PARAGON
ARCHITECTURE

PROJECT MANUAL

Cabool R-IV School District

CABOOL MIDDLE SCHOOL
TORNADO SAFE ROOM

1025 Rogers Avenue
Cabool, MO 65689

Project # 20-606

Issue Date | August 16, 2021

MIDDLE SCHOOL TORNADO SAFE ROOM
CABOOL R-IV SCHOOL DISTRICT
Cabool, Missouri

PROJECT DIRECTORY

OWNER: **CABOOL R-IV SCHOOL DISTRICT**

1025 Rogers Avenue
Cabool, Missouri 65689
Phone: 417-962-3153

Owner's Representative: Dr. Karl Janson, Superintendent

ARCHITECT OF RECORD: **PARAGON ARCHITECTURE**

637 West College Street
Springfield, MO 65806
Phone: 417-885-0002 ext. 1004

Project Contact: Nathan Burkholder & Jared Younglove

STRUCTURAL ENGINEER OF RECORD: **TOTH ASSOCIATES**

830 E. Primrose, Suite 200
Springfield, MO. 65807
Phone: 417.888.0645

Project Contact: Brian Orr

MECHANICAL/ELECTRICAL ENGINEER OF RECORD: **RTM ENGINEERING**

3333 East Battlefield Road, Suite 1000
Springfield, MO. 65804
Phone: 417-881-0020

Project Contact: Jennifer Luce

CIVIL ENGINEER OF RECORD: **TOTH ASSOCIATES**

1550 East Republic Road
Springfield, MO. 65804
Phone: 417-888-0645

Project Contact: Matt Miller & Joe Tuey

GEOTECHNICAL ENGINEER OF RECORD: **TERRACON**

4765 West Junction Street
Springfield, Missouri 65802
Phone: 417-429-1329

Project Contact: Ty Alexander

ARCHITECTURAL SPECIFICATION DISCLAIMER

PROJECT:	Cabool Middle School Tornado Safe Room #20-606
OWNER:	Cabool R-IV School District
LOCATION:	725 Main Street, Cabool, Missouri 65689
ARCHITECT:	PARAGON ARCHITECTURE, LLC 637 W. College Street SPRINGFIELD, MO 65806 P: 417.885.0002

The Specifications to be authenticated by Paragon Architecture and the undersigned seal is limited to the specification sections listed below. Paragon Architecture herby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Paragon Architecture.

07 2100	THERMAL INSULATION
07 2119	FOAMED-IN-PLACE INSULATION
07 2500	WEATHER BARRIER
07 4213	METAL WALL PANELS
07 5400	THERMOPLASTIC (TPO) MEMBRANE ROOFING
07 6200	SHEET METAL FLASHING AND TRIM
07 7200	ROOF ACCESSORIES
07 8400	FIRESTOPPING
07 9200	JOINT SEALANTS
07 9513	EXPANSION JOINT ASSEMBLIES
08 1113	HOLLOW METAL DOORS AND FRAMES
08 1416	FLUSH WOOD DOORS
08 7100	DOOR HARDWARE
08 8000	GLAZING
09 0561	COMMON WORK RESULTS FOR FLOORING PREPARATION
09 2116	GYPSUM BOARD ASSEMBLIES
09 3000	TILING
09 5100	ACOUSTICAL CEILINGS
09 6500	RESILIENT FLOORING
09 8430	SOUND-ABSORBING WALL UNITS
09 9113	EXTERIOR PAINTING
09 9123	INTERIOR PAINTING
10 1400	SIGNAGE
10 2600	WALL AND DOOR PROTECTION
10 2800	TOILET AND BATH ACCESSORIES
10 4400	FIRE PROTECTION SPECIALTIES
12 3600	COUNTERTOPS

JARED A. YOUNGLOVE, ARCHITECT
MO #: A-2017019282

SPECIFICATION DISCLAIMER

PROJECT: Cabool Middle School Tornado Safe Room

OWNER: Cabool R-IV School District

LOCATION: Cabool, MO

CIVIL ENGINEER: TOTH AND ASSOCIATES, INC
1550 EAST REPUBLIC ROAD
SPRINGFIELD, MO 65804
P: (417) 888-0645
MISSOURI COA #2004004242

The Specifications to be authenticated Toth and Associates and the undersigned seal is limited to the specification sections listed below. Toth and Associates herby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Toth and Associates, Inc.

024113 SITE DEMOLITION
311000 SITE CLEARING
312300 EXCAVATION AND FILL
312500 EROSION AND SEDIMENTATION CONTROLS
321100 CAST-IN-PLACE CONCRETE FOR SITEWORK
321373 CONCRETE PAVING JOINT SEALANTS
329200 TURF AND GRASSES
333100 SEWER UTILITY SEWERAGE PIPING

MIDDLE SCHOOL TORNADO SAFE ROOM, #20-606
CABOOL R-IV SCHOOL DISTRICT
Cabool, Missouri

SPECIFICATION DISCLAIMER

PROJECT: Middle School Tornado
Safe Room, #20-606

OWNER: Cabool R-IV School District

LOCATION: Cabool, MO

ARCHITECT: PARAGON ARCHITECTURE, LLC

ENGINEER: RTM ENGINEERING CONSULTANTS
3333 E. BATTLEFIELD, SUITE 1000, SPRINGFIELD, MO 65804
P: (417) 881-0020

The Specifications to be authenticated by Paragon Architecture and the undersigned seal is limited to the specification sections listed below. Paragon Architecture herby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Paragon Architecture, LLC.

DIVISION 22 – PLUMBING

DIVISION 26 – ELECTRICAL

02.23.21

DIVISIONS 22, 23, 26

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END OF SECTION 00 0110

00 0113 ADVERTISEMENT FOR BIDS

Notice is hereby given that sealed bids for **Cabool Middle School Tornado Safe Room** will be received at **Cabool Middle School Library, 1025 Rogers Ave. Cabool, MO 65689** until **2:00pm Thursday, October 7, 2021** and then publicly opened and read aloud. Each bid shall include **a five percent (5%)** bid security in the form of a certified check, cashier's check or bid bond executed by the bidder and an approved Surety Company.

The **Middle School Tornado Safe Room** project consists of the Project consists of the construction of a 3,500 SF FEMA Safe Room with a 600 SF connection lobby. The Safe Room will serve as a middle school band room including instrument storage, practice rooms, and toilets.

Bidders may obtain Contract Documents on **Tuesday, September 7, 2021** from: **Engineers Reprographics, 1600 E. St. Louis St., Springfield, Missouri 65802, Phone: 417-869-2222.** Sets are available for a refundable deposit and are available digitally at **www.erplanroom.com.** For more information, please contact **Nathan Burkholder** at Paragon Architecture, 417-885-0002 EXTN 1004 or burkholder@paragonarchitecture.com.

The Owner reserves the right to award the contract to the lowest responsible bidder and to reject any and all bids and to waive any informality on all bids. No bid may be withdrawn for a period of **fourteen (14) days.**

All bidders must provide a sworn affidavit affirming participation in a federal work authorization program and stating that the bidders does not knowingly employ any person who is not authorized to work in the U.S. **The contractor must comply with current Prevailing Wage laws and other statutory regulations as referred to in the specifications. This project is tax exempt.**

A Pre-Bid Conference will be held at **10:00am on Tuesday, September 21, 2021** at **Cabool Middle School Library, 1025 Rogers Ave. Cabool, MO 65689.**

Substantial Completion: General Contractor shall determine the substantial completion date and number of calendar days for Base Bid Contract Time not to exceed February 16, 2023.

00 2113 INSTRUCTION TO BIDDERS

I. GENERAL:

A. AIA Document A701, "Instruction to Bidders–2018 Edition" as published by the American Institute of Architects are hereby, except as may be inconsistent herewith, made part of these Bidding Documents. These Instructions to Bidders apply equally to and are part of all Bidding Documents between the Owner and each Contractor for Work under this Project.

II. SPECIAL NOTICE TO BIDDERS:

A. These Specifications have bound hereto a complete set of bidding and contract forms. One complete signed set of bid forms as detailed in the Bid Forms Article shall be submitted in a sealed envelope plainly marked identifying the project and the bidder.

III. BID FORM

A. The Bid Form shall be enclosed within a sealed envelope labeled Bid Form noting the Project Title and time for bid opening. Bid documents sent via mail shall be sealed within two envelopes (inner and outer) with the outer envelope addressed for the Project and marked "Sealed Bid Enclosed" on the face thereof and with the inner envelope sealed and clearly labeled as described above.

B. The OWNER may consider informal any bid not prepared and submitted in accordance with the provisions hereof. The OWNER reserves the right to waive minor technicalities and to reject any and all bids. Any bid received after the time and date specified shall not be considered.

C. Each bid must be submitted on the Bid Form (Appendix A). All bids shall be submitted without modification or reservation on the bid form with each space properly filled. All blank spaces for bid prices must be filled in, in ink or typewritten, in both written and numeric, and the foregoing Certifications must be fully completed and executed when submitted.

   i. In the event of discrepancies within bidding documents, the written words will take precedence over the numeric presentation of the bid. If written words are absent from bid form, it will be considered an unresponsive bid.

D. No contractor shall stipulate in their proposal any conditions not contained in the specifications or standard proposal form contained in the Contract Documents. Such submission may be a cause for rejection of bid.

E. No telephonic, telegraphic, electronic mail, facsimile (FAX), or similar bid transmissions will be accepted or allowed. Copies of forms may be made but original signatures must be on the forms at the time of the submission on the bid proposal. Bidders must sign all forms and it is encouraged that a color other than black ink be used. Any modifications to bid shall be made as set forth within the Modifications and Withdrawals of Bids section.

F. Bidders shall include the following bid forms at the time of bid submission. Failure to do so may result in rejection of bid.

   i. Signed Bid Form (Appendix A)
   ii. Bid Guaranty
   iii. Statement of Qualifications (Appendix A)

iv. E-Verify

IV. INTERPRETATIONS AND ADDENDA

A. No oral interpretations will be made to any bidder as to the meaning of the Contract Documents.

B. Every request for interpretation shall be submitted in writing addressed and forwarded to **Nathan Burkholder; Project Manager, burkholder@paragonarchitecture.com.**
   i. Submit requests a minimum of **7 business days prior to date of receipt of Bids**.
   ii. Anticipated release of Final Addenda: **5 business days prior to date of receipt of Bids**.

C. Every interpretation made to the bidder will be in the form of an addendum and will be sent through the plan room listed in the Notice to Bidders. All addenda shall become part of the Contract Documents.

D. Any discrepancy, conflict, ambiguity, error, or issue which may have more than one interpretation should be forwarded to the Architect who may make the interpretation. In absence of an interpretation issued by Addendum the default position shall be for the bidder to bid the more restrictive and/or more costly interpretation which gives the Owner the option of either.

V. EXAMINATION OF DOCUMENTS AND AREA OF WORK

A. Prior to bid each bidder shall examine the Contract Documents carefully. Each bidder must carefully examine the entire limits of construction and surrounding area and shall make necessary investigations to be fully informed of the conditions relating to the construction of the Project and the employment of labor. Failure to do so will not relieve a successful bidder of the obligation to furnish all material and labor necessary to carry out the provisions of the contract. In carrying out the work the contractor must employ such methods and means as will not cause any interruption or interference with the work of any other contractor.

B. Contract Documents are not set up for specific trades and all Contractors and Subcontractors are required to review all drawings and specifications and must complete the work as shown on all portions of the contract documents. Each trade is required to review all portions of the Contract Documents including Drawings and Specifications.

