 2. The interior sensing tip shall be inconspicuous and located within a central corridor on the same level as the entrance.
- C. Low Temperature Limit Switches: Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by one foot of sensor. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- D. Duct Mount Sensors:
 - 1. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - 2. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - 3. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

3.04 ELECTRICAL WIRING

- A. Install wiring in accordance with National Electric Code, ANSI/NFPA 70.
- B. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable. All wiring running exposed in air plenums shall be plenum cable.
- C. Install wiring (low and line voltage) in metal raceways or conduit unless inside control cabinet or unit enclosures. For concealed and accessible areas, plenum-rated wiring and cabling may be used.
- D. Class 2 wiring not installed in conduit shall be supported every five feet from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel

to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.

- E. Low voltage control wiring and 24 VAC can be run in the same conduit. Power wiring 120 VAC and greater must be in a separate conduit.
- F. Fastening shall be secured to walls or ceilings by means of appropriate screws, expansion screws anchors, toggle bolts, hollow wall screw anchors, nylon expansion anchors, or expansion shields. All-purpose plastic anchors are not acceptable.
- G. Locate circuits, relays, transformers, or other equipment that contains or must be connected to voltages exceeding 130 volts, in separate cabinets, which may be adjacent to control panels; permanently label "DANGER 277 VOLTS" or appropriate volts.
- H. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size shall be 3/4 inch.

3.05 CONTROL WIRING AND POWER CONNECTIONS

- A. Provide all incidental control power and wiring required to make the equipment or systems fully operational. Coordinate with equipment manufacture incidental wiring requirements.
- B. Unless indicated elsewhere, provide line voltage, 120VAC, 20 amp dedicated control power circuits and LAN outlet to each of the following and as indicated:
 - 1. BMCS Control panel, 1 circuit.
 - 2. Air handling Unit, 1 circuit.
 - 3. Central Plant, 4 circuits.
 - 4. Cooling towers, 4 circuits.
 - 5. Boiler system, 4 circuits.
 - 6. Chiller system, 4 circuits.
 - 7. Fire/Domestic water pump room, 1 circuit.
 - 8. Main electrical room, 1 circuit.
 - 9. Air Terminal Unit Power supply transformer panel, 1 circuit per 20 terminal units.
 - 10. DDC Power supply and transformer panel. 1 circuit can power 30 terminal units.
 - 11. Coordinate required 120V power circuits and LAN outlets with Electrical Contractor.
- C. Incidental control wiring includes but not limited to:
 - 1. Air Handling Units:
 - a. Fans
 - b. Damper Operators
 - c. Lights
 - d. UVC
 - e. Valve Operators
 - f. Humidifier
 - 2. Automated flue exhaust system
 - 3. Boiler control system
 - 4. Chillers (With or Without Remote Starters)
 - 5. Cooling Towers
 - 6. Electric Duct Heaters
 - 7. Energy Recovery, Make-up Units and Ventilators
 - 8. Equipment Motors Starters
 - 9. Fan Coil Units
 - 10. Fluid Coolers (With or without discharge dampers)
 - 11. Furnaces, Blower Coils, Water Source Heat Pumps, Air to Air Heat Pumps and Condensing Units
 - a. Provide 3/4 inch conduit with a minimum of eight distinctively colored or tagged #14 wires between units and remote panels or thermostats for control wiring
 - 12. HVAC Controls (Including but not limited to):
 - a. Manufacturer's Packaged Control Systems

- b. Control Relays
- c. Fan Powered Air Terminal Units
- d. Air Terminal Units
- e. Control Dampers and Valves
- f. Temperature, Flow and Occupancy Sensors
- g. Flow and BTU Meters
- h. Current Sensors
- i. Transmitters
- 13. Loose Motor Starters
- 14. Manual Multi-Speed Switches (Furnished as an Accessory to Mechanical Equipment)
- 15. Motor Control Centers
- 16. Packaged Chillers
- 17. Packaged Rooftop Units, Packaged Exhaust Fan and Make-Up Air Systems
 - a. Provide 3/4 inch conduit with a minimum of eight distinctively colored or tagged #14 wires between units and remote panels or thermostats for control wiring
- 18. Pushbutton Stations and Emergency Stop Switches
- 19. Pumps
- 20. Remote Monitoring and Control Panels (Provided by Equipment Manufacturers)
- 21. Smoke Dampers at Air Handling Units
- 22. Supply, Return and Exhaust Fans
- 23. Temporary Heating/Cooling Equipment
- 24. Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters
- 25. Variable Frequency Controls.

3.06 START-UP SERVICES

- A. Verify proper location of each device and point-to-point system integrity. Correct as needed.
- B. When installation is complete and automatic control system is placed in operation, adjust and calibrate all instruments and devices in system and ensure that system is operating in accord with specified sequences.
- C. Diagnose component and system problems. Communicate irregularities to the appropriate contractor for correction.
- D. Attend construction meetings as required to coordinate with other contractors and provide input during problem resolution.

3.07 IDENTIFICATION STANDARDS

- A. If the owner utilizes a specific equipment or system identification or naming convention, the contractor shall use for all systems, nameplates and equipment references in all project documentation.
- B. Field Devices: All field devices shall be identified by a typed (not handwritten) securely attached tag label.
- C. Controller Identification: All controllers shall be identified by typed (not handwritten) securely attached tag label.
- D. Panel Identification: All local control panels shall be identified by a plastic engraved nameplate securely fastened to the outside of the controller enclosure.
- E. Panel Devices: All panel devices shall be identified by a typed label securely fastened to the back plate of the local control panel.
- F. Raceway Identification: All the covers to junction and pull boxes of the control system raceways shall be painted blue or have identification labels stating "Control System Wiring" affixed to the covers. Labels shall be typed, not handwritten.
- G. Wire Identification: All low and line voltage control wiring shall be identified by a number or name, as referenced to the associated control diagram, at each end of the conductor cable.

Identification number or name shall be permanently secured to the conductor or cable and shall be typed.

3.08 TRAINING

- A. Provide demonstration and training in accordance with Section 01 7900 - Demonstration and Training.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR BUILDING MANAGEMENT CONTROL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
 - 1. Variable air volume terminal units.
 - 2. Exhaust fans.
 - 3. Unit heaters.

1.02 SYSTEM DESCRIPTION

- A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Specification Compliance Review.
- C. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
 - 1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
 - 2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.
 - 3. Include at least the following sequences:
 - a. System off.
 - b. Start-up.
 - c. Warm-up mode.
 - d. Normal operating mode.
 - e. Unoccupied mode.
 - f. Shutdown.
 - g. Capacity control sequences and equipment staging.
 - h. Temperature and pressure control, such as setbacks, setups, resets, etc.
 - i. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
 - j. Effects of power or equipment failure with all standby component functions.
 - k. Sequences for all alarms and emergency shut downs.
 - l. Seasonal operational differences and recommendations.
 - m. Interactions and interlocks with other systems.
 - 4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
 - 5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
 - 6. Include schedules, if known.

- D. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
 - 1. Label with settings, adjustable range of control and limits.
 - 2. Include flow diagrams for each control system, graphically depicting control logic.
 - 3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
 - 4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
 - 5. Include all monitoring, control and virtual points specified in elsewhere.
 - 6. Include a key to all abbreviations.
- E. Points List: Submit list of all control and monitor points indicating at least the following for each point.
 - 1. Name of controlled system.
 - 2. Point abbreviation.
 - 3. Point description; such as dry bulb temperature, airflow, etc.
 - 4. Display unit.
 - 5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
 - 6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 - 7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 - 8. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.
- F. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 OPERATING SEQUENCES - GENERAL

- A. Sequence of Control indicated illustrates basic control function only. Provide all control devices required for controlling air handling units, exhaust fans, physical plant equipment, terminal equipment, and all related items. Provide monitoring only devices as indicated.
- B. Perform the initial input of all required operational data for each point that is to be used based on information supplied by the Owner. Assist the Owner's staff in developing the schedule and shall demonstrate the operation of the system using the data.
- C. Provide adequate English language notation in the software to assist the operator in understanding the intent of the programmed sequences.
- D. Provide stable operation of all control loops. If the Contractor has not provided self-tuning PID control algorithms then the Contractor shall manually tune all control loops. Verify all control loops are stable whether or not they are self-tuning.
- E. Provide any modifications to the operating sequence programs as requested by the Owner without additional costs until the final acceptance of the entire control system.
- F. All outputs using PID control shall be adjusted to the actual range of end device. Example: If VFC range is from 20% to 100%, output PID loop shall run from 20%-100% to eliminate spooling of PID outside actual operating range of end device.
- G. Graphics shall represent actual range of outputs.

3.02 EQUIPMENT RUN TIME TOTALIZATION

- A. Incorporate run time totalization techniques into the programming logic that will accumulate the operating times for motors as selected by the operator using an interactive procedure. Any piece of equipment that has its status monitored by the building management control system (BMCS) shall be selectable for inclusion in this feature. It shall be possible to concurrently monitor the accumulated operating time for every item of equipment monitored and/or controlled by the BMCS.
- B. The operator shall be able to establish on-line, using an interactive procedure, a value for the accumulated operating time at which a suitably worded message shall be output to the operator advising that the reporting limit has been reached for a specific motor. The message shall be output at the designated device.
- C. The operator shall be able to change the accumulated total for any motor to any value.
- D. The accumulated operating times shall be updated at least every 15 minutes.
- E. The operator shall be able to obtain on demand or on a scheduled basis a report detailing the accumulated operating times.
- F. Operating time software shall be used as the basis for equipment operating selection and standby status. Changeover of units based on operating times shall not take place more than an operator-defined period, initially set at once per week.

3.03 NIGHT (UNOCCUPIED) SETBACK - SETUP

- A. Incorporate unoccupied setback-setup techniques into the programming logic to provide the following:
 - 1. Start HVAC equipment after normal hours of scheduled operation to maintain building after-hour setpoints, while reducing energy consumption.
 - 2. Night setback temperatures for heating shall be initially set at 55 degrees F to activate the heating equipment and 60 degrees F to stop the heating equipment. Once activated, the units involved shall operate as specified in the respective sequence of operation. Coordinate the operation of this program with the requirements for terminal unit controls.
 - 3. Night setup temperatures for cooling shall be initially set at 90 degrees F to activate the cooling equipment and 85 degrees F to stop the cooling equipment. Once activated, the units involved shall operate as specified in the respective sequence of operation. Coordinate the operation of this program with the requirements for terminal unit controls.
- B. The operator shall be able to implement this function for all HVAC equipment using an interactive procedure on an individual or group-controlled basis.
- C. The operator shall be able to assign minimum run times for each piece of equipment.
- D. The operation of this program shall be disabled when the outside air temperature is outside operator defined limits, initially set at 35 degrees F and 95 degrees F.
- E. A report shall be available on demand and on a scheduled basis, which provides the following information:
 - 1. Night setback/setup setpoints and associated equipment.
- F. This feature shall only be implemented for equipment in the BMCS software control mode.
- G. Setpoints for each associated piece of equipment shall be displayed on the associated system display graphics. Setpoints shall be changeable via the graphical display.
- H. The current status of night setback - setup modes shall be indicated on the associated system graphic.

3.04 OPTIMIZED SCHEDULING

- A. Provide an adaptive software program that shall:
 - 1. Start HVAC equipment at the latest possible time while ensuring that space in the building reaches setpoint conditions by the time occupancy commences.

2. Stop HVAC equipment at the earliest possible time while ensuring that space in the building shall still be within the setpoint deadband at the scheduled end of occupancy.
- B. The operator shall be able to implement this function for each group of terminal units and other HVAC equipment using an interactive procedure. A group of terminal units shall comprise all the terminal units on the same floor of the tower served by the same air handling unit. The operator shall be able to assign start of occupancy and end of occupancy times for each day of the week and for holidays. A separate Monday schedule should be provided for earlier start times.
- C. This program shall base the determined equipment start and stop times on monitored data such as space temperatures within the area served by the equipment and ambient conditions. If the BMCS subcontractor requires information other than that provided by the monitoring detailed in the Field Termination Schedules, then the necessary additional instrumentation shall be provided within the base bid price.
- D. The operator shall be able to assign limits to the start and stop times. Initially these limits shall be set as follows:
 1. BMCS determined start times shall not be more than three hours before the scheduled occupancy.
 2. BMCS determined stop times shall not be more than one hour before the scheduled end of occupancy.
- E. A report shall be available on demand and on a scheduled basis, which provides the following information:
 1. Occupancy schedules.
 2. Time of last equipment start and space conditions at scheduled occupancy time.
 3. Time of last equipment stop and space conditions at scheduled end of occupancy time.
- F. This feature shall only be implemented for equipment in the BMCS software control mode.

3.05 ENERGY MANAGEMENT STRATEGIES

- A. Apply additional emergency management strategies listed below to the applicable systems.

3.06 TYPICAL SYSTEMS START-UP AND SHUT-DOWN INITIATION

3.07 AIR TERMINAL UNITS

- A. Single-Duct Variable Volume with Heat:
 1. System Off - When the system is off:
 - a. The primary air damper shall be closed.
 - b. The heating shall be closed or off.
 2. Initiation of System Start-Up - The system shall be started:
 - a. Manual:
 - 1) BMCS single entry operator command.
 - b. Automatic:
 - 1) Based on BMCS occupancy schedule.
 - 2) As required during night setback/setup mode of operation.
 3. System Operation - After system start-up has been initiated the following shall occur:
 - a. The primary air damper shall modulate to the maximum primary airflow rate indicated to maintain the space cooling temperature setpoint.
 - b. When the space temperature falls below the space heating temperature setpoint the following shall occur:
 - 1) The primary air damper shall be set to the minimum primary air flow rate indicated.
 - 2) The heating water valve or electric coil controller shall modulate to maintain the space heating temperature setpoint.
 - 3) The discharge air temperature sensor shall limit discharge air temperature to no more than 20 degrees above space setpoint.

- 4) Upon further call for heating, the primary air damper shall modulate to the maximum heating air flow rate indicated.
4. System Shutdown - Shall be initiated as follows:
 - a. Manual:
 - 1) BMCS single entry operator command.
 - b. Automatic:
 - 1) Based on BMCS occupancy schedule.
 - 2) At the conclusion of setback/setup operation during unoccupied periods.
 - 3) In the event of component failure.
5. System Setpoints - The setpoints shall be operator changeable and initially set as follows:
 - a. Space cooling temperature setpoint shall be 74 degrees F.
 - b. Space heating temperature setpoint shall be 70 degrees F.
 - c. The minimum and maximum primary air flow setpoints shall be set to the design airflow setpoints as indicated in the contract documents.
 - d. The high and low temperature setpoints shall be set initially at 2 degrees F above/below the temperature setpoints.
 - e. The occupant shall have the capability to adjust the space temperature setpoint through the space temperature sensor.
 - f. The programming shall limit user adjustment to + or - 2 degrees F of the base setpoint.
6. Alarms - The BMCS shall generate an alarm for the following conditions:
 - a. High temperature.
 - b. Low temperature.
7. Points List:
 - a. Analog Inputs:
 - 1) Primary air flow.
 - 2) Space temperature.
 - 3) Space temperature setpoint adjust.
 - 4) Discharge air temperature.
 - b. Analog Outputs:
 - 1) Primary air damper.
 - 2) Heating water valve or electric coil controller.

3.08 EXHAUST FANS

- A. System Description: Fans provide exhaust for areas including, but not limited to, restrooms, pool, equipment room, and janitor closet.
- B. Exhaust fans shall operate continuously to provide Code-required bathroom and dryer exhaust. Fan shall not be disabled based on a schedule.
- C. System off - when system is off:
 1. The exhaust fan shall be off.
- D. Initiation of System Startup:
 1. Manually initiated by BMCS operator workstation.
 2. Automatically by the BMCS based on a time schedule.
- E. System operation - after startup has been initiated, the following shall occur:
 1. Exhaust fan shall start.
- F. System shutdown - shall be initiated as follows:
 1. Manually initiated by operator at BMCS workstation.
- G. Alarms - the BMCS shall generate an alarm for the following:
 1. Fan failure.
- H. Failure position - the following shall occur upon BMCS communication failure.
 1. Fan shall remain in last commanded state.

- I. Field Termination Schedule:
 - 1. Digital input:
 - a. Fan status.
 - 2. Digital output:
 - a. Fan start/stop.

3.09 UNIT HEATER CONTROL STAND ALONE

- A. Space thermostat shall module heating water valve to maintain the space temperature setpoint. Unit heater fan shall be cycled from an aquastat on the heating water return line.
- B. Space thermostat shall module steam valve to maintain the space temperature setpoint. Unit heater fan shall be cycled from an aquastat on the condensate return line.

END OF SECTION

**SECTION 23 21 13
HYDRONIC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water piping, above grade.
- C. Unions, flanges, mechanical couplings, and dielectric connections.

1.02 CODE AND PERMIT COMPLIANCE

- A. Work shall be in accordance with all applicable codes. Where the codes and drawings do not agree, the code shall take precedence; however, code shall take precedence over what is shown only when it is more stringent than that indicated. Items that are allowed by codes which are less stringent than that indicated shall not be substituted.
- B. Contractors shall familiarize themselves with all requirements as to permits, fees, etc., and shall comply. All permits, licenses, inspections, and arrangements required for the work shall be provided by the Contractors at their expense.
- C. All utilities shall be installed in accordance with utility company rules and regulations.
- D. Drawings, plans, and schematics and diagrams indicate the general location and the arrangement of piping systems. Wherever practical, install piping as indicated.

1.03 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- D. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings.
- E. ASME B31.9 - Building Services Piping.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- G. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
- H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings.
- K. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
- M. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- N. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
- O. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems.
- P. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
- Q. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe.
- R. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

- S. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- T. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
- U. AWWA C606 - Grooved and Shouldered Joints.
- V. IAPMO (UMC) - 2024 Uniform Mechanical Code.
- W. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections.
- X. ICC (IMC) - International Mechanical Code.
- Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturers catalog information.
 - 3. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.
- B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- C. Pipe pressure testing report.
- D. Mechanical grooved joint couplings, fittings and specialties shall be shown on shop drawings and product submittals, and shall be specifically identified with the manufacturer's style or series designation.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 5 years of experience.
- C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.
- D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.
- E. Coupling Manufacturer:
 - 1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
 - 2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.
- F. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
- G. All grooved joint couplings, fittings and specialties shall be the products of a single manufacturer.
 - 1. Grooving tools shall be of the same manufacturer as the grooved components.
 - 2. All castings used for coupling housings, fittings, etc., shall be date stamped for quality assurance and traceability.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 - 2. Use non-conducting dielectric connections whenever joining dissimilar metals.
 - 3. Grooved mechanical coupling joints may be used in any location.
 - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
 - b. Grooved mechanical connections and joints comply with AWWA C606. Couplings shall be rigid pattern, two-piece, ductile-iron housing cast with offsetting angle-pattern bolt pads.
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
 - 2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
 - c. Couplings to be bolt pad to bolt pad assembly, central cavity pressure-responsive design.
 - d. Installation-Ready, for direct stab installation without field disassembly or loose parts.
 - e. Use rigid joints unless otherwise indicated.
 - f. Use flexible joints at vibrating or rotating equipment.
 - 1) Three (or four, depending on pipe size), flexible joints may be used in lieu of a flexible connector.
 - g. Use gaskets of molded grade EHP synthetic rubber with central cavity, pressure responsive configuration and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
 - h. Provide steel coupling nuts and bolts complying with ASTM A183.
 - 4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
 - 5. Welded piping shall have long radius elbows.
 - 6. Where Schedule 40 is required below, the following shall apply for larger piping: Steel Pipe Sizes 12 Inches and Greater: ASTM A53/A53M, 3/8 inch wall, black, using one of the following joint types:
 - a. Threaded Joints: ASTM A536 ductile iron fittings.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 - 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- D. Valves: Provide valves where indicated:
 - 1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
 - 2. For throttling, bypass, or manual flow control services, use globe or ball valves.
 - 3. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
- E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.
 4. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
1. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
 2. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

2.03 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe of 2 Inches and Less:
1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe 2 Inches and Greater:
1. Ferrous Piping: 150 psig forged steel, slip-on.
 2. Copper Piping: Bronze.
 3. Gaskets: 1/16 inch thick, preformed neoprene.
 4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
 5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 6. Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- C. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
1. Sleeve: ASTM A 126, Class B, gray iron.
 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 3. Gaskets: Rubber.
 4. Bolts and Nuts: AWWA C111.
 5. Finish: Enamel paint.
- D. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Installation-Ready, for direct stab installation without field disassembly or loose parts.
 2. Couplings to be bolt pad to bolt pad assembly.
 3. Coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the proper use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to ensure best practices in grooved joint installations are being followed.
 4. Dimensions and Testing: In accordance with AWWA C606. Couplings shall comply with ASTM F1476 "Standard Specification for the Performance of Gasketed Mechanical Couplings for use in Piping Applications".
 5. Mechanical Couplings: Comply with ASTM F1476.
 6. Housing Material: Ductile iron, galvanized complying with ASTM A536.
 7. Gasket Material: Prelubricated, grade EHP, EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F. Central cavity pressure-responsive design.

8. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel. ASTM A449.
9. When pipe is field grooved, provide coupling manufacturer's grooving tools.
10. Manufacturers:
 - a. Victaulic Company: www.victaulic.com.
11. Grooved Copper Tube Fittings:
 - a. Fittings: ASME B16.22 wrought copper and ASTM B 75 (ASTM B 75M), copper tube or ASME B 16.18 and ASTM B 584, bronze casting.
 - b. Couplings: Rigid pattern, offsetting angle-pattern bolt pads.
12. Grooved Steel Pipe and Fittings:
 - a. Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53/A 53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings.
 - b. Rigid Type Couplings: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B3 1.1 and B31.9.
 - c. Flexible Type Couplings: Used in locations where vibration attenuation and stress relief are required. Use three flexible couplings in lieu of a flexible connector.
- E. Pressed Fittings:
 1. Copper Tube:
 - a. Copper and copper alloy press fitting shall conform to material requirements of ASME B16.18 or ASME 16.22 AND Performance criteria of IAPMO PS 117.
 - b. Sealing elements shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by the fitting manufacturer.
 - c. On sizes 1/2" to 4" the fitting shall have a feature that assures leakage of liquids and/or gases from inside the system past the sealed element of an unpressed connection. this function feature shall provide an easy indication of an unsealed connection.
- F. Dielectric Connections:
 1. **Dielectric unions shall not be used.**
 2. Waterways and Nipples:
 - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - b. Dry insulation barrier able to withstand 600-volt breakdown test.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
 - e. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F
 3. Flanges:
 - a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - c. Dry insulation barrier able to withstand 600-volt breakdown test.
 - d. Construct of galvanized steel with threaded end connections to match connecting piping.
 - e. Suitable for the required operating pressures and temperatures.
 - f. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 4. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
- G. Joining Materials:

1. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
2. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
3. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 PRESSURE INDEPENDENT TEMPERATURE CONTROL VALVES

- A. Manufacturers:
 1. Danfoss
 2. Schneider Electric
 3. Bell and Gossett
 4. Delta P
 5. Belimo
 6. Tour Anderson
 7. Flow Design
 8. Griswold
 9. Nexus Valve, Inc
- B. Valves shall be warranted for minimum of five years from date of shipment.
- C. Pressure independent control valves shall accurately control the flow from 0 to 100% rated flow.
- D. Minimum operating pressure differential range of 5 to 50 PSI differential across the valve and equal or greater than the associated pump's design head pressure.
- E. Valve body flow accuracy of +/- 5% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances and valve hysteresis.
- F. Maintain proportional and linear flow coil characteristics.
- G. Provide minimum Class 4 shut-off on all sizes and field serviceable.
- H. Valve bodies shall be Cast Iron or Brass. All internal parts shall be Stainless Steel.
 1. NPS 2 and Smaller: Forged brass body rated at no less than 250 PSI, stainless steel ball and stem, NPT, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
 2. NPS 2-1/2 through 6: Cast iron body according to ANSI Class 125, standard class B, stainless steel blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.
- I. Valves shall have minimum of two factory installed PTT ports capable of being used to measure pressure or temperature.
- J. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.
- K. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
 1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
 2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 3. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
 4. Provide plenum-rated actuators for service above ceilings to possess UL listings and approvals.
 5. Temperature Rating: 40 to 104 degrees F.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

3.02 INSTALLATION

- A. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- B. Provide drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Install piping at a uniform grade of 0.2 percent (1 inch in 40 feet) upward in direction of flow.
- D. Mechanically formed tees in copper pipe may be formed per ANSI A40 by workers certified after factory authorized training. Branch lines shall be formed with two dimple/depth stops in line with the run of the tube.
 - 1. Fabricate mechanically formed tees/outlets according to manufacturer's standard written procedure.
 - 2. Mechanically formed outlets shall have a collar with a height not less than three times the thickness of the branch tube wall.
 - 3. The branch shall be notched to conform to the inner curve of the run and shall be dimpled or otherwise impeded from penetrating the run pipe/tube to a depth that would obstruct the flow of fluid through the run pipe/tube.
 - 4. The branch tube shall also be dimpled or otherwise marked to indicate the location of the notches with respect to the run.
 - 5. Such marking shall be at a sufficient distance from the face of the joint to allow for a visual point of inspection after the joint is brazed.
 - 6. All joints constructed using this method shall be brazed.
- E. Provide non-conducting dielectric connections wherever joining dissimilar metals. **Dielectric unions are not allowed.**
- F. Install and support in accordance with manufacturer's instructions.
- G. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.
- H. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- I. Install piping to conserve building space and to avoid interference with use of space.
- J. Group piping whenever practical at common elevations.
- K. Sleeve pipe passing through partitions, walls, and floors.
- L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
- M. Slope piping and arrange to drain at low points.
- N. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming off the top of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- O. Anchor piping for proper direction of expansion and contraction.
- P. Provide temperature and pressure test fitting (PTT) in accordance with the contract documents and as required to test and balance all equipment.
 - 1. Provide a pressure/temperature test fitting (PTT) at each water sensor that is an input point to the control system.

- Q. Piping shall be installed so as to allow removal of ceiling hung equipment.
- R. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
 - 2. Use flexible couplings in expansion loops.
- S. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.
 - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
 - 3. Grooving tools shall be manufactured and supplied by the manufacturer of the couplings. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer's installation instructions.
 - 4. Factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.
 - 5. Flexible type couplings can be used in locations where vibration attenuation and stress relief are required. Use three flexible couplings in lieu of a flexible connector.
- T. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- U. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.
- V. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00 .
- W. Use eccentric reducers to maintain top of pipe level.
- X. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

3.03 INCIDENTAL WORK

- A. The following incidental work shall be furnished by the Contractor under the supervision of the Temperature Control Contractor:
 - 1. The Piping Contractor shall install automatic valves and separable wells that are specified to be furnished by the Temperature Control Contractor.
 - 2. The Piping Contractor shall provide all necessary valved pressure taps, water, drain and overflow connections and piping.
 - 3. The Piping Contractor shall provide all necessary piping connections required for flow devices, valve position indicators, etc.

3.04 SAFETY VALVE INSTALLATIONS

- A. Provide safety valves according to ASME B31.1. Pipe safety valve discharge without valves to floor near floor drain or over mop sink.

3.05 HYDRONIC SPECIALTIES INSTALLATION

- A. Provide manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Provide automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

- C. Provide combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve and hose end.
- D. Provide bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve and hose end.
- E. Install expansion tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.
- F. Provide centrifugal separator as indicated. Install purge assembly and pipe discharge to drain. Provide pressure gauges on inlet and outlet.
- G. Provide automatic water fill assemblies wherever domestic water connections are made to HVAC hydronic systems. Provide totaling water meter on water fill makeup line.
- H. Check expansion tanks to determine that they are not air bound and that the system is completely full of water or glycol solution.

3.06 TERMINAL EQUIPMENT CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in hydronic, steam and condensate, and refrigerant piping systems.
- B. Install control valves and accessories in accessible locations close to connected equipment.
- C. When control valve sizes are smaller than indicated pipe or equipment connection size, provide eccentric reducers on inlet and outlet of control valve.
- D. When coil banks are comprised of multiple coils, size individual coil supply and return piping connections same as indicated. Provide reducers to manufacturer's provided coil connections.
- E. Install piping adjacent to coils to allow service and maintenance.
- F. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping.
- G. Provide bypass piping with globe valve around control valve as indicated. If multiple, parallel control valves are installed, only one bypass is required.
- H. Provide ports for pressure and temperature gages at coil inlet connections.+
- I. Connect supply and return hydronic piping to air terminal reheat coil with unions and shutoff valves and hose kits. Hose kit size shall be the full line size as the branch runout indicated. Provide reducer at reheat coil connection.
- J. Connect condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Provide cleanouts in piping at changes of direction.

3.07 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Provide blinds in flanged joints to isolate equipment.
 - 5. Provide safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. Provide relief valve set at pressure no more than 1/3 higher than test pressure to protect against damage by expansion of liquid or other source of overpressure during the test.
3. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
4. Check expansion tanks to determine that they are not air bound and that system is full of water.
5. Subject piping system to a hydrostatic test pressure which, at every point in the system, is not less than 1-1/2 times the design pressure assuming 125 psi minimum design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve or component on the system under the test.
6. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
7. After hydrostatic test pressure has been applied for at least 4 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
8. Prepare written report of testing.

3.08 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Perform these adjustments before operating the system:
 1. Open valves to fully open position. Close coil bypass valves.
 2. Check pump for proper direction of rotation.
 3. Set automatic fill valves for required system pressure.
 4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Check operation of automatic bypass valves.
 7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
 8. Lubricate motors and bearings.

3.09 CLEANING OF PIPING

- A. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

3.10 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
- B. Hanger Spacing for Steel Piping.
 1. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 2. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 3. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 4. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.

END OF SECTION

**SECTION 23 21 14
HYDRONIC SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air vents.
- B. Strainers.
- C. Pump connectors.
- D. Pressure-temperature test plugs.
- E. Balancing valves.
- F. Automatic flow control valves.
- G. Terminal equipment hose kits.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

- A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Project Record Documents: Record actual locations of flow controls.
- E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 - 3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
 - 4. Taco, Inc: www.taco-hvac.com/#sle.
- B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. High Capacity Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
- D. Hygroscopic Air Vent:
 1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.
- E. Maximum Fluid Pressure: 150 psi.
- F. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

- A. Manufacturers:
 1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 3. Crane Co.; Crane Valve Group: www.cranevalve.com.
 4. Flexicraft Industries: www.flexicraft.com/#sle.
 5. Green Country Filtration: greencountryfiltration.com.
 6. Nexus Valve, Inc: www.nexusvalve.com/#sle.
 7. Hammond Valve: www.hammondvalve.com.
 8. The Metraflex Company: www.metraflex.com/#sle.
 9. Milwaukee Valve Company: www.milwaukeevalve.com.
 10. Mueller Co.: www.muellercompany.com.
 11. Nexus Valve.
 12. Nibco Inc.: www.nibco.com.
 13. Powell: www.powellvalves.com.
 14. Stockham: www.stockham.com.
- B. Size 2 inch and Under:
 1. Class 125, screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

2.03 PRESSURE-TEMPERATURE TEST PLUGS (PTT)

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- B. Application: Use extended length plugs to clear insulated piping.
- C. Provide test kit to include thermometer, pressure gage, access fittings, and carrying case.

2.04 MANUALLY CALIBRATED BALANCE VALVES

- A. Manufacturers:
 1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 4. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 5. Nexus Valve, Inc: www.nexusvalve.com/#sle.
 6. Amtrol Inc: www.amtrol.com.
 7. IMI Flow Design Inc.
 8. Griswold Controls.
 9. Oventrop Corporation: www.ventrop.com/#sle.
 10. Nexus Valve.
 11. NuTech Hydronic Products.
 12. Pro Hydronic Specialties
 13. Taco, Inc: www.taco-hvac.com/#sle.
 14. Tyco Flow Control: www.tycoflowcontrol.com.

- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
- C. Size 2 inch and Smaller:
 - 1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections. Blowdown/backflush drain.
 - 2. Metal construction materials consist of bronze or brass.
 - 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- D. Size 2-1/2 inch and Larger:
 - 1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections. Blowdown/backflush drain.
 - 2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
 - 3. Internal components construction materials consist of brass, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.05 AUTOMATIC FLOW CONTROL/BALANCE VALVES

- A. Manufacturers:
 - 1. Armstrong International: www.armstronginternational.com/#sle.
 - 2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 - 3. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 - 4. Nexus Valve, Inc: www.nexusvalve.com/#sle.
 - 5. Amtrol Inc: www.amtrol.com.
 - 6. Griswold Controls.
 - 7. IMI Flow Design Inc.
 - 8. NuTech Hydronic Products.
 - 9. Oventrop Corporation: www.omentrop.com/#sle.
 - 10. Pro Hydronic Specialties
 - 11. Taco Inc: www.taco-hvac.com/#sle.
 - 12. Tyco Flow Control: www.tycoflowcontrol.com.
 - 13. Victaulic Company[<>]: www.victaulic.com.
- B. Provide with a readout kit including flow meter, probes, hoses, flow charts, and carrying case.
- C. Construction:
 - 1. Brass, bronze, or iron body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
 - 2. Built-in lug-type outlet butterfly valve with 2-position handle.
 - 3. Brass or ferrous-metal body, designed for 300 psig at 250 degrees F.
- D. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi.
- E. Control Mechanism: Provide stainless steel or nickel-plated, brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.
- F. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate.

2.06 TERMINAL HEATING/COOLING EQUIPMENT HOSE KIT

- A. Provide hose kits on the following terminal heating/cooling equipment:
 - 1. Water source heat pump.
 - a. Provide with motorized valve that stops water flow through the unit when compressor is off.
 - 2. Hydronic equipment; Air terminal unit reheat coil, Cabinet unit heater, Chilled beam, Convactor, Fan coil unit, Unit heater, and Blower coil

- B. Manufacturers:
 - 1. Flowcon: www.flowcon.com
 - 2. IMI Flow Design Inc.
 - 3. Griswold Controls: www.griswoldcontrols.com.
 - 4. ITT Bell & Gossett[<>]: www.bellgossett.com.
 - 5. Nexus Valve.
 - 6. NuTech Hydronic Products.
 - 7. Oventrop Corporation: www.ventrop.com/#sle.
 - 8. Pro Hydronic Specialties
 - 9. Taco, Inc: www.taco-hvac.com.
 - 10. Tyco Flow Control[<>]: www.tycoflowcontrol.com.
- C. Each terminal unit heating coil shall be provided with a hose kit including the following:
 - 1. Two 24-inch long flame-retardant hoses consisting of stainless steel braid over synthetic polymer or EPDM.
 - a. Rated for 350 psig at 250 degrees F.
 - 2. Supply fitting with combination ball valve, wye strainer and union with one pressure/temperature test fitting, air vent and hose end drain valve with cap and chain.
 - 3. Return balance fitting with two pressure/temperature test fittings, air vent, union and balance valve and ball valve.
- D. A calibrating flow meter shall be provided by the valve manufacturer that shall remain with the building owner after commissioning.
- E. Hose kit size shall be line size as the branch runout indicated. Provide reducer at coil connection.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- D. Provide valved drain and hose connection on strainer blowdown connection.
- E. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.
- F. Provide automatic cold water fill assembly on each separate hydronic system unless hydronic system contains an automatic glycol feed system.

3.02 TERMINAL EQUIPMENT CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in hydronic, steam and condensate, and refrigerant piping systems.
- B. Size for supply and return piping connections shall be same as for coil and equipment connections.
- C. Install control valves and accessories in accessible locations close to connected equipment.
- D. When control valve sizes are smaller than indicated pipe or equipment connection size, provide eccentric reducers on inlet and outlet of control valve.
- E. When coil banks are comprised of multiple coils, size individual coil supply and return piping connections same as manufacturer's provided coil connections.
- F. Install piping adjacent to coils to allow service and maintenance.
- G. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping.

- H. Provide bypass piping with globe valve around control valve as indicated. If multiple, parallel control valves are installed, only one bypass is required.
- I. Provide ports for pressure and temperature gages at coil inlet connections.
- J. Connect supply and return hydronic piping to terminal equipment and heat pump with unions and shutoff valves and hose kits. Hose kit size shall be line size as the branch runout indicated. Provide reducer at reheat coil connection.