VI. BID SECURITY

A. Each bid must be accompanied by an original Bid Guaranty which shall be in the amount of **five (5%) percent** of the bid or bids submitted including all possible alternates and at the option of the bidder **may be a certified check, cashier's check, or a bid bond** issued by a qualified and approved bonding company.

B. No bid will be considered unless it is so guaranteed and manually signed by both a principal of the construction corporation or company as well as the surety supplying the guaranty. Cash deposits and personal or company checks will not be accepted as a bid guaranty. Bid security is required as a guarantee that bidder will enter into a written contract and furnish a performance bond within the time and in form as specified in these specifications; and if successful bidder fails to do so the security will be realized upon or retained by the Owner.

C. The bidder must submit a separate Bid Guaranty to cover each bid proposal submitted.

D. Certified checks may be held uncollected at the bidder's risk. Certified checks of unsuccessful bidders will be returned as soon as a contract has been executed and an acceptable Performance and Payment Bond has been furnished.
E. The Bid Guaranty submitted by the Bidder shall remain in force until such time as the Bidder is not awarded the contract, or if awarded, submits the required Performance and Payment Bond. Failure to submit the Performance and Payment Bond within the time specified or failure to accept award of the contract shall be deemed sufficient cause to forfeit the Bid Guaranty.
F. It is specifically understood that the bid security is a guarantee and shall not be considered as liquidated damages for failure of bidder to execute and deliver their contract and performance bond nor limit or fix bidder's liability to the Owner for any damages sustained because of failure to execute and deliver the required contract and performance bond.

VII. STATEMENT OF QUALIFICATIONS

A. Each bid must be accompanied by a Statement of Qualification using the form furnished in Appendix A.
B. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform the work. The bidder shall furnish to the Owner all such information and data for this purpose as may be requested. The Owner reserves the right to reject any bids where the investigation or consideration of the information submitted by such bidder does not satisfy the Owner that the bidder is qualified to carry out properly the terms of the Contract Documents.
C. All professional service contracts and construction contracts arising from this work must employ firms and businesses that are licensed to operate in the jurisdiction where the Project is located. No funds will be released to pay businesses that do not hold this license. All businesses involved with this project must be licensed and in good standing with the Missouri Secretary of State's Office.

VIII. ALLOWANCES

A. Allowances shall be contained in the Contractor's original proposal and incorporated into the contract. Allowances contained in the contract's original proposal are understood to include the Contractor's overhead and profit and are valid thru the duration of the contract.
B. Please refer to Section 01 2100 Allowances for more information.

IX. UNIT PRICES

A. Unit prices shall be contained in the Contractor's original proposal and incorporated into the contract. Unit prices contained in the contract's original proposal are understood to include the Contractor's overhead and profit and are valid thru the duration of the contract.
B. Please refer to Section 01 2200 Unit Prices for more information.

X. ALTERNATIVE BIDS

A. No alternative bids except those called for will be considered.

B. All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."
C. Please refer to Section 01 2300 Alternates for more information.

XI. APPROVE EQUAL AND SUBSTITUTION POLICY

A. Any request for substitutions by the Contractor, or on behalf of any subcontractor or material supplier, shall be submitted to the Architect at least **ten (10) days prior to the date for receipt of Bids** on the attached **Request for Substitution form in Appendix B**. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. No substitutions will be considered after the contract award unless specifically provided in the Contract Documents.
B. Please refer to Section 01 2500 Substitution Procedures for more information.

XII. TIME FOR RECEIVING BIDS

A. The time and location for receiving bids shall be as noted in the Section 00 0113 Advertisement for Bids.
B. Bid received prior to the time of the opening will be securely kept, unopened. The office whose duty it is to receive bids will decide when the specified time has arrived, and no bid received thereafter will be considered. No responsibility will attach to any office for the premature opening of a bid not properly addressed and identified.
C. Bidders are cautioned to allow ample time for transmittal of bids by mail or otherwise. If a bid is mailed bidders should secure correct information relative to the probable time of arrival and distributions of mail at the place where bids are to be received and make due allowance for possible delays.
D. Bidder's attention is directed to the fact that no bid will be accepted or considered if submitted after the specified time for receiving bids.

XIII. MODIFICATIONS AND WITHDRAWAL OF BIDS

A. Modification or correction of previously submitted bids may only be submitted by letter or in-person prior to the scheduled time for the receipt of bids. Modifications or corrections must be clearly marked with bid date, project title, and received by the Owner prior to the scheduled closing time for the receipt of bids in accordance with following provisions:
    i. To maintain bid confidentiality and ensure assignment to the proper bid, any such written request must be contained in a sealed envelope that is plainly marked "Modification of Bid on (Project Title and bid date)".
    ii. All modifications to bids shall be provided from a verifiable source of those submitting the bid.
    iii. A bidder may withdraw their bid at any time prior to the scheduled closing time for the receipt of bids or authorized postponement thereof, but no bidder may withdraw their bid for the period stated within the Bid Proposal after closing time for the receipt of bids. Request to withdraw bid must be made in-person or by written request.

iv. No bidder may withdraw their bid for a period of sixty (60) calendar days after the date set for opening thereof and bids shall be subject to acceptance by the Owner during this period.

XIV. AWARD OF CONTRACT

A. It is reasonably expected that a contract will be awarded and a notice to proceed provided within **thirty (30) days of bid opening** and that the Work shall commence as indicated in the contract (Appendix B).

B. It is the intent of the Owner to award a contract to the lowest responsive qualified bidder complying with the conditions of the Contract Documents, providing that the bid is reasonable and it is in the interest of the Owner to accept the same. The bidder to whom an award is made will be notified at the earliest possible date.
   i. The Owner reserves the right to reject any and all bids and to waive any or all informalities in bids received whenever such rejection or waiver is in the interest of the Owner.

C. The Contract Sum will be determined by the sum of the base bid, and/or the sum of any or all bid alternates, in any order, which the Owner may choose to add or delete from the base bid.

D. The successful bidder shall execute the contract with the Owner in the form of the draft contract included within Appendix B.

XV. CONTRACT PERFORMANCE AND PAYMENT BOND

A. The bonds in an amount at least equal to 100% of the total amount of the contract guaranteeing the full and prompt completion of the work and performance of the contract and for the payment of all labor and material and be made payable to OWNER.
   i. The bidder shall deliver the required bonds to the Owner **not later than 3 days** following the date of execution of the Contract.

XVI. CONSTRUCTION TIME AND LIQUIDATED DAMAGES

A. The contract requires work to be Substantially Completed no later than the date shown on the draft contract included withing Appendix B.

B. The Owner requires the Contractor to coordinate all work and cooperate with the Owner regarding partial occupancy for purpose of installing furniture and equipment and prepping of floors and spaces for full occupancy.

C. Liquidated Damages**:** refer to Owner-Contractor contract.

XVII. SUBCONTRACTS

A. The Bidder is specifically advised that any person or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner.

B. See Bid Form for Subcontractor List that must be submitted with bid.

C. The Contractor shall list all subcontractors performing the work listed on the Subcontractor List regardless of the amount of work performed.
D. If the General Contractor plans to use its own forces for any portion of the work noted in the categories then the General Contractor must list that on the subcontract form. Failure to list a subcontractor or the General Contractor may result in a rejection of bid as non-responsive.

XVIII. PERMITS, FEES, SPECIAL INSPECTIONS, TAX EXEMPTION AND WAGE RATES

A. The Contractor is responsible for the building permit and plan review fees, trade permits, tap fees and temporary utility installation, and inspections required of the AHJ; these fees shall be included in the contract and paid by the Contractor.
B. The Owner is responsible for utility service charges.
C. The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the contract throughout, and they will be deemed to be included within the contract the same as though herein written out in full. These include State of Missouri RSMo 285.530, (1) No business entity or employer shall knowingly employ, hire for employment, or continue to employ unauthorized alien to perform work within the State of Missouri.
D. The Owner will exercise their tax-exempt status and require that the bid amount not include sales tax on materials. Any materials the Contractor wishes to exempt sales tax may be purchased by the Contractor/Subcontractor by authorization from the Owner via a Project Exemption Certification, which is provided within Appendix B.
E. The Project must comply with Prevailing Wage Laws and the Davis-Bacon Act Wage Determination Order; see Appendix B.

XIX. MATERIALS AVAILABILITY

A. Prior to bidding the Contractor shall confirm that all major materials, suppliers and subcontractors which may impact the critical path of the Construction Schedule are able to be delivered and/or provided such that the project schedule and substantial completion date are not adversely affected. The Contractor shall immediately notify the Architect of any such conflicts and adversities prior to issuance of the final addendum and prior to bidding.
B. The Contractor bears sole and full responsibility for compliance with terms of the contract for time and completion.

XX. SAFETY STANDARDS AND ACCIDENT PREVENTION

A. With respect to all work performed under this contract, the contractor shall comply with safety standards, provisions, applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the standard OSHA regulations and any other Federal, State or municipal regulations.
    i. All on-site employees of the Contractor and subcontractors are required to complete the ten (10) hour OSHA training program.

B. All workers on the Project will be expected to dress neatly wearing shirts with sleeves, bearing the logo of the employing company. Hard hats are to be worn at all times. Tobacco products and other controlled substances are permitted on the property when complying with all local laws and ordinances.

XXI. INSURANCE REQUIREMENTS

A. Please refer to the **Supplemental Conditions for Insurance and Bonds** within Appendix B.

XXII. ADVERSE WEATHER CONDITIONS

A. Time extensions for unusually severe weather: This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the Construction Agreement. For a time extension to be approved under this clause the following conditions must be satisfied:

i. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

ii. The unusually severe weather must cause a delay to the completion of the project. The delay must be beyond the control of contractors and without the fault or negligence of the contractor.

B. The following schedule of monthly anticipated adverse weather delays will constitute the base line for monthly weather time evaluations. The contractor's schedule shall include these anticipated adverse weather delays in all weather-dependent activities. Contractor acknowledges that there will be delays in which work cannot be completed due to the weather and that a certain number of lost days are to be expected under normal weather conditions. For projects less or more than a calendar year, lost weather days should be prorated for the months of construction in accordance with the following schedule. Anticipated weather days for allocation/proration only.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORKDAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	5	4	4	3	3	2	2	3	4	4	5

C. Upon acknowledgement of the Notice to Proceed and continuing throughout the contract, the contractor shall record on the daily reports the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled workday.

D. The number of actual adverse weather delays days shall include days impacted by actual adverse weather (even if weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in chart above,

qualifying days may be converted to calendar days, giving full consideration for equivalent fair weather work days, and a contract amending the contract time will be authorized.

END OF SECTION

SECTION 00 3132 - GEOTECHNICAL DATA

PART 1 GENERAL

1.1 GEOTECHNICAL DATA

A. The geotechnical data and all referenced attachments are a part of the Procurement and Contracting Requirements. The geotechnical data provides information for the Bidder's convenience and is intended to supplement the Bidder's own investigations. The geotechnical data and its attachments are not a part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling of the project site, the Owner, The Architect, the Architect's consultants, and the firm reporting subsurface conditions do not warranty the conditions below the depths of the borings or that the strata identified by the borings are typical of the entire site. Any party using the geotechnical data in the soil borings and geotechnical report shall accept full responsibility for its use.