END OF SECTION

**SECTION 23 31 00
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.

1.02 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in.} / \text{h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W/m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.
 - 1. Example: Apparent Thermal Conductivity (k-Value): 0.25 or 0.037.
- B. Pressure - Velocity Classification for Ductwork: As defined by SMACNA Duct Construction Standards - Metal and Flexible (latest edition), and applicable codes. Pressure classification for this specification:
 - 1. Low Pressure: Maximum 2500 FPM velocity; maximum 2.0 inches WG positive or -2.0 inches WG negative static pressure class.
 - 2. Medium Pressure: Maximum 4000 FPM velocity; maximum 4 inches WG positive or -3.0 inches WG or greater negative static pressure class.
 - 3. High Pressure: Velocity over 4000 FPM, pressure over 4 inches WG.
- C. Gauge:
 - 1. Steel Sheet: U.S. Standard gauge.
 - 2. Aluminum Sheet: Brown & Sharpe schedule.
 - 3. Steel Wire: Washburn & Moen gauge.
- D. Concealed Insulated Surfaces: Ductwork and equipment located in walls, partitions, floors, chases, shafts, and above ceilings.
- E. Exposed Insulated Surfaces: Ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.146 - Permit-Required Confined Spaces.
- B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
- H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- I. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.
- K. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.
- L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

1.04 PERFORMANCE REQUIREMENTS

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Design Professional. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.
- B. Size round ducts in lieu of rectangular ducts indicated in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

- A. Product Data: Provide data for all duct materials, duct liner, and duct connections.
- B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 2" pressure class and higher systems.
 - 1. CAD-generated and drawn to 1/4 inch equals 1 foot (1:50) scale.
 - a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - b. Duct layout indicating sizes and pressure classes.
 - c. Elevations of top and bottom of ducts.
 - d. Dimensions of main duct runs from building grid lines.
 - e. Fittings.
 - f. Reinforcement and spacing.
 - g. Seam and joint construction.
 - h. Penetrations through fire-rated and other partitions.
 - i. Equipment installation based on equipment being used on Project.
 - j. Duct accessories, including access doors and panels.
 - k. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Other systems installed in same space as ducts.
 - 3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
 - 4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).
- E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.
- F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports, AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members, and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

- D. Comply with ASHRAE and SMACNA Design Handbooks.

1.07 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Ductwork shall not be stored directly on the ground. Watermarked ductwork will not be accepted for installation.
- B. Lined ductwork shall have all open ends sealed during delivery and storage periods.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 33 19.
- C. Duct Shape and Material in accordance with Allowed Static Pressure Range:
 - 1. Round: Plus or minus 2 in-wc of galvanized steel.
 - 2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.
 - 3. Flat Oval: Plus 2 in-wc of galvanized steel.
- D. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
 - a. Low Pressure Supply: 1 inch w.g. pressure class, galvanized steel.
 - b. Medium Pressure Supply: 3 inch w.g. pressure class, galvanized steel.
 - c. Supply Air: 1/2 in-wc pressure class, galvanized steel.
 - d. Return and Relief Air: 1 in-wc pressure class, galvanized steel.
 - e. General Exhaust Air: 1 in-wc pressure class, galvanized steel.
- E. Duct Fabrication Requirements:
 - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 - 2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
 - 3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 - 4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
 - 5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
 - 6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 - 7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
 - 8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, FS Type B, with G90/Z275 coating.
 - 1. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- B. Stainless Steel for Ducts: ASTM A666, Type 304.
 - 1. No. 2D finish for concealed ducts and 4D for exposed ducts.
- C. PVC Coating for Steel Ducts: 4 mils polyvinyl chloride plastic on both sides.
 - 1. Acceptable by authorities having jurisdiction for use in fabricating ducts with UL 181, Class 1 listing. Lock-forming-quality, galvanized sheet steel complying with ASTM A 653/A 653M and having G90 coating designation.
- D. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- E. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Water based, non-fibrated, heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
 - 3. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 4. Duct Sealing Rolled Sealant:
 - a. Pressure sensitive, 40-year cycle, duct joint and general purpose rolled sealant. rated for use with sheet metal, duct board, flex board, PVC coated duct, and duct wrap vapor barriers.
 - b. 100 percent solid elastomeric modified butyl with aluminum foil backing.
 - c. Thickness: 17 Mil.
 - 5. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
 - 6. Flange and Joint Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel, threaded steel rod or steel cable with adjustable and removable locking mechanism.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 2. Strap, Rod and Cable Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and steel rod diameters. Comply with SMACNA and manufacturer's recommendations for cable and locking mechanism sizes.
 - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Cable Hanger System:
 - 1. Basis of Design: Gripple and Ductmate Clincher

2. Products shall carry a 5:1 safety factor.
 3. SMACNA compliance - Tested and verified to be an acceptable hanger per the SMACNA, HVAC Duct Construction Standards.
 4. UL Listing - UL 1598 luminaire fitting sizes 1 - 5, UL 2289 Conduit and Cable Hardware sizes 2, 3 and 4.
 5. Housing: Type ZA2 Zinc.
 6. Wedge: Sintered steel hardened to min. 56 Rockwell C.
 7. Spring: 302 Stainless Steel.
 8. End Cap: UV stabilised homopolymer propylene.
 9. Wire Rope: Grade galvanized high tensile steel wire rope to EN12385.
 10. Toggle Plate and End Stop: Zinc plated steel.
 11. Stud Eyelet and Barrel End: Zinc plated steel.
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.
- F. Flexible Duct Elbow Supports:
1. Universal-mount, 1-piece, fully adjustable, radius-forming brace to support 4-inch through 16-inch diameter flexible air ducts.
 2. Classified: UL 2043.
 3. Material: 100 percent recycled copolymer polypropylene.
 4. Support Frame Radius: 8 inches.
 5. Compliance for Flexible Duct Radius:
 - a. SMACNA HVAC Duct Construction Standards.
 - b. ASHRAE Advanced Energy Design Guides.
 - c. ADC Flexible Duct Performance and Installation Standards.
 6. Basis of Design: FlexRight (Durable Elbow Support)

2.04 DUCTWORK FABRICATION

- A. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation. Radius T's, bends and elbows less than 1-1/2 times width of duct on centerline are not allowed.
- B. Low Pressure Ductwork: Construct all ductwork using galvanized steel except as indicated.
1. Seams and Joints: Longitudinal seams shall be grooved seams, button punch snap lock or Pittsburgh lock. Transverse joints shall be drive slip. Joints 36-inch size and larger shall be manufactured duct joining system with downset corners, no-bolt design, or SMACNA T-25 formed on flanges with corner and cleat. Contractor option on smaller sizes.
- C. Medium and High Pressure Duct: Construct all ductwork using galvanized steel except as indicated.
1. Seams and Joints: Longitudinal seams shall be grooved seam type with sealant or gasket and center punched at 12-inch maximum intervals or Pittsburgh lock with sealant or gasket. Transverse joints shall be flanged and gasketed manufactured duct joining system with downset, bolted corner.
- D. Branch ducts to air devices shall be bell-mouth, conical or 45 degrees to round boot type fitting as a basis. Straight tap-ins, splitter dampers, and air extractors shall not be used.
- E. Duct connections to fans/air-handling units shall be designed for proper entering and leaving conditions at the fan to avoid any adverse system effect fan losses.

2.05 MANUFACTURED DUCTWORK, FITTINGS AND CONNECTORS

- A. Manufacturers:
 - 1. Ductmate Industries, Inc.:
 - 2. Eastern Sheet Metal.
 - 3. KB Duct
 - 4. LaPine Metal Products
 - 5. Lewis and Lambert
 - 6. Linx Industries
 - 7. Metal-Fab, Inc.: www.mtlfab.com.
 - 8. MKT Metal Manufacturing: www.mktduct.com.
 - 9. Nexus Inc.
 - 10. Norlock
 - 11. SEMCO Incorporated: www.semcoinc.com.
 - 12. S.E.T. Duct Manufacturing
 - 13. Sheet Metal Connectors.
 - 14. United McGill Corp.: www.unitedmcgill.com.
 - 15. Ward Industries, Inc.
- B. Material Requirements:
 - 1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
 - 2. Ungalvanized Steel: ASTM A1008/A1008M Designation CS (commercial steel), cold-rolled.
 - 3. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.
 - 4. Stainless Steel: ASTM A666, Type 304.
- C. Rectangular Metal Duct:
 - 1. Rectangular Double Wall Insulated: Rectangular spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
 - a. Insulation:
 - 1) Thickness: 1 inch.
 - 2) Material: Air.
- D. Round Metal Ducts:
 - 1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
 - 2. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).
- E. Round Spiral Duct:
 - 1. Round spiral lock seam duct with galvanized steel outer wall.
- F. Connectors, Fittings, Sealants, and Miscellaneous:
 - 1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
 - 2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
 - 3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - b. VOC Content: Not more than 250 g/L, excluding water.
 - c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
 - d. For Use with Flexible Ducts: UL labeled.
 - 4. Gasket Tape:

- a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.

2.06 FLEXIBLE DUCTS

- A. Flexible Air Ducts:
 1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 3. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
 4. Maximum Velocity: 4,000 fpm.
 5. Temperature Range: Minus 20 to 210 degrees F.
- B. Flexible Air Ducts:
 1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 3. Pressure Rating: From 10 in-wc to 1 in-wc negative.
 4. Maximum Velocity: 4,000 fpm.
 5. Temperature Range: Minus 20 to 210 degrees F.
- C. Vapor Barrier Insulated Flexible Air Ducts:
 1. UL 181, Class 1, two-ply polyester or vinyl film supported by helically wound spring steel wire.
 2. Insulation: Fiberglass insulation with polyethylene vapor barrier core.
 3. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
 4. Maximum Velocity: 4,000 fpm.
 5. Temperature Range: Minus 10 to 160 degrees F.

2.07 DUCT LINER

- A. Refer to Section 23 0713 - Duct Insulation.

PART 3 EXECUTION

3.01 PRE-INSTALLATION

- A. Field measure to determine exact conditions.
- B. Provide duct opening closure film on all ductwork until final connections are completed.
- C. Verify location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Refer to reflected ceiling plans, finish schedule, material finish specification, and shop drawings.
- D. Openings required for ductwork through structural elements in new construction shall be coordinated with the General Contractor. Shop drawings locating such openings shall be prepared in ample time to meet the construction schedule.
- E. Coordinate and install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install ducts with a clearance of 2 inches, plus allowance for insulation thickness.
- F. Coordination Process and Drawings:
 1. Provide coordination in determining adequate clearance and space requirements for mechanical equipment and electrical equipment and other items/equipment in the project. The Design Professional reserves the right to determine space priority of equipment in the event of interference between pieces of equipment, piping, conduit, ducts and equipment of the trades. The Design Professional will only review conflicts and given an opinion but will not perform as a coordinator.
 - a. The coordination process shall utilize the actual equipment being provided. Refer to manufacturer's data for physical size, access and maintenance requirements. Provide all code required clearances.

2. Provide coordination drawings indicating structural components, reflected ceiling layout, mechanical items, electrical items, and pneumatic tube systems. Indicate on the coordination drawings where components will be installed and how the service access area to such items shall be maintained, Illustrate items requiring access for maintenance or adjustment.
3. The Contractor will not be allowed any time extensions for participation in the coordination drawing process. The Contractor will not be allowed any contract cost extra for any additional fittings, rerouting or changes of duct size to equivalent sizes to those shown on the drawings that may be determined necessary through the coordination drawing process.
4. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance, and code-required clearances from the structure or other equipment and systems. Provide offsets and elevation changes in piping, conduit and ductwork as required to complete the Layout and Coordination Process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
5. Deviations from the contract documents that are necessary for overall system installation and coordination shall be brought to the attention of the Design Professional.
6. Access panels shall occur only in gypsum wallboard or plaster ceilings where indicated on the drawings. Access to mechanical and electrical items shall be through accessible acoustical ceiling areas. Additional access panels will not be allowed without written approval from the Design Professional at the coordination drawing stage and only after alternatives are reviewed. Layout changes shall be made to avoid additional access panels. If additional access panels are required, they shall be provided at no additional cost to the Owner.
7. Soffit penetrations and light alcoves shall be fully coordinated with hanging devices, studs, fire/smoke ratings, and structural support requirements.
8. Drawings shall be prepared at 1/4 inch = 1 foot, 0 inches (minimum).
 - a. Coordination participants shall provide equipment installation and clearance requirements. This information shall be indicated on the coordination drawings.
 - b. Coordination drawings shall indicate the following major system components (including insulation, hub or connection widths with verification of turning radius):
 - 1) All general construction components
 - 2) Roof drain leaders
 - 3) Large waste piping
 - 4) Sprinkler mains
 - 5) Equipment located above the ceiling
 - 6) Heating hot water piping
 - 7) Chilled water piping
 - 8) Conduit runs 2 inches and larger
 - 9) Cable tray
 - 10) Bus duct
 - 11) Recessed light fixtures
 - 12) Building wiring or cable trays
 - 13) Ceiling heights as shown in contract documents and thickness of system
 - 14) Soffits (including framing of supports)
 - 15) Access points and clearances required
 - 16) Access panels
 - 17) Valves
 - 18) Dampers
 - 19) Coils
 - 20) Ductwork
 - 21) Fire-rated wall, partition, and floor penetrations
 - 22) Steam and condensate piping

- 23) Space allotted for future utilities
- 24) Equipment in mechanical and electrical spaces
- c. Information shall be delineated to indicate distances from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers.
- 9. The Contractor and subcontractors responsible for items of work located in or above ceilings shall participate in the coordination drawing process. Participation is mandatory. If the Contractor or subcontractor fails to participate in the coordination drawing process, the Owner reserves the right to do the following:
 - a. Stop construction progress payments for work performed by the Contractor. Payments will be reinstated only after the Contractor or subcontractor resumes participation in the coordination drawing process.
 - b. Require the relocation and resizing of components as necessary to ensure components will be installed as intended. In the event the Contractor did not participate in the coordination process, the Contractor will not be entitled to contract cost increases or time extensions due to Owner-initiated changes in the work.
 - c. The Contractor shall be held responsible for unnecessary rework that is attributable to failure to participate in the coordination process.
- 10. The coordination drawings shall be submitted to the Design Professional and Owner's representative for review. The submitted coordination drawings shall indicate which contractors participated in the process and where conflicts appear to occur even after the priority ranking of utility routing has been utilized. In the event that conflicts require input from the Design Professional, recommended solutions will be provided with the coordination drawings for review by the Design Professional. The Design Professional will review and return an opinion to the contractors for implementation. All contractors shall agree to the final coordinated layout by signing off on the coordination drawings before any construction can begin.
- 11. Maintain an updated set of coordination drawings at the job site reflecting changes, modifications and adjustments. Changes shall be reflected and sets or new sheets reissued to the Design Professional and the Owner for review on a monthly basis with changes "clouded" and brought to the attention of the Design Professional and the Owner.
- 12. When a change order request is issued, the affected subcontractors shall review the coordination drawings and bring to the attention of the Contractor and the Design Professional revisions necessary to the work of others not directly affected by the change order.
- 13. Contractors that fail to cooperate in the coordination drawing effort shall be responsible for all costs incurred for adjustments to the work made necessary to accommodate installations. Provide adequate clearance and access through accessible ceilings. Conflicts that result after the coordination drawings are signed off will be the responsibility of the Contractor or subcontractor who did not properly identify their work or installed the work improperly.

3.02 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
 - 1. Hanging, Sealing and Supporting:
 - a. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
 - b. Support vertical ducts at a maximum interval of 16 feet and at each floor.
 - c. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
 - d. Install concrete inserts before placing concrete.
 - e. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1) Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

- f. Seal ducts before external insulation is applied.
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Keep openings covered until ready for continuing duct run or final connections. Clean all unlined supply air ductwork during installation by swabbing with a non-toxic, non-flammable cleaning agent.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Provide volume dampers in all branch take-offs connecting to diffusers, registers and grilles, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
 - 1. Provide access door or remote damper operator to adjust dampers.
 - 2. Registers and diffusers with dampers shall be used only if devices are installed directly on the trunk duct.
- G. Provide volume dampers in all duct systems where indicated and as required to perform complete system test and balance. Coordinate all volume damper locations with the test and balance contractor.
 - 1. Provide access door or remote damper operator to adjust dampers.
- H. Flexible Ducts: Connect to metal ducts with draw bands.
 - 1. Flexible ductwork shall be attached to metal collars or sleeves with draw bands. Duct adhesive shall be added to connections as required per duct system sealing class. Metal collars or sleeves 12 inches and larger shall contain draw band holding beads.
 - 2. Low Pressure Ductwork: Peel back vapor barrier and fold back insulation; then secure to duct collar or sleeve with metal or nylon clamps or draw bands; then fold over insulation and vapor barrier and secure with two stretched wraps of approved cut tape.
 - 3. Medium Pressure Ductwork: Peel back vapor barrier and fold back insulation; then secure to duct collar or sleeve with approved duct adhesive; then secure with metal draw bands or clamps; then fold over insulation and vapor barrier and secure with two stretched wraps of approved duct tape. Take two or three tucks in vapor barrier while taping.
 - 4. Support flexible ductwork following manufacturer's recommendations and SMACNA HVAC Duct Construction Standards.
 - 5. Final connections to air inlets and outlets may be made with flexible ductwork. Expanded length of flexible ductwork shall not exceed 36 inches. Path of flexible ductwork shall not exceed 45 degrees unless flexible duct elbow supports are provided.
 - 6. Flexible Duct Elbow Supports:
 - a. Install flexible duct elbow supports in accordance with manufacturer's instructions.
 - b. Install flexible duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree bends to eliminate flexible duct kinks and airflow restrictions.
 - c. Install flexible duct elbow supports at flexible duct 90-degree bends at following locations:
 - 1) Diffusers.
 - 2) Grilles.
 - 3) Registers.
 - 4) Duct take-offs and taps.
 - 5) Air devices with round inlets and outlets.
 - 6) HVAC equipment with round inlets and outlets.
 - 7) As indicated.
- I. Kitchen Hood Exhaust: Provide residue traps at the base of vertical risers with provisions for the cleanout.

- J. Underground Ducts: Slope to plenums or low pump-out points at 1:500. Provide access doors for inspection.
- K. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
- L. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.
- M. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- N. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.
- O. Use double nuts and flat washer on threaded rod supports.
- P. Connect terminal unit inlets to supply ducts directly or with one foot maximum length of straight run of flexible duct. Do not use flexible duct to change direction.
- Q. Set plenum doors at 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- R. At exterior wall louvers, seal duct to louver frame.
- S. Louver Fit-out:
 - 1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.
 - 2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.
- T. Plenums and Casings:
 - 1. Mount floor-mounted casings on 4 inch high concrete curbs.
 - 2. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.
- U. Penetrations:
 - 1. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
 - 2. Provide sleeves at all duct penetrations through walls, floors and roofs. Openings through sound-rated partitions shall have annular space stuffed with fiberglass insulation for full thickness of wall.
 - 3. Provide closure flanges around exposed ductwork at wall and ceiling penetrations, 1-1/4 inches wide minimum.
- V. Provide 2-inch deep bitumastic coated drip pans on all non-ducted hoods, fans or penthouses used for relief or exhaust air service. Pans shall be 12 inches larger all around than roof opening with clear vertical openings between pan and structure as indicated. Insulate pan where indicated.
- W. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.
- X. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- Y. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

Lewis Central High School
Entry Addition

- Z. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- AA. Prevent passage of unfiltered air around filters with felt, rubber, neoprene gaskets, or other approved safing material.
- BB. Paint ductwork visible behind wall-mounted air outlets and inlets matte black.
- CC. Provide flexible connect between ductwork and all moving equipment.

**SECTION 23 33 00
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices.
- B. Duct access doors.
- C. Duct test holes.
- D. Flexible duct connectors.
- E. Volume control dampers.
- F. Miscellaneous Products:
 - 1. Internal strut end plugs.
 - 2. Duct opening closure film.
- G. Duct accessory hardware.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.
- J. UL 555 - Standard for Fire Dampers.
- K. UL 555S - Standard for Smoke Dampers.

1.02 SUBMITTALS

- A. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate for shop and field fabricated assemblies including volume control dampers and duct access doors.
 - 1. Special fittings.
 - 2. Motorized-control damper installations.
 - 3. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
 - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers, combination fire and smoke dampers, and smoke dampers.
- D. Project Record Drawings: Record actual locations of access doors and test holes.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fusible Links: One of each type and size.
- F. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Access Doors, Devices and Accessories:
 - 1. Acudor Products Inc: www.acudor.com.

2. Carlisle HVAC Products: www.carlislehvac.com/sle.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing: www.elgenmfg.com.
5. Flexmaster U.S.A., Inc.
6. Greenheck: www.greenheck.com
7. Krueger: www.krueger-hvac.com.
8. Lloyd Industries, Inc.: www.firedamper.com.
9. Nailor Industries Inc: www.nailor.com.
10. PCI Industries, Inc; Pottorff Brand [$\leftrightarrow$]: www.pottorff.com.
11. Ruskin Company: www.ruskin.com.
12. SEMCO Incorporated: www.semcohvac.com.
13. Titus: www.titus-hvac.com.
14. United Enertech
15. Ventfabrics, Inc.
16. Vent Products Company, Inc.
17. Young Regulator Co
18. Ward Industries, Inc: www.wardind.com.

B. Dampers:

1. Air Balance, Inc.
2. Greenheck: www.greenheck.com
3. Louvers & Dampers, Inc: www.louvers-dampers.com.
4. Lloyd Industries, Inc.[$\leftrightarrow$]: www.firedamper.com.
5. Nailor Industries Inc[$\leftrightarrow$]: www.nailor.com.
6. NCA Manufacturing, Inc.: www.ncamfg.com
7. Pottorff/PCI Industries, Inc; Pottorff Brand : www.pottorff.com.
8. Rossi: www.rossihardware.com
9. Ruskin Company: www.ruskin.com.
10. Tamco
11. United Enertech: www.unitedenertech.com/#sle.
12. Vent Products Company, Inc.
13. Ward Industries, Inc: www.wardind.com.

C. See paragraphs below for additional manufacturers.

2.02 SHEET METAL MATERIALS

- A. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- B. Stainless Steel: ASTM A 480/A 480M.
- C. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 AIR TURNING DEVICES

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually and mounting straps.
- B. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.04 DUCT ACCESS DOORS

- A. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
 - 5. Access doors shall be provided with sash locks only when clearance space does not allow a door swing.
- B. Access doors with sheet metal screw fasteners are not acceptable.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with foam insulation fill and 1-inch thickness.
 - 1. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.
 - 1. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

2.05 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.06 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- D. Maximum Installed Length: 14 inch.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 degrees F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 degrees F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd.
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 degrees F.

2.07 VOLUME CONTROL/BALANCING DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Single Blade Dampers:
 - 1. Fabricate for duct sizes up to 6 by 30 inch.
 - 2. Blade: 24 gauge, 0.0239 inch, minimum.
- C. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-cripped blades in prime-coated or galvanized-channel frame with suitable hardware.
 - 1. Blade: 18 gauge, 0.0478 inch, minimum.
- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. Quadrants:
 - 1. Provide positive-locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.08 MISCELLANEOUS PRODUCTS

- A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.
- B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
 - 1. Thickness: 2 mils.
 - 2. High tack water based adhesive.
 - 3. UV stable light blue color.
 - 4. Elongation Before Break: 325 percent, minimum.
- C. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.09 REMOTE VOLUME DAMPER BALANCING POSITION CONTROL (MANUAL ACTUATOR)

- A. Young Regulator, Bowden Cable Controls Model No. 270-275 or 896 C, concealed ceiling damper regulator with 7/8-inch cap and #030 wrench adjustable with #030 wrench.
- B. Volume damper shaft mounting hardware as required for installation of controls.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 12 x 12 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct access doors to all internal devices requiring inspection for maintenance, including, but not limited to fire dampers, combination fire/smoke dampers, duct smoke detectors, coils (entering side), humidifiers (with window) and similar devices. Coordinate location devices in access door to allow proper access to equipment once project has been completed. Duct access doors shall be square and sized 2 inches less than the width of the duct. Maximum door size shall be 18 inches. If required, provide multiple doors for adequate access to equipment.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.
- F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.
- I. Provide volume control (balancing) dampers on duct take-off to all air inlets and outlets, diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
 - 1. Provide access door or remote damper operator to adjust dampers. Registers and diffusers with dampers shall be used only if devices are installed directly on the trunk duct.
- J. Provide volume control (balancing) dampers in all duct systems where indicated and required to perform complete system test and balance. Coordinate all volume damper locations with the test and balance contractor.
 - 1. Provide access door or remote damper operator to adjust dampers. Registers and diffusers with dampers shall be used only if devices are installed directly on the trunk duct.
- K. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- L. Label all duct access doors.
- M. Volume dampers located above inaccessible ceilings shall be controlled by remote volume damper position controls.
- N. Provide turning vanes in all mitered duct turns.
- O. Provide filter gage for each filter bank.

3.03 REMOTE VOLUME DAMPER POSITION CONTROLS

- A. Provide at all volume dampers that are not accessible from access panels.
- B. Extend cable and locate adjuster to an area that is accessible by an access panel or removal of an accessible ceiling component.
- C. Where dampers are inaccessible, provide ceiling- or wall-mounted adjuster with cap or terminal.
- D. Submit locations of ceiling- or wall-mounted adjusters to Architect/Engineer for review prior to installation.

3.04 ADJUSTING

- A. Adjust duct accessories for proper settings.

3.05 DEMONSTRATION

- A. Demonstrate the following to the owner's representative and maintenance personnel:

Lewis Central High School
Entry Addition

1. Access to all volume damper position controls.

END OF SECTION

**SECTION 23 36 00
AIR TERMINAL UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.
 - 1. Variable-volume units.
- B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
- C. AHRI 880 (I-P) - Performance Rating of Air Terminals.
- D. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.
- E. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.02 SUBMITTALS

- A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
 - 1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.
- C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.
- D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
- E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide one year manufacturer warranty for fan powered air terminal units.

1.05 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
 - 1. Coordinate maintenance clearance requirements of all terminal unit controls components prior to ordering and submitting units for review.

PART 2 PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 MANUFACTURERS

- A. Anemostat.
- B. Carnes Company: www.carnes.com.
- C. Carrier Corp.
- D. Environmental Technologies, Inc.; Enviro-Air Div.
- E. Greenheck; www.greenheck.com.
- F. Johnson Controls, Inc: www.johnsoncontrols.com.
- G. Krueger; www.krueger-hvac.com
- H. Metalaire Inc.; Metal Industries Inc.
- I. Nailor Industries Inc.: www.nailor.com.
- J. Price Industries.; www.priceindustries.com.
- K. Titus; www.titus-hvac.com.
- L. Trane Inc: www.trane.com.
- M. Tuttle & Bailey.
- N. Siemens.

2.03 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, room number served, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

2.04 GENERAL

- A. Basic Assembly:
 - 1. Factory insulated casing, reheat coil, access door and sound attenuating sections.
 - 2. Plenum Air Inlets: Round stub connections for duct attachment.
 - 3. Plenum Air Outlets: S slip and drive connections.
 - 4. Access: Insulated, removable panels or doors for access to heating coils, dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
 - 5. Heating coil access doors located upstream of heating coil for coil cleaning purposes.
- B. Basic Unit:
 - 1. Configuration: Air volume damper assembly inside unit casing.
 - 2. Locate control components inside protective metal enclosure.
 - 3. Heating coil on fan powered units shall be located on the supply air discharge outlet.

2.05 SINGLE-DUCT, VARIABLE-VOLUME UNITS

- A. Acoustic Performance Requirements:
 - 1. Sound ratings of air distribution assemblies: Not to exceed 30 NC at a .50" static pressure drop across the unit, and the downstream static pressure of .25".
- B. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
 2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
 3. Basic Unit:
 - a. Mount damper operator to position damper normally open.
- C. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 - a. Casing leakage to meet ASHRAE Std 130.
 2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 4. Acceptable Liners:
 - a. 3/4 inch thick adhesive of polyurethane or neoprene foam complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E84.
 - b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.
- D. Sound Attenuator:
1. Provide if required to meet scheduled acoustical performance requirements.
 2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
 3. At 2000 fpm inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 in-wc.
- E. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
 2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
 3. Incorporate low leak damper blades for tight airflow shutoff.
- F. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
 2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
 3. Coil leak tested to minimum 350 psig.
 4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.
- G. Controls:
1. DDC (Direct-Digital Controls):
 - a. Include a factory-installed, unit-mounted, direct-digital controller.
 2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
 - a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.
- B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Provide a minimum of 18" clearance to all servicable components.
- B. Provide all code required service clearances.
- C. Provide code required access clearances, 36" minimum, to all electrical components and panels.
- D. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- E. Coordinate locations of control components, heating coil piping and access door or panels with installation space available. Adjusting indicated location of terminal unit and heating coil piping is acceptable if necessary to acheive required service clearances.
- F. Provide 24" x 24" ceiling access doors at each unit or locate units above easily removable ceiling components.
- G. Support units individually from structure with wire rope complying with SMACNA (SRM).
- H. Support fan-powered units from structure vibration isolating hangers per manufacturer's recommendations.
- I. Embed anchors in concrete in accordance with ASTM E488/E488M.
- J. Do not support units from adjacent ductwork.
- K. Connect to ductwork in accordance with Section 23 31 00.
- L. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.
- M. Verify that electric power is available and of the correct characteristics.
- N. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- O. Provide 10" x 8" (min.) access doors upstream of reheat coils, as indicated, for cleaning and service.

3.03 CONNECTIONS

- A. Provide straight run of inlet supply ductwork as required by manufacturer.
- B. Provide flexible duct connection on discharge (supply) air connection to fan powered terminal units as indicated.
- C. Piping installation requirements are specified in other sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Install piping adjacent to air terminal units to allow service and maintenance.
- E. Hot-Water Piping: In addition to requirements in Section 23 21 13 - Hydronic Piping, connect heating coils to supply with shutoff valve, strainer, PTT and union or flange; and to return with PTT, control valve, balancing valve and union or flange.
- F. Connect ductwork according to 23 3100 - HVAC Ducts and Casings. Prvide inlet and outlet duct connections as recommended by air terminal unit manufacturer to achieve proper performance.

3.04 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

3.05 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow.

3.06 FIELD QUALITY CONTROL

- A. Provide manufacturer's field representative to inspect and instruct field-assembled components and equipment installation, including connections. Report results in writing.
 - 1. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - b. Verify that controls and control enclosure are accessible.
 - c. Verify that control connections are complete.
 - d. Verify that nameplate and identification tag are visible.
 - e. Verify that controls respond to inputs as specified.
 - 2. Leak Test:
 - a. After installation, fill water coils and test for leaks.
 - b. Repair leaks and retest until no leaks exist.
 - 3. Operational Test:
 - a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties.
 - c. Replace damaged and malfunctioning controls and other equipment.
 - d. Remove and replace malfunctioning units and retest as specified above.

3.07 CLEANING

- A. Vacuum clean coils and inside of units.

END OF SECTION

**SECTION 23 37 00
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Registers/grilles:
- C. Induction difusers.
- D. Door grilles.

1.02 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets.
- C. SMACNA (ASMM) - Architectural Sheet Metal Manual.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

- A. Specification Compliance Review.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
- D. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.
- E. Samples for Verification: Of diffusers, registers, and grilles, in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.
- F. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of intake and relief ventilators and are based on the specific equipment indicated.
 - 1. Do not modify intended aesthetic effects, as judged solely by Design Professional, except with Design Professional's approval. If modifications are proposed, submit comprehensive explanatory data to Design Professional for review.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. American Louver Company: www.americanlouver.com.
- B. Carnes, a division of Carnes Company Inc: www.carnes.com/sle.
- C. Dadanco: www.dadanco.com
- D. Krueger: www.krueger-hvac.com.
- E. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.
- F. NCA
- G. Nailor Industries.
- H. Price Industries: www.price-hvac.com.
- I. Ruskin Company: www.ruskin.com/#sle.
- J. Titus: www.titus-hvac.com.
- K. Tuttle and Bailey: www.tuttleandbailey.com/sle.
- L. Trox Technik.

2.02 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.03 MANUFACTURED UNITS

- A. General: Sizes, types and capacities shall be as indicated.
- B. Ceiling and wall frame types and dimensions shall be verified from architectural drawings.
- C. Verify ceiling frame and panel style and dimension with reflected ceiling plan, room finish schedule and material type.
- D. If final diffusers or registers have a higher sound level than those specified or if dimensions are not compatible with finished walls, ceilings, floors or architectural air cabinets (millwork), installed diffusers and registers shall be replaced at the Contractor's expense.
- E. Outlets and inlets shall be factory baked enamel finished with color selected by Design Professional unless indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide volume control (balancing) dampers on duct take-off to all air inlets and outlets, diffusers, grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. Provide volume dampers in all duct systems where indicated and required to perform complete system test and balance. Coordinate all volume damper locations with the test and balance contractor.

1. Provide access door or remote damper operator to adjust dampers. Registers and diffusers with dampers shall be used only if devices are installed directly on the trunk duct.
- F. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 91 23.
- G. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- H. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Design Professional for a determination of final location.
- I. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- J. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work. Install roof curb level. Install with openings no less than 36 inches above finished roof surface.
- K. Secure intake and relief ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.
- L. Install louvers in accordance with manufacturer's instructions.
- M. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.
- N. Install intake and relief ventilators with clearances for service and maintenance.
- O. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- P. Label intake and relief ventilators according to requirements specified.
- Q. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- R. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, as directed and as required to prevent drafts before starting air balancing.
- B. Adjust air patterns per manufacturer's recommendations based on installed conditions.

3.04 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic cabinet unit heaters.

1.02 REFERENCE STANDARDS

- A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

1.03 SUBMITTALS

- A. Specification Compliance Review.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - 2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
 - 3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
 - 4. Submit the following for blower-coil units indicating:
 - a. Overall dimensions including installation, operation, and service clearances.
 - b. Lift points, recommendations, and center of gravity.
 - c. Unit shipping, installation, and operating weights including dimensions.
 - d. Fan curves with specified operating point clearly plotted.
 - e. Safety and start-up instructions.
 - 5. Indicate mechanical and electrical service locations and requirements.
- D. Certificates: Certify that coils are tested and rated in accordance with AHRI 410. Coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.
- E. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- F. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- H. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Filters: One set of each type and size.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

- A. Provide 5 year manufacturer's warranty for _____.

PART 2 PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules with Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 HYDRONIC CABINET UNIT HEATERS

- A. Manufacturers:
 - 1. Modine Manufacturing Company: www.modineHVAC.com/#sle.
 - 2. Sterling Hydronics a Mestek Company: www.sterlingheat.com/#sle.
 - 3. Trane, a brand of Ingersoll Rand: www.trane.com.
 - 4. Daikin Applied .
 - 5. Sigma
 - 6. Price
 - 7. Rosemex Products.
 - 8. Airtherm; a Mestek Company.
 - 9. Carrier Corporation.
 - 10. Dunham-Bush, Inc.
 - 11. Engineered Air Ltd.
 - 12. International Environmental Corporation.
 - 13. USA Coil & Air.
 - 14. Zehnder Rittling.: www.rittling.com
- B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.
- C. Coils:
 - 1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
 - a. Minimum Coil Wall Thickness: 0.015 inch
 - b. Minimum Working Pressure: 125 psig.
 - 2. Heating Hot Water: Suitable for working temperatures up to a maximum not less than 200 degrees F.
- D. Cabinet: Minimum 16 gauge, 0.0598 inch thick sheet steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, integral air outlet, and inlet grilles.
- E. Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.
- F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
- H. Control: Factory wired, solid state, infinite speed control, located in cabinet.
- I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Provide all code required service clearances.
- C. Provide code required access clearances, 36" minimum, to all electrical components and panels.
- D. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- E. Do not damage equipment or finishes.
- F. Baseboard Radiation:
 - 1. Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated.

2. Center elements under window with elements of equal length centered under each window for multiple windows.
 3. Install end caps where units butt against walls.
- G. Finned Tube Radiation:
1. Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated.
 2. Center elements under window with elements of equal length centered under each window for multiple windows.
 3. Install wall angles and end caps where units butt against walls.
 4. Align cabinet joints with window mullions.
 5. Install wall angles where units butt against walls and align cabinet joints with window mullions.
- H. Cabinet Unit Heaters:
1. Install as indicated.
 2. Coordinate to ensure correct recess size for recessed units.
- I. Units with Hydronic Coils:
1. Provide with shut-off valve on supply piping and tamper-proof, balancing valve with memory stop on return piping.
 2. If not easily accessible, extend air vent to exterior surface of cabinet for ease of servicing.
 3. Provide float operated automatic air vents with stop valve for cabinet unit heaters, fan coil units, and unit heaters.