C. Soil-boring data for the site is located in the appendices of the project manual.

D. A geotechnical investigation report for the site is located in the appendices of the project manual.

1. The opinions expressed in the report are those of a geotechnical engineer and represent their interpretations of subsoil conditions, tests, and results of analysis conducted by the geotechnical engineer. The Owner is not reponsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that are encountered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.1 PROJECT INFORMATION

A. Project Name: Middle School Tornado Safe Room
   1. Project Location: 1025 Rogers Avenue, Cabool, Missouri65689.

B. Owner: Cabool R-IV School District. 725 Main Street, Cabool, Missouri 65689.
   1. Owner's Representative: Dr. Karl Janson, Superintendent.

C. Architect: Paragon Architecture, LLC.. 637 W. College Street, Springfield, Missouri 65806.
   1. Contact: Nathan Burkholder, AIA | NCARB (417) 885-0002 EXTN 1004.
   2. Alternate: Jared Younglove, AIA | NCARB (417) 885-0002 EXTN 1003.

D. Project Website: A Project website, paid for and administered by the **General Contractor**, will be used for purposes of managing communication and documentation during the course of the project.
   1. See Division 01 3000 Section Administration Proceedures for Contractor's requirements for establishing, administering, and utilizing the Project Website.

E. The Project consists of the construction of a 3,500 SF FEMA Safe Room plus a 600 SF connection lobby. The Safe Room will serve as a middle school band room including instrument storage, practice rooms, and toilets..

1.2 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 5000 - Contracting Forms and Supplements.

1.3 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.

B. Plumbing: Alter existing system and add new construction, keeping existing in operation.

1.4 WORK BY OWNER OR UNDER SEPARATE CONTRACT

A. General: Cooperate fully with Owner's separate Contractors so work may be carried out smoothly, without interfering with or delaying work under this Contract, work under separate contract, or work by Owner. Coordinate the Work of this Contract with other contracts and with work performed by Owner.

B. Concurrent Work: Owner will or has awarded separate contract(s) or self-perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. Computer equipment.
   2. Projection screens, projectors, and sound systems, which may be required, unless included in the specifications or drawings as being in the contract.
   3. All moveable furniture.
   4. Equipment, landscaping, and paving at playground area.
   5. Interior signage, other than that identified in other specification sections or as indicated on the drawings as being in the contract.
   6. Miscellaneous items or equipment specifically noted on the plans to be provided by the Owner.
   7. Cooperate and coordinate with Owner and Owner's Contractors for installation of miscellaneous equipment and furnishings, subject to agreement, regarding insurance, security, and liability.

C. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:

1.5 FUTURE WORK

A. Project is designed for future gymnasium addition west of the safe room.

1.6 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
B. Owner intends to occupy the Project upon Substantial Completion.
C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
D. Schedule the Work to accommodate Owner occupancy.

1.7 CONTRACTOR USE OF SITE AND PREMISES

A. General: Contractor shall have full use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of the Project site beyond areas in which the Work is indicated.
    1. Limits: Confine construction operations to areas directly around the areas of new construction. Maintain all other areas of the site.
    2. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to areas only as required to complete the Work. Restore areas disturbed by construction back to original state or as required by the Work under the contract, as soon as possible.
C. General Contractor shall coordinate with Owner for location of specific areas for parking, materials storage, staging areas, loading, etc.; all trades shall conform to defined use areas and shall not unreasonably or unncessarily encumber or use other areas of the site.
    1. Site must be maintained completely free of trash and construction debris and cleaned everyday. Provide containers for use by workmen.
    2. Contractor and Subcontractors shall allow for secure storage of materials via trailers or fenced enclosure in accordance with General Contractor's Manual and/or direction.
    3. GC shall provide for general security of work areas by fencing, posted entries and lighting as may be necessary.
    4. GC shall take measures to control soil erosion and silt migration by use of site fences, hay bales, swales, detention, etc.
    5. Traffic Control: GC shall coordinate with Owner any temporary construction entrances, and take all necessary measures to ensure safe entry and exit, including signs, flagmen, coordinatoin with the Owner, City and other measures as required.
    6. All waste materials shall be disposed of off-site. Burning is NOT permitted on Owner's property.
    7. Provide barricades and/or fences and gates to provide security, and to restrict unauthorized parking and access.
D. Construction Operations: Limited to areas noted on Drawings.
    1. Locate and conduct construction activities in ways that will limit disturbance to site.
E. Arrange use of site and premises to allow:
    1. Owner occupancy.
    2. Use of site and premises by the public.
F. Provide access to and from site as required by law and by Owner:
    1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
    2. Do not obstruct roadways, sidewalks, or other public ways without permit.
G. Existing building spaces may not be used for storage.

H. On-site Work Hours:
   1. Contractor may have full access to site. Coordinate activities with Owner.
   2. Hours for Noisy Activities: Coordinate with Owner, and consideration of adjacent private property owners shall be taken.

I. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

1.8 WORK RESTRICTIONS

A. Nonsmoking Building: Smoking is not permitted within the building or on the building property.

B. The property is a public school. Tobacco, alcohol, drugs, profanity, inappropriate behavior, weapons [concealed or otherwise] are not allowed on the property at anytime. Violation of this policy shall result in the immediate and permanent dismissal of the individual and/or contractor that committed this violation.

C. Public safety is of the utmost priority to the Owner. Any individual and/or contractor exhibiting a disregard for public safety will be immediately and permanently dismissed from the property.

D. The Contractor shall provide protection for the existing fire alarm systems and devices in order to protect against damage, including smoke and dust contamination. Fire alarm devices that are removed by the Contractor shall be immediately deleted from the system programming. Only pre-approved vendors are allowed to perform programming work and/or supply parts for existing fire alarm systems.

E. The Contractor shall protect the building and contents during the duration of the project. Contractor shall maintain the building and site in a clean and orderly state every day. The Contractor shall provide protection for the existing flooring, ceiling, walls, and doors along with the building contents to prevent damage during construction. Materials that are likely to cause floor damage are to be removed immediately.

F. Prior to beginning work, the Contractor shall furnish the Owner with telephone numbers of emergency contacts that are available at all times to arrange for an immediate response to emergencies. The Contractor shall also furnish the Owner with keys to all temporary locks installed.

G. The Contractor shall protect existing utilities and shall not disrupt utility service to the existing building, equipment, and/or site except as when scheduled with the Owner 24 hours in advance. Accidental disruptions shall be restored immediately. The Contractor is responsible for restoring service to all connected equipment after the Contractor has restored the utility service.

H. The Contractor shall provide proper identification for all workers on site for the protection of the students and building staff. Shirts with company logos are required for all workers on site. Building Services will determine/provide contractor ID badges to any contracting group doing work while students are present in the building. All badges must be returned upon completion of job.

1.9 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.
B. Documentation of changes in Contract Sum and Contract Time.
C. Change procedures.
D. Procedures for preparation and submittal of application for final payment.

1.2 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Payment procedures relating to allowances.
B. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.
C. Section 01 7800 - Closeout Submittals: Project record documents.

1.3 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
C. Forms filled out by hand will not be accepted.
D. Submit Schedule of Values within 15 days after date of Owner-Contractor Agreement.
E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.
F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.
B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
D. Forms filled out by hand will not be accepted.
E. Execute certification by signature of authorized officer.
F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
H. Submit one electronic and one hard-copy of each Application for Payment.
I. Include the following with the application:
    1. Construction progress schedule, revised and current as specified in Section 01 3000.
    2. Partial release of liens from major subcontractors and vendors.
    3. Certificate of Insurance and photos attesting to products stored off-site.
        a. Certificate of Insurance shall name Owner as Additional Insured.
        b. Photos should clearly show materials labeled with Owner and Project Name.
J. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.5 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

E. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

H. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

I. Promptly enter changes in Project Record Documents.

1.6 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100 - ALLOWANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cash allowances.
B. Lump-sum allowances.
C. Unit-cost allowances.
D. Quantity allowances.
E. Contingency allowances.

1.2 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.3 CASH ALLOWANCES

1.4 LUMP-SUM, UNIT-COST AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include freight and delivery to Project site.

1.5 CONTINGENCY ALLOWANCE

A. Use the contingency allowance only as directed by Architect for Owner's purposes.
B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
C. Funds will be drawn from the Contingency Allowance only by Change Order.
D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.6 ALLOWANCES SCHEDULE

A. Allowance No. 1: Quantity Allowance: Include 400 cu. yd. of general excavation and removal from site of unclassified or unsuitable materials in base bid. Unit Price A.
B. Allowance No. 2: Quantity Allowance: include 150 cu. yd. of Trench and Footing Excavation and removal from site of unclassified material or unsuitable materials in base bid. Unit Price C.
C. Allowance No. 3: Quantity Allowance: Include 400 cu. yd. of compacted engineered fill or structural fill; in place – (from offsite material) in base bid. Unit Price G.
D. Allowance No. 4: Quantity Allowance: include 150 cu. yd. of Lean Concrete (for Backfill of footing over excavation if require) in base bid. Unit Price O.
E. Allowance No. 5: Quantity Allowance: include 50 cu. yd. of rock excavation for footing & trench rock less than 10 feet below existing grade in base bid. Unit Price J2.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 2200 - UNIT PRICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.2 RELATED REQUIREMENTS

A. Document Bid Form: List of Unit Prices.

B. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.3 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.4 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.5 MEASUREMENT OF QUANTITIES

A. Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specificed in those Sections.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to the Contractor.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

1.6 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

1.7 SCHEDULE OF UNIT PRICES

A. General excavation and **removal from site** of unclassified material or unsuitable materials. Cost for more or less than that shown.

B. General excavation and **relocation on site** of unclassified material General excavation and **relocation on site** of unclassified material on plans. (requires respreading of soil)

C. Trench and Footing excavation and **removal from site** of unclassified material or unsuitable materials.

D. Trench and Footing excavation and **relocation on site** of unclassified material or unsuitable materials from footings and trenches. Cost for more or less than that shown on plans. (requires respreading of soil)

E. Earth borrow; in place (non structural) - (from off-site material)

F. Compacted engineered fill or structural fill; in place - (from site material).

G. Compacted engineered fill or structural fill; in place - (from off-site material).

H. Compacted drainage fill, in place (clean ¾” crushed stone).

I. Compacted granular fill, in place (base rock and gravel).

J. Price for rock excavation:

1. Mass Rock.
2. Footing & Trench Rock less than 10 feet below existing grade.

K. Import and placement of shot-rock stabilization material (12” minus rock).

L. Import and placement of shot-rock stabilization material (6” minus rock)
M. Import and placement of crushed stone stabilization material (1” +/- rock).
N. Geogrid (Tensar Bx1100 or equivalent) in place.
O. Lean concrete (for backfill of footing over-excavation if required).
P. Low Volume Change Layer. Cost for more or less than shown on plans.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED
END OF SECTION

SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Alternates.
B. Procedures for pricing Alternates.

1.2 RELATED REQUIREMENTS

A. Document Bid Form: List of Alternates.

1.3 ACCEPTANCE OF Alternates

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.4 SCHEDULE OF Alternates

A. Alternate No. 01 - Add casework, sinks and associated plumbing to Art Room:
   1. Base Bid Item: Provide new 4" sewer line only per plumbing plans.
   2. Alternate Item: Provide sinks and plastic laminate cabinetry in existing Art classrom per architectural and plumbing plans.
B. Alternate No. 02 - Add utility screen around ground-mounted packaged units:
   1. Base Bid Item: None in Project.
   2. Alternate Item: Provide new louvered screen around ground mounted pacakge units. See Civil and Architectural plans for more information.
C. Alternate No. 03 - Sound-Absorbing Wall Panels and Diffusers:
   1. Base Bid Item: None in Project.
   2. Alternate Provide sound-absorbing wall panels and diffusers as indicated in drawings.
D. Alternate No. 04 - Premanufactured Roof Access Ladder:
   1. Base Bid Item: None in Project.
   2. Alternate Item: Provide roof access ladder as indicated in drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

A. Section 00 2113 - Instructions to Bidders: Restrictions on timing of substitution requests.
B. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
    1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
    2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
        a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.4 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.
B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
    1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
    2. Agrees to provide the same warranty for the substitution as for the specified product.
    3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
    4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
    5. Waives claims for additional costs or time extension that may subsequently become apparent.
B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
    1. Note explicitly any non-compliant characteristics.
C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
    1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
D. Limit each request to a single proposed substitution item.
    1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Section 00 2113 - Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
B. Submittal Form (before award of contract):
   1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
B. Architect will consider requests for substitutions only within 60 days after date of Agreement.
C. Submit request for Substitution for Cause immedately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 60 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
E. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.5 CLOSEOUT ACTIVITIES

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

END OF SECTION

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General administrative requirements.
B. Electronic document submittal service.
C. Preconstruction meeting.
D. Progress meetings.
E. Construction progress schedule.
F. Coordination drawings.
G. Submittals for review, information, and project closeout.
H. Number of copies of submittals.
I. Requests for Information (RFI) procedures.
J. Submittal procedures.

1.2 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
B. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 PROJECT MANAGEMENT AND COORDINATION

A. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
B. Unless otherwise specified, all submittals and correspondence should be submitted electronically in pdf, xls, or doc formats if possible.
C. Requests for Information (RFIs): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Use AIA Document G716-2004 or equivalent forms acceptable to Architect and Owner.
D. Preconstruction Conference: Contractor will schedule a preconstruction conference before starting construction, at a time convenient to Owner, Architect, and Engineer, but no later than Fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
    1. Minutes: Architect or Engineer will record minutes and distribute them electronically via email to all concerned parties including all in attendance at meeting.
    2. Attendees: Authorized representatives of Owner, Architect, Engineer, and their consultants; Site Administrator; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
    3. Agenda: Discuss items of significance that could affect progress, including the following:
        a. Tentative construction schedule.
        b. Critical work sequencing and long-lead items.
        c. Designation of key personnel and their duties.
        d. Discuss electronic format for correspondence and communications.
        e. Procedures for processing field decisions and Change Orders.
        f. Procedures for RFIs.
        g. Procedures for inspecting.
        h. Procedures for processing Applications for Payment.

i. Distribution of the Contract Documents.
j. Submittal procedures.

4. Preparation of Record Documents.
   a. Use of the premises.
   b. Work restrictions (non-smoking, no firearms, etc.)
   c. Owner's occupancy requirements.
   d. Construction waste management.
   e. Parking availability.
   f. Office, work, and storage areas.
   g. Equipment deliveries and priorities.
   h. First aid.
   i. Security.
   j. Progress cleaning.
   k. Working hours.

E. Project Meetings: Contractor to schedule and conduct progress meetings at Project site at **biweekly intervals (or as project requires).** Notify Owner, Architect, Engineer, Consultants and Site Administer of meeting dates and times. Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.

1. Minutes: Architect or Engineer will record minutes and distribute electronically via email to all concerned parties including all in attendance at meeting.
   a. Review present and future needs of each entity present, including the following:
   b. Review minutes of previous meeting
   c. Review work progress
   d. Review progress compared to schedule.
   e. Identification of problems which impeded planned progress (including weather)
   f. Corrective measures to regain schedule.
   g. Field observations, problems, and decisions.
   h. Review of submittals schedule and status of submittals. (from submittal schedule log in excel format)
   i. Deliveries.
   j. Off-site fabrication.
   k. Safety, Hazards, and risks.
2. Project cleaning.
   a. Access or site issues.
   b. Work hours.
   c. Status of RFIs, ASIs, and PRs, and Change Orders presented as a log in excel format.
   d. Planned progress during succeeding work period.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
2. Submit four copies of each action submittal. Architect will return one approved copy. Two copies will be given to Owner.
3. Submit three copies of each informational submittal. Architect will not return copies.

4. Architect will discard submittals received from sources other than Contractor.

B. Place a permanent label or title block on each submittal for identification. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect or Engineer. Include the following information on the label:
   1. Project name.
   2. Date.
   3. Name and address of Contractor.
   4. Name and address of subcontractor or supplier.
   5. Number and title of appropriate Specification Section.

C. Identify deviations from the Contract Documents on submittals.

D. Contractor's Construction Schedule Submittal Procedure: Submit schedule electronically within 10 days after preconstruction meeting and before date established for Commencement of the Work.

PART 2 PRODUCTS

2.1 ACTION SUBMITTALS

A. Product Data: Mark each copy to show applicable products and options. Include the following:
   1. Manufacturer's written recommendations, product specifications, and installation instructions.
   2. Wiring diagrams showing factory-installed wiring.
   3. Printed performance curves and operational range diagrams.
   4. Testing by recognized testing agency.
   5. Compliance with specified standards and requirements.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data without approval of Architect or Engineer. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
   1. Dimensions and identification of products.
   2. Fabrication and installation drawings and roughing-in and setting diagrams.
   3. Wiring diagrams showing field-installed wiring.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.

C. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include name of manufacturer and product name on label.
   1. If variation is inherent in material or product, submit at least three sets of paired units that show variations.

2.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

2.3 DELEGATED DESIGN SERVICES

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

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

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit copies of a statement electronically, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Submit a comprehensive, overall, horizontal Gantt-chart-type schedule electronically within 10 days of preconstruction meeting and before date established for Commencement of the Work. Construction schedule must include allowances for normal adverse weather days when they could impact critical path of construction timeline.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.5 SUBMITTAL REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Architect will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action. Only Architects stamped approval submittals and shop drawings are to be used on site.

C. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

D. CONTRACTOR'S CONSTRUCTION SCHEDULE

E. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

F. As the Work progresses, indicate Actual Completion percentage for each activity.

G. Distribute copies of approved schedule to Owner, Architect, Engineer, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties

PART 3 EXECUTION

4.1 SUBMITTAL REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Architect will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action. Only Architects stamped approval submittals and shop drawings are to be used on site.

C. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

4.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
B. As the Work progresses, indicate Actual Completion percentage for each activity.
C. Distribute copies of approved schedule to Owner, Architect, Engineer, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties

4.3 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
B. Cost: The cost of the service will be paid by Owner.
C. Submittal Service: The selected service is:
   1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
D. Training: At Contractor's option, FREE training is available for Submittal Exchange regarding use of website, website's services and PDF submittals. Contact Submittal Exchange for more information.
E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

4.4 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.
B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Subcontractors..
C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of schedule of values, and progress schedule.

5. Submission of initial Submittal schedule.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect , Owner , participants, and those affected by decisions made.

4.5 COORDINATION DRAWINGS

A. Review drawings prior to submission to Architect.

4.6 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

4.7 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data. Indicate:
a. Manufacturer, model type and number; intended location and use; size and physical characteristics; proposed options; installation methods and accessories.
2. Shop drawings.
a. Drawings shall be clearly labeled with space/room names matching those on the Construction Documents.
3. Samples for selection. Indicate:
a. Manufacturer, model type and number; intended location and use.
4. Samples for verification.
5. Other types indicated.
6. Submittals failing to clearly indicate information required above, shall be subject to immediate rejection.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

4.8 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

4.9 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.
B. Submit Final Correction Punch List for Substantial Completion.
C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.
D. Submit for Owner's benefit during and after project completion.

4.10 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

4.11 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   2. Sequentially identify each item.
      a. File name shall use Specification Section number followed by a hyphen and then a sequential number (e.g., 061000-01).
      b. For revised submittals use original number, the letter "R" and a sequential numerical suffix (e.g., 061000-01 R1).
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Identify options requiring selection by Architect or reviewer in written format.
   5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Upload submittals in electronic form to Electronic Document Submittal Service website.
   7. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.

8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Identify options requiring selection by Architect or reviewer in written format.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not requested will be recognized, and will be returned "Not Reviewed",

4.12 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
   1. Submittals failing to clearly indicate information required in 3.08A, shall be subject to immediate rejection.
   2. Submittals which have not been reviewed by the Contractor prior to submission shall be subject to immediate rejection.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.
B. Section 01 4216 - Definitions.
C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
C. Test Reports: After each test/inspection, promptly submit copies of report to Architect and to Contractor.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of inspector.
        d. Date and time of sampling or inspection.
        e. Identification of product and specifications section.
        f. Location in the Project.
        g. Type of test/inspection.
        h. Date of test/inspection.
        i. Results of test/inspection.
        j. Compliance with Contract Documents.
        k. When requested by Architect, provide interpretation of results.
D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
    1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
    1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.4 REFERENCES AND STANDARDS

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

1.5 Testing and Inspection Agencies and Services

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspections.
B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

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

3.2 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
D. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

E. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
F. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 TOLERANCES

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

3.4 TESTING AND INSPECTION

A. Limits on Testing/Inspection Agency Authority:
    1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
    2. Agency may not approve or accept any portion of the Work.
    3. Agency may not assume any duties of Contractor.
    4. Agency has no authority to stop the Work.
B. Contractor Responsibilities:
    1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
    2. Cooperate with laboratory personnel, and provide access to the Work.
    3. Provide incidental labor and facilities:
        a. To provide access to Work to be tested/inspected.
        b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
        c. To facilitate tests/inspections.
        d. To provide storage and curing of test samples.
    4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
    5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
    6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

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SECTION 01 4216 - DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Other definitions are included in individual specification sections.