3.03 TERMINAL EQUIPMENT CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in hydronic, steam and condensate, and refrigerant piping systems.
- B. Size for supply and return piping connections shall be same as for coil and equipment connections.
- C. Install control valves and accessories in accessible locations close to connected equipment.
- D. When control valve sizes are smaller than indicated pipe or equipment connection size, provide eccentric reducers on inlet and outlet of control valve.
- E. When coil banks are comprised of multiple coils, size individual coil supply and return piping connections same as manufacturer's provided coil connections.
- F. Install piping adjacent to coils to allow service and maintenance.
- G. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping.
- H. Connect steam piping with gate valve and union and steam condensate piping with union, strainer, trap, and gate valve to allow coils to be disconnected without draining piping.
- I. Provide bypass piping with globe valve around control valve as indicated. If multiple, parallel control valves are installed, only one bypass is required.
- J. Provide ports for pressure and temperature gages at coil inlet connections.
- K. Connect condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Provide cleanouts in piping at changes of direction.

3.04 FIELD QUALITY CONTROL

- A. Provide manufacturer's field representative to test, inspect, instruct, and observe.

3.05 CLEANING

- A. After construction and painting is completed, clean exposed surfaces of units.
- B. Vacuum clean coils and inside of units.

Lewis Central High School
Entry Addition

- C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- D. Install new filters.

3.06 PROTECTION

- A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

DIVISION 26 - ELECTRICAL

**SECTION 26 04 00
COMMON REQUIREMENTS FOR ELECTRICAL**

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the general requirements of these specifications and shall apply to all phases of the work specified, shown on the drawings, or required to provide for complete installation of all systems for this project.
- B. This Section includes basic materials and methods to complement other Division 26 Sections.
- C. This Section includes basic materials and methods to complement Section 28 46 00 - Fire Detection and Alarm.

1.02 WARRANTIES

- A. Warrant materials, workmanship and equipment against defects for a period of one year after the date of substantial completion.
- B. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those divisions of the Project Manual.
- C. Repair or replace, at no additional cost to the Owner, any item which may become defective within the warranty period.
- D. Any manufacturers' warranties concerning any item installed will run to the benefit of the Owner.
- E. The Contractor agrees not to void or impair, or to allow Sub-Contractors to void or impair, any warranties regarding products or items installed as part of this project.
- F. The repair of faulty workmanship shall be considered to be included in the contract.

1.03 ALTERNATES

- A. Alternates, if required, shall be as described in the "Alternates" section of this Project Manual, as described on the proposal form, or as indicated on the drawings.

1.04 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda, properly issued to each person holding documents, prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.05 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.

- D. The Architect shall be the sole judge regarding interpretations of conflicts within contract documents.

1.06 DEFINITIONS

- A. The following definitions shall apply throughout the contract documents:
1. Architect: Architect or Engineer
 2. Code: Applicable national, state and local codes
 3. Mechanical: Plumbing, HVAC, and Fire Protection work required by the Contract Documents
 4. Electrical: Electrical and Fire Alarm work required by the Contract Documents
 5. Contractor: Any Contractor performing work required by the Contract Documents
 6. Indicated: Noted, scheduled or specified
 7. Selected: Selected by the Architect.
 8. Provide: Furnish, install, connect and tested complete and ready for use
 9. Furnish: Supply and deliver to the site ready for installation
 10. Install: Install complete, per Contract Documents and manufacturer's requirements.
 11. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
 12. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
 13. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
 14. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
 15. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
 16. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
 17. Damp Locations: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.
 - a. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.
 18. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.07 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols on the plans.

1.08 ABBREVIATIONS

- A. Refer to abbreviations list on the Drawings.
- B. The following abbreviations apply throughout the Contract Documents:
1. ADA: Americans with Disabilities Act
 2. ANSI: American National Standards Institute
 3. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
 4. ASME: American Society of Mechanical Engineers
 5. ASTM Specification: Standard specifications of the American Society for Testing Materials
 6. FM: Factory Mutual Engineering Corporation
 7. IRI: Industrial Risk Insurers

8. NEC: National Electrical Code, latest edition
9. NEMA: National Electrical Manufacturers Association
10. NFPA: National Fire Protection Association
11. UL or Underwriters: Underwriters Laboratories, Inc.

1.09 CODES

- A. The work shall be performed by persons skilled in the trade involved and shall be done in a manner consistent with normal industry standards.
- B. The work shall conform to all applicable sections of currently adopted editions of the following codes, standards, and specifications:
 1. International Building Code (IBC)
 2. International Fire Code (IFC)
 3. International Energy Conservation Code (IECC)
 4. Safety and Health Regulations for Construction
 5. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards
 6. National Electrical Code (NEC)
 7. National Electrical Safety Code (NESC)
 8. National Fire Protection Association (NFPA)
 9. Life Safety Code (NFPA 101)
 10. Factory Mutual Global Engineering (FMG)
 11. Underwriters' Laboratories, Inc. (UL)
 12. National Electrical Manufacturers Association (NEMA)
 13. Institute of Electrical and Electronics Engineers (IEEE)
 14. Insulated Power Cable Engineers Association (IPCEA)
 15. Telecommunications Industry Association (TIA)
 16. Building Industry Consulting Service International (BICSI)
 17. Applicable national, state and local codes
- C. Where there is a conflict between the code and the Contract Documents, the code shall have precedence only when it is more stringent than the Contract Documents.
 1. Items that are allowed by the code but are less stringent than those specified shall not be substituted.

1.10 PERMITS

- A. The Contractors shall familiarize themselves with requirements regarding permits, fees, etc., and shall comply with them.
- B. Permits, licenses, inspections and arrangements required for the work shall be obtained by the Contractor at his expense.
- C. Utilities shall be installed in accordance with the local rules and regulations.

1.11 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
 1. Primary Design Products: Primary design products are those products around which the project was designed in terms of capacity, performance, physical size and quality.
 2. Primary design products are indicated by use of a single manufacturer's name, model number or similar data on drawings or schedules or within the specifications.
 3. Provide primary design products unless substitutions are made in accordance with the following paragraphs.

4. **Acceptable Equivalent Substitutions:** Acceptable equivalent substitutions are products of manufacturers other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements:
 - a. The product shall be manufactured by one of the acceptable manufacturers listed in the Project Manual, drawings, or addenda.
 - b. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - c. The Contractor providing the substitution shall bear the total cost of changes due to substitutions. These costs may include additional compensation to the Architect for redesign and evaluation services, increased cost of work by the Owner or other Contractors, and similar considerations.
5. **Performance Requirements:** Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.
6. **Compliance with Standards, Codes and Regulations:** Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.
- C. Proposed substitutions will be judged on the basis of quality, performance, appearance and on the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
- D. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.12 SUBMITTALS

- A. **Shop Drawings, Product Data and Samples:**
 1. Other sections in the Project Manual shall be adhered to if more stringent than the following paragraphs.
 2. When required by other sections of this Project Manual, submit shop drawings, product data or samples to the Architect for review.
 3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
 4. A completed copy of the transmittal form included with the Project Manual shall accompany each submittal.
 5. Submittals shall be numbered consecutively.
 6. Unless otherwise noted, submit one copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
 7. Where samples are required, submit one (1) sample of each required item.
 8. Shop drawings are drawings, diagrams, schedules and other data specifically prepared for this project by the Contractor, Manufacturer, Supplier, or Distributor to illustrate some portion of the work. Shop Drawings shall also detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
 - a. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 9. Product data are illustrations, standard schedules, performance charts, instruction brochures, diagrams and other information furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate a material, product or system for some portion of the work.
 10. Samples are physical examples furnished by the Contractor, Manufacturer, Supplier, or Distributor to illustrate materials, equipment or workmanship and to establish the standards by which the work will be performed.
 11. Each submittal shall clearly indicate proposed items, capacities, characteristics and details in conformance with contract documents. Equipment items shall be marked with the same

item number as used on drawings or schedules. Capacities, dimensions and special features required shall be certified by the manufacturer.

12. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect.
 13. When required by other sections of this Project Manual, the Contractor shall submit a Specification Compliance Review consisting of a paragraph-by-paragraph review of the specifications and addenda with the following marked for each paragraph. Markings may be made in the margins of the original specification or addenda. Unless a deviation or exception is specifically noted in the Specification Compliance Review, it is assumed that the equipment, product, or material is in complete compliance with the contract documents. Submit Specification Compliance Review with shop drawings and product data.
 - a. "C": Comply with no exceptions.
 - b. "D": Comply with minor deviations. For each deviation, provide the reasons for the deviation and how the intent of the specification can be satisfied.
 - c. "E": Exception. Equipment, product, or material does not comply. For each exception, provide reasons for the exception, and suggest possible alternatives for the Owner's consideration.
 - d. "N/A": The paragraph does not apply to the proposed equipment, product, or material.
 14. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
 15. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data or samples.
 16. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Architect's review of those drawings.
 17. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been reviewed by the Architect. Such portions of the work shall be in accordance with reviewed submittals.
 18. The successful Contractor/Supplier may, at their option, obtain DXF or AutoCad DWG electronic drawing files for use in preparation of shop drawings.
 - a. This information is available from Alvine Engineering upon written request.
 - b. A non-refundable handling charge of \$10.00 per drawing file requested will be required at the time of receipt of the electronic files.
 - c. The use of these drawing files is intended solely for the preparation of drawings as required by these contract documents.
 - d. Any other use is strictly prohibited by copyright laws.
 - e. The user of these electronic drawing files assumes full responsibility for their accuracy and scale.
- B. Operation and Maintenance Manuals:
1. Prepare three (3) operation and maintenance manuals for the equipment furnished. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than 30 days prior to substantial completion of the project. Manuals not meeting the following requirements may be rejected by the Architect.
 2. Each manual shall be assembled in a three-ring binder with hard cover and plastic finish. Binders shall not exceed a 3-inch thickness. Where more than one binder is required, the manuals shall be separated into a logical grouping, i.e., "Mechanical", "Electrical", "Maintenance", "Operation", "Parts", Shop Drawings", etc. Each binder shall have the following information clearly printed on its front cover:
 - a. Project name and address.

- b. Portion of the work covered by each volume (if more than one volume in the set). Where more than one volume is required, label each volume as "Volume _____ of _____".
 - c. Name, address and telephone number of Contractor and Sub-Contractors including night or emergency number.
3. Manual shall include, but shall not be limited to, the following:
- a. A Complete Index. Contractor may submit the index to the Architect for review prior to submittal of complete manuals if desired.
 - b. Names, Addresses and Telephone Numbers. This list shall include the manufacturer and local representative who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the binder.
 - c. Startup, Operation and Shutdown Procedures. Provide a written description of procedures for startup, operation and shutdown of each electrical item or system. This description shall include switches to operate, buttons to push, etc., in proper sequence, and the location of switches, starters, and pushbuttons. Description shall include item references or labels used in the contract documents unless otherwise instructed in advance by the Owner.
 - d. Equipment Accessory Schedule. Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required and the manufacturer of renewable items.
 - e. Manufacturer's Operation and Maintenance Manuals and Parts Lists.
 - f. Emergency Procedures. Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
 - g. One copy of shop drawings and product data, clearly marked for each item furnished using the designation label specified or indicated on Drawings.
 - h. Manufacturers' warranty information.
 - i. Normal Maintenance Schedule. Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days and yearly.

1.13 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner's designated personnel.
- B. Operation and Maintenance Manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall be scheduled at the convenience of the Owner. A minimum of 4 hours of training shall be provided.
- D. Training shall include instructions on the following:
 - 1. Startup and shutdown procedures
 - 2. Periodic maintenance
 - 3. Emergency operation
 - 4. Safety
- E. In addition to the instructions required above, wherever possible perform the operations being described in order to fully illustrate system operation.
- F. At the completion of training, turn over to the Owner required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.

1.14 QUALITY ASSURANCE

- A. Conform to the requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.15 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment.
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- D. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- E. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- F. Coordinate electrical testing of electrical, mechanical, or architectural items so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.
- G. Provide offsets and elevation changes in conduit and cable tray as required to complete the Layout and Coordination Process.

1.16 STRUCTURAL COORDINATION

- A. In cases where the Contractor determines that superimposed loads such as suspended or floor mounted electrical system or equipment exist which exceed design loads indicated on structural contract documents, Contractor shall submit load data to Architect for review prior to proceeding with work.
- B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, ductwork, piping, etc. over the member's tributary area in a way that the design superimposed dead loads listed in structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required achieving the allowable load distribution.
- C. Connections of systems designed by Contractor's engineer such as, but not limited to mechanical, electrical, plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

PART 2 PRODUCTS

2.01 PERFORMANCE, CAPACITIES AND CHARACTERISTICS

- A. See Drawings for Equipment Schedules for Equipment Performance Requirements when capacities and characteristics are not indicated in the specifications.

2.02 EQUIPMENT SHORT CIRCUIT CURRENT RATING

- A. Where the National Electrical Code or applicable codes require equipment to be marked with a Short Circuit Current Rating (SCCR), the equipment shall be manufactured as required such that the SCCR of the equipment meets or exceeds the available short circuit current at the equipment. Acceptable methods of complying with this requirement are as follows:
1. Provide SCCR rating at the equipment that meets or exceeds the available short circuit current at the switchboard or panelboard where the equipment circuit originates.
 2. Provide calculations, based on the available short circuit current at the switchboard or panelboard where the equipment circuit originates, that document the actual short circuit current available at the equipment. The SCCR rating of the equipment shall meet or exceed this calculated value.

2.03 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production.

2.04 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.05 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device or piece of equipment is referred to in the singular number; such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.06 SLEEVES

- A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.07 ACCESS DOORS

- A. Manufacturers:
1. Access Doors:
 - a. J. L. Industries
 - b. Karp Associates, Inc.
 - c. Larsons Mfg. Co.
 - d. Milcor, Inc.
 - e. Miller Limited Partnership
 - f. Nystrom, Inc.
- B. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated.

2.08 BACKFILL MATERIAL AND MIXES

- A. Earth Fill: Approved type of soil classified, in accordance with ASTM D2487, as GW, GP, GM, GC, SW, SP, SM. SC, ML or CL, and free of foreign substances, obtained from excavation on this project or other approved source, and having a plasticity index between 7.5 and 17.
- B. Granular Fill: Granular fill shall include clean, natural or prepared gravels, gravel-sand mixtures, sands or gravelly sands with little or no fines. A minimum of 95% shall be retained on a No. 200 sieve.
- C. Pea Gravel: Pea gravel shall consist of clean, hard, round particles of crushed stone, crushed or uncrushed gravel with the following gradation:

Sieve Size	Percent Passing
3/8 inch	85 - 95
#4	55 - 15

#8	0 - 2

- D. Crushed Rock: Crushed rock shall consist of clean, hard, particles of crushed limestone, dolomite, granite, quartzite, or other approved rock. It shall have a percentage of wear of not more than 45 and a percent loss of not more than 30 at the end of 16 cycles of the freezing and thawing test. Gradation for crushed rock shall be as follows:

Sieve Size	Percent Retained
1-1/2 inch	0
3/4 inch	5 - 35
3/8 inch	30 - 64
#10	70 - 90
#200	90 - 100

PART 3 EXECUTION

3.01 GENERAL

- A. Fabrication, erection, and installation of the complete electrical system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project.
- B. Check areas and surfaces where electrical equipment or materials are to be installed and report any unsatisfactory conditions before starting work.
- C. Commencement of work signifies the Contractor's acceptance of the conditions as fit and proper for the execution of the electrical work.
- D. Install equipment and systems in accordance with manufacturer's instructions, requirements, or recommendations.
- E. Comply with NECA 1.
- F. Unless otherwise noted, measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- G. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- H. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- I. Right of Way: Give to raceways and piping systems installed at a required slope.
- J. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

3.02 DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions for the delivery and safe storage of materials. Make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.
- B. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.
- C. Adequately protect supplies and equipment during cold weather.
- D. Protect items subject to cold weather damage by covering, insulating, or storing in a heated space.

3.03 COOPERATION WITH OTHER CONTRACTORS

- A. Perform the electrical work in conformance with the construction called for by other trades and afford other contractors reasonable opportunity for the execution of their work.

- B. Properly connect and coordinate the electrical work with the work of other contractors at such time and in such a manner as not to delay or interfere with their work.
- C. Examine the contract documents for the General, Mechanical, and Electrical work and the work of other trades. Coordinate work accordingly.
- D. Promptly report to the Architect any delay or difficulties encountered in the installation of the electrical work which might prevent prompt and proper installation of work required from other trades.

3.04 COORDINATION OF WORK

- A. Plan work so it proceeds with a minimum of interference with other trades.
- B. Inform the General Contractor of all openings required in the building construction for the installation of the electrical work.
- C. Cooperate with other contractors in furnishing material and information, in proper sequence, for the correct location of sleeves, inserts, foundations, wiring, etc.
- D. Make provisions for special frames, openings, and sleeves as required.
- E. The Electrical Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.05 LAYING OUT WORK

- A. Carefully lay out work in advance of installation using data and measurements from the site, the appropriate civil, architectural, and structural drawings, and shop drawings.
- B. Confirm code required clearances.
- C. Do not infringe upon space required for operation, maintenance, or clearance for items installed by other contractors.
- D. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location.
- E. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, inform the Architect prior to installation and request clarification.
- F. Failure to properly coordinate and lay out work will require correction by the Contractor at the Contractor's expense

3.06 DATA AND MEASUREMENTS

- A. Mechanical and Electrical drawings are diagrammatic or schematic. Do not scale drawings.
- B. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed.
- C. Obtain exact locations, measurements, levels, etc., at the site and adapt their work to actual conditions.
- D. Examine the General Construction, Mechanical, Electrical, and other applicable drawings and the Specifications.
- E. Utilize only Architectural drawings, Structural drawings, and site measurements in calculations.
- F. Layout and coordinate work prior to installation to provide clearances for operation, maintenance and codes. Verify non-interference with other work.
- G. Locate outlets and devices mounted on finished surfaces with regard to paneling, furring, trim, etc.
- H. Install outlets and devices with vertical edges of plates plumb.
- I. Install boxes or plaster rings such that the front edge extends to the finished surface of the wall, ceiling or floor without projecting beyond the surface.
- J. Install receptacles, switches, etc., on wood trim, cases, or other fixtures symmetrically and, where necessary, install with the long dimension of the plate horizontal.

- K. Coordinate locations of outlets and devices with other contractors so as not to destroy the aesthetic effect of the surface in which the outlets and devices are mounted. Coordinate the locations of electrical items with work furnished by other trades to avoid interference.
- L. Heights of outlets are measured from finished floor to centerline of device.
- M. Adjust heights as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.
- N. Mounting heights shall be in compliance with ADA requirements.
- O. Install outlets at the heights indicated below unless otherwise noted.
 - 1. Wall switches: 46 inches.
 - 2. Receptacle outlets (general): 18 inches.
 - 3. Receptacle outlets (kitchen, utility room, workbenches, etc.): 46 inches.
 - 4. Communications outlets: 18 inches.
 - 5. Communications outlets (wall phones): 46 inches.
 - 6. TV outlets: 18 inches.
 - 7. Pushbuttons: 46 inches.
 - 8. Clock outlets: 98 inches when possible Allow space below ceiling to service or replace. Above doors, center between door trim and ceiling.
 - 9. Bells, buzzers, chimes: 8 inches below ceiling (field verify with Architect unless noted otherwise).
 - 10. Fire alarm station: 46 inches.
 - 11. Fire alarm visual signals and audible/visual signals, wall-mounted: 80 inches to the bottom of the lens unless local code or ADA requirement mandates a lower mounting height.
 - 12. Fire alarm audible signals, wall-mounted: Match height of audible/visual signals.
 - 13. Exit lights: 4 inches between top of door frame and bottom of exit sign where possible.
- P. The mounting heights of disconnect switches, circuit breakers, motor controllers, pushbutton stations and other similar devices and equipment may vary depending upon location and whether individually or group mounted.
- Q. For convenience and safety, mount equipment with the center of operating levers, handles or buttons no more than 72 inches above the finished floor.
- R. Locate individual devices or pieces of equipment, unless otherwise specified, so the operating handle, lever or button is located approximately 5 feet above finished floor. Coordinate heights of electrical items with work furnished by other trades to avoid interferences.
- S. Improperly located devices or outlets shall be relocated by the Contractor at the Contractor's expense including necessary patching.

3.07 PROTECTION OF APPARATUS

- A. Take necessary precautions to properly protect apparatus, fixtures, appliances, material, equipment, and installations from damage.
- B. Failure to provide such protection to the satisfaction of the Architect shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.08 SLEEVE INSTALLATION

- A. Coordinate sleeve selection and application with selection and application of firestopping.
- B. Concrete Slabs and Walls: Install sleeves during erection of slabs and walls. Space sleeves a minimum of three sleeve diameters on center, unless otherwise noted. Sleeves are not required for core-drilled penetrations.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Sleeves through walls: Install flush with both surfaces of wall.
- E. Sleeves through floors: Extend 2 inches above finished floor.

- F. Sleeves through roofs: Seal with flexible boot-type flashing units applied in coordination with roofing work
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceways or cable unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
- J. Underground, Exterior-Wall Penetrations: Size sleeves to allow for appropriate clear space between raceway and sleeve for sleeve seals.

3.09 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to maintain fire-resistance rating of assembly.

3.10 EXCAVATION

- A. Perform excavation of every description and of whatever substances encountered, to the depths required or indicated on the drawings, in accordance with OSHA.
- B. During excavation, deposit material suitable for backfill in an orderly manner a sufficient distance from the excavation banks to avoid overloading and to prevent slides or cave-ins.
- C. Dispose of material unsuitable for backfill as directed by the Architect.
- D. Grade as necessary to prevent surface water from flowing into trenches or other excavations, and remove any water accumulating therein by pumping or by other acceptable method.
- E. Fill any excess excavation below the levels indicated for structures or raceways with sand, gravel or concrete.
- F. Unsuitable Material:
 - 1. Where the bottom of the trench is found to be unstable or to include ashes, cinders, any types of refuse, vegetable or other organic material, or large pieces or fragments of inorganic material, which in the judgment of the Architect should be removed, excavate and remove such unsuitable material to a minimum depth of 12 inches below the conduit.
 - 2. Backfill the trench with selected bedding material and compact to provide uniform and continuous bearing for the conduit.
 - 3. Dispose of the unsuitable material.
- G. Shoring Requirements:
 - 1. Perform shoring and sheeting that is required to protect the excavation and to safeguard employees in accordance with OSHA.
 - 2. Widen excavation to provide for space occupied by shoring and sheeting.
 - 3. Shoring shall meet the requirements of applicable codes and regulations.
- H. Dewatering:
 - 1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 2. Do not allow water to accumulate in excavations.
 - 3. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
 - 4. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 5. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas.
 - 6. Do not use trench excavations as temporary drainage ditches.

3.11 BACKFILL

- A. Do not backfill until required inspections are made and tests are performed for the specific utility.
- B. Backfill with the excavated materials specified for backfilling, consisting of earth, loam, sandy clay, sand and gravel or other materials, free from large clods of earth or stones.
- C. Do not use broken concrete as backfill materials.
- D. Do not backfill in freezing weather or with frozen material.
- E. Adjust the moisture content of the backfill material if required for proper compaction.
- F. Reopen any trenches improperly backfilled, or where settlement occurs, to the depth required for proper compaction, refill and compact to specified density.
- G. Compact backfill for structures to the specified density.
- H. During the backfilling of each exterior underground conduit system, install continuous underground type plastic line markers.
 - 1. Locate markers directly over the buried conduit at 12 inches to 18 inches below finished grade.
 - 2. Where multiple small conduits are buried in common trenches and do not exceed an overall trench width of 16 inches, install a single line marker.
- I. Deposit suitable backfill material around the conduit in 6-inch layers and thoroughly compact by hand, machine tamper, or other suitable equipment.
- J. Backfill to at least 90 percent of maximum density at optimum moisture content determined by ASTM D698 until the conduit has a minimum cover of 2 feet.
- K. The moisture content of the soil at time of compaction shall be not more than 3 percent above or 3 percent below the optimum.
- L. Be careful not to disturb the conduit.
- M. Carry backfilling on simultaneously on both sides of the conduit to eliminate the possibility of lateral displacement.
- N. Return surface to original condition.

3.12 WORK IN EXISTING BUILDINGS

- A. Execute work in the existing building, indicated on the drawings or specified herein, with a minimum amount of interference with the normal activities of the occupants of the building.
- B. Schedule work in advance with the Owner and proceed only with the Owner's written approval.
- C. Utilities:
 - 1. Do not interrupt utilities without the Owner's prior written approval regarding the time and duration of such interruptions.
 - 2. Do not disconnect utilities to existing facilities until new or temporary facilities are installed except for short periods of interruption which are necessary for the performance of the new work and which are approved by the Owner.
 - 3. Storm water may be temporarily diverted to surface drainage provided such drainage is arranged to prevent flooding of structures, basements and excavations for construction.
- D. Fire Alarm System:
 - 1. As a minimum, maintain the existing degree of protection for all areas throughout construction.
 - 2. Coordinate required outages with the Owner and the Fire Marshal.
 - 3. After any additions or modifications to the fire alarm system, a re-acceptance test shall be performed by a licensed party in accordance with NFPA 72.
- E. Welding:
 - 1. Notify the Owner before starting welding or cutting.

2. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc.
 3. Stop operations involving welding or cutting with an open flame or arc not less than one hour before leaving the premises.
- F. Noisy Operations:
1. Schedule noisy operations, such as those involving use of air hammers, etc., in demolition or cutting of openings, with the Owner.
- G. Occupancy:
1. The Owner will continue to occupy the building and carry on normal activity.
 2. Protect the occupied areas from dust, smoke, etc., by a method reviewed by the Architect.
- H. Owner's Right to Direct Work: The Owner shall have the right to direct the places of beginning work, its prosecution, and the manner in which all work under this contract is to be conducted, insofar as may be necessary to secure the safe and proper progress and quality of the work.
- I. Existing Conduits or Electrical Equipment:
1. Remove or relocate, as required, or as directed by the Architect, existing conduit or electrical equipment which would interfere with the proper installation of new work.
 2. Modify existing work in conformance with these specifications.
 3. Use the same materials as for new work unless otherwise specified.

3.13 DEMOLITION AND REMODEL

- A. Protect existing electrical equipment and installations indicated to remain.
- B. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- C. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- D. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- E. Remove demolished material from Project site.
- F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- G. Remove existing lights, receptacles, switches, etc., indicated on plans or which are not indicated but must be removed to accommodate demolition or new remodeling.
- H. Where existing walls are indicated to be removed, disconnect power to electrical devices and associated appurtenances relating to the walls.
- I. Maintain circuit continuity up and down stream from removed outlets.
- J. Extend circuiting to up and downstream devices and reconnect as required.
- K. Where existing site lighting fixtures are removed, verify the routing of existing circuits. Maintain circuit continuity between existing fixtures which remain.
- L. In areas which are remodeled, replace existing wire with new wire. No existing wire is permitted to remain unless noted.
- M. Existing concealed conduit and boxes may be reused.
- N. Verify existing conditions in field prior to bid date.

3.14 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations.
- B. Perform cutting by skilled mechanics of trades involved.

- C. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.
- D. Install new fireproofing where existing firestopping has been disturbed.
- E. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.15 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work. Repair as necessary.

3.16 CLEANING AND PROTECTION

- A. Remove burrs, dirt, paint spots, and construction debris from electrical items.
- B. Protect electrical items so that finishes are without damage or deterioration at time of Substantial Completion.
- C. All cables and wiring shall be protected from paint. This includes but is not limited to power conductors and feeders, lighting control wiring, and fire alarm cabling. Painted cables shall be replaced in their entirety.

3.17 TEMPORARY POWER AND LIGHTING

- A. Provide temporary power and lighting throughout the construction period for the use by all trades, Contractors and Sub-Contractors.
- B. Temporary facilities shall be installed in compliance with applicable codes and in compliance with OSHA requirements.
- C. Cost of temporary power used during construction, including the cost of setting and removing temporary service, shall be paid by the Contractor.
- D. Where existing building electrical system is used to provide temporary power and lighting, energy costs shall be paid by the Owner.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Oxide inhibiting compound.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
 - 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.

2. Control Circuits: 14 AWG.
- I. Conductor Color Coding:
 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. For control circuits, comply with manufacturer's recommended color code.

2.02 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 1. Copper Building Wire: Type THHN/THWN, THHN/THWN-2, or XHHW-2, except as indicated below.
 - a. Installed Underground: Type XHHW-2 or THHN/THWN-2.

2.03 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.04 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. When circuit destination is indicated without specific routing, determine exact routing required.
 - 2. Install service and feeder conductors unspliced unless otherwise indicated.
 - 3. Arrange branch circuiting to minimize splices.
 - 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than 6 #12 AWG current-carrying conductors in 1/2 inch conduit; 9 #12 AWG current-carrying conductors in 3/4 inch conduit.
 - b. Provide no more than 6 #10 AWG current-carrying conductors in 3/4 inch conduit; 9 #10 AWG current-carrying conductors in 1 inch conduit.
 - c. Provide no more than 4 #8 AWG current-carrying conductors in 3/4 inch conduit; 6 #8 AWG current-carrying conductors in 1 inch conduit; 9 #8 AWG current-carrying conductors in 1-1/4 inch conduit.

7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Installation in Raceway:
 1. Pull all conductors and cables together into raceway at same time.
 2. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 3. Use suitable wire pulling lubricant where necessary, except as below:
 - a. Do not use when lubricant is not recommended by the conductor manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Install conductors with a minimum of 6 inches of slack at each outlet.
- H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- J. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
 2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 3. Wet Locations: Use heat shrink tubing.
- L. Insulate ends of spare conductors using vinyl insulating electrical tape.
- M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- N. Identify conductors and cables in accordance with Section 26 05 53.

Lewis Central High School
Entry Addition

- O. Install firestopping to preserve fire resistance rating of partitions and other elements.
- P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

**SECTION 26 05 26
GROUNDING AND BONDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- E. NFPA 70 - National Electrical Code.
- F. UL 467 - Grounding and Bonding Equipment.
- G. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 DEFINITIONS

- A. ACEG: Alternating Current Equipment Ground
- B. BCT: Bonding Conductor for Telecommunications (formerly Telecommunications Bonding Conductor)
- C. BBC: Backbone Bonding Conductor (formerly Grounding Equalizer)
- D. PBB: Primary Bonding Busbar (formerly Telecommunications Main Grounding Busbar)
- E. SBB: Secondary Bonding Busbar (formerly Telecommunications Grounding Busbar)
- F. TBB: Telecommunications Bonding Backbone

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Comply with TIA/EIA-607 for telecommunications grounding.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare tinned copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections, high-pressure compression connections, or high-pressure compression connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use compression connectors for accessible connections. For #6 AWG and smaller, use one-hole lugs. For #4 AWG and larger, use two-hole lugs.
 - a. Exceptions:
 - 1) Use exothermic welded connections or high-pressure compression connections for connections to metal building frame.
 4. Manufacturers - High-Pressure Compression Connectors:
 - a. Burndy: www.burndy.com; Hyground System
 - b. Thomas & Betts: www.tnb.com.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install each bonding conductor in a direct route, and parallel or perpendicular to building structure or surfaces, without interfering with other systems or equipment.
- D. Install exterior grounding electrode conductors with a minimum bending radius of 12 inches.
- E. Install interior grounding conductors with a minimum bending radius of 8 inches.

- F. Install grounding conductors in EMT conduit unless otherwise indicated. Bond each end of the conduit to the grounding conductor using an appropriate grounding bushing.
- G. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- H. Identify grounding and bonding system components in accordance with Section 26 05 53.
 - 1. Clean each surface prior to attachment of label.
 - 2. Follow manufacturer's recommendations for affixing labels.

**SECTION 26 05 29
HANGERS AND SUPPORTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- E. MFMA-4 - Metal Framing Standards Publication.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- G. NFPA 70 - National Electrical Code.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 2. Comply with MFMA-4.
 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 4. Hollow Masonry: Use toggle bolts, expansion anchors, or expansion anchors.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood: Use wood screws.
- G. Cable Supports for Vertical Conduit: Factory-fabricated body with insulated wedging plug, appropriately sized for conductors being supported.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

Lewis Central High School
Entry Addition

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3-1/2 inch high concrete pad.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
 6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Secure fasteners in accordance with manufacturer's recommended torque settings.
- I. Remove temporary supports.
- J. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

**SECTION 26 05 33.13
CONDUIT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible metal conduit (FMC).
- B. Liquidtight flexible metal conduit (LFMC).
- C. Galvanized steel electrical metallic tubing (EMT).
- D. Rigid polyvinyl chloride (PVC) conduit.
- E. Accessories.
- F. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
- L. NFPA 70 - National Electrical Code.
- M. UL 1 - Flexible Metal Conduit.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit.
- O. UL 514B - Conduit, Tubing, and Cable Fittings.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
- Q. UL 797 - Electrical Metallic Tubing-Steel.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.03 DEFINITIONS

- A. Telecommunications Pathway: Any item, raceway, box or enclosure in which telecommunications cabling is placed.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Outdoor Underground Installations:
 - 1. Unless otherwise indicated, use rigid non-metallic conduit
- C. Outdoor Locations Above Grade: Use electrical metallic tubing.
- D. In Slab Above Grade or Beneath Slab-on-Grade:
 - 1. Use rigid non-metallic conduit.
- E. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use electrical metallic tubing.
- F. Connection to Motors: Use liquid-tight flexible metal conduit, except use flexible metal conduit in air plenums.
- G. Connection to Vibrating Equipment (including transformers):
 - 1. Indoors: Use flexible metal conduit.
 - 2. Outdoors: Use liquid-tight flexible metal conduit.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 1/2-inch trade size.
 - 2. Telecommunications Pathways: 1 inch trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel, malleable iron, or die cast zinc.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360; rated for use with conductors rated 75 degrees C.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel, malleable iron, or die cast zinc.

2.05 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Colored EMT:
 - 1. Manufacturer: Allied Tube and Conduit.

2. Color Code:
 - a. Fire Alarm: Red
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel, malleable iron, or die cast zinc.
 3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.06 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.07 ACCESSORIES

- A. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- B. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 200 lbf.
- C. Foam Conduit Sealant:
 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 3. Rated to hold minimum of 10 ft water head pressure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- D. Conduit Routing:
 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 2. When conduit destination is indicated without specific routing, determine exact routing required.
 3. Conceal conduits unless specifically indicated to be exposed.
 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.

- c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 9. Exterior Branch Circuits: Route conduits adjacent to curbs. Push or directional bore conduits beneath paved areas; otherwise, sawcut and remove pavement. Replace removed pavement to match existing.
 - 10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 11. Maintain minimum clearance of 12 inches between conduits and hot surfaces.
 - 12. Group parallel conduits in same area on common rack.
- E. Conduit Support:
- 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
 - a. Support PVC conduit within 3 feet of termination points and at intervals not exceeding those listed below in accordance with NFPA 70 Table 352.30.
 - 1) 1/2" to 1" trade size = 3 feet spacing between supports.
 - 2) 1-1/4" to 2" trade size = 5 feet spacing between supports.
 - 3) 2-1/2" to 3" trade size = 6 feet spacing between supports.
 - 4) 3-1/2" to 5" trade size = 7 feet spacing between supports.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use of spring steel conduit clips for support of conduits is permitted only as follows:
 - a. Support of electrical metallic tubing (EMT) 1-1/2 inch trade size concealed above accessible ceilings and within hollow stud walls.
 - 5. Use of wire for support of conduits is permitted only as follows:
 - a. For suspending conduits supported by spring steel conduit clips, where specifically indicated or permitted.
- F. Connections and Terminations:
- 1. Use suitable adapters where required to transition from one type of conduit to another.
 - 2. Provide insulated bushings on box connectors 1-inch and larger, on conduits stubbed above an accessible ceiling, and on conduits used for telecommunications pathways.
 - 3. Secure joints and connections to provide mechanical strength and electrical continuity.
- G. Penetrations:
- 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 - 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 - 3. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 - 4. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 - 5. Install firestopping to preserve fire resistance rating of partitions and other elements.
- H. Conduits Beneath Slab on Grade:

1. Transition to rigid steel conduit, intermediate metal conduit, or electrical metallic tubing where conduit exits slab, except where concealed in walls rigid nonmetallic conduit may be stubbed a maximum of 14 inches above floor level.
- I. Conduits Embedded in Concrete Slabs:
 1. Install with at least 2 inches of concrete cover.
 2. Space a minimum of three diameters on center.
 3. Transition to rigid steel conduit, intermediate metal conduit, or electrical metallic tubing where conduit exits slab, except where concealed in walls rigid nonmetallic conduit may be stubbed a maximum of 14 inches above floor level.
 4. Do not place raceways in plain concrete, such as cement toppings on structural floors, without special permission. Do not displace reinforcing steel to accommodate raceway installation in reinforced concrete. Particular attention is called to the fact that there are many extenuating conditions where the Contractor may be instructed, during the course of the project, not to place embedded conduits in certain areas, generally due to the possibility of unsightly cracking or for structural reasons. Being so instructed shall not entitle the Contractor to extra compensation. Obtain permission from the Engineer for any raceway installation in reinforced concrete which requires concrete displacement exceeding the following:
 - a. Columns: 4 percent of plan area of column.
 - b. Floors : 1/3 of thickness of concrete.
 - c. Beams and Joists: 1/3 of least dimension.
- J. Telecommunications Raceways: Install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent between boxes or pull points. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Locate junction boxes in straight conduit runs. Do not install junction boxes where conduit runs change direction. Keep telecommunications raceways at least 5 inches away from light fixtures, transformers, panelboards, and feeders. Keep non-metallic telecommunications raceways at least 24 inches away from electrical equipment, feeders, and services.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where change in length, calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground, is expected to be 1/4 inch or greater between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations, which includes the following conditions:
 - a. 100 foot intervals within spaces that have an ambient temperature range of 0-5 degrees Fahrenheit or less.
 - b. 60 foot intervals within spaces that have an ambient temperature range of 5-10 degrees Fahrenheit or less.
 - c. 40 foot intervals within spaces that have an ambient temperature range of 10-15 degrees Fahrenheit or less.
 3. Where conduits are subject to earth movement by settlement or frost.
- L. Conduit Sealing:
 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant, junction box, or type C conduit at accessible point near penetration to prevent condensation. This includes, but is not limited to:

- a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- M. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- N. Provide grounding and bonding; see Section 26 05 26.
- O. Identify conduits; see Section 26 05 53.