1.2 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 4219 - REFERENCE STANDARDS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.1 AA -- ALUMINUM ASSOCIATION, INC.
2.2 AABC -- ASSOCIATED AIR BALANCE COUNCIL
2.3 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION
2.4 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
2.5 AATCC -- AMERICAN ASSOCIATION OF TEXTILE CHEMISTS & COLORISTS
2.6 ABMA -- AMERICAN BEARING MANUFACTURERS ASSOCIATION, INC.
2.7 ACA -- AMERICAN COATINGS ASSOCIATION
2.8 ACG -- AABC COMMISSIONING GROUP
2.9 ACGIH -- AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS
2.10 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL
2.11 ACT
2.12 ADC -- AIR DIFFUSION COUNCIL
2.13 AEIC -- ASSOCIATION OF EDISON ILLUMINATING COMPANIES
2.14 AFPA -- AMERICAN FOREST AND PAPER ASSOCIATION
2.15 AGA -- AMERICAN GALVANIZERS ASSOCIATION, INC.
2.16 AGC -- ASSOCIATED GENERAL CONTRACTORS OF AMERICA
2.17 AGMA -- AMERICAN GEAR MANUFACTURERS ASSOCIATION
2.18 AHA -- AMERICAN HARDBOARD ASSOCIATION
2.19 AHAM -- ASSOCIATION OF HOME APPLIANCE MANUFACTURERS:
2.20 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE
2.21 AI -- THE ASPHALT INSTITUTE
2.22 AIA -- THE AMERICAN INSTITUTE OF ARCHITECTS
2.23 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.
2.24 AISI -- AMERICAN IRON AND STEEL INSTITUTE
2.25 AIST -- ASSOCIATION FOR IRON AND STEEL TECHNOLOGY
2.26 AITC -- AMERICAN INSTITUTE OF TIMBER CONSTRUCTION
2.27 ALI -- AMERICAN LADDER INSTITUTE
2.28 ALSC -- AMERICAN LUMBER STANDARDS COMMITTEE
2.29 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.
2.30 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE
2.31 AOSA -- ASSOCIATION OF OFFICIAL SEED ANALYSTS
2.32 APA -- APA - THE ENGINEERED WOOD ASSOCIATION
2.33 APHA -- AMERICAN PUBLIC HEALTH ASSOCIATION

2.34 API -- AMERICAN PETROLEUM INSTITUTE

2.35 API -- ALLIANCE FOR THE POLYURETHANES INDUSTRY, AMERICAN PLASTICS COUNCIL

2.36 APSP -- ASSOCIATION OF POOL & SPA PROFESSIONALS

2.37 ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE (See AHRI)

2.38 ARPM - ASSOCIATION FOR RUBBER PRODUCTS MANUFACTURERS

2.39 ARRA -- ASPHALT RECYCLING AND RECLAIMING ASSOCIATION

2.40 ASA -- ACOUSTICAL SOCIETY OF AMERICA

2.41 ASCA -- ARCHITECTURAL SPRAY COATERS ASSOCIATION

2.42 ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS

2.43 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

2.44 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

2.45 ASPA -- AMERICAN SOD PRODUCERS ASSOCIATION (see Turfgrass Producers International)

2.46 ASSE -- AMERICAN SOCIETY OF SANITARY ENGINEERING

2.47 ASTM A Series -- ASTM INTERNATIONAL

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

2.48 ASTM B Series -- ASTM INTERNATIONAL

A. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.

B. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric) 2012.

C. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

D. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.

2.49 ASTM D Series -- ASTM INTERNATIONAL

A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).

B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013.

C. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

2.50 ASTM E Series -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

B. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

2.51 AWC -- AMERICAN WOOD COUNCIL

2.52 AWCI -- ASSOCIATION OF THE WALL AND CEILING INDUSTRIES INTERNATIONAL

2.53 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

2.54 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

2.55 AWMAC -- ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA

2.56 AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

2.57 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

A. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.

2.58 AWPB -- AMERICAN WOOD PRESERVERS BUREAU

2.59 AWS -- AMERICAN WELDING SOCIETY

2.60 AWWA -- AMERICAN WATER WORKS ASSOCIATION

2.61 BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION

2.62 BIA -- BRICK INDUSTRY ASSOCIATION

2.63 BIFMA -- BUSINESS AND INSTITUTIONAL FURNITURE MANUFACTURERS ASSOCIATION

2.64 ODVA -- OPEN DEVICENET VENDOR ASSOCIATION, INC.

2.65 BOMA -- BUILDING OWNERS AND MANAGERS ASSOCIATION

2.66 C2C -- CRADLE TO CRADLE PRODUCTS INNOVATION INSTITUTE

2.67 CABO -- COUNCIL OF AMERICAN BUILDING OFFICIALS:

2.68 CAGI -- COMPRESSED AIR AND GAS INSTITUTE

2.69 CARB -- CALIFORNIA AIR RESOURCES BOARD

2.70 CDA -- COPPER DEVELOPMENT ASSOCIATION, INC.

2.71 CEA -- CONSUMER ELECTRONICS ASSOCIATION

2.72 CFSEI - COLD-FORMED STEEL ENGINEERS INSTITUTE

2.73 CGA -- COMPRESSED GAS ASSOCIATION

2.74 CHPS -- COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

2.75 CISCA -- CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION

2.76 CISPI -- CAST IRON SOIL PIPE INSTITUTE

2.77 CLFMI -- CHAIN LINK FENCE MANUFACTURERS INSTITUTE

2.78 CONSENSUSDOCS -- CONSENSUSDOCS, LLC

2.79 CPA -- COMPOSITE PANEL ASSOCIATION

2.80 CRI -- CARPET AND RUG INSTITUTE

2.81 CRRC -- COOL ROOF RATING COUNCIL

2.82 CRSI -- CONCRETE REINFORCING STEEL INSTITUTE

2.83 CSA -- CSA INTERNATIONAL (FORMERLY CANADIAN STANDARDS ASSOCIATION)

2.84 CSI/CSC -- CONSTRUCTION SPECIFICATIONS INSTITUTE/CONSTRUCTION SPECIFICATIONS CANADA

2.85 CSSB -- CEDAR SHAKE AND SHINGLE BUREAU

2.86 CTA -- CONSUMER TECHNOLOGY ASSOCIATION (FORMERLY CONSUMER ELECTRONICS ASSOCIATION)

2.87 CTI -- CERAMIC TILE INSTITUTE

2.88 CTI -- COOLING TECHNOLOGY INSTITUTE

2.89 DASMA -- DOOR & ACCESS SYSTEMS MANUFACTURERS' ASSOCIATION, INTERNATIONAL

2.90 DBIA -- THE DESIGN BUILD INSTITUTE OF AMERICA, INC.

2.91 DFI -- DEEP FOUNDATION INSTITUTE

2.92 DHI -- DOOR AND HARDWARE INSTITUTE

2.93 DIN -- DEUTSCHES INSTITUT FUR NORMUNG

2.94 EIA -- ELECTRONIC INDUSTRIES ALLIANCE

2.95 EIMA -- EXTERIOR INSULATION MANUFACTURERS ASSOCIATION
2.96 EJMA -- EXPANSION JOINT MANUFACTURERS ASSOCIATION
2.97 ETL -- ETL TESTING LABORATORY
2.98 FM -- FACTORY MUTUAL GLOBAL
2.99 GA -- GYPSUM ASSOCIATION
2.100 GANA -- GLASS ASSOCIATION OF NORTH AMERICA
2.101 GEI -- GREENGUARD ENVIRONMENTAL INSTITUTE
2.102 GREEN GLOBES -- GREEN BUILDING INITIATIVE
2.103 GREENSEAL -- GREENSEAL, INC.
2.104 HI -- HYDRAULIC INSTITUTE
2.105 HI -- THE HYDRONICS INSTITUTE (See AHRI)
2.106 HPDC -- HEALTH PRODUCT DECLARATION COLLABORATIVE
2.107 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION
2.108 HPW -- H.P. WHITE LABORATORY, INC.
2.109 IAPMO -- INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
2.110 IAS -- INTERNATIONAL ACCREDITATION SERVICE
2.111 ICBO -- INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS
2.112 ICBO-ES -- ICBO EVALUATION SERVICE, INC.
2.113 ICC -- INTERNATIONAL CODE COUNCIL, INC.
2.114 ICC-ES -- ICC EVALUATION SERVICE, INC.
2.115 ICEA -- INSULATED CABLE ENGINEERS ASSOCIATION
2.116 ICRI -- INTERNATIONAL CONCRETE REPAIR INSTITUTE
2.117 IEC -- INTERNATIONAL ELECTROTECHNICAL COMMISSION
2.118 IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
2.119 IES/IESNA -- ILLUMINATING ENGINEERING SOCIETY
2.120 IGMA -- INSULATING GLASS MANUFACTURERS ALLIANCE
2.121 IGSHPA -- INTERNATIONAL GROUND SOURCE HEAT PUMP ASSOCIATION
2.122 ILI -- INDIANA LIMESTONE INSTITUTE OF AMERICA, INC.
2.123 IMIAWC -- INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL
2.124 ISDI -- INSULATED STEEL DOOR INSTITUTE
2.125 ISFA - INTERNATIONAL SURFACE FABRICATORS ASSOCIATION
2.126 ISS -- IRON AND STEEL SOCIETY
2.127 ISSFA - INTERNATIONAL SOLID SURFACE FABRICATORS ASSOCIATION
2.128 ISO -- INTERNATIONAL STANDARDS ORGANIZATION
2.129 ITS -- INTERTEK TESTING SERVICES NA, INC.
2.130 ITU-T -- International Telecommunications Union -Telecommunication Standardization Sector
2.131 KCMA -- KITCHEN CABINET MANUFACTURERS ASSOCIATION
2.132 LIA -- LEAD INDUSTRIES ASSOCIATION, INC.
2.133 LPI -- LIGHTNING PROTECTION INSTITUTE
2.134 MBMA -- METAL BUILDING MANUFACTURERS ASSOCIATION
2.135 MFMA -- MAPLE FLOORING MANUFACTURERS ASSOCIATION
2.136 MFMA -- METAL FRAMING MANUFACTURERS ASSOCIATION
2.137 MIAMI -- MIAMI-DADE COUNTY
2.138 ML/SFA -- METAL LATH/STEEL FRAMING ASSOCIATION - See NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

2.139 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)
2.140 MMSA -- MATERIALS AND METHODS STANDARDS ASSOCIATION
2.141 MSS -- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC.
2.142 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS
2.143 NACE -- NACE INTERNATIONAL
2.144 NADCA -- NATIONAL AIR DUCT CLEANING ASSOCIATION
2.145 NAGDM -- NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS
2.146 NAMM -- NATIONAL ASSOCIATION OF MIRROR MANUFACTURERS
2.147 NASSPA -- NORTH AMERICAN STEEL SHEET PILE ASSOCIATION
2.148 NBBI -- THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS
2.149 NBGQA -- NATIONAL BUILDING GRANITE QUARRIES ASSOCIATION, INC.
2.150 NCAA -- NATIONAL COLLEGIATE ATHLETIC ASSOCIATION
2.151 NCMA -- NATIONAL CONCRETE MASONRY ASSOCIATION
2.152 NEBB -- NATIONAL ENVIRONMENTAL BALANCING BUREAU
2.153 NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
2.154 NEII -- NATIONAL ELEVATOR INDUSTRY, INC.
2.155 NELMA -- NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION, INC.
2.156 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
2.157 NETA -- INTERNATIONAL ELECTRICAL TESTING ASSOCIATION
2.158 NFHS -- NATIONAL FEDERATION OF STATE HIGH SCHOOL ASSOCIATIONS:
2.159 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION
2.160 NFRC -- NATIONAL FENESTRATION RATING COUNCIL, INC.
2.161 NHLA -- NATIONAL HARDWOOD LUMBER ASSOCIATION
2.162 NIBS -- NATIONAL INSTITUTE OF BUILDING SCIENCES
2.163 NLGA -- NATIONAL LUMBER GRADES AUTHORITY (CANADA)
2.164 NOFMA -- NATIONAL OAK FLOORING MANUFACTURERS ASSOCIATION
2.165 NPA -- NATIONAL PARTICLEBOARD ASSOCIATION
2.166 NPCA -- NATIONAL PAINT AND COATINGS ASSOCIATION
2.167 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION
2.168 NSF -- NSF INTERNATIONAL (THE PUBLIC HEALTH AND SAFETY ORGANIZATION)
2.169 NSPI -- NATIONAL SPA AND POOL INSTITUTE
2.170 NSSA - National Storm Shelter Association
2.171 NTMA -- NATIONAL TERRAZZO AND MOSAIC ASSOCIATION, INC., THE
2.172 NTMA -- NATIONAL TILE AND MARBLE ASSOCIATION
2.173 NWFA -- NATIONAL WOOD FLOORING ASSOCIATION
2.174 PCA -- PORTLAND CEMENT ASSOCIATION
2.175 PCI -- PRECAST/PRESTRESSED CONCRETE INSTITUTE
2.176 PDI -- PLUMBING AND DRAINAGE INSTITUTE
2.177 RCSC -- RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS
2.178 RIS -- REDWOOD INSPECTION SERVICE
2.179 RFCI -- RESILIENT FLOOR COVERING INSTITUTE
2.180 SAE -- SAE INTERNATIONAL
2.181 SCAQMD -- SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
2.182 SCS - SCIENTIFIC CERTIFICATION SYSTEMS