3.03 ELECTRICAL SERVICE

- A. Provide a primary duct bank consisting of PVC 40 conduit(s) for the power company primary cables unless otherwise indicated on the drawings or required by the power company. Provide 36-inch radius PVC 80 elbows at the transformer pad.
- B. Provide a secondary duct bank consisting of PVC 40 conduits sized as indicated on drawings. Provide 36-inch radius elbows at the transformer pad and beneath service equipment.
- C. In order to provide drainage for the duct banks, lay conduits with a minimum slope of 4 inches per 100 feet. Install duct lines so the top is not less than 48 inches below finish grade or finished paving. Where duct lines enter a manhole, terminate each conduit with an end bell.
- D. Symmetrically arrange concrete-encased duct banks with more than one conduit unless otherwise indicated on drawings. Provide plastic conduit spacers a maximum of 8 feet on center for the full length of the duct bank. Maintain a 1-1/2 inch minimum spacing between ducts and a minimum 3-inch concrete envelope on all sides of duct bank.
- E. Seal all secondary conduits watertight at the transformer pad and service entrance after installation of secondary conductors.
- F. Provide pullboxes as required by the serving utility for all primary duct banks. Size and install pull boxes per code and in accordance with all power company requirements.

3.04 FIELD QUALITY CONTROL

- A. Correct deficiencies and replace damaged or defective conduits.

3.05 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.06 PROTECTION

- A. Immediately after installation of conduit, use suitable caps to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 REFERENCE STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
- C. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- D. NFPA 70 - National Electrical Code.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
- G. UL 508A - Industrial Control Panels.
- H. UL 514A - Metallic Outlet Boxes.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Do not use "through-wall" boxes designed for access from both sides of wall.
 7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 11. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch deep trade size.
 - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 12. Wall Plates: Comply with Section 26 27 26.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Include cable supports if any dimension of the box is greater than 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify locations of floor boxes prior to rough-in.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
 - 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in unfinished areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- H. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 - 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.

- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 26 05 26.
- Q. Identify boxes in accordance with Section 26 05 53.
- R. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- S. Orient each box located above an accessible ceiling so the box opening faces down or to one side.
- T. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- U. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- V. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

**SECTION 26 09 23
LIGHTING CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall pushbutton stations.
- B. Occupancy sensors.
- C. Emergency lighting relays.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
- C. NFPA 70 - National Electrical Code.
- D. UL 1472 - Solid-State Dimming Controls.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
 - 2. Coordinate placement of wall switch occupancy sensors with installed door swings.
 - 3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
 - 4. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.
 - 5. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install lighting control devices until final surface finishes and painting are complete.
- C. Pre-Wire Meeting:
 - 1. Include the services of a factory trained technician to attend and facilitate an on-site pre-wire meeting to review system installation requirements.
 - 2. Schedule meeting to occur after receipt of final shop drawings.

1.04 SUBMITTALS

- A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features of products being provided.
- B. Shop Drawings:
 - 1. Provide lighting plan, drawn to scale, indicating location, model number, and orientation of each device being provided.
 - 2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
 - 3. Pushbutton Stations: Provide elevation of each unique pushbutton station indicating button labeling.
 - 4. Interconnection diagram of field installed wiring.
- C. Functional Performance Testing Reports.
- D. Operation and Maintenance Data: Submit within 90 days of receipt of the Certificate of Occupancy. Include the following:
 - 1. Name and address of not less than one service agency for installed equipment.
 - 2. Narrative of how each system is intended to operate, including recommended setpoints.
 - 3. Submittal data indicating all selected options for each piece of lighting control equipment and lighting controls.

4. Manual for each piece of lighting control equipment indicating required routine maintenance actions and cleaning.
 5. Schedule for inspecting and recalibrating lighting controls.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Occupancy Sensors, Daylight Harvesting Sensors, Outdoor Photosensor, Power Packs, Room Controllers, and Wall Pushbutton Stations (without labeling): Two percent of total quantity installed for each type, but not less than one of each type.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Provide five year manufacturer warranty for lighting control components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acuity Brands.
- B. Lutron.
- C. Wattstopper.
- D. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier, where possible, unless indicated otherwise.
- E. Substitutions and Prior Approval Requests: Manufacturers not listed will be considered as a prior approval or substitution request. Provide the following:
 1. Manufacturer's cut sheets for proposed components.
 2. Example wiring schematic.
 3. Upon request, a working sample.

2.02 LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

- A. System Description: Distributed, low voltage, digital load controllers that control lighting within rooms/spaces.
- B. Provide system consisting of wired components.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system compatible with controlled luminaires.
- E. Provide controller as required to support time of day and astronomical time clock capabilities for scheduled lighting control events.
- F. Provide factory pre-terminated and tested plenum rated cables for interconnection of system components, types as recommended by manufacturer.

1. Select cable lengths based on actual installation conditions.
2. Cables shall be as short as practical.
3. Provide white cables unless noted otherwise.

G. Where dimming is indicated, provide a continuous flicker-free dimming system.

2.03 WALL PUSHBUTTON STATIONS

- A. General Requirements: Low voltage, quiet operating, types as indicated on drawings, compatible with load types being controlled. Provide factory labeled pushbuttons.
- B. Where dimming controls are indicated, provide separate raise and lower buttons.
- C. Provide devices and plates with finishes matching wiring devices.

2.04 OCCUPANCY SENSORS

- A. General Requirements:
 1. Provide the following type of sensor per area, unless indicated otherwise:
 - a. Offices: Dual technology.
 - b. Classrooms: Dual technology.
 - c. Restrooms: Ultrasonic or microphonic.
 - d. Corridors: Passive infrared.
 - e. Other Areas: As recommended by manufacturer.
 2. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 3. Provide LED to visually indicate motion detection.
 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
 7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 8. Sensitivity: Field adjustable.
 9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 10. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.
 11. Isolated Relay for Low Voltage Occupancy Sensors: Where indicated, SPDT dry contacts, ratings as required for interface with system indicated.
- B. Wall Switch Occupancy Sensors:
 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Where indicated or required, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.

- d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - e. Where dimming is indicated or required, comply with the following:
 - 1) Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 - 2) Provide field adjustable dimming preset for occupied state.
 - 3) Provide fade-to-off operation to notify occupant of impending load turn-off.
 - 2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.
 - 3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within area of 400 square feet.
 - 4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.
- C. Ceiling Mounted Occupancy Sensors:
- 1. General Requirements:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - c. Finish: White unless otherwise indicated.
 - 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - 3. Ultrasonic Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within area of 500 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - b. Medium Range Sensors: Capable of detecting motion within area of 1,000 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - c. Extended Range Sensors: Capable of detecting motion within area of 2,000 square feet at mounting height of 9 feet.
 - 4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - 5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet.
- D. Directional Occupancy Sensors:
- 1. General Requirements:
 - a. Description: Occupancy sensors designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
 - 2. Passive Infrared (PIR) Directional Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.
 - b. Long Range Sensors: Capable of detecting motion within distance of 80 feet at mounting height of 10 feet.

- c. High Bay Sensors: Capable of detecting motion within distance of 50 feet at mounting height of 30 feet.
- 3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.
- E. Power Packs for Occupancy Sensors:
 - 1. Description: Plenum rated, self-contained class 2 transformer and relay compatible with specified occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 4. Load Rating: As required to control load indicated on drawings.
 - 5. Provide auxiliary contact closure output where indicated.
 - 6. Rated Life of Relay: One million cycles.

2.05 EMERGENCY LIGHTING RELAYS

- A. Manufacturers:
 - 1. Bodine: www.signify.com
 - 2. ETC: www.etcconnect.com
 - 3. IOTA Engineering: www.iotaengineering.com.
 - 4. LVS: <http://www.lvscontrols.com>
 - 5. Myers Power Products: www.myerseps.com
 - 6. Wattstopper: www.legrand.us.
 - 7. Same as manufacturer of lighting control system.
- B. All Relays:
 - 1. Products shall be capable of switching 20 amp loads under normal power conditions at 120-277V.
 - 2. Provide with universal rated voltage inputs for normal power sense, normal switched power, and emergency power at 120-277V.
 - 3. Provide with integral momentary test switch to test a normal power loss condition. Releasing the switch shall return the device into normal operation.
 - 4. LED indicators indicating normal or emergency operation mode of the device.
 - 5. Where dimming is required, provide products compatible with dimming protocols being provided.
 - 6. Provide with auxiliary input for connection to remote systems, where indicated, to force emergency indicated luminaires to full brightness. Remote systems, where indicated, shall provide a normally closed and maintained dry contact.
- C. Automatic Load Control Relay (ALCR)
 - 1. UL924 listed device.
 - 2. Operation:
 - a. Allows emergency luminaires to be controlled with non-emergency luminaires when normal power is present.
 - b. Upon loss of normal power the device shall bypass lighting controls and shunt dimmed inputs (when present) to force emergency luminaires to full brightness.
- D. Branch Circuit Emergency Lighting Transfer Switch (BCELTs)
 - 1. UL1008 listed device.
 - 2. Operation:
 - a. Allows emergency luminaires to be controlled with non-emergency luminaires when normal power is present.
 - b. Upon loss of normal power the device transfers power from normal to emergency for emergency luminaires and shunts dimmed inputs (when present) to force emergency luminaires to full brightness.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 05 33.16.
 - 1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
 - 2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate; see Section 26 27 26.
- G. Provide required supports; see Section 26 05 29.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Identify lighting control devices; see Section 26 05 53.
- J. Occupancy Sensor Locations:
 - 1. Drawings are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 - 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
 - 3. Locate sensors so that coverage does not extend beyond the area controlled.

4. Drawings are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
- K. Unless otherwise indicated, install emergency lighting relays and power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- L. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- M. Unless otherwise indicated, install low voltage control cabling in conduit in areas with exposed structure and above inaccessible ceilings.
- N. Low voltage control cabling may be installed without conduit where concealed above an accessible ceiling. For wall-mounted devices, provide conduit stubbed to above the nearest accessible ceiling. Route cabling parallel or perpendicular to building structure or surfaces.
 1. Support using J-hook cable hangers or plenum rated cable ties attached to conduit supports or to branch circuit conduits as allowed by Code. Locate supports with a maximum spacing of 10 feet.
 2. Do not support from piping, ductwork or other systems. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 3. Coil and support excess cable slack.
- O. Maintain separation of normal and emergency branch circuit wiring connected to emergency lighting relays as required by NFPA 70. Normal and emergency branch circuits can be combined only within the emergency lighting relay enclosure.
- P. Fire Alarm System Integration: Program emergency lighting relay(s) to drive emergency lighting to full brightness upon signal from fire alarm system under general fire alarm.

3.04 SYSTEM STARTUP AND PROGRAMMING

- A. Coordinate system programming and device engraving with Owner.
- B. Provide factory startup and programming of system. Program according to Owner's requirements.
- C. Coordinate high end and/or low end trim levels with Owner and Architect during system programming.

3.05 FIELD QUALITY CONTROL

- A. Inspect each lighting control device for damage and defects.
- B. Perform functional performance tests as required by this specification section and as required by applicable codes.
- C. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

3.07 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.08 FUNCTIONAL PERFORMANCE TESTING

- A. Prior to final inspection, perform functional performance testing and submit documentation to the Architect that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions.

1. Occupancy sensor controls.
 - a. Certify that each occupancy sensor has been located and aimed in accordance with manufacturer recommendations
 - b. Test each occupancy sensor.
 - c. Verify the following:
 - 1) Where included, status indicators operate correctly.
 - 2) The controlled lights turn off or down to the permitted level within the required time.
 - 3) For auto-on occupancy sensor controls, the lights turn on to the permitted level when an occupant enters the space.
 - 4) For manual-on occupancy sensor controls, the lights turn on only when manually activated.
 - 5) The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.
2. Time switch controls.
 - a. Confirm that the time switch control is programmed with accurate weekday, weekend and holiday schedules.
 - b. Provide documentation to the Owner of time switch controls programming including weekday, weekend, holiday schedules, and set-up and preference program settings.
 - c. Verify the correct time and date in the time switch.
 - d. Verify that any battery backup is installed and energized.
 - e. Verify that the override time limit is set to not more than 2 hours.
 - f. Simulate occupied condition. Verify and document the following:
 - 1) All lights can be turned on and off by their respective area control switch.
 - 2) The switch only operates lighting in the enclosed space in which the switch is located.
 - g. Simulate unoccupied condition. Verify and document the following:
 - 1) Nonexempt lighting turns off.
 - 2) Manual override switch allows only the lights in the enclosed space where the override switch is located to turn on or remain on until the next scheduled shutoff occurs.
3. Daylight responsive controls.
 - a. Verify the following:
 - 1) Control devices have been properly located, field calibrated and set for accurate setpoints and threshold light levels.
 - 2) Daylight controlled lighting loads adjust to light level setpoints in response to available daylight.
 - 3) The calibration adjustment equipment is located for ready access only by authorized personnel.
4. Provide a report of the test results. Include the following:
 - a. Results of functional performance tests.
 - b. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.

3.09 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of two hours of training.
 3. Instructor: Manufacturer's authorized service representative.
 4. Location: At project site.

3.10 MAINTENANCE

- A. Occupancy Adjustments: Within one year of Substantial Completion, provide on-site assistance by a manufacturer's authorized service representative to make system adjustments or to provide training. Provide three visits, at approximately three, six and twelve months after Substantial Completion for this purpose.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Device plates and box covers.

1.02 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices.
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications.
- C. NFPA 70 - National Electrical Code.
- D. UL 20 - General-Use Snap Switches.
- E. UL 498 - Attachment Plugs and Receptacles.
- F. UL 514D - Cover Plates for Flush-Mounted Wiring Devices.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

- A. Provide wiring devices suitable for intended use with ratings adequate for load served.

2.02 MANUFACTURERS

- A. Cooper Wiring Devices: www.cooperwiringdevices.com.
- B. Hubbell Incorporated: www.hubbell-wiring.com.
- C. Leviton Manufacturing Company, Inc: www.leviton.com.
- D. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

- E. Source Limitations: Where possible, provide products for each type of wiring device produced by a single manufacturer and obtained from a single supplier.

2.03 WIRING DEVICE FINISHES

- A. Device Color: Gray unless otherwise indicated or required by code; brown in dark brick, wood paneled or dark-finished walls.

2.04 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Acceptable products are listed below for specific device types.
- C. Standard Switches: 20A, 120/277 V AC

Description	Cooper	Hubbell	Leviton	P & S
Single pole	CSB120	CSB120	CS120-2	CSB20AC1
Double pole	CSB220	CSB220	CS220-2	CSB20AC2
Three-way	CSB320	CSB320	CS320-2	CSB20AC3
Four-way	CSB420	CSB420	CS420-2	CSB20AC4

2.05 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
- B. Acceptable products are listed below for specific device types.
- C. Straight Blade Receptacles: 20A, 125V.

Description	Cooper	Hubbell	Leviton	P & S
Simplex	1877	HBL5361	5891	5361
Duplex	BR20	BR20	5362	CRB5362
Duplex tamper resistant	TRBR20	BR20TR	T5362	TR5362
Duplex GFCI	SGF20	GFRST20	GFNT2	2097
Duplex GFCI tamper resistant	TRSGF20	GFTRST20	GFTR2	2097TR
Duplex GFCI weather resistant	WRSGF20	GFWRST20	GFWT2	2097TRWR
Duplex GFCI weather resistant, tamper resistant	WRSGF20	GFTWRST20	GFWR2	2097TRWR
Duplex isolated ground	IG5362	IG20CR	5362-IG	IG5362
Duplex tamper resistant with USB-A and	TRUSBAC20	USB20AC5	T5833	TR20USBAC6

USB-C charging ports				
Duplex TVSS	5362S	HBL5362SA	7380	5362SP
Clock hanger	775V	RR151CHI	688	S3713

2.06 WALL PLATES AND COVERS

- A. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Wall Plates for Flush Devices: Type 302 or 304, satin finished stainless steel, minimum thickness 0.03 inches.
- C. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 - 1. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
 - 2. Where multiple devices are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 3. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- B. Install wiring devices in accordance with manufacturer's instructions.
- C. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer or by using screw-actuated pressure plate. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

- F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- G. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices unless otherwise indicated.
- H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- I. Install wall switches with OFF position down.
- J. Install vertically mounted receptacles with grounding pole on bottom.
- K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- M. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas and above accessible ceilings.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 26 51 00
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Luminaires mounted on exterior of building.
- C. Exit signs.
- D. Drivers

1.02 REFERENCE STANDARDS

- A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.
- C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems.
- F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.
- I. NFPA 70 - National Electrical Code.
- J. NFPA 101 - Life Safety Code.
- K. UL 924 - Emergency Lighting and Power Equipment.
- L. UL 1598 - Luminaires.
- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide dimensioned drawing for each custom length luminaire.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting

requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 - c. Include color temperature, CRI, luminaire input wattage and delivered lumen output.
 - d. Include color information based on IES TM-30 test upon request.
2. Drivers: Include product data, dimming protocol, voltage and environmental rating.
- C. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Extra Drivers: Two percent of total quantity installed for each type, but not less than one of each type.
- E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- C. Luminaires for the project shall be submitted through an electrical distributor within 250 miles of the project site. Deviations from this requirement must be submitted for prior approval.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 WARRANTY

- A. Provide minimum five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in schedule included on the drawings.
- B. Substitutions (for cost reduction after bid) and Prior Approval Requests (prior to bid):

Luminaires not specified or listed as an alternate in the Luminaire Schedule will be considered as a prior approval or substitution request. Provide and identify the following information with the manufacturer's cut sheet:

 1. Estimated useful life, calculated based on IES LM-80 test data.
 2. Delivered lumen output, calculated based on IES LM-79.
 3. Color temperature, CRI, luminaire input wattage and warranty.
 4. Color information, based on IES TM-30 test report.
 5. Upon request, IES LM-79 report, LM-80 report, and TM-30 report.
 6. Upon request, photometric calculation comparison to the basis of design luminaire for the applicable project space/area.
 7. Upon request, a working sample with 120 Volt cord and plug.
 8. Deviations from the specified luminaire.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

- C. Unless otherwise indicated, for each type of lamp/luminaire, provide products which are consistent in perceived color temperature. Replace lamps/ luminaires that are determined by the Architect to be inconsistent in perceived color temperature.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide luminaires including lamp(s) and all sockets, ballasts/drivers, reflectors, lenses, housings, wiring and other appurtenances required for a complete and operational system.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operational system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. For continuous wall-to-wall luminaires, field verify exact wall-to-wall dimensions prior to ordering.
- I. Sheet Metal Components: Steel, unless otherwise indicated, without sharp corners or edges.
- J. Doors and Frames: Free of light leaks.
- K. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- L. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
 - 1. Self-Powered Exit Signs:
 - a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - b. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - c. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 DRIVERS

- A. Drivers - General Requirements:
 - 1. Provide drivers containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state driver efficiency/efficacy standards.
 - 3. Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.05 ACCESSORIES

- A. Provide accessories and fittings as recommended by the manufacturer to properly and completely install and wire luminaires.
- B. Provide accessory plaster frames as required, designed and finished to preclude the possibility of rust stains on surrounding surfaces.
- C. Fixture Whips: Flexible whips including phase, neutral and grounding conductors, #18 AWG minimum; minimum length, 4 feet; maximum length, 6 feet, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Verify ceiling and wall details from general construction documents prior to ordering luminaires. Provide proper mounting accessories for the intended installation. Install fixture trim tight to surrounding surfaces. Secure to prevent movement.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install products in accordance with manufacturer's instructions.
- E. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- F. Provide required support and attachment in accordance with Section 26 05 29.
- G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- H. Suspended Ceiling Mounted Luminaires:
 1. Do not use ceiling tiles to bear weight of luminaires.
 2. Support luminaires from grid. Provide additional supports or support clips as required.
 3. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 4. Luminaires smaller than grid openings: Center in acoustical panels unless otherwise indicated on reflected ceiling plan. Provide supporting members as required.
 5. Secure surface-mounted luminaires to building structure.
 6. Secure pendant-mounted luminaires to building structure.
- I. Recessed Luminaires:
 1. Install trims tight to mounting surface with no visible light leakage.

- J. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Install canopies tight to mounting surface.
- K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- L. Surface Mounted Luminaires:
 - 1. Mount tight to surrounding surfaces.
 - 2. Locate outlet boxes in finished areas so they are concealed by luminaires.
- M. Install accessories furnished with each luminaire.
- N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.
- O. Fixture Whips:
 - 1. Use for recessed luminaires installed in an accessible ceiling.
 - 2. Anchor according to code.
 - 3. Install between each fixture and a junction box located above the ceiling. Wire from fixture to fixture only for tandem ballast installations.
- P. Bond products and metal accessories to branch circuit equipment grounding conductor.
- Q. Dimmable Luminaires: Provide required control wiring, as recommended by the manufacturer, between each luminaire and its associated control device.
- R. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- S. Remote Ballasts and Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Just prior to Substantial Completion, review proper operation of luminaires and correct deficiencies or make adjustments as required. Replace failed components as required.

Lewis Central High School
Entry Addition

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 26 56 00
EXTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires. See Section 26 5100 - Interior Lighting for luminaires mounted to building.
- B. Drivers.
- C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.
- D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.
- G. NFPA 70 - National Electrical Code.
- H. NFPA 101 - Life Safety Code.
- I. UL 924 - Emergency Lighting and Power Equipment.
- J. UL 1598 - Luminaires.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 - c. Include color temperature, CRI, luminaire input wattage and delivered lumen output.
 - d. Include color information based on IES TM-30 test upon request.
 - 2. Drivers: Include product data, dimming protocol, voltage, and environmental rating.
- B. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Drivers: Two percent of total quantity installed for each type, but not less than one of each type.
- D. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

- B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- C. Luminaires for the project shall be submitted through an electrical distributor within 250 miles of the project site. Deviations from this requirement must be submitted for prior approval.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

1.06 WARRANTY

- A. Provide minimum three year manufacturer warranty for all LED luminaires, including drivers.
- B. Provide minimum three year manufacturer warranty for pole finish adhesion and corrosion.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in schedule included on the Drawings.
- B. Substitutions (for cost reduction after bid) and Prior Approval Requests(prior to bid):
Luminaires not specified or listed as an alternate in the Luminaire Schedule will be considered as a prior approval or substitution request. Provide and identify the following information with the manufacturer's cut sheet:
 - 1. Estimated useful life, calculated based on IES LM-80 test data.
 - 2. Delivered lumen output, calculated based on IES LM-79.
 - 3. Color temperature, CRI, luminaire input wattage and warranty.
 - 4. Color information, based on IES TM-30 test report.
 - 5. Upon request, IES LM-79 report, LM-80 report, and TM-30 report.
 - 6. Upon request, photometric calculation comparison to the basis of design luminaire for the applicable project space/area.
 - 7. Upon request, a working sample.
 - 8. Deviations from the specified luminaire.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Unless otherwise indicated, for each type of lamp/luminaire, provide products which are consistent in perceived color temperature. Replace lamps/luminaires that are determined by the Architect to be inconsistent in perceived color temperature.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide luminaires including lamp(s) and all sockets, ballasts/drivers, reflectors, lenses, housings, wiring and other appurtenances required for a complete and operational system.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

- J. Exposed Hardware: Stainless steel.

2.03 DRIVERS

- A. Drivers - General Requirements:
 - 1. Provide drivers containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state driver efficiency/efficacy standards.
 - 3. Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Pole-Mounted Luminaires:
 - 1. Foundation-Mounted Poles:
 - a. Provide cast-in-place or precast concrete foundations for poles as indicated.
 - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
 - b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts as required to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
 - f. Install anchor base covers or anchor bolt covers as indicated.
 - 2. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
- G. Install accessories furnished with each luminaire.
- H. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.03 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.05 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. Just prior to Substantial Completion, replace all components that have failed.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

DIVISION 27 – COMMUNICATIONS

**SECTION 27 05 01
COMMON WORK RESULTS FOR COMMUNICATIONS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section describes the general communications infrastructure requirements of these specifications and applies to all phases of the work specified, indicated on the drawings, or required to provide the complete installation of communications infrastructure for this project.

1.02 ALTERNATES

- A. Alternates, if required, shall be as described in the "Alternates" section of the project manual, as described on the proposal form, or as indicated on the drawings.

1.03 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda and properly issued to each person holding documents prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within the contract documents.

1.04 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work, unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.
- D. The Architect shall be the sole judge regarding interpretations of conflicts within the contract documents.

1.05 DEFINITIONS

- A. Furnish:
 - 1. Supply and deliver to the site, ready for use, items required to complete tasks or perform tests required to build a complete and ready-to-use system.
- B. Install:
 - 1. Supply labor to construct complete system, ready for intended use.
- C. Provide:
 - 1. Furnish, install, connect, and test, supplying required labor to construct a complete system, ready for the intended use.
- D. Administration:
 - 1. The method for labeling, documentation, and usage needed to implement moves, adds, and changes to the telecommunications infrastructure.
- E. Backbone Cabling:

1. Cabling or conductors that deliver interconnection between entrance facilities, equipment rooms, and telecommunication rooms; usually installed from floor to floor, but can also be installed between spaces on the same floor.
- F. Entrance Facility (EF):
1. An enclosed architectural space housing service provider, campus, or building communications cabling, terminations, cross-connects, and hardware. Where an EF contains sensitive electronic communications equipment, it shall be environmentally-controlled.
- G. Equipment Room (ER):
1. An enclosed, environmentally-controlled, and centralized architectural space where the structured cabling system is terminated and communications equipment is installed. ERs usually house a main or intermediate cross-connect which serves a building, campus, tenant, or service provider. Historically, these spaces have been known as Main Distribution Frames (MDFs). The MDF may also be the EF.
- H. Horizontal Cabling:
1. Cabling or conductors that run from a telecommunications space to a work area outlet location. It may be installed in either a horizontal or vertical plane.
- I. Inside Plant Cable (ISP):
1. The part of the structured cabling system that runs within a building. This definition applies to inside plant cable elements passing through any element of the outside plant pathway. Inside plant cable includes the work area outlet assembly (WAO), backbone cabling, horizontal cabling, telecommunications equipment, and all termination hardware not terminating outside plant cables.
- J. Outside Plant Cable (OSP):
1. The part of the structured cabling system that runs between buildings, from a building to a definable exterior point, between definable exterior points, or from another outside source to the building or exterior definable point. It includes termination hardware, transition splices, and any other device into which cable attaches. Outside plant cable includes underground and overhead cabling.
- K. Pathway:
1. The part of a cable distribution system that may consist of raceways, cable trays, cable ladder runways, cable managers, conduits, sleeves, distribution rings, j-hooks, junction boxes, fire-rated pathway devices, and mechanical cable-supporting devices.
- L. Structured Cabling System (SCS):
1. The part of a telecommunications cable distribution system that may consist of twisted-pair copper, fiber optic, coaxial, networked audiovisual (AV), and networked security cabling systems.
- M. Telecommunications Enclosure (TE):
1. A case or housing where the structured cabling system is terminated and telecommunications equipment is installed.
- N. Telecommunications Room (TR):
1. An enclosed, environmentally-controlled, and centralized architectural space where the structured cabling system is terminated and communications equipment is installed. TRs usually house a horizontal cross-connect which serves a floor, area, or tenant. Historically, these spaces have been known as Intermediate Distribution Frames (IDFs).
- O. Telecommunications Space (TS):
1. A room or area where the structured cabling system is terminated and telecommunications equipment is installed.
- P. Work Area Outlet (WAO):
1. A connecting device for the termination of horizontal telecommunications cabling that provides connectivity for patch cables, which in turn connect to end-user network

equipment, such as computers or telephones. A WAO can be recessed or surface-mounted in the wall, floor, or ceiling. WAOs may consist of connectors, jacks, plugs, termination blocks, and faceplates.

1.06 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols on the plans. Some of the symbols scheduled may not be required for the project. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the installation location. Verify exact locations with the Architect and the Owner.

1.07 ABBREVIATIONS

- A. The following abbreviations apply throughout the contract documents:

1. ACR: Attenuation-to-Crosstalk Ratio
2. ADA: Americans with Disabilities Act
3. AFF: Above Finished Floor
4. ANSI: American National Standards Institute
5. ASME: American Society of Mechanical Engineers
6. ASTM: American Society for Testing Materials
7. ATM: Asynchronous Transfer Mode
8. AWG: American Wire Gauge
9. BICSI: Building Industry Consulting Services International
10. CATV: Community Antenna Television
11. CCA: Communications Cable and Connectivity Association
12. CCTV: Closed-Circuit Television
13. CFR: Code of Federal Regulations
14. CSA: Canadian Standards Association
15. EF: Entrance Facility
16. ELFEXT: Equal Level Far-End Crosstalk
17. EMC: Electromagnetic Compatibility
18. EMI: Electromagnetic Interference
19. EMT: Electrical Metallic Tubing
20. ENT: Electrical Nonmetallic Tubing
21. ER: Equipment Room
22. ETL: Electrical Testing Laboratories
23. FCC: Federal Communications Commission
24. FDDI: Fiber Distribution Data Interface
25. FEXT: Far-End-Crosstalk
26. FM: Factory Mutual Engineering Corporation
27. FM: Frequency Modulation
28. FMC: Flexible Metal Conduit
29. FO: Fiber Optic
30. Gbps: Gigabits Per Second
31. GbE: Gigabit Ethernet
32. GND: Ground
33. GPS: Global Positioning System
34. HH: Handhole
35. HVAC: Heating, Ventilation, and Air Conditioning
36. Hz: Hertz
37. IC: Intermediate Cross-Connect
38. ID: Inner Diameter
39. IDC: Insulation Displacement Connector
40. IDF: Intermediate Distribution Frame
41. IEEE: Institute of Electrical and Electronics Engineers
42. IP: Internet Protocol

Lewis Central High School
Entry Addition

- 43. ISP: Inside Plant Cable System
- 44. LAN: Local Area Network
- 45. Mbps: Megabits Per Second
- 46. MC: Main Cross-Connect
- 47. MDF: Main Distribution Frame
- 48. MGB: Main Ground Bar
- 49. MH: Manhole
- 50. MIMO: Multiple-Input and Multiple-Output
- 51. MM: Multi-Mode
- 52. MPTL: Modular Plug Terminated Link
- 53. NCTA: National Cable & Telecommunications Association
- 54. NEC: National Electrical Code
- 55. NECA: National Electrical Contractors Association
- 56. NEMA: National Electrical Manufacturers Association
- 57. NFPA: National Fire Protection Association
- 58. NTP: Network Time Protocol
- 59. NTSC: National Television Standards Committee
- 60. NVP: Nominal Velocity of Propagation
- 61. OD: Outer Diameter
- 62. OFE: Owner-Furnished Equipment
- 63. OFL: Overfilled Launch
- 64. OSHA: Occupational Safety and Health Administration
- 65. OSP: Outside Plant Cable System
- 66. OTDR: Optical Time Domain Reflectometer
- 67. Pr: Pair
- 68. PBB: Primary Bonding Busbar
- 69. PDU: Power Distribution Unit
- 70. PSIG: Pounds Per Square Inch Gauge
- 71. PSTN: Public Switched Telephone Network
- 72. PVC: Polyvinyl Chloride
- 73. RCDD: Registered Communications Distribution Designer
- 74. RF: Radio Frequency
- 75. RFI: Radio Frequency Interference
- 76. SBB: Secondary Bonding Busbar
- 77. ScTP: Screened Twisted-Pair
- 78. SFP: Small Form-Factor Pluggable
- 79. SISO: Single-Input and Single-Output
- 80. SM: Single-Mode
- 81. SNMP: Simple Network Management Protocol
- 82. SNTP: Simple Network Time Protocol
- 83. SPD: Surge Protection Device
- 84. STP: Shielded Twisted-Pair
- 85. TBB: Telecommunications Bonding Backbone
- 86. TBC: Telecommunications Bonding Conductor
- 87. TIA: Telecommunications Industry Association
- 88. TR: Telecommunications Room
- 89. UL: Underwriters Laboratories
- 90. UPS: Uninterruptible Power Supply
- 91. UTP: Unshielded Twisted-Pair
- 92. VoIP: Voice Over Internet Protocol
- 93. WAP: Wireless Access Point
- 94. WPA: Wi-Fi Protected Access

1.08 CODES AND STANDARDS

- A. The work shall be performed by competent tradespeople skilled in the trade involved and shall be done in a manner consistent with normal industry standards. All work shall conform to all applicable sections of currently adopted editions of the codes and standards listed below or the codes, standards, and specifications published by the organizations listed below:
1. American National Standards Institute (ANSI).
 2. ASTM International.
 3. Building Industry Consulting Service International (BICSI).
 4. Code of Federal Regulations (CFR).
 5. FM Global, or other recognized national laboratories.
 6. International Building Code (IBC).
 7. Institute of Electrical and Electronics Engineers (IEEE).
 8. Insulated Power Cable Engineers Association (IPCEA).
 9. Intertek.
 10. Life Safety Code (NFPA 101), latest edition.
 11. National Electrical Code (NFPA 70), latest edition.
 12. National Electrical Manufacturers Association (NEMA).
 13. National Electrical Safety Code (NESC).
 14. National Fire Protection Association (NFPA).
 15. Occupational Safety and Health Administration (OSHA): National Consensus Standards, Established Federal Standards, and Safety and Health Regulations for Construction.
 16. State and Local Codes.
 17. Telecommunications Industry Association (TIA).
 18. Underwriters Laboratories (UL).
 19. Uniform Building Code (UBC).
- B. Where there is a conflict between the code or referenced standards and the contract documents, the code or standard shall have precedence only when it is more stringent than the contract documents. Items that are allowed by the code, but are less stringent than those specified, shall not be substituted.

1.09 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
1. Primary Design Products:
 - a. Primary design products are those products around which the project was designed in terms of capacity, performance, physical size, and quality.
 - b. Primary design products are indicated by use of a single manufacturer's name, model number, or similar data on drawings or schedules, or within the specifications.
 - c. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
 2. Acceptable Equivalent Substitutions:
 - a. Acceptable equivalent substitutions are products of manufacturers other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements.
 - b. The product shall be manufactured by one of the acceptable manufacturers listed in the project manual, drawings, or addenda.
 - c. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - d. The Contractor providing the substitution shall bear the total cost of changes due to substitutions. These costs may include additional compensation to the Architect for

- redesign and evaluation services, increased cost of work by the Owner or other contractors, and similar considerations.
3. Performance Requirements:
 - a. Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.
 4. Compliance with Standards, Codes, and Regulations:
 - a. Where the specifications require only compliance with an imposed standard, code, or regulation, the Contractor has the option of selecting a product that complies with the specification requirements, including the standards, codes, and regulations.
 5. Proposed substitutions will be judged on the basis of quality, performance, appearance, and the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
 6. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.10 SUBMITTALS

- A. Submittal Requirements:
 1. Other sections in the project manual shall be adhered to if more stringent than the following paragraphs.
 2. When required by other sections of the project manual, submit shop drawings, product data, or samples to the Architect for review.
 3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
 4. A completed copy of the transmittal form included with the project manual shall accompany each submittal.
 5. Submittals shall be numbered consecutively by specification section (i.e., 270501-01, 270501-02, etc.).
 6. Unless otherwise noted, submit one (1) copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.
 7. Each submittal shall clearly indicate proposed items, capacities, characteristics, and details in conformance with the contract documents. Equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions, and special features required shall be certified by the manufacturer.
 8. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect.
 9. When required by other sections of the project manual, the Contractor shall submit a "specification compliance review" (SCR) consisting of a paragraph-by-paragraph review of the specifications and addenda. Markings may be made in the margins of the original specification or addenda. Unless a deviation or exception is specifically noted in the SCR, it is assumed that the equipment, product, or material is in complete compliance with the contract documents. Submit the SCR with shop drawings and product data.
 10. Submittals will be returned to the Contractor by the Architect with one of the following responses:
 - a. "A": Reviewed, No Exceptions Taken.
 - b. "B": Reviewed, Exceptions Taken as Noted.
 - c. "C": Revise and Resubmit.
 - d. "D": Rejected.
 - e. "E": No Action Taken.
 11. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data, and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.

12. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data, or samples.
 13. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data, or samples by the Architect's review of those drawings.
 14. No portion of the work requiring submission of a shop drawing, product data, or sample shall be commenced until the submittal has been reviewed by the Architect. Such portions of the work shall be in accordance with reviewed submittals.
 15. The successful Contractor may, at their option, obtain DXF or AutoCAD DWG electronic files for use in preparation of shop drawings.
 - a. This information is available from IP Design Group upon written request.
 - b. The use of these drawing files is intended solely for the preparation of shop drawings as required by these contract documents.
 - c. Any other use is strictly prohibited by copyright laws.
 - d. The user of these electronic drawing files assumes full responsibility for their accuracy and scale.
- B. Bid Submittals:
1. The Contractor shall submit a resume with their proposal containing the qualification data listed below.
 - a. A list of five (5) recently completed projects of similar type and size with contact names and telephone numbers for each.
 - b. Installer qualifications.
 - c. RCDD certificate(s).
 - d. Letter of good standing from structured cabling system manufacturer(s).
- C. Pre-Construction Submittals:
1. The Contractor shall submit shop drawings in accordance with the requirements listed below.
 - a. Shop drawings are drawings, diagrams, schedules, and other data specifically prepared for this project by the Contractor to illustrate some portion of the work. Shop drawings shall also detail fabrication and installation for metal and wood supports, and anchorage for mechanical materials and equipment.
 - b. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 - c. Maximum sheet size shall be 36 inches by 48 inches. For each hard copy shop drawing sheet larger than 11 inches by 17 inches, submit one (1) drawing on reproducible media.
 - d. The Architect's action shall be indicated on the reproducible drawing and the drawing shall be returned to the Contractor.
 2. The Contractor shall submit product data in accordance with the requirements listed below.
 - a. Product data are illustrations, schedules, performance charts, instruction brochures, diagrams, and other information furnished by the Contractor to illustrate a product, material, or system for some portion of the work.
 - b. Includes data on features, ratings, and performance for each component specified.
 3. A proposed test plan shall be submitted to the Owner for approval prior to commencement of testing.
- D. Operation and Maintenance Manuals:
1. Prepare an electronic copy of the operation and maintenance manuals for the equipment furnished. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than thirty (30) days prior to substantial completion of the project. Manuals not meeting the following requirements may be rejected by the Architect.
 2. Each manual shall be assembled in a three-ring binder with hard cover and plastic finish. Binders shall not exceed a 3-inch thickness. Where more than one binder is required, the

manuals shall be separated into a logical grouping, i.e., "Telecommunications", "Audiovisual", "Maintenance", "Operation", "Parts", "Shop Drawings", etc. Each binder shall have the following information clearly printed on its front cover:

- a. Project name and address.
 - b. Portion of the work covered by each volume (if more than one volume in the set). Where more than one volume is required, label each volume as "Volume _____ of _____".
 - c. Name, address, and telephone number of Contractor and subcontractors, including night or emergency number.
3. Manual shall include, but shall not be limited to, the following:
- a. A Complete Index:
 - 1) Contractor may submit the index to the Architect for review prior to submittal of complete manuals, if desired.
 - b. Names, Addresses, and Telephone Numbers:
 - 1) This list shall include the manufacturer(s) and local representative(s) who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the binder.
 - c. Startup, Operation, and Shutdown Procedures:
 - 1) Provide a written description of procedures for startup, operation, and shutdown of each electrical item or system. This description shall include switches to operate, buttons to push, etc., in proper sequence, and the location of switches, starters, and push-buttons. Description shall include item references or labels used in the contract documents, unless otherwise instructed in advance by the Owner.
 - d. Equipment Accessory Schedule:
 - 1) Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required, and the manufacturer(s) of renewable items.
 - e. Emergency Procedures:
 - 1) Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
 - f. Provide all manufacturer operation and maintenance manuals and parts lists.
 - g. One (1) copy of shop drawings and product data, clearly marked for each item furnished using the designation label specified or indicated on the drawings.
 - h. Manufacturers' warranty information.
 - i. Detailed operating instructions covering operation under both normal and abnormal conditions.
 - j. Routine maintenance requirements for system components.
 - k. Normal maintenance schedule: Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days, and yearly.
 - l. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
- E. Post-Construction Submittals:
1. Field quality-control test reports in PDF format.
 2. As-built shop drawings in accordance with the requirements listed below.
 - a. Work area outlet, equipment room, telecommunications space, telecommunications enclosure, telecommunications space, and pathway identifiers.
 - b. Routing of cables from equipment racks to devices.
 - c. Routing of cables between equipment racks.
 - d. Revisions to construction documents (addenda and field changes).
 - e. Floor plans with all final device locations, equipment rack locations, and labels.
 - f. Network diagrams, configurations, connections, and uplinks.
 3. Cable labeling schedule(s).

4. When required, submit manufacturer's printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for shop drawings and equipment brochures.
5. Maintain current documents at the construction site. Submit with operations and maintenance manuals.

1.11 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner.
- B. Operation and maintenance manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall be scheduled at the convenience of the Owner. A minimum of four (4) hours of training shall be provided.
- D. Training shall include, but not be limited to, instructions on the following:
 1. Startup and shutdown procedures.
 2. Periodic maintenance.
 3. Emergency operation.
 4. Safety.
 5. Infrastructure management, such as cable patching.
 6. Infrastructure identification, such as patch panel labels.
 7. Configuration and setup.
 8. Additional training identified in other sections.
- E. In addition to the instructions required above, wherever possible, perform the operations being described in order to fully illustrate system operation.
- F. At the completion of training, the Contractor shall turn over to the Owner all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.
- G. Train the Owner in cable management operations, such as rerouting signals in failed cables.

1.12 QUALITY ASSURANCE

- A. Provide one of the following warranties:
 1. Hubbell Mission Critical 25-Year Warranty.
 2. Proterial Cable America Lifetime Warranty.
- B. The Contractor shall prepare and submit all required performance warranty documentation to the manufacturer and shall deliver all complete and final warranty information to the Owner prior to project closeout.
- C. The Contractor shall have an existing quality assurance and quality control plan for the installation. Upon request, the Contractor shall submit the quality assurance and control plan for the project.
- D. The Contractor shall have extensive experience (5+ years) with the specified manufacturer(s), hardware, and cabling type(s).
- E. The Contractor shall:
 1. Employ an experienced installer to supervise the project who is a Registered Communications Distribution Designer (RCDD) certified by BICSI and who has a minimum of five (5) years of experience installing and certifying similar systems.
 2. Allow only installers trained and certified by the manufacturer to install, terminate, and test the structured cabling system products. Others may pull or place product only if under the direct supervision of the certified installer and trained by the manufacturer of the product.
 3. Be experienced in all aspects of the work.
 4. Have the manufacturer's recommended number of employees on the job site who have completed the required training courses for the above-mentioned warranties.
 5. Be certified by the manufacturer for the project location to install and warranty the product specified herein.

- F. The Contractor shall employ a qualified project manager (PM) who must meet the following requirements:
 - 1. Required participation in meetings and conferences.
 - 2. Be present at the project site for substantial completion inspection and final inspection.
 - 3. Approve the operation and maintenance manuals.
 - 4. Provide any additional instruction as needed to the Owner.
 - 5. Be responsible for supervision of all technical work that is part of this specification.
 - 6. Supervise preparation of shop drawings and submittals, and sign all submittals.
 - 7. Supervise the shop fabrications and field installation work to ensure strict conformance in accordance to the drawings, specifications, and the reviewed shop drawings to assure workmanship of the specified quality.
 - 8. Oversee the testing of all assemblies and all sub-assemblies prior to their delivery to the project site.
 - 9. Lead in the specified testing of completed installation to assure the Owner that all contract requirements were met. Work with and assist the Owner in the final testing for approval and acceptance of the system by the Owner.
- G. The Contractor must provide proof of registration(s) and certification(s) along with the list of planned installers prior to commencing work.

1.13 WARRANTIES

- A. The Contractor shall warrant all materials, workmanship, and equipment against defects for a period of one (1) year after the date of substantial completion. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those sections of the project manual. The Contractor shall repair or replace, at no additional cost to the Owner, any item which may become defective within the warranty period. Any manufacturer warranties concerning any item installed will run to the benefit of the Owner. The Contractor agrees not to void or impair, or to allow subcontractors to void or impair, any warranties regarding products or items installed as part of this project. The repair of faulty workmanship shall be considered to be included in the contract.

1.14 REFERENCE STANDARDS

- A. The Contractor's performance of work shall comply with applicable federal, state, and local laws, rules, and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections, and shall pay without burden to the Owner all fees and charges in connection therewith, unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission (FCC) registration or approval for any equipment requiring such approval shall be appropriately identified and obtained by the Contractor.
- C. Design, manufacture, test, and install communications cabling per manufacturer requirements, state codes, local codes, requirements of authorities having jurisdiction, and particularly the most recent edition of the following standards:
 - 1. ANSI/TIA-568-B.1: Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements.
 - 2. ANSI/TIA-568-B.2: Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components.
 - 3. ANSI/TIA-568-B.3: Optical Fiber Cabling Components Standard.
 - 4. ANSI/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 5. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure.
 - 6. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
 - 7. ANSI/TIA 526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.

8. ANSI/TIA 526-14-D: Optical Power Loss Measurement of Installed Multi-Mode Fiber Cable Plant.
 9. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Standard.
 10. TIA/EIA-TSB-67: Transmission Performance Specifications for Field Testing of Twisted-Pair Cabling Systems.
- D. Install communications cabling in accordance with the most recent edition of the following publications:
1. BICSI Telecommunications Distribution Methods Manual (TDMM).
 2. BICSI Outside Plant Design Reference Manual (OSPDRM).
 3. ANSI/BICSI 007-2020: Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises.
 4. ANSI/BICSI 008-2018: Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices.
 5. ANSI/BICSI N1-2019: Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure.
 6. ANSI/BICSI N2-17: Practices for the Installation of Telecommunications and ICT Cabling Intended to Support Remote Power Applications.
 7. ANSI/BICSI N3-20: Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure.
- E. Electrical Components, Devices, and Accessories:
1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. The aforementioned and following additional federal, state, and local rules, regulations, and ordinances govern the work as fully a part of the specifications as if herein attached. Where requirements of the drawings or specifications are more stringent than the applicable codes, rules, regulations, and ordinances, the drawings or specifications shall apply.
1. ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems.
 2. UL 1479: Standard For Fire Tests of Through-Penetration Firestops.
 3. Americans with Disabilities Act (ADA): Accessibility Guidelines.
 4. Code of Federal Regulations, Title 29, Subtitle B, Chapter XVII, Part 1910 (Occupational Safety and Health Standards).
- G. Follow the Owner's installation standards unless otherwise shown on the drawings or stated herein. Where requirements of installation standards conflict with performance standards or a manufacturer's recommendations, refer to the Owner for a decision before proceeding.

1.15 COORDINATION

- A. Coordinate and schedule all construction work with the General Contractor prior to beginning work. Do not interrupt building activities without strict coordination with the General Contractor. Unscheduled appearance to work without prior scheduling with the General Contractor is not allowed.
- B. The Contractor shall attend all meetings as required by the General Contractor.
- C. Convene a meeting at least one (1) week prior to commencing the work of this section, with the following agenda at a minimum:
 1. Tour, inspect, and discuss building conditions related to the structured cabling system.
 2. Review submittals, both completed and yet to be completed.
 3. Review plans, specifications, and proposed equipment.
 4. Review construction schedule, availability of materials, personnel, equipment, and facilities needed to proceed without delay.
 5. Review required inspections and testing.
 6. Review cable routing, cable support, primary pathways, communications spaces, and environmental conditions.
- D. The Contractor's project manager must be readily available on-site when needed.

- E. Coordinate layout and installation of communications cabling with Owner's workstation and network equipment suppliers, if applicable.
- F. Coordinate service entrance arrangements with Owner's service provider(s), if applicable.
- G. Meet jointly with the Architect, network equipment suppliers, service provider representative(s), and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
- H. Coordinate network configuration requirements for communications equipment with the Owner.
- I. Record agreements reached in meetings and distribute to other participants.
- J. Coordinate communications device rough-ins and conduit with general construction work. Coordinate the arrangement of these items within the building structure during progress of construction to facilitate the communications installations that follow.
- K. Coordinate exact location(s) of ceiling-mounted equipment and devices with architectural plans, reflected ceiling plans, structural plans, and all affected trades prior to construction and installation.
- L. Coordinate exact location(s) of all equipment and devices mounted to desktops and countertops with the millwork, casework, and furniture plans prior to installation.
- M. Adjust arrangements and locations of distribution frames, cross-connect blocks, and patch panels in equipment rooms and telecommunications rooms to accommodate and optimize arrangement and space requirements of network equipment.
- N. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the installations that follow.
- O. Fully examine the drawings and specifications for other trades and coordinate the installation of communications work with the work of the other trades. Consult and cooperate with the other trades for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment, and the building.
- P. Coordinate installation of communications cabling with the raceway installer. Verify raceways are installed according to current TIA standards before installing cabling.
- Q. Environmental Conditions:
 - 1. Do not deliver or install cables and connecting materials to the installation location until areas are complete, dry, and temporary or permanent HVAC systems are operating and maintaining acceptable ambient temperature and humidity conditions for the remainder of the project. Communications cabling damaged (including painted cables) as a result of premature occupancy of the site will be replaced at the expense of the Contractor.
 - 2. Do not deliver or install equipment racks, network cabinets, and network electronics until communications rooms are enclosed, painted, water-tight, complete, dry, dust-free, and work above and in ceiling spaces is complete. Communications equipment damaged as a result of premature occupancy of the communications spaces will be replaced at the expense of the Contractor.
 - 3. System components shall be equipped and rated for the environments where installed.
 - 4. Rate outdoor equipment for continuous operation under specified environmental conditions, unless otherwise indicated.
 - a. Temperature range of -40 °C (-40 °F) to +70 °C (+158 °F).
 - b. Relative humidity range of five percent (5%) to one-hundred percent (100%).
 - c. Provide enclosures to prevent entry of moisture due to melting ice buildup, or driven rain or snow.
 - 5. Rate indoor equipment for continuous operation under specified environmental conditions, unless otherwise indicated.
 - a. Temperature range of 0 °C (32 °F) to +70 °C (+158 °F).
 - b. Relative humidity range of zero percent (0%) to ninety-five percent (95%).

- R. Provide offsets and elevation changes in cable tray, cable ladder runway, conduit, and devices as required to complete the layout and coordination process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- S. Painted Cables and Devices:
 - 1. Protect communications cabling from direct painting or over-spray and coordinate the painting and cable installation schedules with respective subcontractors. Painted cables shall be replaced at the Contractor's expense.
 - 2. Protect faceplates and connectors from direct painting or over-spray. Painted faceplates and connectors will be replaced at the Contractor's expense.

1.16 STRUCTURAL COORDINATION

- A. In cases where the Contractor determines that superimposed loads (such as suspended or floor-mounted mechanical, electrical, plumbing systems or equipment) exist which exceed design loads indicated on the structural contract documents, the Contractor shall submit the load data to the Architect for review prior to proceeding with the work.
- B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, ductwork, piping, etc., over the member's tributary area in a way that the design superimposed dead loads listed in the structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required to achieve allowable load distribution.
- C. Connections of systems designed by the Contractor such as, but not limited to, mechanical, electrical, and plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

PART 2 – PRODUCTS

2.01 PERFORMANCE, CAPACITIES, AND CHARACTERISTICS

- A. Refer to the drawings for equipment schedules and equipment performance requirements when capacities and characteristics are not indicated in the specifications.

2.02 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused, and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production and shall bear the UL listing, or listing by other recognized testing laboratory when such listings are available. Materials shall be free of damage or corrosion and shall be of the best quality obtainable for the purpose intended.
- B. Refer to individual specification sections for manufacturers.

2.03 COMPLETENESS OF WORK

- A. The contract documents depict low voltage systems which are intended to be complete and functioning systems. All products, labor, and programming necessary to render a full and functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout the drawings and specifications are intended to convey the understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge will be allowed because a catalog number is found to be incomplete or obsolete.

2.04 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.05 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device, or piece of equipment is referred to in the singular number, such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

2.06 SLEEVE SEALS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Sleeve Seals:
 - a. Calpico, Inc.
 - b. Flexicraft Industries.
 - c. Metraflex.
 - d. Link-Seal.
 - 2. Seal Sleeves:
 - a. Pipe Shields, Inc.
 - b. ProSet Systems, Inc.
 - c. Crete-Sleeve.
- B. Description:
 - 1. Modular design with interlocking rubber links, shaped to continuously fill annular space between pipe and sleeve.
- C. Sealing Elements:
 - 1. EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- D. Pressure Plates:
 - 1. Plastic. Include two for each sealing element.
- E. Connecting Bolts and Nuts:
 - 1. Carbon steel with corrosion-resistant coating, of length required to secure pressure plates to sealing elements. Include one (1) for each sealing element.

2.07 SLEEVES

- A. Electrical Metallic Tubing:
 - 1. Pre-fabricated, galvanized steel, deburred, with plastic bushings on each end.
- B. Fire-Rated Pathway Devices:
 - 1. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - a. Specified Technologies, Inc. (STI).
 - b. Hilti.
 - 2. Pre-fabricated pathway with intumescent pads conforming to cabling loads from zero percent (0%) to one-hundred percent (100%) fill capacity.
 - 3. Provide sizes and quantities as indicated on the drawings.

2.08 SEALANTS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Sealants:
 - a. Dow.
 - b. Pecora.
 - c. Sonneborn.
 - d. Tremco.
- B. Silicone Sealant:

1. Single-component, air-curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected.
- C. Primer:
 1. Non-staining type, recommended by sealant manufacturer to suit application.
- D. Joint Cleaner:
 1. Non-corrosive and non-staining type, recommended by sealant manufacturer, compatible with joint forming materials.
- E. Joint Backing:
 1. In compliance with ASTM D1056, round, closed-cell, polyethylene foam rod, oversized 30% to 50% larger than joint width.
- F. Bond Breaker:
 1. Pressure-sensitive tape recommended by sealant manufacturer to suit application.
- G. Firestopping Materials:
 1. Subject to compliance with the requirements of Division 07, provide one of the following:
 - a. Specified Technologies, Inc. SpecSeal SSS Intumescent Firestop Sealant.
 - b. 3M Fire Barrier Sealant CP 25WB+.
 - c. Tremco TREMstop Fyre-Sil Gun-Grade Silicone Firestop Sealant.
 - d. Metacaulk.
 - e. Dow.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, cable ladder runways, conduits, sleeves and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Provide all specified materials, installation hardware, and labor required to complete the work shown on the drawings and specified in this section and other Division 28 security specifications sections. This shall include work and miscellaneous items that are not explicitly specified, but are necessary to build a complete system installation, including all tools and test equipment, accessories, appurtenances, and all items required for testing the system. All systems shall be complete, operational, and ready for use by the Owner.
- B. Bring to the attention of the Owner and Architect conflicts between manufacturer instructions and contract documents.
- C. Cabling Installation Method:
 1. Provide cabling in raceway, cable tray, cable ladder runway, conduit, and sleeves except within consoles, cabinets, desks, and counters. Conceal pathways and cabling, except in unfinished spaces.
- D. Use UL-listed, plenum-rated cabling in environmental air spaces, including plenum ceilings.
- E. Install cables without damaging conductors, shield, or jacket.
- F. Use cable bundling hardware rated for the environment and application in which used. Applications include, but are not limited to, general purpose, outdoor, chemical-resistant, flame-retardant, high-temperature, and vibration.
- G. Provide reusable cable management straps for bundling and securing cables. Do not use nylon cable ties.
- H. Do not bend cables, in handling or in installation, to smaller radii than minimums recommended by manufacturer.

- I. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
- J. Install exposed cables parallel and perpendicular to surfaces or exposed structural members. Follow surface contours where possible.
- K. Secure and support cables at intervals not exceeding 48 inches, and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, equipment racks, frames, and terminals.
- L. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by the manufacturer.
- M. Comply with ANSI/TIA-569-D for separating unshielded copper data communications cabling from potential EMI sources, including electrical power lines and equipment.
- N. Make splices and terminations only at indicated outlets, terminals, cross-connects, patch panels, and splices.
- O. Use splice connectors compatible with media types.
- P. Install cabling using techniques, practices, and methods that are consistent with Category rating of components and that ensure Category performance of completed and linked signal paths, end-to-end.

3.03 FIRESTOPPING

- A. Firestop all smoke-rated and fire-rated walls, partitions, and openings after the installation of communications cabling in sleeves and pathways. Firestop material shall be approved for use with the communications cables and jackets being installed.
- B. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of firestopping for communications cabling as called for in these specifications and related drawings.
- C. Deliver firestopping products to the project site in original, unopened containers or packages with intact and legible manufacturer labels identifying project, manufacturer, date of manufacture, lot number, shelf life (if applicable), qualified testing and inspecting agency's classification marking applicable to the project, curing time, and mixing instructions for multi-component materials.
- D. Creation of such openings, as necessary, for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor.
- E. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the Contractor for cabling pass-through, shall be the responsibility of the Contractor.
- F. Any openings created by or for the Contractor and left unused shall be sealed as part of this work.
- G. Firestop system installation must meet requirements of ASTM E814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- H. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- I. Ventilate firestopping per the firestopping manufacturer's instructions by natural means or, where this is inadequate, forced air circulation.
- J. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.
- K. Do not use materials that contain flammable solvents.
- L. Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of the firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of openings and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean openings and joint substrates and penetrating items to produce clean, sound surfaces capable of developing the optimum bond with firestopping. Remove loose particles remaining from the cleaning operation.
- M. When the firestop system has been installed, place a label next to the system. The label shall contain the following items:
 1. UL rating and any other pertinent certification information.
 2. The date the firestop was installed.
 3. Name of contractor who installed the firestop.
- N. Protect firestopping during and after the curing period from contact with contaminating substances or form damage resulting from construction operations or other causes so that they are without deterioration or damage at the time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.
- O. Keep areas of work accessible until inspection by applicable code authorities.

3.04 AS-BUILT DRAWINGS

- A. As-built drawings shall include all information required for shop drawings and, in addition, shall indicate the following:
 1. All construction changes posted to all portions of the documents including, but not limited to, communications drawings, enlarged plans, wall and rack elevations, schematics, labeling, and installation details. As-built documents shall include and clearly show final cable labeling designations down to the individual outlet and port.
- B. Final drawings shall be provided to the Architect in electronic format.
- C. As-built drawings shall be complete and organized to be suitable for use as disaster recovery and cable infrastructure administration documents.
- D. Post a complete set of as-built documents in the MDF serving the project. In each MDF and IDF, post a final floor plan of the outlets served by the MDF or respective IDF on the wall behind a protective plexiglass wall frame.

3.05 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

- A. Trenching, excavation, backfilling, and repairs are the responsibility of the Contractor. Coordinate the extent of all work with the General Contractor where applicable and coordinate related work with all trades. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling, or repairs shall be performed at no additional cost by the Contractor.

3.06 OBSERVATIONS

- A. Specifications and drawings represent work to be done in view of the total project requirements. Final locations of all pathways, cables, outlets, equipment racks, components, etc., to eliminate possible conflict with other trades is the responsibility of the Contractor. The Contractor is to provide all project management and supervision required for their personnel to ensure installation is made in accordance with the plans and specifications and that all codes, safety rules, and regulations are observed. In the event of conflicts with other trades, the Contractor is to make every reasonable effort to resolve the conflict with other trades involved, by preparation of drawings or sketches, or by other appropriate action. Only after this on-site coordination has taken place, and a resolution cannot be found, is the Contractor to request assistance. Assistance shall be requested in adherence with the request for information (RFI) process defined for this project.

3.07 DEMONSTRATION

- A. Participate in project site observations, walkthroughs, and punch lists as requested by the Owner and/or the Architect.
- B. Demonstrate completeness of work relative to completion percentages submitted for payment.

3.08 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finishes.
- B. Remove burrs, dirt, and construction debris, and repair damaged finishes, including chips, scratches, and abrasions.

END OF SECTION

SECTION 27 05 27
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section describes the grounding and bonding requirements for telecommunications systems and equipment. Grounding and bonding requirements specified in this section may be supplemented by special requirements of systems described in other sections.

1.02 SUBMITTALS

- A. As specified in Section 270501.
- B. Product Data:
 - 1. Lugs and connectors.
 - 2. Conductors.
- C. Shop Drawings.
- D. Test Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action(s) taken to achieve test results that comply with requirements.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
 - 2. Comply with UL 467.
- B. Comply with NFPA 70.
- C. Comply with NFPA 780.
- D. Comply with ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Lugs and Connectors:
 - a. Chatsworth Products.
 - b. CommScope.
 - c. Harger.
 - d. Hubbell.
 - e. Legrand.
 - f. nVent.
 - g. Panduit.

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26.
- B. On larger conductors where green insulation is not available, insulate with green-colored insulation. Use green-colored tape at each termination point or splice to identify bonding conductor, with the exception of the use of manufacturer-recommended straps to bond cable trays, cable ladder runways, or equipment racks.

2.03 CONNECTOR PRODUCTS

- A. Comply with IEEE 837, UL 467, and ANSI/TIA-607; listed for use of specific types, sizes, and combinations of conductors and connected items.
- B. High-Pressure Compression Connectors:
 - 1. Hubbell Burndy HYGROUND, Panduit StructuredGround, or approved equivalent.

PART 3 – EXECUTION

3.01 APPLICATION

- A. Use only copper conductors for bonding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Equipment Grounding Conductor Terminations:
 - 1. Use bolted pressure clamps.
- D. Underground Grounding Conductors:
 - 1. Use copper conductor, 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Signal and Communication Systems:
 - 1. For all communications systems, provide #6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - a. For service and central equipment locations and wiring closets, terminate bonding conductors on a 12-inch long by 2-inch wide by 1/4-inch thick busbar.
 - b. For terminal cabinets: Terminate bonding conductors on cabinet grounding terminal.

3.03 INSTALLATION

- A. Bonding Conductors:
 - 1. Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors or high-pressure compression connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
 - 1. Install such that vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly-mounted equipment. Use exothermic-welded connectors or high-pressure compression connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- C. Install each bonding conductor in a direct route and parallel or perpendicular to building structure or surfaces, without interfering with other systems or equipment.
- D. Install exterior grounding electrode conductors with a minimum bending radius of 12 inches.
- E. Install interior bonding conductors with a minimum bending radius of 8 inches.
- F. Install bonding conductors in EMT conduit unless otherwise indicated. Bond each end of the conduit to the bonding conductor using an appropriate bushing.

3.04 CONNECTIONS

- A. General:
 - 1. Make connections such that galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 2. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 3. Make connections with clean, bare metal at points of contact.
 - 4. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 5. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - 7. Clean ground bars and apply a light coating of antioxidant between the busbar and lug.
- B. Bonding Conductor Terminations:
 - 1. Provide compression lugs. For #4 AWG and larger, use two-hole lugs. For #6 AWG and smaller, use one-hole lugs.
- C. Non-Contact Metal Raceway Terminations:
 - 1. If metallic raceways terminate at metal housings without mechanical and electrical connection to housing or at a nonmetallic housing, terminate each conduit with a bushing. Connect bushings with a bare bonding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with bushings and bare bonding conductors, unless otherwise indicated.
- D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- E. High-Pressure Compression-Type Connections:
 - 1. Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- F. Moisture Protection:
 - 1. If insulated bonding conductors are connected to rods or busbars, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.05 TELECOMMUNICATIONS GROUNDING

- A. When present, bond the following to the Primary Bonding Busbar (PBB):
 - 1. Metallic equipment racks.
 - 2. Cable shields.
 - 3. Metal raceways, cable trays, and cable ladder runways for communications cabling extending from the same room or space where the PBB is located.
 - 4. Entrance protectors.
- B. When present, bond the following to the nearest Secondary Bonding Busbar (SBB):
 - 1. Metallic equipment racks.
 - 2. Cable shields.
 - 3. Metal raceways, cable trays, and cable ladder runways for communications cabling extending from the same room or space where the SBB is located.

3.06 LABELING

- A. Busbars:
 - 1. Clean all surfaces prior to attachment of any label.

2. Follow manufacturer's recommendations for cleaning and affixing labels.
 3. Label location shall be in the upper right-hand corner of the busbar.
 4. Refer to the drawings for label identifier information.
 5. Labels shall be self-adhesive, engraved plastic nameplate, black with white letters.
 6. Format shall be all capital letters; font shall be as large as possible to fill the label space with the required information. The font shall be Helvetica, or equal, and bold. One-line format. Letters shall be at least 1/2 inch tall for readability.
- B. Bonding Conductors:
1. Label location shall be on the conductor at each end where it terminates.
 2. Refer to the drawings for label identifier information.
 3. Labels shall be machine-printed; design basis is Brady WML-1223-292.
 4. Format shall be all capital letters; font shall be as large as possible to fill the label space with the required information. The font shall be Helvetica, or equal, and bold. One-line format.
- C. Examples:
1. Telecommunications Bonding Conductor (TBC). The TBC bonds the MGB to the PBB.
 2. Telecommunications Bonding Backbone (TBB). The TBB bonds the PBB to the SBB. There may be multiple TBBs.
 3. Telecommunications Equipment Bonding Conductors: EK, followed by the sequence numbers (e.g., EK001, EK002, etc.).

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes pathways used for low-voltage communications cabling.

1.02 SUBMITTALS

- A. As specified in Section 270501.
- B. Product Data:
 - 1. J-hooks.
 - 2. Fire-rated pathway devices.
 - 3. Pathway accessories (e.g., cable dropouts, conduit waterfalls, etc.).
- C. Shop Drawings.
- D. Warranty.

1.03 QUALITY ASSURANCE

- A. Comply with Division 26.
- B. Confirm locations of cable pathways and supports during installation to identify and remedy potential cable installation conflicts before installation of cables.
- C. Insure that all minimum bend radius requirements are maintained.
- D. Coordinate the placement of pathway elements with other trades.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. J-Hooks:
 - a. Eaton.
 - b. nVent.
 - c. Legrand.

2.02 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment which comprise the communications pathway system so that they form an integrated system.
- B. Match components and interconnections for optimum future cable installation and performance.
- C. UL-classified for suitability as an equipment grounding conductor.
- D. Comply with NEMA BI 50015-2024 (VE1) and NEMA BI 50016-2024 (VE2).

2.03 CABLE RACEWAYS

- A. Conduit:
 - 1. Comply with Division 26.
- B. Boxes:
 - 1. Comply with Division 26.

2.04 J-HOOKS

- A. Size:
 - 1. Between 3/4 inch and 4 inches as required to serve quantity of cables being run.
- B. Category 6A-rated.
- C. With wire spring cable retaining clips or slots for cable ties.

2.05 DROPOUTS & WATERFALLS:

- A. Conduit Waterfalls:
 - 1. Provide conduit end waterfalls for all 4-inch conduits or sleeves where located 12 inches or more above cable trays, cable ladder runways, or wall termination fields.
- B. Provide additional cable dropouts and waterfalls as indicated on the drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, conduits, sleeves, cable trays, cable ladder runways, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine all pathways for obstructions and clear prior to installation of cabling.
- C. Examine all pathways for burrs and sharp edges. Remove prior to the installation of cabling. All cables damaged as a result of improperly prepared pathways shall be the responsibility of the installer.

3.02 J-HOOK INSTALLATION

- A. Provide hook-and-loop ties around J-hooks to secure cables.
- B. Strategically place J-hooks to aid in cable routing at corners and at changes in height.
- C. If cable tray or cable ladder runway is not used as a primary pathway, use 2-inch or larger J-hooks to support cabling in primary pathways. Provide a second J-hook in a tiered or back-to-back configuration for each J-hook installed only when the quantity of outlets served from that primary pathway exceeds 40% of the manufacturer's rated capacity.
- D. J-hooks used to support cable in secondary pathways can be 3/4 inch or larger. Provide a second J-hook for each J-hook installed only when the quantity of outlets served from that secondary pathway exceeds 40% of the manufacturer's rated capacity.
- E. Provide J-hooks as indicated on drawings and as required between discontinuous sections of cable tray or cable ladder runway.
- F. Where multiple J-hooks are installed, place J-hooks back-to-back if possible; otherwise, stack J-hooks one above the other.
- G. Install J-hooks at maximum of 5-foot intervals, unless cable manufacturer requires different interval to maintain warranty. Unevenly space J-hooks to avoid standing waves on the cables.
- H. Attach J-hooks to building structure.

3.03 PATHWAY INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure cable tray or cable ladder runway directly to top of equipment racks and network cabinets using manufacturer's recommended solution for attachment.
- C. Install raceways securely, in a neat and workmanlike manner, as specified in NECA 1.
- D. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- E. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- F. For wireway supports, provide steel channel as specified in Division 26.
- G. Close ends of wireways and unused conduit openings.
- H. Ground and bond raceways and wireways under provisions of Division 26.
- I. Install metallic cable tray and cable ladder runway in accordance with NEMA VE 1.
- J. Remove sharp edges from pathways.

- K. Support pathways in accordance with Division 26. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 10 ft maximum.
- L. Additional requirements for cable management tray and cable ladder runway:
 - 1. Cut using manufacturer's recommended cutting tool. File cut edges smooth.
 - 2. Locate supports a maximum of 5 feet on center and no more than 30 inches from a joint.
 - 3. Install hardware with bolts oriented such that nuts are on the outside pathway element.
- M. Provide a dropout fitting at the free end(s) of each run of cable tray or cable ladder runway and at elevation changes.
- N. Install cable tray and cable ladder runway with sufficient space to allow access for cabling installation and for future cabling moves, adds, and changes.
- O. Use expansion connectors where required.
- P. Provide firestopping under provisions of Division 07 to sustain ratings when passing cable tray or cable ladder runway through fire-rated elements.
- Q. Install cable trays and cable ladder runways to preserve fire-resistance rating of partitions and other elements.
- R. Ground and bond cable tray and cable ladder runway under provisions of Division 26:
 - 1. Provide continuity between pathway components. Use lugs and grounding clamps compatible with tray material.
 - 2. Provide #2 AWG bare copper equipment grounding conductor through entire length of pathway; bond to each component.
 - 3. Connections may be made using mechanical or exothermic connectors.

END OF SECTION

SECTION 27 05 53.01
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes instructions for labeling and documentation of communications infrastructure.

1.02 SUBMITTALS

- A. As specified in Section 270501.
- B. Product Data:
 - 1. Label printer.
 - 2. Label tape.
- C. Shop Drawings:
 - 1. Cable labeling scheme.
- D. Maintenance Data:
 - 1. Include all information required for shop drawings.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure.
- B. Comply with BICSI Telecommunications Distribution Methods Manual (TDMM), current edition.

PART 2 – PRODUCTS

2.01 IDENTIFICATION PRODUCTS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Brady.
 - 2. Brother.
 - 3. Dymo.
 - 4. Panduit.
- B. Cable Labels:
 - 1. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine-printed with alphanumeric cable designations.
- C. Label Maker:
 - 1. Suitable for cable wraps, cable flags, patch panels, punch blocks, faceplates, barcodes, etc.

PART 3 – EXECUTION

3.01 IDENTIFICATION & LABELING

- A. General Label Requirements:
 - 1. Mechanically print and install all labels per drawings.
 - 2. Select font size to be readable and to fit all information required without overlap of text. Recommended font is Helvetica (bold).
 - 3. Use all capital letters.
 - 4. Clean all surfaces prior to attachment of any label. Follow manufacturer's recommendations for cleaning and affixing labels.
 - 5. Coordinate room name and/or number information used in labels with final approved room signage. Final room signage may not match room tags used in construction documents.
- B. Cable Labeling System:
 - 1. Use a unique alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects. Use logical and systematic designations for facility's architectural arrangement.

2. Refer to drawings.
- C. Work Area Outlets:
 1. Label each terminated work area outlet jack per drawings.
 2. Refer to drawings for label information.
 3. Outlet identifiers shall be unique to the building.
 4. Method:
 - a. Use manufacturer's white paper inserts or approved equal. Utilize commercial software to print the information on an adhesive label and affix the label to the paper insert or type the information on the strip. Do not affix labels to the clear plastic window. If label information does not legibly fit within window, then affix individual label above each jack.
- D. Patch Panels:
 1. Label each patch panel per drawings.
 2. Refer to drawings for label information.
 3. Patch panel identifiers shall be unique to the telecommunications room in which they are installed.
 4. Method:
 - a. Affix label to the left-hand side of the patch panel without covering any port numbers.
- E. Outside Plant Cables:
 1. Label location shall be on the jack or sheath of the cable at the ends and at every splice, case, and manhole. Place near the hardware on which the cable is terminated.
 2. Locate label in a visible and readable location.
 3. Label information shall contain the cable identifier, which shall include the cable number followed by the cable pair count (numeric characters), both the beginning and ending count. The cable identifier is unique to the building. Refer to drawings.
 4. Provide polyethylene non-conductive cable tags with cable numbers as shown on the plans.
 5. Install tags at all splices (on each cable that enters the splice case), terminations, cable tray or cable ladder runway to conduit transitions, in manholes (at least once on each cable as it passes through the manhole), and at other locations as directed.
- F. Inside Plant Cables (Including Coaxial):
 1. Label location shall be within 12 inches of each termination and tap, where it is accessible in an equipment rack, network cabinet, junction box or outlet box, and elsewhere as indicated.
 2. Refer to drawings for label information.
- G. Equipment Racks, Network Cabinets, and Wall Enclosures:
 1. Label location shall be centered at the top and bottom of the rack or cabinet in both the front and rear.
 2. Refer to drawings for label information.
- H. Fiber Termination Enclosure:
 1. Label location shall be on the outside of the enclosure surface in the top-left corner of the front panel.
 2. Refer to drawings for label information.
- I. Fiber Termination Enclosure Ports:
 1. Label location shall be on the inside front panel of the enclosure in the location identified by the manufacturer for the label. In most cases, the manufacturer's insert can be used for which to affix installer-provided labels. The connector layout within each enclosure may vary. In general, the columns of fiber connectors are grouped in units of six (6) connectors. Columns count from left to right. Termination positions within a column count from top to bottom.
 2. Refer to drawings for label information.

- J. Cable Labeling System Schedule:
 - 1. Post in prominent location in each telecommunications room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for project, in approved software and format.
- K. Cable Administration Drawings:
 - 1. Show building floor plans with cable administration labeling. Identify labeling convention and show labels for telecommunications spaces, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas outlets, grounding buses and pathways, and equipment grounding conductors. Follow conventions of ANSI/TIA-606-D. Furnish electronic record of all drawings, in approved software and format.

END OF SECTION

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes cabling requirements and installation methods for horizontal twisted-pair copper communications systems to be used for voice and high-speed data transmission.
- B. Horizontal cabling communications systems shall include the installation of twisted-pair copper cabling, connecting hardware, supports, faceplates, patch cords, cable terminations, cable testing, and cutover to form a complete and functioning system.

1.02 SUBMITTALS

- A. As specified in Section 270501.
- B. Product Data:
 - 1. Twisted-pair copper cabling.
 - 2. Patch panels.
 - 3. Patch cords.
 - 4. Punch-down blocks.
- C. Shop Drawings:
 - 1. Cabling interconnection diagram(s) and work area outlet locations.
 - 2. Connector and termination hardware layouts.
- D. Maintenance Data.
- E. Qualifications:
 - 1. Documentation of certification from the cabling manufacturer.
- F. Warranty.
- G. Test Reports:
 - 1. Documentation of the test results, test equipment, equipment certification, and calibration of test equipment utilized.

1.03 QUALITY ASSURANCE

- A. Coordinate layout and installation of communications equipment with the Owner as directed.
- B. Coordinate entrance arrangements with the Owner's service provider(s) as directed.
- C. The Contractor shall be responsible for verifying that all conduits and raceways are ready for cabling placement.
- D. Coordinate with pathway installer to ensure that TIA distance limits and installation tolerances are maintained. Outlets that are beyond TIA distance shall be brought to the attention of the Owner and the Architect as soon as possible. Owner and Architect shall not be responsible for outlets beyond distance limits as a result of deviation from the plans and/or incorrectly routed sleeves and/or pathways.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Twisted-Pair Copper Horizontal Cabling:
 - a. Hubbell.
 - b. Proterial Cable America.
 - 2. Copper Termination Equipment:
 - a. Hubbell.
 - b. Proterial Cable America.
 - 3. Manufacturer(s) shall comply with specified warranty in Section 270501.

2.02 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment so that they form an integrated system.
- B. Match components and interconnections for optimum future performance.
- C. Obtain all cabling products through one source from a single manufacturer.
- D. Horizontal cabling shall provide interconnections between telecommunications spaces and work area outlets. The horizontal cabling system shall consist of all cables, horizontal cross-connects, mechanical terminations, patch cords used for termination or cross-connection.
- E. Horizontal cabling shall be installed in a star topology. Each work area outlet shall be cabled directly to telecommunications space serving the area.
- F. All horizontal cabling terminations shall be located in telecommunications spaces. Bridged taps, splitters, or other unapproved hardware and facilities not specifically indicated on the drawings shall not be used as a part of the horizontal cabling.
- G. Multi-user telecommunications outlet assemblies (MUTOAs) are not allowed unless otherwise specifically detailed in the construction documents.
- H. Consolidation points and intermediate cross-connects are not allowed unless otherwise specifically detailed in the construction documents.
- I. All cables placed in conduits, cable trays, and cable ladder runways shall not exceed the fill capacities as listed in ANSI/TIA-569-E even though maximum fill quantities as listed in NFPA 70 are less strict.
- J. Upon entering a telecommunications space, cabling shall be neatly combed and separated according to service application. All added cables shall consistently follow the same path. Separate system cabling by pathway sleeve where possible.
- K. All cabling shall be new and unused, provided, installed, terminated, and tested to form a complete system. The Contractor shall not deviate from the specified structured cabling system components and any substitutions not approved via the formal substitution process will be rejected and removed and replaced with the approved products at the Contractor's expense.
- L. General Data Device, Wireless Access Point, and Networked Security Device Cables:
 - 1. Provide horizontal cabling to each device outlet location where indicated on the drawings.
 - 2. Cables and jacks for these devices shall be provided with a unique coloring scheme.
 - 3. Cables shall be terminated, tested, and warranted utilizing the same criteria as the work area outlet horizontal cabling system.

2.03 EXPANSION CAPACITY

- A. Provide spare positions in patch panels and punch-down blocks to accommodate a twenty percent (20%) future increase in active work area outlets.

2.04 MATERIALS

- A. Twisted-Pair Cables:
 - 1. Listed as complying with ANSI/TIA-568-B.
 - 2. Conductors shall be composed of solid copper.
 - 3. Unshielded twisted-pair, thermoplastic-insulated, individually twisted pairs of conductors, #23 AWG, color-coded, and enclosed in PVC jacket.
 - 4. Listed for use in air-handling (plenum) spaces. Features are as specified for cables and conductors, except materials are modified as required for listing.
 - 5. Cabling shall be UL-listed.
 - 6. Rated for use in indoor (inside plant) environments, and rated for use in outdoor (outside plant) environments where noted. Refer to drawings.
- B. Category 6:
 - 1. Four (4) pairs.
 - 2. Jacket color scheme shall be unique to the device type being served.
 - a. General Data Device: Blue.

- b. Networked Security Device: Blue.
- C. Category 6A: Wireless Access Point
 - 1. Four (4) pairs.
 - 2. Jacket color shall be blue.
- D. Patch Panels:
 - 1. Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 2. Flat configuration.
 - 3. Compliant with EIA-310-E for mounting within 19-inch equipment racks or network cabinets.
 - 4. Unloaded front connections.
 - 5. Unloaded rear connections.
 - 6. T568B wiring scheme.
 - 7. 48-port.
 - 8. Capacity shall account one jack for each 4-pair cable, plus spares and blank positions adequate to satisfy specified expansion criteria.

2.05 PATCH CORDS

- A. Telecommunications Room
 - 1. Quantity:
 - a. One (1) for each terminated jack.
 - 2. Length:
 - a. 3 feet.
 - 3. Color:
 - a. Jacket color shall match color of copper horizontal cabling jacket.
 - 4. Jacket Rating:
 - a. CM.
- B. General Data Device (e.g., Workstation, VoIP Telephone, Printer, etc.)
 - 1. Quantity:
 - a. One (1) for each terminated jack.
 - 2. Length:
 - a. 7 feet.
 - 3. Color:
 - a. Jacket color shall match color of copper horizontal cabling jacket.
 - 4. Jacket Rating:
 - a. CM.
- C. Wireless Access Point
 - 1. Quantity:
 - a. One (1) for each terminated jack.
 - 2. Length:
 - a. 3 feet.
 - 3. Color:
 - a. Jacket color shall match color of copper horizontal cabling jacket.
 - 4. Jacket Rating:
 - a. CMP (listed for use in a plenum).
- D. Networked Security Device
 - 1. Quantity:
 - a. One (1) for each terminated jack.
 - 2. Length:
 - a. 3 feet.
 - 3. Color:
 - a. Jacket color shall match color of copper horizontal cabling jacket.

- 4. Jacket Rating:
 - a. CMP (listed for use in a plenum).
- E. Provide patch cords which comply with manufacturer's warranty.
- F. Final quantities of each length to be confirmed with the Owner prior to ordering.

PART 3 – EXECUTION

3.01 APPLICATION

- A. Use cabling identified above for runs between telecommunications spaces and work area outlets.

3.02 INSTALLATION

- A. Provide quantity of horizontal cables as indicated on the drawings. Install cables continuously from the jack on the communications outlet faceplate to the telecommunications space serving the area.
- B. Do not install bruised, kinked, scored, deformed, or abraded cables. Remove and discard cabling if damaged during installation and replace it with new cabling.
- C. Splicing of horizontal cables is not allowed.
- D. Intermediate cross-connects or other termination of horizontal cables is not allowed unless specifically detailed and specified otherwise.
- E. Terminate cables in accordance with ANSI/TIA-568-B, observing industry standards for terminating various types of color-coded cables within a building.
- F. Route cables in a direct path between termination points. Neatly arrange cables in cable trays cable ladder runways, and telecommunications spaces. Provide distribution rings spaced a maximum of 12 inches on center to support cables run on the face of any wall containing a plywood backboard.
- G. Install cables in cable trays, cable ladder runways, conduits, sleeve, and other pathways provided.
- H. Hook-and-loop ties shall be used where appropriate or where specifically indicated in the contract documents. Where required, ties shall be spaced 5 feet to 6 feet in cable tray or cable ladder runway.
- I. Where cables must be installed between devices and primary pathways, continuously support all cables from building structure in such a manner that the cables will not be damaged by normal building use.
- J. Run all cabling parallel and perpendicular to building structural elements unless specifically noted otherwise, or as necessary where end-to-end lengths would otherwise exceed 295 feet.
- K. Provide strain relief for cables above suspended ceilings and where any continuous cable support system is interrupted. Use mechanical fasteners as necessary to maintain cable Category rating of J-hooks and other necessary devices to support cables from the structure or ceiling support. Do not use suspended ceiling support wires or the ceiling grid to support telecommunications cabling. Space cable supports 4 feet to 5 feet apart. Where cable runs exceed 100 feet and metallic J-hook supports are utilized, place supports at differential intervals. Even spacing of metallic J-hooks for runs exceeding 100 feet are not permitted.
- L. Do not attach to or support cabling by fire sprinkler heads, delivery systems, or any environmental sensor located in the ceiling space.
- M. Plan cabling installation and cabling routes such that the capacity of the conduit, cable tray, and cable ladder runway is used most efficiently. Fill conduits and sleeves to maximize capacity and minimize crossover of future cabling installations.
- N. Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.

3.03 HORIZONTAL CABLES

- A. Allow adequate slack for cable termination.
 - 1. Work Area Outlets:
 - a. 3 feet.
 - 2. Systems Furniture:
 - a. As necessary to reach the farthest point on each desktop using the furniture raceways plus 12 inches at the jack location.
 - 3. Telecommunications Spaces:
 - a. As necessary to reach the most distant patch panel or punch-down block, plus a length equal to two (2) times the room height.
- B. Neatly arrange cables in cable trays, cable ladder runways, conduits, sleeves, and in telecommunications spaces.
- C. For areas and locations that are close to TIA distance limits, run a length test on proposed routing to said area or location. Inform Owner and Architect of any jacks beyond TIA distance limits. Owner and Architect shall not be responsible for out-of-distance outlets that are not tested prior to installation.

3.04 PATCH PANELS

- A. Provide patch panels wired in T568B scheme in each telecommunications space to terminate copper twisted-pair cables.
- B. Mount patch panels on equipment racks or network cabinets. Refer to drawings.
- C. Group connecting hardware for cables into separate logical fields.

3.05 HORIZONTAL PATHWAYS

- A. Horizontal cables between telecommunications spaces and work area outlets shall be no longer than 295 feet. If a location is identified which appears to exceed the distance limitation, it shall be the responsibility of the Contractor to field-verify the actual distance prior to installing the horizontal cable. Upon discovery of an over-length cable, the Contractor shall cease installation of the cable and immediately notify the Owner and Architect. The Contractor shall follow this notification with a formal request for information (RFI). The Contractor shall consult with the Owner and Architect to resolve the problem. There shall be no additional payment to the Contractor for rerouting of over-length cables which are discovered after installation.

3.06 GROUNDING

- A. If applicable, bond horizontal cable shields and drain wires at each end.
- B. Comply with Division 26 and Section 270527.

3.07 PERFORMANCE TESTING

- A. The horizontal cabling system shall comply with transmission standards in ANSI/TIA-568-B.1 when tested according to test procedures of this standard.
- B. After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all conductors installed. Remove temporary connections when tests have been satisfactorily completed.
- C. Provide certification reports printed electronically on 8-1/2 inch x 11 inch digital sheets. Provide a separate section for each group of cables served from a common telecommunications space. Present cable testing results in a sequenced or otherwise orderly matrix format.
- D. Twisted-Pair Copper Cabling Testing:
 - 1. Test horizontal cables from the punch-down blocks, patch panels, or other termination equipment to the jacks, unless noted otherwise.
 - 2. Utilize cable testing equipment capable of generating a report for each cable tested. Provide a report per ANSI/TIA-568-B.

3. Inspect for physical damage and test each conductor signal path for continuity and shorts. Test for faulty connectors, splices, and terminations.
- E. Field Test Requirements for a Category 6A Balanced Twisted-Pair Cabling System:
1. Test every cabling link in the installation in accordance with ANSI/TIA-568B.
 2. The installed twisted-pair horizontal links shall be tested from the telecommunications space to the work area outlet against the "permanent link" performance limits specification as defined in ANSI/TIA-568-B.
 3. Test one-hundred percent (100%) of the installed cabling links. All cable links must pass the requirements of the standard(s) mentioned above and as further detailed below. Any failing link shall be diagnosed and corrected. Follow corrective action with a new test to prove that the corrected link meets the performance requirements. Provide the final and passing result of the tests for all links in the test results documentation in accordance with this section.
 4. Trained technicians who have successfully attended an appropriate training program and have obtained certification as proof thereof shall execute the tests. These certificates shall have been issued by any of the following organizations, or an equivalent organization.
 - a. The manufacturer of the twisted-pair copper cabling and/or the twisted-pair copper connectors.
 - b. The manufacturer of the test equipment used for the field certification.
 - c. Training organizations authorized by BICSI or by the CCA.
 5. The test equipment (tester) must comply with or exceed the accuracy requirements for Level III field testers as defined in ANSI/TIA-568-B. The tester, including the appropriate interface adapter, must meet the specified accuracy requirements.
 6. The tester must be within the calibration period recommended by the manufacturer in order to achieve the manufacturer specified measurement accuracy.
 7. The tester interface adapters must be of high quality and the cable must not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. Provide proof that the interface has been calibrated within the period recommended by the manufacturer.
 8. Determine the pass or fail condition for the link-under-test by the results of the required individual tests as detailed below. Any fail result yields a fail for the link-under-test. In order to achieve an overall pass condition, the results for each individual test parameter must pass (pass* is not accepted).
- F. 4-Pair Unshielded Twisted-Pair Performance Test Parameters:
1. Test all horizontal twisted-pair copper cables according to the parameters in the ANSI/TIA-568-B standard. The test of each link must contain the following parameters as detailed below. In order to pass the link test, all measurements at each frequency in the range from 1 MHz through 500 MHz must meet or exceed the limit value determined in the above-mentioned standard.
 2. Perform the following tests as defined in ANSI/TIA-568-B:
 - a. Wire map.
 - b. Length.
 - c. Insertion loss (attenuation).
 - d. NEXT loss.
 - e. Pair-to-pair PSNEXT loss.
 - f. ELFEXT loss.
 - g. Pair-to-pair PSELFEXT loss.
 - h. Return loss.
 - i. ACR.
 - j. PSACR.
 - k. Propagation delay.
 - l. Delay skew.

- G. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Horizontal Twisted-Pair Copper Test Equipment:
 - a. Agilent.
 - b. Fluke.
 - c. Ideal Industries.
- H. Test Result Documentation:
 - 1. Record the test results information for each link in the memory of the field tester upon completion of the test.
 - 2. Transfer the test results records saved by the tester into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. Guarantee these results are transferred to the PC unaltered; i.e., "as saved in the tester", at the end of each test and that these results cannot be modified at a later time.
 - a. "CSV" (comma separated value) format does not provide adequate protection and will not be acceptable.
 - 3. Store and deliver the database for the completed job, including optical fiber cabling links if applicable, by electronic means. Include the software tools required to view, inspect, and print any selection of test reports.
 - 4. Provide a paper copy of the test results that lists all the links that have been tested with the following summary information.
 - a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - b. The overall pass/fail evaluation of the link-under-test, including the NEXT headroom (overall worst case) number.
 - c. The date and time that the test results were saved in the memory of the tester.
 - 5. General information to be provided in the electronic database containing the test result information for each link.
 - a. The identification of the project site as specified by the end user.
 - b. The overall pass/fail evaluation of the link-under-test.
 - c. The name of the standard selected to execute the stored test results.
 - d. The cable type and the value of NVP used for length calculations.
 - e. The date and time the test results were saved in the memory of the tester.
 - f. The manufacturer, model, and serial number of the tester.
 - g. The revision of the tester software and the revision of the test standards database in the tester.

END OF SECTION

SECTION 27 15 43
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes the provision and installation of jacks, faceplates, copper twisted-pair cabling termination, labeling, and associated hardware recognized as necessary and as described in the drawings and in these specifications.

1.02 SUBMITTALS

- A. As specified in Section 270501.
- B. Product Data:
 - 1. Jacks.
 - 2. Faceplates.
 - 3. Connectors and terminated hardware.
- C. Shop Drawings:
 - 1. Cabling interconnection diagram(s) and work area outlet locations.
 - 2. Connector and termination hardware layouts.
- D. Maintenance Data.
- E. Qualifications:
 - 1. Documentation of certification from the cabling manufacturer.
- F. Warranty.
- G. Test Reports:
 - 1. Documentation of the test results, test equipment, equipment certification, and calibration of test equipment utilized.

1.03 QUALITY ASSURANCE

- A. Coordinate with pathway/box installer to ensure that faceplates are installed plumb and level, flat to wall, and without gaps.
- B. In situations where communications device mounting heights vary from the adjacent electrical devices, match the electrical device mounting heights.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Hubbell.
 - 2. Proterial Cable America.

2.02 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment so that they form an integrated system.
- B. Match components and interconnections for optimum future performance.
- C. All materials and products specified herein are to be new, unused, of first quality and delivered to site in original packaging or shipping containers unless otherwise indicated on the drawings.

2.03 MATERIALS

- A. Standard Communications Faceplate:
 - 1. Single-gang.
 - 2. Number of outlet positions shall be four (4).
 - 3. Provide blanking fillers as required for unused jack openings.
 - 4. Material shall match adjacent electrical receptacles.
 - 5. Color shall match adjacent electrical receptacles.

- B. Modular Communications Jack:
 - 1. Mounting within modular faceplate.
 - 2. Category 6 or 6A.
 - 3. Eight (8) pins.
 - 4. T568B termination.
 - 5. Color shall be blue.
- C. Surface-Mount Box:
 - 1. Number of outlet positions shall be two (2).
 - 2. Plenum-rated.
 - 3. Material shall be plastic.
 - 4. Color shall match adjacent electrical receptacles.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that floor boxes are adjusted and installed properly.
- D. Verify that furniture openings and furniture outlet faceplates are coordinated.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Provide faceplates and jacks as indicated on the drawings.
- B. Plate configurations shall be as indicated on the drawings.
- C. Provide a blanking filler for each unused faceplate opening.
- D. Coordinate faceplate requirements for furniture with furniture manufacturer.
- E. Install devices, such as (but not limited to) faceplates and jacks, plumb and level.
- F. Provide faceplates for all active and blank (spare) outlet locations.
- G. Install devices securely and in a neat and workmanlike manner.
- H. For all work area outlets, follow manufacturer's procedures for termination of the specific products installed and performance required.
- I. All coaxial cables shall be terminated using the matching connector and tool assembly for compression-type connectors. Follow manufacturer's procedures for termination.

3.04 INTERFACE WITH OTHER WORK

- A. Coordinate locations of outlet boxes with other trades to obtain unified and consistent location and mounting heights specified.

3.05 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Test each communications port.
- C. Label each wall plate and communications port.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING AND PROTECTION

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

**SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SECURITY**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section describes the general electronic security systems (ESS) requirements of these specifications and applies to all phases of the work specified, indicated on the drawings, or required to provide the complete installation of ESS for this project.
- B. This section contains requirements that pertain to other Division 28 security specifications, such as requirements for warranty, submittals, quality assurance, record drawings, installation, demonstrations, and operator training.
- C. The term security systems (SSI) shall be synonymous with the term Contractor for the Division 28 security scope.

1.02 QUESTIONS OF INTERPRETATION DURING BIDDING PHASE

- A. If questions arise during the bidding process regarding the meaning of any portion of the contract documents, the prospective bidder shall submit the questions to the Architect for clarification.
- B. Any definitive interpretation or clarification of the contract documents will be published by addenda and properly issued to each person holding documents prior to the bid date.
- C. Verbal interpretation or explanation not issued in the form of an addendum shall not be considered part of the bidding documents.
- D. When submitting questions for clarification, adequate time for issuance and delivery of addenda must be allowed.
- E. The Architect shall be the sole judge regarding interpretations of conflicts within the contract documents.

1.03 CONTRACT DOCUMENT DISCREPANCIES

- A. If any ambiguities should appear in the contract documents, request clarification from the Architect before proceeding with the work.
- B. If the Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a manner satisfactory to the Architect.
- C. Should a conflict occur within the contract documents, the Contractor is deemed to have estimated the more expensive way of doing the work, unless a written clarification from the Architect was requested and obtained before submission of proposed methods or materials.
- D. The Architect shall be the sole judge regarding interpretations of conflicts within the contract documents.

1.04 DEFINITIONS

- A. Furnish:
 - 1. Supply and deliver to the site, ready for use, items required to complete tasks or perform tests required to build a complete and ready-to-use system.
- B. Install:
 - 1. Supply labor to construct complete system, ready for intended use.
- C. Provide:
 - 1. Furnish, install, connect, and test, supplying required labor to construct a complete system, ready for the intended use.

1.05 SYMBOLS

- A. Items of equipment and materials are indicated on the drawings in accordance with the symbols on the plans. Some of the symbols scheduled may not be required for the project.

Because of the scale of the drawings, symbols are shown on drawings as close as possible to the installation location. Verify exact locations with the Architect and the Owner.

1.06 ABBREVIATIONS

A. The following abbreviations apply throughout the contract documents:

1. ADA: Americans with Disabilities Act
2. AFF: Above Finished Floor
3. ANSI: American National Standards Institute
4. AWG: American Wire Gauge
5. BICSI: Building Industry Consulting Services International
6. CCTV: Closed-Circuit Television
7. CFR: Code of Federal Regulations
8. DAC: Digital Alarm Communicator
9. DPS: Door Position Switch
10. DVR: Digital Video Recorder
11. EAC: Electronic Access Control
12. EMI: Electromagnetic Interference
13. EMT: Electrical Metallic Tubing
14. ENT: Electrical Nonmetallic Tubing
15. EPT: Electrical Power Transfer
16. EVS: Electronic Video Surveillance
17. FACP: Fire Alarm Control Panel
18. FCC: Federal Communications Commission
19. FO: Fiber Optic
20. FMC: Flexible Metal Conduit
21. FPS: Frames Per Second
22. Gbps: Gigabits Per Second
23. GbE: Gigabit Ethernet
24. GND: Ground
25. HH: Handhole
26. HVAC: Heating, Ventilation, and Air Conditioning
27. IDF: Intermediate Distribution Frame
28. IDS: Intrusion Detection System
29. IEEE: Institute of Electrical and Electronics Engineers
30. IP: Internet Protocol
31. KVM: Keyboard, Video, and Mouse
32. LAN: Local Area Network
33. LCD: Liquid-Crystal Display
34. LED: Light-Emitting Diode
35. LBM: Latch Bolt Monitor
36. Mbps: Megabits Per Second
37. MDF: Main Distribution Frame
38. MGB: Main Ground Bar
39. MH: Manhole
40. MPL: Modular Plug Terminated Link
41. NEC: National Electrical Code
42. NEMA: National Electrical Manufacturers Association
43. NFPA: National Fire Protection Association
44. NVE: Network Video Encoder
45. NVR: Network Video Recorder
46. OFE: Owner-Furnished Equipment
47. OSHA: Occupational Safety and Health Administration
48. PBB: Primary Bonding Busbar

- 49. PDU: Power Distribution Unit
- 50. PSTN: Public Switched Telephone Network
- 51. PTZ: Pan-Tilt-Zoom
- 52. PVC: Polyvinyl Chloride
- 53. REX: Request-to-Exit
- 54. RCDD: Registered Communications Distribution Designer
- 55. RF: Radio Frequency
- 56. RFI: Radio Frequency Interference
- 57. RTE: Request-to-Exit
- 58. RQE: Request-to-Exit
- 59. SBB: Secondary Bonding Busbar
- 60. ScTP: Screened Twisted-Pair
- 61. SFP: Small Form-Factor Pluggable
- 62. SSI: Security Systems Integrator
- 63. STP: Shielded Twisted-Pair
- 64. SPD: Surge Protection Device
- 65. UL: Underwriters Laboratories
- 66. UPS: Uninterruptible Power Supply
- 67. UTP: Unshielded Twisted-Pair
- 68. VMS: Video Management System
- 69. WAN: Wide Area Network
- 70. WTH: Wire Transfer Hinge

1.07 CODES AND STANDARDS

- A. The work shall be performed by competent craftsmen skilled in the trade involved and shall be done in a manner consistent with normal industry standards. All work shall conform to all applicable sections of currently adopted editions of the codes and standards listed below or the codes, standards, and specifications published by the organizations listed below:
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing Materials (ASTM).
 - 3. Building Industry Consulting Service International (BICSI).
 - 4. Building Officials and Code Administrators International, Inc. (BOCA).
 - 5. Electrical Testing Laboratories (ETL).
 - 6. International Building Code (IBC)
 - 7. Institute of Electrical and Electronics Engineers (IEEE).
 - 8. National Electrical Code (NEC), latest edition.
 - 9. National Electrical Manufacturer's Association (NEMA).
 - 10. National Fire Protection Association (NFPA).
 - 11. Life Safety Code (NFPA 101).
 - 12. Independent Testing Laboratories (ITL).
 - 13. International Organization for Standardization (ISO)
 - 14. Occupational Safety and Health Standards (OSHA), National Consensus Standards and Established Federal Standards.
 - 15. Safety and Health Regulations for Construction.
 - 16. Telecommunications Industry Association (TIA).
 - 17. Uniform Building Code (UBC).
 - 18. Underwriters' Laboratories, Inc., Standards (UL).
 - 19. State and Local Codes.
- B. Where there is a conflict between the code or referenced standards and the contract documents, the code or standard shall have precedence only when it is more stringent than the contract documents. Items that are allowed by the code but are less stringent than those specified shall not be substituted.

1.08 MATERIALS AND EQUIPMENT MANUFACTURERS

- A. Options in selecting materials and equipment are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced on previous construction projects.
- B. Materials and equipment shall be provided in accordance with the following:
 - 1. Primary Design Products:
 - a. Primary design products are those products around which the project was designed in terms of capacity, performance, physical size, and quality.
 - b. Primary design products are indicated by use of a single manufacturer's name, model number, or similar data on drawings or schedules, or within the specifications.
 - c. Provide primary design products unless substitutions are made in accordance with the following paragraphs.
 - 2. Acceptable Equivalent Substitutions:
 - a. Acceptable equivalent substitutions are products of manufacturers other than those listed for the primary design products. Equivalent acceptable substitutions shall meet each of the following requirements.
 - b. The product shall be manufactured by one of the acceptable manufacturers listed in the project manual, drawings, or addenda.
 - c. The product shall meet or exceed the requirements of the contract documents in terms of quality, performance, suitability, appearance, and physical characteristics.
 - d. The Contractor providing the substitution shall bear the total cost of changes due to substitutions. These costs may include additional compensation to the Architect for redesign and evaluation services, increased cost of work by the Owner or other contractors, and similar considerations.
 - 3. Performance Requirements:
 - a. Where the contract documents list performance requirements or describe a product or assembly generically, provide products that comply with the specific requirements indicated and that are recommended by the manufacturer for the respective application.
 - 4. Compliance with Standards, Codes, and Regulations:
 - a. Where the specifications require only compliance with an imposed standard, code, or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes, and regulations.
 - 5. Proposed substitutions will be judged on the basis of quality, performance, appearance, and the governing space limitations. The reputation of the manufacturer, delivery time requirements, and the availability of repair or replacement parts may also be considered.
 - 6. The Architect shall be the sole and final judge as to the suitability of substitution items.

1.09 SUBMITTALS

- A. Submittal Requirements:
 - 1. Other sections in the project manual shall be adhered to if more stringent than the following paragraphs.
 - 2. When required by other sections of the project manual, submit shop drawings, product data, or samples to the Architect for review.
 - 3. Submittals deemed unnecessary by the Architect shall be returned indicating "No Action Taken".
 - 4. A completed copy of the transmittal form included with the project manual shall accompany each submittal.
 - 5. Submittals shall be numbered consecutively by specification section (i.e., 280501-01, 280501-02, etc.).
 - 6. Unless otherwise noted, submit one (1) copy electronically of shop drawings and product data for review. Review comments will be returned electronically. A hard copy of the electronic submittal will be returned if requested.

7. Each submittal shall clearly indicate proposed items, capacities, characteristics, and details in conformance with the contract documents. Equipment items shall be marked with the same item number as used on drawings or schedules. Capacities, dimensions, and special features required shall be certified by the manufacturer.
 8. Submittals shall indicate manufacturer's delivery time for the item after review by the Architect.
 9. When required by other sections of the project manual, the Contractor shall submit a "specification compliance review" (SCR) consisting of a paragraph-by-paragraph review of the specifications and addenda. Markings may be made in the margins of the original specification or addenda. Unless a deviation or exception is specifically noted in the SCR, it is assumed that the equipment, product, or material is in complete compliance with the contract documents. Submit the SCR with shop drawings and product data.
 10. Submittals will be returned to the Contractor by the Architect with one of the following responses:
 - a. "A": Reviewed, No Exceptions Taken.
 - b. "B": Reviewed, Exceptions Taken as Noted.
 - c. "C": Revise and Resubmit.
 - d. "D": Rejected.
 - e. "E": No Action Taken.
 11. The Architect shall review or take other appropriate action upon the Contractor's submittals such as shop drawings, product data, and samples, but only to determine conformance with the design concept of the work and the information given in the contract documents.
 12. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect's review of shop drawings, product data, or samples.
 13. Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data, or samples by the Architect's review of those drawings.
 14. No portion of the work requiring submission of a shop drawing, product data, or sample shall be commenced until the submittal has been reviewed by the Architect. Such portions of the work shall be in accordance with reviewed submittals.
 15. The successful Contractor may, at their option, obtain DXF or AutoCAD DWG electronic files for use in preparation of shop drawings.
 - a. This information is available from IP Design Group upon written request.
 - b. The use of these drawing files is intended solely for the preparation of shop drawings as required by these contract documents.
 - c. Any other use is strictly prohibited by copyright laws.
 - d. The user of these electronic drawing files assumes full responsibility for their accuracy and scale.
- B. Bid Submittals:
1. The Contractor shall submit a resume with their proposal containing the following:
 - a. A list of five (5) recently completed projects of similar type and size with contact names and telephone numbers for each.
 - b. Installer qualifications.
 - c. Letter of good standing from electronic security manufacturer(s).
- C. Pre-Construction Submittals:
1. The Contractor shall submit shop drawings in accordance with the requirements listed below.
 - a. Shop drawings are drawings, diagrams, schedules, and other data specifically prepared for this project by the Contractor to illustrate some portion of the work. Shop drawings shall also detail fabrication and installation for metal and wood supports, and anchorage for mechanical materials and equipment. Shop drawings shall include, but not be limited to, the following:

- 1) Functional block and wiring diagrams showing single-line interconnections between components for signal transmission and control. Show cable types, quantities, and sizes.
 - 2) Dimensioned plans and elevations of equipment racks and enclosures.
 - b. Shop drawings shall be drawn to accurate scale and of adequate size to illustrate required details.
 - c. Maximum sheet size shall be 36 inches by 48 inches. For each hard copy shop drawing sheet larger than 11 inches by 17 inches, submit one (1) drawing on reproducible media.
 - d. The Architect's action shall be indicated on the reproducible drawing and the drawing shall be returned to the Contractor.
 2. The Contractor shall submit product data in accordance with the requirements listed below.
 - a. Product data are illustrations, schedules, performance charts, instruction brochures, diagrams, and other information furnished by the Contractor to illustrate a product, material, or system for some portion of the work.
 - b. Includes data on features, ratings, and performance for each component specified.
 3. The Contractor shall submit programming data in accordance with the requirements listed below:
 - a. Device names and descriptions.
 - b. Complete written sequence of operations for all functions of the system.
 4. A proposed test plan shall be submitted to the Owner for approval prior to commencement of testing.
- D. Operation and Maintenance Manuals:
1. Prepare an electronic copy of the operation and maintenance manuals for the equipment furnished. Manuals shall be submitted to the Architect for review and distribution to the Owner not less than thirty (30) days prior to substantial completion of the project. Manuals not meeting the following requirements may be rejected by the Architect.
 2. Each manual shall be assembled in a three-ring binder with hard cover and plastic finish. Binders shall not exceed a 3-inch thickness. Where more than one binder is required, the manuals shall be separated into a logical grouping, i.e., "Electronic Access Control", "Electronic Video Surveillance", "Maintenance", "Operation", "Parts", "Shop Drawings", etc. Each binder shall have the following information clearly printed on its front cover:
 - a. Project name and address.
 - b. Portion of the work covered by each volume (if more than one volume in the set). Where more than one volume is required, label each volume as "Volume _____ of _____".
 - c. Name, address, and telephone number of Contractor and subcontractors, including night or emergency number.
 3. Manual shall include, but shall not be limited to, the following:
 - a. A Complete Index:
 - 1) Contractor may submit the index to the Architect for review prior to submittal of complete manuals, if desired.
 - b. Names, Addresses, and Telephone Numbers:
 - 1) This list shall include the manufacturer(s) and local representative(s) who stocks or furnishes repair parts for all items of equipment and shall be typed on a single page in front of the binder.
 - c. Startup, Operation, and Shutdown Procedures:
 - 1) Provide a written description of procedures for startup, operation, and shutdown of each electrical item or system. This description shall include switches to operate, buttons to push, etc., in proper sequence, and the location of switches, starters, and push-buttons. Description shall include item references or labels used in the contract documents, unless otherwise instructed in advance by the Owner.