2.183 SDI -- STEEL DECK INSTITUTE
2.184 SDI -- STEEL DOOR INSTITUTE
2.185 SEFA -- SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION
2.186 SIGMA -- SEALED INSULATING GLASS MANUFACTURERS ASSOCIATION (SEE IGMA)
2.187 SJI -- STEEL JOIST INSTITUTE
2.188 SMA -- SCREEN MANUFACTURERS ASSOCIATION
2.189 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.
2.190 SPIB -- SOUTHERN PINE INSPECTION BUREAU, INC.
2.191 SPRI -- SINGLE PLY ROOFING INDUSTRY
2.192 SRI -- STEEL RECYCLING INSTITUTE
2.193 SSPC -- SOCIETY FOR PROTECTIVE COATINGS
2.194 STI -- STEEL TANK INSTITUTE
2.195 SWI -- STEEL WINDOW INSTITUTE
2.196 SWRI -- SEALANT, WATERPROOFING AND RESTORATION INSTITUTE
2.197 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.
2.198 TIA -- TELECOMMUNICATIONS INDUSTRY ASSOCIATION
2.199 TPI -- TRUSS PLATE INSTITUTE
2.200 TPI -- TURFGRASS PRODUCERS INTERNATIONAL
2.201 UL -- UNDERWRITERS LABORATORIES INC.
2.202 USGBC -- U.S. GREEN BUILDING COUNCIL
2.203 WCLIB -- WEST COAST LUMBER INSPECTION BUREAU
2.204 WCMA -- WINDOW COVERING MANUFACTURERS ASSOCIATION
2.205 WDMA -- WINDOW AND DOOR MANUFACTURERS ASSOCIATION (formerly NWWDA)
2.206 WI -- WOODWORK INSTITUTE
2.207 WMMPA -- WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION
2.208 WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.1 CFR -- CODE OF FEDERAL REGULATIONS
A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
3.2 ATBCB -- US ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD (THE ACCESS BOARD)
A. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; 2002.
3.3 CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION
3.4 EPA -- ENVIRONMENTAL PROTECTION AGENCY
3.5 FAA -- FEDERAL AVIATION ADMINISTRATION
3.6 FEMA -- U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY
3.7 FHWA -- FEDERAL HIGHWAY ADMINISTRATION
3.8 FS -- FEDERAL SPECIFICATIONS AND STANDARDS (General Services Administration)
3.9 GSA -- U.S. GENERAL SERVICES ADMINISTRATION
3.10 HHS -- U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION
3.11 MIL -- MILITARY SPECIFICATIONS AND STANDARDS
3.12 NIJ -- NATIONAL INSTITUTE OF JUSTICE (DEPT. OF JUSTICE)
3.13 NSA -- NATIONAL SECURITY AGENCY
3.14 PS -- PRODUCT STANDARDS
A. PS 1 - Structural Plywood 2009.

B. PS 20 - American Softwood Lumber Standard 2020.

3.15 USAB -- UNITED STATES ACCESS BOARD

A. ABA Standards - ABA Accessibility Standards 2004 (Amended 2015).

3.16 USGS -- UNITED STATES GEOLOGICAL SURVEY

END OF SECTION

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SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary utilities.
B. Temporary sanitary facilities.
C. Temporary Controls: Barriers, enclosures, and fencing.
D. Security requirements.
E. Vehicular access and parking.
F. Waste removal facilities and services.
G. Project identification sign.
H. Field offices.

1.2 TEMPORARY UTILITIES

1.3 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide protection for plants designated to remain. Replace damaged plants.
C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.4 FENCING

A. Construction: Commercial grade chain link fence.
B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.5 EXTERIOR ENCLOSURES

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

1.6 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.7 SECURITY

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

1.8 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.9 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.10 PROJECT IDENTIFICATION

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

1.11 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Identification of Owner-supplied products.
B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
C. Section 01 4000 - Quality Requirements: Product quality monitoring.
D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.3 SUBMITTALS

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

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.2 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.
B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
C. Use of products having any of the following characteristics is not permitted:
    1. Made outside the United States, its territories, Canada, or Mexico.
    2. Made using or containing CFC's or HCFC's.
    3. Containing lead, cadmium, or asbestos.
D. Where other criteria are met, Contractor shall give preference to products that:
    1. If used on interior, have lower emissions, as defined in Section 01 6116.
    2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

2.3 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.4 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
B. Store and protect products in accordance with manufacturers' instructions.
C. Store with seals and labels intact and legible.
D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Providebonded off-site storage and protection when site does not permit on-site storage or protection.
G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
H. Comply with manufacturer's warranty conditions, if any.
I. Do not store products directly on the ground.
J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
K. Prevent contact with material that may cause corrosion, discoloration, or staining.
L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, [_____].
C. Pre-installation meetings.
D. Cutting and patching.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Demonstration and instruction of Owner personnel.
H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
I. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
C. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
D. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.
    5. Work of Owner or separate Contractor.
    6. Include in request:
        a. Identification of Project.
        b. Location and description of affected work.
        c. Necessity for cutting or alteration.
        d. Description of proposed work and products to be used.
        e. Effect on work of Owner or separate Contractor.
        f. Written permission of affected separate Contractor.
        g. Date and time work will be executed.
C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.4 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site for positive drainage. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.5 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with [____] copies to Architect, Architect, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
F. Utilize recognized engineering survey practices.
G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.
   4. Controlling lines and levels required for mechanical and electrical trades.
H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.
B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.
C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to specified condition. Restore to original condition if condition is not specified.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.9 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Architect and Owner seven days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.
B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

A. Execute final cleaningafter Substantial Completion but before making final application for payment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Replace filters of operating equipment.
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.
B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

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

END OF SECTION

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project record documents.
B. Operation and maintenance data.
C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions and 00 7300 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
D. Individual Product Sections: Specific requirements for operation and maintenance data.
E. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

A. Project Record Documents: Submit documents to Architect a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion.
B. Operation and Maintenance Data:
    1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
    2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
    3. Submit one copy of completed documents a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
    4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
    1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
    2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
    3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
    1. Drawings.
    2. Addenda.
    3. Change Orders and other modifications to the Contract.
B. Ensure entries are complete and accurate, enabling future reference by Owner.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide control diagrams by controls manufacturer as installed.
K. Include test and balancing reports.
L. Additional Requirements: As specified in individual product specification sections.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
J. Arrangement of Contents: Organize each volume in parts as follows:
    1. Project Directory.
    2. Table of Contents, of all volumes, and of this volume.
    3. Operation and Maintenance Data: Arranged by system, then by product category.
        a. Source data.
        b. Product data, shop drawings, and other submittals.
        c. Operation and maintenance data.
        d. Field quality control data.
        e. Photocopies of warranties and bonds.

3.6 SUBSTANTIAL COMPLETION

A. Before requesting Substantial Completion inspection, complete the following:
    1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
    2. Advise Owner of pending insurance changeover requirements.
    3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
    4. Make final changeover of permanent locks and deliver keys to Owner.
    5. Complete startup testing of systems.
    6. All commissioning pre-functional test forms are to be completed and submitted.
    7. Systems are complete and ready for the test and balance process.

8. Remove temporary facilities and controls.
9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
10. Complete final cleaning requirements, including touchup painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

C. Prior to Final Completion, submit the following:
1. Submit specific warranties, maintenance service agreements, and similar documents.
2. Submit record Drawings, operation and maintenance manuals, and similar final record information.
3. Deliver tools, spare parts, extra materials, and similar items.

D. Request inspection for Final Completion, once the following are complete:
1. Submit a copy of Substantial Completion inspection list stating that each item has been completed or otherwise resolved for acceptance.
2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

E. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

F. Submit a written request for final inspection for acceptance. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

G. Prior to the end of the warranty period, the Architect, Owner, and Contractor will make a final walk through of the project to assure issues arising during the warranty period were properly addressed

3.7 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.
B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Items specified in individual product Sections.
C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
B. Other Specification Sections: Additional requirements for demonstration and training.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than two weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.
D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

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

3.2 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. Owner will provide classroom and seating at no cost to Contractor.
C. Provide training in minimum two hour segments.
D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.
F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.
B. Selective demolition of building elements or structure for alteration purposes.
C. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
B. Section 01 1000 - Summary: Sequencing and staging requirements.
C. Section 01 1000 - Summary: Description of items to be removed by Owner.
D. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
G. Section 07 0150.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.
H. Section 311000 - Site Clearing: For site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Site Plan: Showing:
    1. Vegetation to be protected.
    2. Areas for temporary construction and field offices.
C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.
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. Use of explosives is not permitted.
4. 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.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. 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.
10. 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. Protect existing structures and other elements that are not to be 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.
E. 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.
F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.2 EXISTING UTILITIES

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. 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 utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.3 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of 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 other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
1. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and [_____]): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. 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 if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.4 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 024113 - SITE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: removal of existing buildings, equipment pads, foundations, paving, curb and gutter, underground tanks, pipes and utilities, fences, and other site items as required by the project drawings.

1.2 SUBMITTALS

A. Obtain necessary permits required for demolition and submit copies to the Owner before beginning site demolition work.

1.3 PROTECTION

A. Protection of Existing Work: Before beginning cutting or other site demolition work, carefully survey the existing work and examine the project drawings and specifications to determine the extent of the work. Take necessary precautions to ensure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner. Restore damaged improvements to their original condition, as acceptable to the Owner. Carefully coordinate the work of this section with other work and construct and maintain shoring, bracing and supports, as required. Ensure that structural elements are not overloaded. Increase structural support or add new supports, as required as a result of cutting, removal, or demolition of work performed.

B. Benchmarks, Property Markers, and Iron Pins: The Contractor shall maintain all benchmarks, monuments, property markers, iron pins and other reference points during site clearing operations. In the event that any of the above mentioned are disturbed or destroyed during any construction activities the Contractor shall replace them, as directed by the Owner, at the Contractor's expense.

C. Existing Utilities:
   1. Follow rules and regulations of the authorities having jurisdiction for the respective utilities in execution of the work under this section.
   2. Notify utility locator service for area where project is located before site demolition.
   3. Active Utilities Shown on Project Drawings: Protect from damage and remove or relocate only as indicated or specified. Take special precautions not to damage utility lines, manholes, or other structures. Correct any damage to utilities or structures to original or better condition at no additional cost to the Owner.
   4. Active Utilities Not Shown on Project Drawings: When any functioning underground utilities are uncovered during the work which are not shown on the project drawings, promptly notify the Owner in writing. Protect or relocate in accordance with written instructions of the Owner. The Contractor shall exercise caution during all phases of the work, as all utilities may not be shown on the Project Drawings. A utilities' omission from the Project Drawings

will not relieve the Contractor of their responsibility to correct any damage to said utility at no additional cost to the Owner.

5. Inactive and Abandoned Utilities: Remove, plug, or cap in the absence of specific requirements. Plug or cap utility lines at least five feet outside of new building walls or as required by local regulations.