- d. Equipment Accessory Schedule:
 - 1) Upon completion of the work, furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required, and the manufacturer of renewable items.
 - e. Emergency Procedures:
 - 1) Provide a written description of emergency operating procedures or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency services to the various parts of the system.
 - f. Provide all manufacturer operation and maintenance manuals and parts lists.
 - g. One (1) copy of shop drawings and product data, clearly marked for each item furnished using the designation label specified or indicated on Drawings.
 - h. Manufacturers' warranty information.
 - i. Detailed operating instructions covering operation under both normal and abnormal conditions.
 - j. Routine maintenance requirements for system components.
 - k. Normal maintenance schedule: Include a listing of work to be performed at various time intervals; i.e., 30, 90, 180 days, and yearly.
 - l. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
 - m. Software Manual:
 - 1) Describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation.
 - 2) Definition of terms and functions
 - 3) System use and application software
 - 4) Initialization, startup, and shutdown
 - 5) Report generation.
 - 6) Details on forms customization and field parameters.
 - n. Operator Manual:
 - 1) Fully explain all procedures and instructions for the operation of the system.
 - 2) Computers and peripherals
 - 3) System start up and shut down procedures
 - 4) Use of system, command, and applications software
 - 5) Recovery and restart procedures
 - 6) Graphic alarm presentation
 - 7) Use of report generator and generation of reports
 - 8) Data entry
 - 9) Operator commands
 - 10) Alarm messages and reprinting formats
 - 11) System permissions functions and requirements
- E. Post-Construction Submittals:
- 1. Field quality-control test reports in PDF format.
 - 2. As-built shop drawings in accordance with the requirements listed below.
 - a. Wiring and device identifiers.
 - b. Routing of cables from equipment cabinets to devices.
 - c. Routing of cables between equipment cabinets.
 - d. Revisions to construction documents (addenda and field changes)
 - e. Floor plans with all final device locations, equipment cabinet locations, and labels.
 - f. Diagrams, configurations, connections, and uplinks.
 - 3. Cable labeling schedule(s).
 - 4. When required, submit manufacturer's printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for shop drawings and equipment brochures.
 - 5. Cable labeling schedule(s).

1.10 OPERATING TRAINING

- A. Complete operating instructions for each system and item of equipment shall be provided to the Owner.
- B. Operation and maintenance manuals must be reviewed and accepted by the Architect and provided to the Owner prior to operating training.
- C. Training shall be scheduled at the convenience of the Owner. A minimum of two (2) hours of training shall be provided.
- D. Training shall include, but not be limited to, instructions on the following:
 - 1. Startup and shutdown procedures.
 - 2. Periodic maintenance.
 - 3. Emergency operation.
 - 4. Safety.
 - 5. Configuration and setup of software.
 - 6. Issuing credentials.
 - 7. Creating and editing user accounts.
 - 8. Creating and exporting reports.
 - 9. Setting up alerts and alarms
 - 10. Configuring and setup of devices.
 - 11. Setting up schedules.
 - 12. Using the software.
 - 13. Using the mobile application.
 - 14. Additional training identified in other sections.
- E. In addition to the instructions required above, wherever possible, perform the operations being described in order to fully illustrate system operation.
- F. At the completion of training, the Contractor shall turn over to the Owner all required keys and special tools for installed equipment. Each key or tool shall be labeled with its use.
- G. Train the Owner in cable management operations, such as rerouting signals in failed cables.

1.11 QUALITY ASSURANCE

- A. The Contractor shall prepare and submit all required performance warranty documentation to the manufacturer and shall deliver all complete and final warranty information to the Owner prior to project closeout.
- B. The Contractor shall have an existing quality assurance and quality control plan for the installation. Upon request, the Contractor shall submit the quality assurance and control plan for the project.
- C. The Contractor shall extensive experience (5+ years) with the specified manufacturer(s), hardware, software, and cabling type(s).
- D. The Contractor shall:
 - 1. Employ a qualified installer to supervise the project who is experienced in the design, fabrication, installation, warranty, and contract management of systems described in these specifications.
 - 2. Be an authorized representative of the equipment manufacturer(s) with industry-accepted experience relative to the size and nature of this project.
 - 3. Allow only installers trained and certified by the manufacturer to install, terminate, and test the ESS products. Others may install or program product only if under the direct supervision of the certified installer and trained by the manufacturer of the product.
 - 4. Have the manufacturer's recommended number of employees on the job site who have completed the required training courses for the above-mentioned warranties.
 - 5. Be certified by the manufacturer for the project location to install and warranty the product specified herein.

- E. The Contractor shall employ a qualified project manager (PM) who must meet the following requirements:
 - 1. Required participation in meetings and conferences.
 - 2. Be present at the project site for substantial completion inspection and final inspection.
 - 3. Approve the operation and maintenance manuals.
 - 4. Provide any additional instruction as needed to the Owner.
 - 5. Be responsible for supervision of all technical work that is part of this specification.
 - 6. Supervise preparation of shop drawings and submittals, and sign all submittals.
 - 7. Supervise the shop fabrications and field installation work to ensure strict conformance in accordance to the drawings, specifications, and the reviewed shop drawings to assure workmanship of the specified quality.
 - 8. Oversee the testing of all assemblies and all sub-assemblies prior to their delivery to the project site.
 - 9. Lead in the specified testing of completed installation to assure the Owner that all contract requirements were met. Work with and assist the Owner in the final testing for approval and acceptance of the system by the Owner.
- F. The Contractor must provide proof of registration(s) and certification(s) along with the list of planned installers prior to commencing work.

1.12 WARRANTIES

- A. The Contractor shall warrant all materials, workmanship, and equipment against defects for a period of one (1) year after the date of substantial completion. Certain equipment shall be warranted beginning at the time of final acceptance or for longer periods of time as specified in those sections of the project manual. The Contractor shall repair or replace, at no additional cost to the Owner, any item which may become defective within the warranty period. Any manufacturer warranties concerning any item installed will run to the benefit of the Owner. The Contractor agrees not to void or impair, or to allow subcontractors to void or impair, any warranties regarding products or items installed as part of this project. The repair of faulty workmanship shall be considered to be included in the contract.
- B. Warranty Maintenance and Service Agreement
 - 1. General Requirements:
 - a. The Contractor shall provide all services required and equipment necessary to maintain the entire ESS in an operational state as specified for a period of one (1) year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.
 - 2. Personnel:
 - a. Service personnel shall be factory-certified in the maintenance and repair of the equipment installed under this section of the specifications. The Owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.
 - 3. Description of Work:
 - a. The service and repair of the ESS, including all equipment provided under this specification, shall be supplied by the Contractor. The Contractor shall provide the manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the ESS at its maximum performance.
 - 4. Schedule of Work:
 - a. Work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.
 - 5. Inspections:
 - a. The Contractor shall perform two (2) minor inspections at six-month intervals (or more often if required by the manufacturer), and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 - b. Minor inspections shall include:

- 1) Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
 - 2) Mechanical adjustments if required on any mechanical or electromechanical devices.
 - c. Major inspections shall include all minor inspection items, and the following:
 - 1) Clean all ESS equipment, including interior and exterior surfaces.
 - 2) Perform diagnostics on all equipment.
 - 3) Check, test, and if required by the manufacturer's maintenance procedures, calibrate each sensor.
 - 4) Run all system software diagnostics and correct all diagnosed problems.
6. Operation:
 - a. Performance of scheduled adjustments and repair shall verify operation of the ESS as demonstrated by applicable tests from the proposed test plan submittal.
7. Emergency Service:
 - a. The Owner shall have the option to initiate service calls when the ESS is not functioning properly. Qualified personnel shall be available to provide service to the complete ESS. The Owner shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within twenty-four (24) hours after receiving a request for service. The ESS shall be restored to proper operating condition within twenty-four (24) hours after service personnel arrive on site.
8. Records and Logs:
 - a. The Contractor shall keep records and logs of each task, and shall organize cumulative records for each component and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the ESS.
9. Work Requests:
 - a. The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, name(s) of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) days after work is accomplished.
10. System Modifications:
 - a. The Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications shall be made without the prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
11. Software:
 - a. The Contractor shall provide all software updates during the period of the warranty and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with ESS operators, and shall include training for any changes or new features. Any changes or new features shall be incorporated into the operations and maintenance manuals, and other documentation affected.

1.13 REFERENCE STANDARDS

- A. The Contractor's performance of work shall comply with applicable federal, state, and local laws, rules, and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections, and shall pay without burden to the Owner all fees and charges in connection therewith, unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties including attorney's fees and other defense costs and expenses in connection therewith.

- B. Federal Communications Commission (FCC) registration or approval for any equipment requiring such approval shall be appropriately identified and obtained by the Contractor.
- C. Design, manufacture, test, and install communications cabling per manufacturer requirements, state codes, local codes, requirements of authorities having jurisdiction, and particularly the most recent edition of the following standards:
 - 1. Guide for Premises Security (NFPA 730).
 - 2. Standard for the Installation of Premises Security Systems (NFPA 731).
 - 3. IEEE C62.41.1: Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
 - 4. EIA-310-E: Cabinets, Racks, Panels, and Associated Equipment.
 - 5. ANSI/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 6. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure.
 - 7. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- D. Install security cabling in accordance with the most recent edition of the following publications:
 - 1. BICSI Telecommunications Distribution Methods Manual (TDMM).
 - 2. BICSI Outside Plant Design Reference Manual (OSPDRM).
 - 3. ANSI/BICSI 007-2020: Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises.
 - 4. ANSI/BICSI N1-2019: Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure.
 - 5. ANSI/BICSI N2-17: Practices for the Installation of Telecommunications and ICT Cabling Intended to Support Remote Power Applications.
 - 6. ANSI/BICSI N3-20: Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure.
- E. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. The aforementioned and following additional federal, state, and local rules, regulations, and ordinances govern the work as fully a part of the specifications as if herein attached. Where requirements of the drawings or specifications are more stringent than the applicable codes, rules, regulations, and ordinances, the drawings or specifications shall apply.
 - 1. ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems.
 - 2. UL 1479: Standard For Fire Tests of Through-Penetration Firestops.
 - 3. Americans with Disabilities Act (ADA): Accessibility Guidelines.
 - 4. Code of Federal Regulations, Title 29, Subtitle B, Chapter XVII, Part 1910 (Occupational Safety and Health Standards).
- G. If allow the Owner's installation standards unless otherwise shown on the drawings or stated herein. Where requirements of installation standards conflict with performance standards or a manufacturer's recommendations, refer to the Owner for a decision before proceeding.

1.14 COORDINATION

- A. Coordinate and schedule all construction work with the General Contractor prior to beginning work. Do not interrupt building activities without strict coordination with the General Contractor. Unscheduled appearance to work without prior scheduling with the General Contractor is not allowed.
- B. The Contractor shall attend all meetings as required by the General Contractor.
- C. Convene a meeting at least one (1) week prior to commencing the work of this section, with the following agenda at a minimum:
 - 1. Tour, inspect, and discuss building conditions related to the ESS.
 - 2. Review submittals, both completed and yet to be completed.

3. Review plans, specifications, and proposed equipment.
 4. Review construction schedule, availability of materials, personnel, equipment, and facilities needed to proceed without delay.
 5. Review required inspections and testing.
 6. Review cable routing, cable support, primary pathways, and communications spaces, and environmental conditions.
- D. The Contractor's project manager must be readily available on-site when needed.
- E. Coordinate network configuration requirements for ESS equipment with the Owner.
- F. Record agreements reached in meetings and distribute to other participants.
- G. Coordinate security device rough-ins and conduit, as well as door and door frame prep with general construction work. Coordinate the arrangement of these items within the building structure during progress of construction to facilitate the security installations that follow.
- H. Coordinate exact location(s) of ceiling-mounted equipment and devices with architectural plans, reflected ceiling plans, structural plans, and all affected trades prior to construction and installation.
- I. Coordinate exact location(s) of all equipment and devices mounted to desktops and countertops with the millwork, casework, and furniture plans prior to installation.
- J. Fully examine the drawings and specifications for other trades and coordinate the installation of communications work with the work of the other trades. Consult and cooperate with the other trades for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment, and the building.
- K. Coordinate installation of security cabling with the raceway installer. Verify raceways are installed according to current TIA standards before installing cabling.
- L. Environmental Conditions:
1. Do not deliver or install ESS equipment to the installation location until areas are complete, dry, and temporary or permanent HVAC systems are operating and maintaining acceptable ambient temperature and humidity conditions for the remainder of the project. ESS equipment damaged or painted as a result of premature occupancy of the site will be replaced at the expense of the Contractor.
 2. Do not deliver or install equipment cabinets or network electronics until communications rooms are enclosed, painted, water-tight, complete, dry, dust-free, and work above and in ceiling spaces is complete. ESS equipment damaged as a result of premature occupancy of the communications spaces will be replaced at the expense of the Contractor.
 3. System components shall be equipped and rated for the environments where installed.
 4. Rate outdoor equipment for continuous operation under specified environmental conditions, unless otherwise indicated.
 - a. Temperature range of -40 °C (-40 °F) to +70 °C (+158 °F).
 - b. Relative humidity range of five percent (5%) to one-hundred percent (100%).
 - c. Provide enclosures to prevent entry of moisture due to melting ice buildup, or driven rain or snow.
 5. Rate indoor equipment for continuous operation under specified environmental conditions, unless otherwise indicated.
 - a. Temperature range of 0 °C (32 °F) to +70 °C (+158 °F).
 - b. Relative humidity range of zero percent (0%) to ninety-five percent (95%).
- M. Provide offsets and elevation changes in cable tray, cable ladder runway, conduit, and devices as required to complete the layout and coordination process. Offsets and elevation change information shall be indicated in the coordination process documentation and must be submitted for review.
- N. Do not install ESS devices until final surface finishes and painting are complete.

1.15 STRUCTURAL COORDINATION

- A. In cases where the Contractor determines that superimposed loads (such as suspended or floor-mounted mechanical, electrical, plumbing systems or equipment) exist which exceed design loads indicated on the structural contract documents, the Contractor shall submit the load data to the Architect for review prior to proceeding with the work.
- B. Distribute the maximum load hung from any structural member for mechanical, electrical, plumbing, ductwork, piping, etc., over the member's tributary area in a way that the design superimposed dead loads listed in the structural contract documents are not exceeded. The Contractor shall coordinate the loads and provide additional support or distribution framing as required to achieve allowable load distribution.
- C. Connections of systems designed by the Contractor such as, but not limited to, mechanical, electrical, and plumbing loads are assumed to impose vertical and/or horizontal loads on the base building structural members without generating torsion in the supporting structural members. Contractor is responsible for furnishing and installing all supplementary bracing members as required to prevent torsion on the base building structure.

PART 2 – PRODUCTS

2.01 PERFORMANCE, CAPACITIES, AND CHARACTERISTICS

- A. Refer to the drawings for equipment schedules and equipment performance requirements when capacities and characteristics are not indicated in the specifications.

2.02 MATERIALS

- A. Unless otherwise specified, all materials and equipment shall be new, unused, and undamaged. Materials and equipment shall be the current and standard designs of manufacturers regularly engaged in their production and shall bear the UL listing, or listing by other recognized testing laboratory when such listings are available. Materials shall be free of damage or corrosion and shall be of the best quality obtainable for the purpose intended.
- B. Refer to individual specification sections for manufacturers.

2.03 COMPLETENESS OF WORK

- A. The contract documents depict low voltage systems which are intended to be complete and functioning systems. All products, labor, and programming necessary to render a full and functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout the drawings and specifications are intended to convey the understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge will be allowed because a catalog number is found to be incomplete or obsolete.

2.04 MATERIALS AND EQUIPMENT FURNISHED BY OTHERS

- A. Where materials and equipment are indicated as furnished by others and installed or connected under this contract, it shall be the Contractor's responsibility to verify installation details and requirements.

2.05 QUANTITY OF SPECIFIED ITEMS REQUIRED

- A. Wherever in these specifications an article, device, or piece of equipment is referred to in the singular number, such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, cable ladder runways, conduits, sleeves and other elements for compliance with space allocations,

installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

- B. For serial communication devices that are close to distance limits of the serial protocol being used (e.g., RS-232, RS-422, RS-485, Wiegand, OSDP), run a length test on the proposed routing to the device in question. Inform the Owner and the Architect of any devices beyond the recommended distance limit for the protocol being used. The Owner and the Architect shall not be responsible for cables that exceed distance limits.
- C. If applicable, the Contractor shall maintain the integrity of the existing system throughout the project. The Contractor shall coordinate any outages or downtime with the Owner prior to starting any work.
- D. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the ESS installation.
- E. Examine rough-ins to verify that they are plumb and level, and that the installation height above finished floor is correct. Immediately notify the General Contractor and the Architect of any rough-ins which are incorrectly installed.
- F. Examine rough-ins for embedded and built-in anchors to verify actual locations of ESS connections prior to installation.
- G. Inspect built-in and cast-in anchor installations prior to installing ESS devices to verify that anchor installations comply with manufacturer requirements.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Re-inspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional anchor installations.
- H. Prepare a written and endorsed report listing conditions detrimental to performance of the ESS.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SYSTEM INSTALLATION

- A. Provide all specified materials, installation hardware, and labor required to complete the work shown on the drawings and specified in this section and other Division 28 security specifications sections. This shall include work and miscellaneous items that are not explicitly specified, but are necessary to build a complete system installation, including all tools and test equipment, accessories, appurtenances, and all items required for testing the system. All systems shall be complete, operational, and ready for use by the Owner.
- B. Bring to the attention of the Owner and the Architect conflicts between manufacturer instructions and the contract documents.
- C. Systems shall be complete and operational in all respects.
- D. The Contractor shall program and provision the system per the drawings, specifications, and Owner requirements.
- E. ESS software shall be configured and programmed as indicated within these specifications and final programming shall be coordinated with the Owner. Programming schedules shall be utilized to configure and program the ESS software.
- F. Configuration and setup of ESS servers shall be coordinated with the Owner prior to programming and installation.
- G. Integrations between different portions of the ESS or to other systems indicated shall be configured to allow for the most optimal efficiency of the combined systems. Where possible, these systems shall work as a single system. Integrations shall be complete in all respects and approved in writing by the Owner.
- H. Program all required licenses for ESS devices and software.
- I. Configure ESS workstations to meet manufacturer recommendations and the requirements indicated on the drawings and in the specifications.

- J. Comply with the manufacturer instructions and recommendations for installation of all devices and software.
- K. All security equipment, junction boxes, terminal cans, etc., shall be installed utilizing tamper-proof mounting hardware. Provide a minimum of two (2) driver bits or hand tools for each type of security fastener provided.
- L. If required, provide seismic restraints for all security cabinets, consoles, etc.
- M. All components of the ESS shall be tested prior to installation on site.
- N. Install security enclosures to plywood backboard.
- O. Provide a surge protection device for all security devices located in outdoor locations, including security cameras, credent readers, and intercoms. Locate surge protection devices within security cabinets or provide rack-mountable modules.
- P. Install security cables continuously from the device location to the security cabinet serving that area, or between security cabinets. If a splice is required, provide tamper-resistant "torx with peg" security fasteners for junction boxes containing security cable splices.
- Q. All security devices located in exterior or wet-rated locations shall be rated as weatherproof.

3.03 WIRING AND CABLE INSTALLATION

- A. Provide cabling in raceway, cable tray, cable ladder runway, conduit, and sleeves except within consoles, cabinets, desks, and counters. Conceal pathways and cabling, except in unfinished spaces.
- B. Bundle, lace, and train conductors to terminal points within enclosure(s). Use lacing bars and distribution spools as needed. Separate power-limited and non-power-limited conductors as recommended in writing by the manufacturers. Install conductors parallel with or at right angles to sides and back of enclosure(s). Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the ESS systems to terminal blocks. Mark each terminal according to system's wiring diagram(s). Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Provide all system wiring between all components in accordance with manufacturer guidelines. Each cable for each device shall be home run. No splices are allowed unless otherwise noted. Provide size and pair quantities as recommended in writing by system manufacturer, unless otherwise indicated.
- D. All wiring and cables shall be plenum-rated and shall be installed in conduit or approved raceway in exposed spaces unless shown otherwise on the drawings.
 - 1. If exposed, install cables parallel and perpendicular to surfaces or exposed structural members. Follow surface contours where possible.
- E. Install cables without damaging conductors, shield, or jacket.
- F. Use cable bundling hardware rated for the environment and application in which used. Applications include, but are not limited to, general purpose, outdoor, chemical-resistant, flame-retardant, high-temperature, and vibration.
- G. Provide reusable cable management straps for bundling and securing cables. Do not use nylon cable ties.
- H. Do not bend cables, in handling or in installation, to smaller radii than minimums recommended by manufacturer.
- I. Pull cables without exceeding cable manufacturer's recommended pulling tensions. All cables shall be free of tension at both ends. Provide strain relief connectors at each device and junction box where cables enter.
- J. For wiring within equipment rooms and enclosures, provide conductors of adequate length.
- K. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by the manufacturer.

- L. Refer to drawings for conduit sizes. Where not specified on drawings, the minimum conduit size shall be 3/4".
- M. Low-voltage ESS wiring and cables may share communications pathways indicated in Division 27 and shall not share pathways with any other building wiring systems.
 - 1. Where communications pathways are not provided, j-hooks anchored to structure shall be provided to support ESS cabling. J-hooks shall comply with Division 27 requirements. Cable sag at mid-span shall not exceed 6 inches (150 mm).
 - 2. Secure and support cables at intervals not exceeding 60 inches, and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, equipment racks, frames, and terminals.
- N. For 120-volt AC wiring, comply with Division 26.
- O. For terminal connections, comply with torque-tightening values specified in UL 486A-486B.
- P. Install power supplies and other auxiliary components for ESS devices within dedicated ESS enclosures within equipment rooms. Do not install such items near the devices they serve, unless noted otherwise or required by the manufacturer.

3.04 FIRESTOPPING

- A. Firestop all smoke-rated and fire-rated walls, partitions, and openings after the installation of security cabling in sleeves and pathways. Firestop material shall be approved for use with the security cables and jackets being installed.
- B. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of firestopping for security cabling as called for in these specifications and related drawings.
- C. Deliver firestopping products to the project site in original, unopened containers or packages with intact and legible manufacturer labels identifying project, manufacturer, date of manufacture, lot number, shelf life (if applicable), qualified testing and inspecting agency's classification marking applicable to the project, curing time, and mixing instructions for multi-component materials.
- D. Creation of such openings, as necessary, for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor.
- E. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the Contractor for cabling pass-through, shall be the responsibility of the Contractor.
- F. Any openings created by or for the Contractor and left unused shall be sealed as part of this work.
- G. Firestop system installation must meet requirements of ASTM E814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- H. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- I. Ventilate firestopping per the firestopping manufacturer's instructions by natural means or, where this is inadequate, forced air circulation.
- J. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.
- K. Do not use materials that contain flammable solvents.
- L. Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of the firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of openings and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean openings and joint substrates and penetrating items to produce clean, sound surfaces capable of developing the optimum bond with firestopping. Remove loose particles remaining from the cleaning operation.
- M. When the firestop system has been installed, place a label next to the system. The label shall contain the following items:
1. UL rating and any other pertinent certification information.
 2. The date the firestop was installed.
 3. Name of contractor who installed the firestop.
- N. Protect firestopping during and after the curing period from contact with contaminating substances or form damage resulting from construction operations or other causes so that they are without deterioration or damage at the time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.
- O. Keep areas of work accessible until inspection by applicable code authorities.

3.05 AS-BUILT DRAWINGS

- A. As-built drawings shall include all information required for shop drawings and, in addition, shall indicate the following:
1. All construction changes posted to all portions of the documents including, but not limited to, security drawings, enlarged plans, wall and rack elevations, schematics, labeling, and installation details. As-built documents shall include and clearly show final cable labeling designations down to the individual device.
- B. Final drawings shall be provided to the Architect in electronic format.
- C. As-built drawings shall be complete and organized to be suitable for use as disaster recovery and cable infrastructure administration documents.
- D. Post a complete set of as-built documents in the security command center or in the communications room where the headend security equipment is installed. In each communications room containing security equipment, post a final floor plan of the outlets served by the respective communications room on the wall behind a protective plexiglass wall frame.

3.06 INTERFACE WITH OTHER WORK

- A. Coordinate with the electrical contractor to confirm required cabling pathways, device rough-ins, emergency power, and line-voltage power requirements.
- B. Coordinate with the fire alarm contractor to confirm required modules, connections, and configuration requirements.
- C. If applicable, coordinate with the elevator contractor to confirm hardware placement, cabling, and interface requirements relating to security devices mounted in elevator cabs.

3.07 GROUNDING AND BONDING

- A. Comply with Division 26 section: "Grounding and Bonding".
- B. Comply with Division 27 section: "Grounding and Bonding for Communications Systems".
- C. Bond security cabinets with minimum #6 AWG ground wire to the telecommunications primary bonding busbar (PBB) or to the nearest telecommunications secondary bonding busbar (SBB) when cabinets are located indoors. When security cabinets are installed in outdoor locations, bond the cabinet's grounding busbar to an approved ground rod installed by the electrical contractor.

3.08 OBSERVATIONS

- A. Specifications and drawings represent work to be done in view of the total project requirements. Final locations of all pathways, cables, devices, equipment cabinets, components, etc., to eliminate possible conflict with other trades is the responsibility of the Contractor. The

Contractor is to provide all project management and supervision required for their personnel to ensure installation is made in accordance with the plans and specifications and that all codes, safety rules, and regulations are observed. In the event of conflicts with other trades, the Contractor is to make every reasonable effort to resolve the conflict with other trades involved, by preparation of drawings or sketches, or by other appropriate action. Only after this on-site coordination has taken place, and a resolution cannot be found, is the Contractor to request assistance. Assistance shall be requested in adherence with the request for information (RFI) process defined for this project.

3.09 PERFORMANCE VERIFICATION TESTING

- A. Notify the Owner, General Contractor, and Architect in advance of testing to prevent delays in the construction schedule. Notification shall be provided in writing.
- B. Testing shall be completed prior to the final punch list performed by the Owner and Architect.
- C. Prior to testing, provide a summary of the proposed test plan. The test plan shall include, at a minimum, the proposed schedule, a list of tests to be completed, equipment to be utilized, expected results, and documentation. The test plan and results shall be provided to the Owner, General Contractor, Architect.
- D. Equipment and personnel required for performance verification testing shall be provided by the Contractor.
- E. Test and place in proper and specified working order all systems prior to demonstration of the systems.
- F. Perform additional tests as directed by the authorities having jurisdiction over the site.
- G. If requested, testing shall be performed in the presence of the Owner, General Contractor, Architect, and representative(s) of the authorities having jurisdiction.
- H. Power Connections
 - 1. Visually inspect all wiring and plugs to ensure that they are complete and conform to the wiring patterns defined by the security equipment manufacturers.
 - 2. Test battery backup units for complete operation. Provide test reports as required.
 - 3. Test power connections to all security devices, including (but not limited to): electrified door hardware, credential readers, security control panels, door devices, motion sensors, security cameras, intercoms, security workstations, and security servers.
- I. Wiring and Devices
 - 1. Visually inspect all cabling, splices, and termination points to ensure that they are complete and conform to the wiring patterns defined by the security equipment manufacturers.
 - 2. Test all cables for continuity, ground faults, and line-to-line short circuits.
 - 3. Test field hardware cables as applicable to verify resistance in both door-open and door-closed conditions. Document results on a chart that lists each door and the measured resistance of each conductor pair.
 - 4. Visually inspect all security devices and associated equipment to ensure that they are complete and conform to manufacturer recommendations and as defined herein.
- J. IP Network
 - 1. Test and verify that all networked security devices are connected to the correct IP network as designated by the Owner, including (but not limited to): EAC field hardware, security cameras, intercoms, ESS servers, and ESS workstations. Coordinate assignment of the IP address, subnet mask, default gateway, VLAN, TCP/UDP port(s), and switchport for each device with the Owner.
- K. ESS Software
 - 1. Visually inspect that all functions for ESS software defined herein are complete and functional.
 - 2. Visually inspect that the information for the ESS programming schedules as a part of the pre-construction submittal process have been completed within the ESS software.

- L. Test system grounds to demonstrate that the ground resistance does not exceed the requirements of UL 1449 "Surge Protection Devices (SPD)" and the National Electrical Code (NEC).
- M. Where systems have been expanded and/or upgraded, the Contractor shall provide the personnel and labor to completely test and demonstrate all new, existing, and upgraded software and hardware.

3.10 ACCEPTANCE TESTING

- A. Conduct acceptance testing and system startup according to a schedule coordinated with the Owner, General Contractor, Architect, and representative(s) of the authorities having jurisdiction.
- B. Prior to testing, provide a summary of the proposed test plan. The test plan shall include, at a minimum, the proposed schedule, a list of tests to be completed, equipment to be utilized, expected results, and documentation. The test plan and results shall be provided to the Owner, General Contractor, Architect, and representative(s) of the authorities having jurisdiction.
- C. Prior to acceptance of the work, the Contractor shall demonstrate to the Owner, General Contractor, Architect and representative(s) of the authorities having jurisdiction, all systems, subsystems, features and functions of the systems, and shall instruct the Owner in the proper operation and event sequences of the system. The Contractor shall check for correct connections and test for short circuits, ground faults, continuity, and insulation before energizing any cables and wires.
- D. The Contractor shall furnish the necessary trained personnel to perform demonstrations and instruction, and shall arrange to have the respective manufacturer's representative(s) present to assist with the demonstrations.
- E. Demonstrate each system and subsystem. Each demonstration is to consist of no less than the following:
 - 1. Designate the actual location of each component of the system or subsystem and demonstrate its function and its relationship to other components within the system or subsystem.
 - 2. Verify the final field-of-view for all security cameras.
 - 3. Demonstrate operations via actual "start/stop", "on/off", and "open/close" cycling, showing how to work controls, reset devices, replace fuses, and emergency operating procedures.
 - 4. Trip all alarm and intrusion detection devices and verify response of alarm and trouble signals.
 - 5. Check installation, supervision, and operation of all intelligent addressable initiating and control devices by physically testing each device in accordance with the manufacturer's requirements.
 - 6. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the front-end processing unit and the correct activation of all control points and the sequence of operations.
- F. Conduct system startup testing to verify, at a minimum, the functionality of the following items (where applicable):
 - 1. Electronically controlled and/or monitored doors.
 - 2. Authentication hardware (i.e., credential readers).
 - 3. Alarm notifications.
 - 4. System administrative diagnostic tools and services.
 - 5. Access level permissions.
 - 6. Credential management.
- G. Activate each installed security device through the front-end processing unit and verify proper system operation.

- H. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.
- I. Comply with the requirements of system demonstrations outlined in Division 01.
- J. Upon completion and approval of acceptance testing and system startup, training for the Owner shall proceed.

3.11 DEMONSTRATION

- A. Participate in project site observations, walkthroughs, and punch lists as requested by the Owner and/or the Architect.
- B. Demonstrate completeness of work relative to completion percentages submitted for payment.

3.12 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finishes.
- B. Remove burrs, dirt, and construction debris, and repair damaged finishes, including chips, scratches, and abrasions.

3.13 INSPECTIONS

- A. At the completion of the project and prior to final acceptance of the work, provide evidence of final inspections and approvals to the Owner as required by the authorities having jurisdiction per Division 01.

3.14 ADJUSTMENTS

- A. Within one (1) year of the date of substantial completion, provide up to three (3) site visits, when requested by Owner, to adjust and calibrate components and to assist the Owner in making program changes and in adjusting equipment and controls to suit actual conditions. Visits for this purpose shall be in addition to any required by warranty.

END OF SECTION

**SECTION 28 13 00
ELECTRONIC ACCESS CONTROL SYSTEM**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes the necessary components required to provide a complete and fully functional electronic access control (EAC) system, including (but not limited to) servers, credentials and credential readers, door hardware, peripherals, software, and installation for wiring systems to be used for connection of equipment and devices.

1.02 SYSTEM DESCRIPTION

- A. The EAC system shall be an extension of the existing and will serve as the key component for managing the EAC software and hardware. The software, equipment, devices, and server specified herein shall form one integrated system.
- B. The EAC system shall provide for a variety of integral functions, including (but not limited to):
 - 1. Controlled access for authorized personnel within predetermined areas based on time and/or clearance level.
 - 2. Monitor, track, and interface the following alarms (at a minimum):
 - a. Access granted.
 - b. Access denied.
 - c. Door forced open.
 - d. Door held open.
 - 3. Programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times.
 - 4. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance
 - 5. Manual control stations shall have the ability to override programmed settings.
 - 6. The system shall support the functions and features indicated herein.

1.03 SUBMITTALS

- A. As specified in Section 280500.
- B. Product Data:
 - 1. Field hardware.
 - 2. Authentication hardware.
 - 3. Access and door devices
 - 4. Wiring and cabling.
- C. Shop Drawings:
 - 1. System interconnection diagram(s) and EAC device locations.
 - 2. Enclosure and equipment rack layouts and elevations.
- D. Programming Schedule:
 - 1. Programming information in spreadsheet format, to include (but not be limited to) the following information by door:
 - a. When door is scheduled to be secured.
 - b. What groups or individuals have access and when.
 - c. Holiday schedules.
 - d. Users.

1.04 QUALITY ASSURANCE

- A. Coordinate locations of power raceways and receptacles with locations of security equipment requiring power to operate. Coordinate with Division 26.
- B. Coordinate electrified door hardware and door devices being provided with the EAC system. Coordinate door leaf and frame preparations with the door hardware provider to meet ESS requirements. Coordinate with Division 08.

PART 2 – PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment such that they form an integrated system. Match components and interconnections for optimum present and future performance.

2.02 SOFTWARE

- A. Integrate with the Owner's existing EAC software.
 - 1. Genetec Synergis.
- B. The following software functions and features shall be provided and configured. These features are in addition to the required setup and programming required to provide a fully functional EAC system.
 - 1. Scheduled locking and unlocking of all electronically-controlled doors.
 - 2. Live unlocking of ingress and egress doors with dedicated buttons.

2.03 SERVER

- A. Integrate with the Owner's existing server.

2.04 FIELD HARDWARE

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Mercury.
- B. All decisions regarding access, alarms, and automatically-timed functions shall be made at the controller level, independent of the server.
- C. All field hardware shall be fully compatible with each other.
- D. Intelligent Controller Board
 - 1. Basis of Design:
 - a. Mercury LP1502.
 - 2. Provide intelligent controller(s) for connection to the EAC software and to all downstream credential reader, input, and output interface boards.
 - 3. Hardware and firmware shall be compatible with the EAC software.
 - 4. Capable of receiving, processing, and transmitting real-time commands from the EAC software.
 - 5. Capable of acting as a standalone system when the EAC software is down/offline.
 - 6. Connectivity:
 - a. TCP/IP to EAC software.
 - b. Serial to downstream credential reader, input, and output boards.
 - 7. Mounting:
 - a. Within EAC enclosure.
 - 8. Power:
 - a. Match EAC power supply.
- E. Door Interface Relay
 - 1. Basis of Design:
 - a. Camden CX-12.
 - 2. Provide door interface relay board(s), as required, for connection to all powered door auto-operators and associated actuators to the EAC system.
 - 3. Reporting:
 - a. Upstream to intelligent controller board.
 - 4. Mounting:
 - a. At door location on secure side.
 - 5. Power:
 - a. Match EAC power supply.
 - 6. Provide relay module(s) to interface powered door auto-operator actuators.

- a. Basis of Design:
 - 1) Altronix RBST.
- b. Normally closed for fail safe; normally open for fail secure.
- c. Capable of 6, 12, or 24 VDC operation.
- d. Contacts:
 - 1) DPDT, 1A / 120 VAC or 2A / 28 VDC.

2.05 AUTHENTICATION HARDWARE

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Credential Readers:
 - a. HID.
- B. Credential Reader
 - 1. Credential Technology Compatibility:
 - a. 13.56 MHz smart card.
 - b. 125 kHz proximity card.
 - 2. Credential reader shall support the specified credentials.
 - 3. Communication:
 - a. Wiegand and Open Supervised Device Protocol (OSDP).
 - 4. Connection:
 - a. Upstream to credential reader interface board.
 - 5. Read Range:
 - a. Minimum of 2" away.
 - 6. Integrated RGB LED indicates credential access.
 - a. Green: Successful authentication.
 - b. Red: Unsuccessful authentication.
 - 7. Audible Feedback:
 - a. Single beep: Successful authentication.
 - 8. Mounting:
 - a. Refer to drawings.
 - 9. Form Factor:
 - a. Refer to drawings.
 - 10. Finish:
 - a. Black.
 - 11. Environmental Rating:
 - a. IP65.

2.06 ACTIVATION DEVICES

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 - 1. Alarm Controls.
 - 2. Bosch.
 - 3. George Risk Industries (GRI).
 - 4. Honeywell.
 - 5. Potter Electric Signal.
 - 6. Safety Technology International (STI).
 - 7. Seco-Larm.
 - 8. Securitron.
 - 9. Security Door Controls (SDC).
- B. Provide wiring and connection to EAC interface board for each device.
- C. Door Release Push-Button
 - 1. Basis of Design:
 - a. Securitron PB3ER.

2. Mounting:
 - a. Undermount.
3. Switch Type:
 - a. Double pole, double throw.
4. Operation:
 - a. Momentary.
5. Finish:
 - a. Black.
6. Connectivity:
 - a. Wired.
7. Function:
 - a. Release door(s) indicated.
8. Provide labeling which identifies push-button operation and associated door(s).
9. Coordinate exact location(s) with the Owner prior to installation.

2.07 DOOR DEVICES

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 1. Bosch.
 2. George Risk Industries (GRI).
 3. Honeywell.
 4. Magnasphere.
 5. Seco-Larm.
 6. Securitron.
- B. Provide wiring and connection to EAC interface board for each device.
- C. Standard Door Position Switch
 1. Mounting:
 - a. Recessed.
 2. Size:
 - a. 3/4" diameter.
 3. Gap Distance:
 - a. Up to 1/2".
 4. Switch Type:
 - a. Double pole, double throw.
 5. Finish:
 - a. Match door hardware.
 6. Function:
 - a. Generate propped door alarm in EAC software based on schedule and duration.
 7. UL-listed.

2.08 DOOR HARDWARE

- A. Provide wiring and connection to EAC interface board for each device.
- B. Electric Strike
 1. Furnished with door hardware. Contractor shall provide cabling and connection to EAC interface board, and shall coordinate connection point with door hardware supplier.
- C. Electrified Lockset
 1. Furnished with door hardware. Contractor shall provide cabling and connection to EAC interface board, and shall coordinate connection point with door hardware supplier.
- D. Electrified Exit Device
 1. Furnished with door hardware. Contractor shall provide cabling and connection to EAC interface board, and shall coordinate connection point with door hardware supplier.
- E. Electric Power Transfer / Wire Transfer Hinge

1. Furnished with door hardware. Contractor shall provide cabling and connection to EAC interface board, and shall coordinate connection point with door hardware supplier.

2.09 CONDUCTORS AND CABLES

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 1. Belden.
 2. Windy City Wire.
- B. Access Control Composite Cable
 1. Type:
 - a. Overall jacket.
 2. Each set of conductors shall be individually labeled and colored.
 - a. Lock:
 - 1) Four (4) conductors.
 - 2) #16 AWG.
 - 3) Unshielded.
 - b. Credential Reader:
 - 1) Six (6) conductors.
 - 2) #18 AWG.
 - 3) Shielded.
 - c. Door Position Switch:
 - 1) Two (2) conductors.
 - 2) #18 AWG
 - 3) Unshielded.
 - d. Request-to-Exit or Spare:
 - 1) Four (4) conductors.
 - 2) #18 AWG.
 - 3) Unshielded.
 3. Jacket Rating:
 - a. Plenum (CMP).
 4. Jacket Color:
 - a. Yellow.
 5. Verify final conductor sizes prior to ordering.
- C. Ancillary Security Cable
 1. Type:
 - a. Overall jacket.
 2. Each set of conductors shall be individually labeled and colored.
 - a. Quantity, size, and shielding shall be provided as required. Refer to drawings.
 3. Jacket Rating:
 - a. Plenum (CMP).
 4. Jacket Color:
 - a. Yellow.
 5. Verify final conductor sizes prior to ordering.

2.10 ENCLOSURES, POWER SUPPLIES, AND CABLE MANAGEMENT

- A. Subject to compliance with requirements, provide products by one of the following pre-approved manufacturers.
 1. EAC Enclosures:
 - a. Altronix.
 - b. LifeSafety Power.
 2. EAC Power Supplies:
 - a. Altronix.
 - b. LifeSafety Power.

B. EAC Enclosure

1. Provide an EAC enclosure(s) to house EAC field hardware and to route cabling. Enclosure(s) shall house equipment, batteries, and power supplies.
2. Construction:
 - a. High-grade steel.
 - b. Conduit knockouts at top and bottom.
3. Security:
 - a. Lock and key.
 - b. Door position switch.
4. Backplane:
5. Finish:
 - a. Black.
6. Enclosure(s) shall be sized to house all EAC field hardware, plus ten percent (10%).

C. EAC Power Supply

1. Mounting:
 - a. Within EAC enclosure.
2. Power Input:
 - a. 115 volts AC @ 60 Hz.
3. Input Options:
 - a. Minimum of four (4) normally open or open collector, or any combination of each.
4. Power Output:
 - a. 12 volts DC or 24 volts DC @ 6 amps (minimum).
5. Output Options:
 - a. Minimum of four (4) independently-controlled fail-safe, fail-secure, or auxiliary (unswitched) power outputs.
6. Output Fuse Rating:
 - a. 3.5 amps; individually fused.
7. Power Distribution:
 - a. Dedicated for each device.
8. Supervision:
 - a. AC fail with SPDT contacts.
9. Features:
 - a. Visual Indicators.
 - b. Thermal overload protection.
 - c. Alarm output relays.
10. Battery Backup:
 - a. Built-in charger with sealed lead-acid batteries.
 - b. Automatic cutover to standby batteries upon AC power failure.
 - c. AC fail supervision relay output.
 - d. Battery fail and battery presence supervision relay output.
 - e. Provide battery capacity for four (4) hours of operation, assuming thirty (30) 1.25-amp door unlocks, per door, per hour.
11. Fire Alarm Disconnect:
 - a. Latching or non-latching.
 - b. Individually selectable for any or all outputs.
 - c. Normally open (NO) or normally closed (NC) dry contact input.
 - d. Alarm output relay indication that fire alarm control panel input is triggered.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. As specified in Section 280500.

3.02 SYSTEM INSTALLATION

- A. As specified in Section 280500.
- B. Install, wire, and power all devices per manufacturer recommendations.
- C. Mount server within the indicated equipment rack or network cabinet. Refer to drawings.
- D. Install workstation(s) on or within security desk(s) as indicated. Refer to drawings.
- E. Mount all credential readers where shown on drawings. Coordinate exact placement with architectural element; refer to architectural drawings. Placement shall be in accordance with ADA requirements.
 - 1. Multiple ESS devices at a single door location shall be mounted adjacent to one another.

3.03 DOOR HARDWARE COORDINATION

- A. Doors and frames shall be properly prepared to receive specified electrified hardware and door devices without additional field modifications. Coordinate requirements with the hardware, door, and frame providers.
- B. Verify operation of each electronically controlled and/or monitored door and door opening to ensure proper secured operation and function. Adjust door hardware and door devices as needed to ensure proper operation. Door hardware and door devices that cannot be adjusted to operate as required shall be replaced.

3.04 WIRING INSTALLATION

- A. As specified in Section 280500.
- B. Route individual conductors neatly within enclosure(s). Each access control composite cable shall be neatly bundled per door and terminated at interface board. Each bundle shall be clearly identified for troubleshooting, and moves, adds, or changes.

3.05 GROUNDING AND BONDING

- A. As specified in Section 280500.
- B. Bond EAC field hardware and enclosures to the telecommunications primary bonding busbar (PBB) or to the nearest telecommunications secondary bonding busbar (SBB). Comply with manufacturer recommendations.

3.06 INTERFACE WITH OTHER WORK

- A. As specified in Section 280500.
- B. Coordinate with the Division 08 installer regarding door hardware, frames, and leaves which are associated with the ESS. Verify rough-in requirements and coordinate installation requirements for all ESS equipment which is to be mounted on or within a door frame or leaf.
- C. Prior to the start of installation, schedule and facilitate a preinstallation meeting with the pertinent door hardware, frame, leaf, lock, etc., manufacturer representative(s) and related trades to coordinate materials, techniques, and to sequence complex hardware items and system installation. Proper installation and adjustment of hardware shall be reviewed. Convene at least one (1) week prior to commencement of ESS installation. Provide written documentation of the meeting, including date, list of participants, and minutes.

3.07 IDENTIFICATION AND LABELING

- A. Label all installed electronic access control cabling and equipment.
- B. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used.
- C. Label equipment and cables such that they can be easily identified.
 - 1. Label field hardware with identifier of door being served.
 - 2. Label overall jacket of each access control composite cable.
 - a. Near door being served.
 - b. Just before entering the EAC enclosure.

3. Label each individual bundle within each access control composite cable.
 4. Label each ancillary security cable.
- D. Wiring and cables shall be color-coded as required by function. Maintain color-coding and labeling scheme throughout entire system.

3.08 ACCEPTANCE TESTING

- A. As specified in Section 280500.

3.09 SYSTEM STARTUP

- A. As specified in Section 280500.

END OF SECTION

**SECTION 28 46 00
FIRE DETECTION AND ALARM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Maintenance of fire alarm system under contract for specified warranty period.
- C. NFPA 70 - National Electrical Code.
- D. NFPA 72 - National Fire Alarm and Signaling Code.

1.02 DEFINITIONS

- A. FACP: Fire Alarm Control Panel

1.03 SUBMITTALS

- A. Submittals to Authorities Having Jurisdiction: Prior to submitting to the Architect, submit product data and shop drawings to authorities having jurisdiction. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review. Submittals received without the approval of authorities having jurisdiction will be returned with no action taken.
- B. Specification Compliance Review: See Section 26 0400 - Common Requirements for Electrical, for requirements.
- C. Product Data: Manufacturer's data sheets for each system component.
- D. Shop Drawings: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. System interfaces to fire safety systems.
 - 2. Floor plans indicating locations of components; mark components with device addresses used in control unit programming. Show interconnection of devices.
 - 3. Riser Diagram: Indicate circuiting, device addresses and cable types.
 - 4. Calculations: Battery sizing, voltage drop, and audio amplifier sizing.
- E. Inspection and Test Reports:
 - 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.
 - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- F. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
- G. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
 - 1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data.
 - 2. Furnish the following:
 - a. Remote Indicating Lamp Units: Quantity equal to 5 percent of amount installed, but not less than 1 unit.
 - b. Smoke and Heat Detectors: Quantity equal to 5 percent of amount of each type installed, but not less than 1 unit of each type.
 - c. Detector Bases: Quantity equal to 5 percent of amount of each type installed, but not less than 1 unit of each type.
 - d. Keys and Tools: One extra set.
 - e. Audible and Visual Notification Appliances: One of each type installed.
 - f. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer .
- B. Provide products listed and labeled by testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated.

1.05 WARRANTY

- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. SimplexGrinnell: www.simplexgrinnell.com
- B. Source Limitations: Furnish fire alarm components produced by a single manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in the contract documents or not.
 - 2. Comply with the following:
 - a. The Americans With Disabilities Act (ADA).
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction .
 - d. NFPA 72 and other applicable codes.
 - e. ANSI B117.1, for elevator operation.
 - 3. Signal Priority, not affected by order of occurrence:
 - a. Alarm
 - b. Supervisory
 - c. Trouble
 - 4. System Trouble or Supervisory Signal:
 - a. Sound trouble signal and indicate at FACP and remote annunciator.
 - b. Record event in system memory.
 - 5. Alarm Signal:
 - a. Indicate at FACP and remote annunciator.
 - b. Record event in system memory.
 - c. Operate notification appliances continuously, until silenced.
 - d. Operate notification appliances throughout the building.
 - 6. System Silencing and Reset:
 - a. Controlled by buttons in the FACP and remote annunciator.
 - b. Subsequent alarm signals reactivate notification appliances.
 - 7. Fire Alarm Control Panel (FACP): New.
- B. Circuits:
 - 1. Signaling Line Circuits (SLC): Class B, Style 4.
 - 2. Notification Appliance Circuits (NAC): Class B, Style Y.

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.

- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
 - 2. Manual stations.
 - 3. Heat detectors.
 - 4. Smoke detectors.

2.04 COMPONENTS

- A. General:
 - 1. Unless otherwise indicated, provide flush-mounted or semi-recessed units where installed in finished areas; in unfinished areas, surface-mounted units are acceptable.
- B. Fire Alarm Control Units, Initiating Devices: Analog, addressable type; listed by Underwriters Laboratories or other testing agency acceptable to authority having jurisdiction as suitable for the purpose intended.
- C. Signal Circuit Remote Power Supply
 - 1. General: Filtered, regulated, power limited with trouble indication; with emergency power supply.
 - 2. Cabinet: Lockable steel, surface-mounted enclosure.
- D. Initiating Devices:
 - 1. Manual Pull Stations:
 - a. Single-action.
 - b. Constructed of metal or plastic.
 - c. Integral addressable module.
 - d. Key-operated reset.
 - 2. Smoke Detectors:
 - a. 24 Volt, DC
 - b. Photoelectric type.
 - c. Self-restoring.
 - d. Integral addressable module.
 - e. LED indicator to show detector status.
 - f. Plug-in mounting in fixed detector base.
 - 3. Duct Smoke Detectors:
 - a. Photoelectric type.
 - b. Sampling tube as required for the location where the detector is installed.
 - 4. Heat Detectors:
 - a. Combination fixed temperature and rate-of-rise.
 - b. Analog temperature measuring device.
 - c. Self-restoring.
 - d. Integral addressable module.
 - e. LED indicator to show detector status.
 - f. Plug-in mounting in fixed detector base.
- E. Addressable Interface Devices:
 - 1. Monitor Module: Allows individual monitoring of non-addressable points.
 - 2. Control Module: Provides a system address to relays for control functions.
 - a. Relay: 24 VDC coil; contacts rated 10A, 115 VAC, minimum; suitable for control function required.
- F. Remote Indicators and Test Switches
 - 1. LED indicator connected to flash when the associated detector is in an alarm or trouble condition.
 - 2. Combined with a keyed detector test switch where indicated.
 - 3. Flush-mounted in a single gang wall plate.
- G. Notification Appliances:

1. Combination devices consist of audible and visual devices, factory-assembled as a single assembly. Provide low frequency devices where required by Code.
 2. Horns: Electronic, multi-tone type, 24 Volt DC, sound pressure of 90 dB measured 10 feet from the horn.
 - a. Ceiling-mounted horns: White.
 - b. Wall-mounted horns: Red.
 3. Strobes:
 - a. Xenon strobe with clear polycarbonate lens.
 - b. Rated light output: as selected by the system supplier to provide Code-required coverage of the area where the strobe is located.
 - c. Synchronized operation.
 - d. Ceiling-mounted strobes: White.
 - e. Wall-mounted strobes: Red.
- H. Guards for Physical Protection:
1. Wire Guard:
 - a. Welded wire mesh of size and shape for the device requiring protection.
 - b. Finish: White epoxy powder coat.
 2. Manual Station Protective Shield:
 - a. Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm, Safety Technology International, Inc. Stopper II series or equivalent.
 - b. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.
- I. Circuit Conductors:
1. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 degrees C, color-coded insulation.
 - a. Low-Voltage Circuits: No. 14 AWG, minimum.
 - b. Line-Voltage Circuits: No. 12 AWG, minimum.
 2. Power-Limited Circuits: Types FPL, FPLR, or FPLP, as recommended by manufacturer.
- J. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
- K. Locks and Keys: Deliver keys to Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The locations and spacing of alarm initiating devices and notification appliances indicated on the drawings are approximate. Quantities indicated are minimum. 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 his representative to determine the type of detector required by local authorities for each type of installation.
- B. 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.
- C. Coordinate system programming with the authority having jurisdiction.
- D. Provide 120 volt power to remote signal circuit power supplies.
- E. Coordinate the installation of equipment and devices that pertain to the work of other trades with the appropriate contractors.

- F. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- G. Install wiring in metal raceways.
- H. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- I. Install end-of-line resistors at farthest device from panel or module.
- J. Ground cable shields and equipment according to manufacturer's instructions.
- K. Install instruction cards and labels.

3.02 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 and each control panel or subpanel.
 - 2. Duct Detectors:
 - a. Provide duct type smoke detectors in the supply and return ductwork of all air handling equipment with a flow rate greater than 2000 CFM.
 - b. Provide duct type smoke detector in the return ductwork of each heat pump, fan coil unit, or similar equipment sharing a common return plenum with a combined flow rate greater than 2000 CFM.
 - c. Provide duct type smoke detectors in the return ductwork of all air handling equipment which has a flow rate greater than 15,000 CFM and which serves more than one floor. Install at each story prior to the connection to a common return and prior to recirculation or fresh air inlet connection.
 - d. Install duct detectors in accordance with NFPA 90A.
 - e. 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.
 - f. 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 recommended by system supplier or Owner.
 - 5. Program device output text by address and geographic location (zone).
 - 6. Provide an addressable interface module for each non-addressable detector zone as indicated on drawings.
 - 7. Provide an addressable interface module for each non-addressable initiating device.
- C. Notification Appliances:
 - 1. Where plans indicate a notification appliance installed adjacent to a manual station, install the notification appliance on the wall directly above the manual station.
 - 2. Provide a minimum of one weatherproof audible notification appliance of the same type as other notification appliances provided with the system. Mount device on the building exterior; verify location. Provide a separate circuit for exterior audible notification appliances.
 - 3. In sprinkled buildings, provide a 120 volt circuit to the fire sprinkler bell location.
- D. Control Devices:
 - 1. Provide a control module with relay for each fan requiring fire alarm shutdown or control.

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 with 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. Connect to nearest temperature control panel.

3.03 INTERCONNECTION TO OTHER SYSTEMS

- A. Alarm Indicating:
 1. Provide 4-pair, 24 gauge, Category 3 cable in 3/4-inch conduit from control panel to main telephone terminal board for connection of Digital Alarm Communicator Transmitter. Allow adequate slack at terminal board for connection by Owner.
 2. Provide 2-pair, 18 gauge, cables in 3/4-inch conduit as required from alarm and trouble contacts in fire alarm control panel to the nearest temperature control panel. Coordinate with Control Contractor.
- B. Fire Protection System:
 1. Connect all sprinkler system flow detection devices and tamper switches, including post or wall indicator valves. Provide an addressable interface module for each device.
 2. Provide RGS conduit where exposed at post or wall indicator valve.
 3. Verify exact quantities and locations of devices with Fire Protection Contractor.
- C. Smoke Dampers:
 1. Provide necessary wiring and controls to close 120V smoke dampers located in air supply ducts upon activation of local smoke detector(s). Provide power for smoke damper motors from a dedicated circuit in 120V panels. Provide a breaker lock for each circuit serving smoke dampers.
- D. Access Control / Security Systems:
 1. Provide a control module and relay for each electrically locked exit door or group of exit doors. Connect so relay will interrupt power to the locking device(s) under an alarm condition.
- E. Lighting Control System:
 1. Provide a control module containing suitable contacts for each emergency lighting relay serving egress lighting circuits or by using an alternative method approved by the authority having jurisdiction.
 2. Connect output of the fire alarm control module to the auxilliary input of the emergency lighting relay. Connect to the lighting control system such that a general fire alarm will drive all emergency lighting on the egress path to full brightness.
 3. Verify exact requirements and location with lighting control system submittal, refer to specification 26 0923.

3.04 IDENTIFICATION

- A. Paint power-supply disconnect switch or breaker red and label "FIRE ALARM". Provide locking means.
- B. Affix the name and telephone number of the local service organization to the inside of the door of the FACP and each remote cabinet.
- C. Label each addressable device with its address using laminated tape. See Section 26 0553 Identification for Electrical Systems for tape requirements. Attach label to detector base shroud so it is visible without removing detector or shroud.
- D. Label each control module to indicate the equipment controlled.
- E. Maintain wiring color codes throughout the system.

3.05 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.

- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of a factory-authorized service representative to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents and applicable standards.

3.06 OWNER PERSONNEL INSTRUCTION

- A. Schedule training with the Owner through the Architect, with at least seven days advance notice.
- B. Provide a minimum of four hours training.
- C. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
- D. Furnish the services of the manufacturer's factory-authorized instructors; have copies of operation and maintenance data available during instruction.

3.07 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 to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- E. Comply with Owner's requirements for access to facility and security.

END OF SECTION

DIVISION 31 - EARTHWORK

**SECTION 31 10 00
SITE CLEARING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and grubbing.
- B. Selective removal and trimming.
- C. Repair and restoration.
- D. Debris removal.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Demolition: Removal of built elements and utilities.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.266 - Logging Operations; Current Edition.
- B. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning); 2017.
- C. ANSI Z133 - American National Standard for Arboricultural Operations - Safety Requirements; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene prework meeting one week prior to start of work of this section; require attendance by affected personnel.
- B. Sequencing: Ensure utility disconnections are in orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Site Plan:
 - 1. Indicate vegetation removal limits.
 - 2. Indicate areas for temporary construction and field offices.
- C. Clearing Firm Qualification Statement: Documentation of specialized experience.

1.06 QUALITY ASSURANCE

- A. Clearing Firm Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 FIELD CONDITIONS

- A. Ambient Conditions: Terminate work during hazardous environmental conditions according to 29 CFR 1910.266.
- B. Existing Conditions: See soil report, site and utility survey, geotechnical report, existing conditions survey, and site drawing; see Section 00 31 00 - Available Project Information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL SITE PREPARATION

- A. Review and implement recommendations noted within the geotechnical exploration report included within Section 00 31 32 - Geotechnical Data . Site clearing, grubbing and stripping will need to be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive rutting and mixing of organic debris with the underlying soils.
- B. Keep project site free from drainage ponding due to construction operations during progress of work. Make arrangements for disposal of all water and sewage received on the site from

temporary connection or stoppages. Do not discharge any water or sewage onto private property outside of the construction right-of-way.

- C. Remove and store obstructions such as signs and fences for replacement upon completion of construction. Provide temporary fencing if necessary to prevent accidents until permanent fencing is restored.

3.02 EXAMINATION

- A. Comply with additional requirements specified in Front End Documents and Civil Drawings.
- B. Identify potential runoff areas.
- C. Identify potential dust sources.
- D. Identify preexisting debris, junk, and trash on-site.

3.03 PREPARATION

- A. Coordinate work with utility companies; notify before starting work and comply with local requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are to remain.
- E. Install sedimentation barrier according to Section 01 57 13 - Temporary Erosion and Sediment Control.
- F. Install substantial, highly visible fences at least 4 feet high to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits, as indicated on the drawings.
 - 2. The contractor shall exercise all possible care to avoid damage to existing trees and their roots which are scheduled to remain.
- G. Develop dust remediation controls and methods. Do not use water if that results in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- H. Remove preexisting debris, junk, and trash on-site.

3.04 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.05 CLEARING AND GRUBBING

- A. Clearing: Cut trees, stumps, shrubs, downed timber, and other vegetation for removal within identified area as indicated on drawings according to 29 CFR 1910.266. Follow recommendations of ANSI Z133 and best local practices for species involved.
- B. Do not remove or damage vegetation beyond limits indicated on drawings.
- C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum subsoil disturbance.

3.06 SELECTIVE REMOVAL AND TRIMMING

- A. Selective Removal: Individual tree and shrub identified for removal as indicated on drawings according to 29 CFR 1910.266.
 - 1. Includes trees, stumps, shrubs, downed timber, and other vegetation identified for removal as indicated on drawings.

- B. Selective Trimming: Individual limbs and branches cut back according to ANSI A300 Part 1 identified for removal as indicated on drawings. Follow recommendations of ANSI Z133 and best local practices for species involved.

3.07 REMOVED VEGETATION PROCESSING

- A. Do not burn, bury, landfill, or leave on-site, except as indicated on drawings.
 - 1. Clearing shall consist of the felling and cutting up of trees and landscaping and their satisfactory disposal. Trees and other vegetation designated for removal, together with down timber, vegetation, stumps, roots, and brush in areas to be cleared, shall be removed in their entirety.
 - 2. Remove and dispose of stumps, matted roots and roots larger than 2-inches in diameter under paved areas and cut areas, and areas having 2-feet or less of fill. Exercise special care to avoid damage to trees and their roots which are scheduled to remain.

3.08 REPAIR AND RESTORATION

- A. Remaining Existing Facilities, Utilities, and Site Features: If damaged due to this work, repair or replace to original condition.
- B. Vegetation: Replace damaged or destroyed vegetation identified to remain as indicated on drawings at no cost to Owner:
 - 1. Outside removal limits.
 - 2. Inside protection limits.

3.09 DEBRIS REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and windblown debris from public and private lands.

3.10 CLEANING

- A. Remove unused stockpiled subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and ready to receive work.

END OF SECTION

**SECTION 31 20 00
EARTHWORK**

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section covers excavation, trenching, cutting, filling, backfilling, overexcavation & recompaction and related work for construction. Refer to the full Geotechnical Engineering Report prepared for this project included under Specification Section 00 31 32 - Geotechnical Data for additional information.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00 31 32 - Geotechnical Data.
- B. Section 01 40 00 - Quality Requirements.
- C. Section 31 10 00 - Site Clearing.

1.03 PROTECTION

- A. Utility Removal: Before the Prime (General) Contractor begins his/her grading operations, he/she shall confer with the Mechanical and Electrical Subcontractors to assure that they have contacted the owners of any underground and overhead utilities which may be on or in close proximity to the grading areas, and have arranged for the necessary disconnection of these utilities in accord with the regulations of the utility company concerned. Such utility disconnections, if performed by the owning utility company, shall be paid for by the Mechanical or Electrical Subcontractors, respectively, and such costs shall be included within their bid. Where such disconnection is not customarily performed by the owning utility, the respective Mechanical or Electrical Subcontractors shall perform the disconnection and the costs shall be included in their bid. The Prime Contractor shall take such measures as the Architect/Engineer may direct in properly protecting utilities which are scheduled to remain throughout the period when his/her grading operations are in progress. Whenever and wherever disconnection and removal operations are undertaken by the Mechanical or Electrical Subcontractors, or the owners of the utilities, the Prime Contractor shall cooperate to the extent that ample protection of their work will be provided, so that the entire work as contemplated be expedited to the best interests of all concerned, as judged by the Architect/Engineer. Known existing abandoned utility lines shall not be allowed to remain under the building or under areas less than 5-feet outside the building line regardless of the depth of the lines. They shall not be allowed to remain under paving and walk areas and nonpaved areas where the utility will be less than 3-feet below finish grade. Where abandoned utilities are required to be removed, they shall be totally removed, and the excavations backfilled and compacted as specified elsewhere in this Section.
- B. Protection of Existing Service Lines and Utility Structures: The existing service lines and utility structures which are scheduled to remain and which are shown or indicated on the Drawings, the location of which is known to the Contractor prior to excavation or construction of fills and embankments, shall be protected and safeguarded from damage during grading operations, and, if damaged, shall be repaired by the Contractor at his/her expense. The above provisions are applicable to all service lines and utility structures, all or any portion of which protrudes above the original ground surface or lies beneath the ground surface within the grading area.
- C. Protection of Existing Site Features: The Contractor shall guard against, and be responsible for, movement, settlement, and collapse of existing site features including but not limited to sidewalks, monument signs, street passages, and aboveground and underground utilities. The Contractor shall repair damage done to the Owner's property and other property, on or off premises, by reason of required work.
- D. Provide for surface drainage during the period of construction in a manner that will protect newly graded and adjacent areas. At all times, maintain positive drainage away from the building area.

- E. Protect all excavations within the area of construction from the action of the elements. Keep all excavations free of water at all times during the entire progress of construction, regardless of the cause, source, or nature of the water. Temporarily grade away from excavated areas to prevent excessive moisture from penetrating at those areas.
- F. All areas of the site which are regraded as shown on the Drawings shall be finished graded to the profile shown on the Drawings.
- G. Erosion Control: Every precaution and temporary measure shall be taken, such as temporary seeding or temporary grading to prevent damage from erosion of freshly graded areas. This shall apply to damage to newly graded areas within the site and damage to adjacent properties by eroded materials. Comply with all codes and ordinances regarding erosion control requirements.
- H. Adjoining Streets and Roads: The Contractor shall prevent excessive dirt from depositing on adjacent roads and streets. In the event that dirt gathers on adjacent roads and streets contractor shall clean streets, removing dirt and soil.
- I. Care of Trees to Remain: The Contractor shall exercise all possible care to prevent damage to roots and other members of trees scheduled to remain. Do not grade or strip vegetation off of the ground surface at areas inside tree protection fencing shown on the plans until the time of finish grading. Grading within those areas shall be accomplished with small equipment or by hand rather than large equipment.
- J. Contractor shall install barricades and/or temporary fencing during excavation and earthwork as required for public safety.
- K. Subsurface Investigations: A Geotechnical Engineering Report has been created for this project. Refer to Section 00 31 32 - Geotechnical Data for a full copy of this report. The Prime (General) Contractor shall thoroughly familiarize himself/herself with this report and adhere to its recommendations.

PART 2 PRODUCTS

2.01 GENERAL STRUCTURAL FILL COMPOSITION REQUIREMENTS

- A. All fill and backfill material under new building and paving areas, and within 5-feet of the edge of building and 2 feet of the edge of paving, shall be USCS Classification CL, clean, inorganic low plasticity cohesive materials with a liquid limit less than 45 and a plasticity index between 10 and 20 and approved by the Testing Laboratory. The excavated site soils will generally be suitable for reuse as structural fill, although some moisture conditioning may be required. Refer to the geotechnical report in Section 00 31 32 - Geotechnical Data for information regarding fill material, compaction and placement requirements.
- B. Granular Fill: The top 4-inches minimum of fill under slabs-on-grade, unless otherwise noted, and at other locations noted on the Drawings, shall be a granular material which is pervious, which will prevent capillary action, and which conforms to the following requirements:
 - 1. USGS Classification SP, SW, GW
 - 2. Well graded, crushed stone or crushed concrete, containing 100 percent passing the 1-inch sieve, less than about 40 percent passing the No. 40 sieve, and less than 5 percent passing the No. 200 sieve.
 - 3. The Testing Agency shall review gradations of proposed materials and perform necessary tests as may be required.
- C. Extensive additional depths of granular fill use in lieu of compacted earth will not be permitted. Granular fill may not be used as backfill around underground and underslab utilities.
- D. Granular Working Layer and Drainage Fill: See geotechnical report for all requirements.

PART 3 EXECUTION

3.01 PREPARATION

- A. Completely remove stumps, roots, brush, etc., as noted in the geotechnical report and as specified in Section 31 10 00 - Site Clearing.

- B. Coordinate with the mechanical and electrical subcontractors to assure that they have notified the utility companies which have utilities that interfere with construction, and have arranged for their disconnection.

3.02 GENERAL EXCAVATION AND FILLING REQUIREMENTS

- A. General: Excavate to the lines and grades indicated on the Drawings and specified hereinafter. During construction, excavation shall be performed in a manner and sequence that will provide drainage at all times. All areas under and within 5-feet of building and 2-feet of paving areas which are disturbed shall also be inspected by the Testing Laboratory before the fill is placed.
- B. Fills and embankments shall be constructed at locations and to lines and grades indicated on the Drawings. Completed surfaces shall correspond to the shape of the typical sections shown on the Drawings, or shall meet the requirements of the particular case.
- C. Finished Excavations and Embankments: Uniformly smooth grading of all areas covered by the Project, including excavations, embankments and adjacent transition areas shall be accomplished. Finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. All swales shall be finished so as to drain readily. Construction debris shall not be present to any significant extent in the final finish grade. This latter requirement will be strictly enforced.
- D. Soils in the building areas, and within 20-feet of the building perimeter, shall be protected against moisture content increase throughout the construction period. Footing and utility excavations shall be exposed for as short a time as practical, and, if water enters the excavations, the softened soils shall be removed completely before footings and utilities are placed. All swales shall be kept a minimum of 20-feet away from exterior walls.
- E. All excavation work shall be completed in accord with OSHA Standards. All excavations shall have safe back-slopes or bracing. Where safe back-slopes cannot be provided, properly designed bracing shall be installed.

3.03 TRENCH EXCAVATION

- A. Trenches included in the building shall be carefully excavated, maintaining a minimum width and in no way impairing the bearing value of footings and foundations.

3.04 FOOTING EXCAVATION

- A. Cut excavations for footings vertically from the widest part of the footing. Undercutting for footing projections will not be permitted.
- B. Surface water shall not be allowed to stand in footing excavations, and all water shall be removed immediately. Soil that inadvertently becomes wet must be removed prior to the placement of footing construction. This is important because the existing on-site soils are of a type which tend to lose their bearing capacity if wetted.
- C. Pour footings immediately after excavation for footings is completed and inspected. The last 4-inches to 6-inches of subsoil shall not be removed until preparations are complete for pouring footings. Concrete for footings which bear on earth shall be placed on undisturbed soil and/or compacted fill. When footings are inadvertently over-excavated below elevations shown on the Drawings, the footings shall be filled to the proper level with concrete.

3.05 SLAB-ON-GRADE

- A. Granular fill for slab-on-grade shall be placed in uniform depths and compacted by vibratory hand-held compaction equipment or other approved means until complying with the compaction requirements for granular fill.

3.06 BACKFILLING

- A. Support walls laterally while the fill and backfill is placed and compacted against walls and until all permanent lateral support is in place.

- B. Place backfill for structures in horizontal uniform layers not to exceed 8-inches loose lifts. Bring each layer up uniformly on all sides of the structure and thoroughly compact using pneumatic compaction or other methods as approved by the Geotechnical Engineer.

3.07 STRUCTURAL FILL COMPACTION REQUIREMENTS

- A. All fill and backfill shall be wetted or dried by aeration, and then compacted to the following percentage of maximum density, at a moisture content within the limits specified above or below optimum moisture content, as determined by testing Procedure ASTM D698 (Standard Proctor), unless otherwise specified. These compaction requirements shall also apply to all utility trenches in the respective areas.
- B. Requirements for minimum percentages of maximum densities of moisture content are discussed for materials in the Geotechnical Report included in Section 00 31 32 - Geotechnical Data.

3.08 QUALITY CONTROL

- A. Testing Laboratory: See Section 01 40 00 - Quality Requirements.
- B. Testing: Testing Laboratory will take the number of tests required to determine the specified compaction. Fill and backfill not meeting the required compaction, as determined by the Testing Laboratory, shall be removed, replaced, recompact, and retested at the expense of the Contractor. All footing excavations shall be inspected before concrete is placed.
- C. Inspection: See references earlier in this Section and within the Geotechnical Engineering Report for specific inspections that the Geotechnical Engineer shall make.
- D. Unexpected Conditions: Notify the Testing Laboratory if conditions are uncovered which appear to be questionable as far as soil bearing capacity is concerned.

END OF SECTION

**SECTION 31 22 00
GRADING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough grading the site for site structures.
- B. Topsoil and finish grading.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Hauled in or onsite excavated material.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1 inch, subsoil, debris, large weeds and foreign matter.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Verify the absence of standing or ponding water.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.
- D. Protect plants and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

- A. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- C. When excavating through roots, perform work by hand and cut roots with sharp axe.
- D. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- E. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove soil contaminated with petroleum products.
- C. Where topsoil is to be placed, scarify surface to depth of 3 inches.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- E. Place topsoil in areas indicated.
- F. Place topsoil where required to level finish grade.
- G. Place topsoil during dry weather.
- H. Remove roots, weeds, rocks, and foreign material while spreading.
- I. Near plants spread topsoil manually to prevent damage.

- J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- K. Lightly compact placed topsoil.
- L. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.05 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.06 REPAIR AND RESTORATION

- A. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

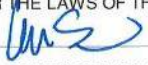
3.07 CLEANING

- A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SEALS PAGE

ARCHITECT:

	I HEREBY CERTIFY THAT THE PORTION OF THIS TECHNICAL SUBMISSION DESCRIBED BELOW WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND RESPONSIBLE CHARGE. I AM A DULY REGISTERED PROFESSIONAL ARCHITECT UNDER THE LAWS OF THE STATE OF IOWA. SIGN & DATE: <u> 6/19/2025</u> PRINTED NAME: GREGORY S. STIEREN LICENSE NUMBER: 07744 MY LICENSE RENEWAL DATE IS JUNE 30, 2027 PAGES/ SHEETS/ DIVISIONS COVERED BY THIS SEAL:
ONLY THESE COPIES OF THIS DOCUMENT SIGNED IN CONTRASTING INK COLOR ARE TO BE CONSIDERED CERTIFIED OFFICIAL COPIES PER IOWA ADMINISTRATION CODE 554D.	Divisions 0 through 12

STRUCTURAL ENGINEER:

	I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA <u> 6/19/25</u> JAMES F LANGE, SE LICENSE NUMBER: 20084 LICENSE RENEWAL DATE: DECEMBER 31, 2025 PAGES / SHEETS / DIVISIONS COVERED BY THIS SEAL: 03, 05

MECHANICAL ENGINEER:

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	 06/19/2025
	MATTHEW M. SARGENT (date)
	License Number P21077
	My license renewal date is December 31, 2025
	Pages or sheets covered by this seal:
	<u>Divisions 21, 22, and 23</u>
	<u>Specifications</u>

ELECTRICAL ENGINEER:

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	 06/19/2025
	MARY R. WURST (date)
	License Number 22287
	My license renewal date is December 31, 2025
	Pages or sheets covered by this seal:
	<u>Division 26 and Division 28, Section 28 46 00</u>
	<u>Specifications</u>

END OF SECTION