D. Adjacent Properties: Protect adjacent properties during site demolition operations. Site demolition shall be limited to Owner's property. The Contractor shall also protect existing structures on adjacent properties; including by not limited to fences, utility lines, manholes, catch basins, valve boxes, poles, guys and other appurtenances. Damage done to structures on adjacent properties shall be the Contractor's responsibility to repair, at no additional cost to the Owner.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 DEMOLITION

A. Structures: Demolish existing structures by breaking these materials into smaller pieces for transport. The use of explosives is not permitted.

B. Utilities: Remove or abandon in place existing utilities as indicated on the project drawings. Disconnect utility services, in coordination with the Owner, with related meters and equipment, employing appropriate utility company. When utility lines are encountered that are not indicated on the project drawing, notify the Owner.

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
2. Notify Architect/Engineer not less than two days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Architect/Engineer's written permission.

C. Sidewalks, driveways, curb and gutter, drainage structures and similar obstructions permitted to be removed shall be cut in straight lines or removed to the nearest construction joint if located within five feet of the edge of the excavation. In no case shall the joint or line of cut be less than one foot outside the edge of excavation.

3.2 RELOCATION AND RETURN OF MATERIAL OR EQUIPMENT

A. Carefully dismantle, in manner to avoid damage, all materials and equipment specified or indicated to be relocated or returned to the Owner.

B. Store materials and equipment to be reused in a manner to avoid corrosion, staining, breakage, or damage.

C. Material or equipment specified or indicated to be relocated or returned to the Owner and damage due to Contractor's negligence shall be repaired or replaced as directed by Owner.

3.3 DISPOSITION OF MATERIALS

A. Remove and legally dispose of demolished materials off of the project site. Transport materials in a manner that will prevent spillage on streets and adjacent areas. Dispose of materials in a manner acceptable to the regulatory agency having jurisdiction.

3.4 PROTECTION OF EXISTING TREES

A. Protect trees to remain in the manner described in Section 31 10 00 Site Clearing.

B. Provide tree protection measures prior to beginning of demolition and maintain throughout the work period.

3.5 BACKFILLING AND COMPACTION

A. Backfill holes and depressions resulting from site demolition in the manner described in Section 312300 Excavation and Fill.

END OF SECTION 024113

SECTION 03 0516 - UNDERSLAB VAPOR BARRIER - STEGO

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.3 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Underslab Vapor Barrier:

1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
2. Thickness: 15 mils.
3. Products: Subject to compliance with requirements, provide one of the following:
    a. Grace Construction Products, W.R. Grace & Co.; Perminator 15 mil
    b. Stego Industries LLC; Stego Wrap Vapor Barrier 15 mil
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:
   1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
   2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans; subject to compliance with requirements.

1.4 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. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder

F. Welding certificates.

G. 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. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
   8. Bonding agents.
   9. Adhesives.
   10. Vapor retarders.
   11. Semirigid joint filler.
   12. Joint-filler strips.
   13. Repair materials.

H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

J. Field quality-control reports.

1.5 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 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.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 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 single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: 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, "Specifications 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.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT
A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
C. Plain-Steel Wire: ASTM A 82, as drawn.
D. Deformed-Steel Wire: ASTM A 496.
E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES
A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
B. 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.

2.4 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/II, gray, with the following:

      a. Fly Ash: ASTM C 618, Class F.
      b. Fly Ash: Class C flyash is also acceptable.
B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
C. Water: ASTM C 94 and potable.

2.5 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, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Raven Industries Inc.; Vapor Block 15.
      b. Reef Industries, Inc.; Griffolyn 15 mil Green.
      c. Stego Industries, LLC; Stego Wrap 15 mil Class A.
      d. Other products are subject to Architect/Engineer Approval.

B. 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 sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ChemMasters; Chemisil Plus.
      b. ChemTec Int'l; ChemTec One.
      c. Conspec by Dayton Superior; Intraseal.
      d. Curecrete Distribution Inc.; Ashford Formula.
      e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      f. Edoco by Dayton Superior; Titan Hard.
      g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
      h. Kaufman Products, Inc.; SureHard.
      i. L&M Construction Chemicals, Inc.; Seal Hard.
      j. Meadows, W. R., Inc.; LIQUI-HARD.
      k. Metalcrete Industries; Floorsaver.
      l. Nox-Crete Products Group; Duro-Nox.
      m. Symons by Dayton Superior; Buff Hard.
      n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
      o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Note: use of curing compounds will not be allowed at slabs that are indicated to receive flooring – concrete slabs receiving flooring shall be wet cured.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
      b. BASF Construction Chemicals - Building Systems; Confilm.
      c. ChemMasters; SprayFilm.
      d. Conspec by Dayton Superior; Aquafilm.
      e. Dayton Superior Corporation; Sure Film (J-74).

f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.
d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.10 RELATED MATERIALS
A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
D. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS
A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch 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 or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface 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 or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, Foundation Walls, Interior Slabs on Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: Refer to drawings.
2. Maximum Water-Cementitious Materials Ratio: Refer to drawings.
3. Slump Limit: Refer to drawings.
4. Air Content: 6 percent, plus or minus 1 percent at point of delivery for concrete exposed to freezing.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

B. Exterior Uses, Stairs, Slabs-on-Grade etc: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1 percent at point of delivery.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 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 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch 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. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
H. Chamfer exterior corners and edges of permanently exposed concrete.
I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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 AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, 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 for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.
2. Tape around all penetrations & Lap edges up over tp of foundation wall a min of 4”

3.5 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.

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

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 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 into concrete.
3. Use a bonding agent 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. 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 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 or more than 1 inch 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.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record.
C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
D. 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 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.
E. 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.
F. 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 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.
G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.
B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 20; and of levelness, F(L) 17.
   3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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.

3.12 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 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 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, 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
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.

3.13 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 one month. 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 deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 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 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 in any dimension to solid concrete. Limit cut depth to 3/4 inch. 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 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 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 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 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 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.

3.15 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.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

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 one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
a. 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; 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; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
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; 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.
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 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 do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 03 3511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.
   1. Sealed Concrete
   2. Polished Concrete
   3. Stained/Dyed Polished Concrete

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.3 REFERENCES

A. ASTM 3363-05 Standard Test Method for Film Hardness by Pencil Test.
B. ASTM D2047 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method (Slip Coefficient).
C. ASTM D523 tandard test for Specular Gloss – Gloss Meter Reflectivity.
D. ASTM E 430 Standard Method for Measurement of Gloss of High Gloss surfaces by Abridged Goniophotometry.
E. ASTM E1155 Standard Test for Determining FF Floor Flatness and FL Floor Levelness Numbers.
F. ACI 302.1R-89 American Concrete Institute Guide for Concrete Floor and Slab Construction.
G. CPAA: Concrete Polishing Association of America.
H. American Society of Concrete Contractors, Concrete Polishing Council.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 PREINSTALLATION MEETING

A. Conduct preinstallation conference at Project Site.
B. Representatives to participate in a pre-construction conference at the project site to assure compliance with the requirements of this section. This pre-construction conference is to take place prior to establishing finish floor benchmark height for the building to coordinate installation construction sequence of concrete slab, cmu wall and initial floor grind as hand grinding edges near walls should be at a minimum.
C. Discuss each step of grinding, honing, and polishing operations.
D. Discuss the application of liquid applied products.
E. Discuss protection of polished concrete floors before and after installation.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
C. Installation Instructions: outline each step procedure for each material and product used, descrtiption for protection of surrounding areas, surface preparation, application, and final cleaning.
D. Maintenance Data: Provide data on maintenance and renewal of applied finishes. These instructions should contain precautions against cleaning products and methods that may be detrimental to finishes and performance.

E. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
F. Samples for Initial Selection: For each type of product requiring color selection.
G. Samples for verification: For each type of exposed color.
H. Qualification Data: Provide written Installer's Certification documentation from the manufacturer confirming that installer meets the qualifications as specified and is eligible for manufacturer's warranty.
I. Installer's Project References: Submit installers list of successfully completed polished concrete floor system projects, including project name and location, name of architect, and type and quantity of polished concrete floor system installed. Installer must provide a minimum list of ten successfully completed projects for verification of finished product(s).

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced, approved, certified installer and adequate number of skilled workers who are trained and experienced in the work being performed.
   2. Provide a Letter of Certification from Product System manufacturer stating installer is a certified applicator of approved material and is equipped with necessary machinery needed for proper performance of work in this section.
   3. Contractor agrees to perform all work in accordance with the CPAA and will adhere to their standards and those specified herein.
B. Protection:
   1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from concrete surfaces. Prevention is therefore essential.
      a. All hydraulic powered equipment must be diapered to avoid staining the concrete.
      b. No trade will park vehicles on the inside slab. If parking on the inside slab is necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
      c. No pipe fitting machine will be used on the inside slab floor.
      d. Steel will not be placed on interior slab to avoid rust staining.
      e. Acids and acidic detergents will not come into contact with slab.
      f. All trades informed that the slab must be protected at all times.
      g. A janitorial-grade acrylic floor finish shall be applied to protect the slab from stains.

1.8 MOCK-UP

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
B. Provide a mock-up area of polished concrete representative of specified process, exposure, surface, finish, color and joint design treatments.
C. A field Mock Up shall be provided on site and protected from damage until completion of polishing. These mock-ups should be polished using the same personnel who will perform work. Mock-up will be approved by owner and matched throughout the project.
D. Mock-Up Size: 10 feet square by 4" thick.
E. Mockup to consist of the required building or sidewalk slab concrete mix design. General Contractor to coordinate with Concrete Subcontractor to furnish material and labor to install mock-up slab. If approved by owner mock-up slab may be part of the permanent construction. The location to be determined by owner, but it will not be the patio or interior finished floor slab.
F. Locate where directed.

G. Agenda: Polisher shall demonstrate understanding of work required according to the following.
   1. Details of each step of grinding, honing and polishing
   2. Application of liquid applied products.
   3. Protecting concrete floor surfaces until polishing work begins.
   4. Protecting polished concrete floors after polishing work is completed and until turned over to owner.

H. A technically qualified manufacturer's field representative of the Densifier and stain protector product shall be on site during the initial application of the Densifier and stain protector and occasional observations during the remainder of the applications. The representative shall ensure that the correct amount of Densifier and stain protector onsite and in numbered containers prior to commencement of work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.10 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

D. Concrete must be cured a minimum of 28 days.

E. Comply with manufacturer's written instructions of substrate temperature, moisture content, ambient temperature, humidity, ventilation and other conditions affecting process.
   1. Alkalinity
      a. Test Method: Measure pH according to method indicated in ASTM F710
      b. Acceptable results: 8- 13.
   2. Moisture Vapor Transmission Rate:
      a. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
      b. Acceptable results: Not more than 5 pounds per 1000 square feet in 24 hours.
   3. Relative Humidity:
      a. Test Method: Perform relative humidity test using in-situ probes according to ASTM F 2170.
      b. Acceptable results: Not more than 75 percent.

F. Inspect the existing substrate and document unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct unacceptable conditions prior to installation of system. Commencement of work constitutes acceptance of substrate conditions.

G. Close areas to traffic during and after application for a time period recommended by the manufacturer.

PART 2 PRODUCTS

2.1 DENSIFIERS AND HARDENERS

A. Pre- Densifier floor cleaner: As recommended by densifier manufacturer.

B. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
   1. The manufacturer's densifier must be hybrid or multi-silicate based. Concrete chemical densifier specifically for concrete surface treatment which reacts chemically to the concrete surface maintaining a clear, dense, durable, hard, abrasion and chemical resistant surface. Product shall be a solution that is less than 40 VOC.
      a. Products:

1) Ameripolish, Inc; 3D HS Hybrid Silicate Densifier: www.ameripolish.com/#sle.
2) PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.
3) PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.
4) PROSOCO, Inc; ColorHard used with Consolideck LS or LS/CS: www.prosoco.com/consolideck/#sle.
5) Diamond Shield.

2.2 COATINGS

A. Concrete Stain or Dye: Translucent, penetrating compound for interior or exterior use; must be finished with a topical sealer.
   1. Applied with Acetone. Water Based Not Allowed.
   2. Number of Coats: Minimum of two.
   3. Primary Color: As indicated in Drawings, in a formulation to match approved mock-up.
   4. Products:
      a. Ameripolish, Inc; Surelock Concrete Dye: www.ameripolish.com/#sle.
      b. PROSOCO, Inc; GemTone Stain: www.prosoco.com/consolideck/#sle.
      c. Diamond Shield.

B. Stain Protector: Concrete chemical stain protector specifically for concrete surface treatment which reacts chemically to the concrete surface maintaining a clear, dense, durable, hard, abrasion and chemical resistant surface. Product shall be a solution that is less than 40 VOC.

C. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.
   1. Composition: Acrylic polymer-based.
   2. Nonvolatile Content: 15 percent, minimum, when measured by volume.
   3. Products:
      a. PROSOCO, Inc; LSGuard: www.prosoco.com/consolideck/#sle.

D. Penetrating Sealer: Transparent, non-yellowing, water- or solvent-based coating.
   1. Products:
      a. Ameripolish, Inc; 3D SP Concrete Sealer: www.ameripolish.com/#sle.
      b. Ameripolish, Inc; SR2 Concrete Sealer: www.ameripolish.com/#sle.

2.3 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
   1. Basis of Design Product: Subject to compliance with requirements, provide complete solute-based polishing system by PROSOCO, Inc.; Consolideck Polished Concrete System or comparable product by one of the following:
      a. Ameripolish, Inc; Ameripolish Polished Concrete System: www.ameripolish.com/#sle.
      b. PROSOCO, Inc; Consolideck Polished Concrete System: www.prosoco.com/consolideck/#sle.
      c. Diamond Shield

B. Appearance: Provide Polished Concrete Appearance as indicated on Drawings with reference to American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Appearance Chart, PCAC-11.17.

C. Aggregate Exposer: Expose aggregate with polishing installation as indicated on Drawings with reference to American Society of Concrete Conctractors, Concrete Polishing Council, Polished Concrete Aggregate Exposure Chart, PCAEC-11.17.

2.4 EQUIPMENT

A. Sprayer: Manufacturer approved high volume, low pressure sprayer and sprayer tip.
B. Scrubber Machine used for cleaning operations shall have a head pressure of 150 lbs. or as required to produce the specified results.
C. Field Grinding and Polishing Equipment: A multi-head, counter rotating, walk-behind or ride-on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
    1. Use equipment capable of removing generated dust for dry grinding, honing or polishing.
    2. Use equipment capable of slurry extraction and containment for wet grinding, honing or polishing

2.5 ACCESSORIES

A. Oil remediation system
B. pH compatible detergent
C. Repair material: A product that is designed to repair cracks and surface imperfections. The specified bonding materials shall have sufficient bonding to adhere after polishing process and to have abrasion resistance equal to or greater than adjacent substrate.
D. Grout Material: A thin mortar used for filling voids such as a rapid set structural repair polymer or other material as recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.
B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
C. Examine substrate for conditions affecting polishing process. Correct conditions detrimental to process.
D. Verify that concrete floor flatness rating is at least 40. Notify the contractor if floor flatness rating not achieved. Do not proceed with installation unitl concrete floor flatness rating is achieved.
E. Verify that concrete floor levelness rating is at least 30. Notify the contractor if floor levelness rating not achieved. Do not proceed with installation unitl concrete floor levelness rating is achieved.

3.2 GENERAL

A. Apply materials in accordance with manufacturer's instructions.
B. Application is to take place at least 10 days prior to placement of furniture, fixtures and/or equipment, thus providing a complete, uninhibited concrete slab for application.
C. Fill joints and saw cuts, repair spawled areas.
D. Shave and level filled areas.
E. Start any of the floor finish applications in presence of manufacturer’s technical representative.

3.3 CLEANING

A. Coordinate with joint filling operations. DO NOT perform wet cleaning within 72 hours prior to joint filling or per joint filler manufacturer’s recommendations.
B. Do not use stain or scuff removing agents on finished floor surface.
C. Use non-oil based sweeping compound to control airborne dust.
D. Treat oil spots with oil remediation system.
E. Scrub floor with scrubber machine and appropriate brushes or pads and pH compatible detergent.

3.4 CLEANING FOR POLISH SYSTEM

A. Clean floors as specified prior to polishing application.
B. Polish floors as specified prior to application of densifier or stain protector.

3.5 COATING APPLICATION

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

3.6 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
B. Polished edge work of all areas shall be done with a 5” or 7” hand held or walk behind polishing tool.
C. All grinding and polishing completed with grinder/polisher equipment connected to a dust collector.
D. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION

SECTION 034100 - PRECAST STRUCTURAL CONCRETE – PLANT CAST

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes precast structural concrete units, including the following:

1. Long-span units (Double Tees).
2. Structural framing units.
3. Insulated, precast concrete units.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Section 033000 “Cast-In-Place Concrete”.
2. Section 079200 “Joint Sealants” for sealants and backing in and around precast concrete units.
3. Division 09 Specification Sections for applied finishes on and around precast concrete units.
4. Section 034500 “Precast Architectural Concrete – Plant Cast”, as needed, for architectural precast concrete units.

1.2 RELATED DOCUMENTS

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

B. NOTE: Coordinate with General Contractor and Electrical, Plumbing, Mechanical, and Data Sub-Contractors for installation of electrical boxes, conduits, sleeves, etc. in precast panels and/or tees prior to fabrication of precast structural concrete units.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product and instructions for materials and products. Include manufacturer’s certifications and laboratory test reports as required.

B. Design Mixtures: For each precast concrete mixture as specified in Part 2 of this Section.

C. Shop Drawings:

1. Prepare under the supervision of a qualified Professional Engineer.

2. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
3. Include lifting devices necessary for handling and erection.

4. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data Signed and Sealed by the qualified professional engineer in the jurisdiction having authority (**Missouri Professional Engineer**) responsible for their preparation. See Structural Drawings for loading criteria.

1. Indicate layout and dimensions, and identify each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
2. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates, if required, for accurate placement.
3. Show all openings for doors, windows, louvers, and other openings as required. Coordinate with other trades for opening sizes and locations.
4. Test reports as required by provisions of this Section.
5. Data for materials incorporated into insulated precast panels indicating "R" value of insulation.
6. Comprehensive engineering design signed and sealed by a qualified professional engineer responsible for its preparation licensed in jurisdiction having authority - **Missouri**.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, and testing agency.

B. Welding certificates.

C. Material certificates.

D. Material Test Reports: For aggregates.

E. Source quality-control reports.

F. Field quality-control and special inspection reports.

1.6 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except as otherwise indicated:

1. ACI 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. AWS D1.1, "Structural Welding Code: Steel" for welding qualifications. Qualify procedures and personnel according to AWS D1.1.
4. AWS D1.4, "Structural Welding Code: Reinforcing Steel" for welding qualification. Qualify procedures and personnel according to AWS D1.4.
5. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
6. Prestressed Concrete Institute (PCI) MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products" for manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, and all other requirements of PCI MNL 116.

B. Fabricator Qualifications: A firm experience in fabrication of precast concrete units similar to units required for this Project and that have a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the Work. A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a Producer Member of PCI and/or participant in PCI Plant Certification Program and as follows OR participant in APA's Plant Certification Program for Production of Architectural Precast Concrete Products and is designated an APA certified plant:

a. Producer of Group A, Category A1 – Architectural Cladding and Load Bearing units.

C. Design by Fabricator: Design precast slab units to support superimposed dead loads, live loads and wind loads as indicated on drawings and as required for compliance with local governing code requirements and Factory Mutual requirements.

F. Professional Engineer Qualifications: A professional engineer licensed in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of structural precast concrete that are similar to those indicated for this Project in material, design, and extent.

1.7 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver the amount of precast concrete units needed in a timely manner to the Project site to ensure installation continuity.

B. Store and handle the units at the Project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

B. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated on Drawings.

1. Design structural precast concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load

deflection, shrinkage and creep of primary building structure, and other building movements. Maintain structural precast concrete deflections within limits of ACI 318.

C. Fire-Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, include calculation for fire resistance in engineering calculations.

2.2 FORMWORK

A. Provide forms and, where required, form facing materials of metal, plastic, wood, or another acceptable material that is nonreactive with concrete and will produce required finish surfaces.

B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and for prestressed, pre-tensioning, and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or movement during detensioning.

2.3 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Steel Wire: ASTM A 82, plain, cold-drawn steel.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M.

F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116 and CRSI recommendations.

2.4 PRESTRESSING TENDONS

A. Strand: ASTM A 416, Grade 250 unless Grade 270 is indicated, uncoated, seven-wire, stress-relieved, low-relaxation strand.

1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

B. A strand similar to above, but having the size and ultimate strength of wires increased so that the ultimate strength of the strand is increased approximately 15 percent, or a strand with increased strength but fewer number of wires per strand, may be used at manufacturer's option.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III. See "Mix Proportion and Design" in this Section for color.

1. Use only one brand and type of cement throughout Project, unless otherwise acceptable by Architect.

B. Aggregates: Except as modified by PCI MNL 116, ASTM C 33. Stockpile aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Local aggregates not complying with ASTM C 33, but that have shown by special test or actual service to product concrete of adequate strength and durability, may be used when acceptable by Architect.

C. Light-weight Aggregates: Except as modified by PCI MNL 116, ASTM C 330.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Water-Reducing Admixture: ASTM C 494, Type A, or other Type approved for fabricator's units.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.1 percent chloride ions or other salts by weight of admixture.

2.6 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36.

B. Carbon-Steel Plate: Structural quality, hot-rolled, ASTM A 283, Grade C.

C. High-Strength Bolts and Nuts and/or High Strength Threaded Fasteners: ASTM A 325 or ASTM A 490 Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.

1. Do not zinc coat ASTM A 490 bolts.

D. Shop-Primed Finish: Prepare surfaces of non-galvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

2.7 BEARING PADS

A. Provide bearing pads for precast structural concrete units as indicated on Drawings.

1. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50-60 shore A durometer.

2. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70-80 shore A durometer.

3. Frictionless Pads: Tetrafluoroethylene (TFE), with glass-fiber reinforcing as required for service load-bearing stress.

4. Tempered Hardboard Pads: Smooth both sides.

B. Welding Electrodes: Comply with AWS Standards.

C. Accessories: Provide clips, hangers, and other accessories required to install units and to support subsequent construction or finishes.

2.8 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade B for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218.

C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Non-metallic Shrinkage-Resistant Grout:

a. Conspec, Inc., 100 Non-Shrink Grout (Non-Metallic).
b. Cormix, Inc., Supreme Grout.
c. Dayton Superior, Sure Grip Grout.
d. Euclid Chemical Co., Euco NS.
e. L & M Construction Chemicals, Crystex.
f. Master Builders Inc., Masterflow 928.
g. Protex Industries Inc., Propak.
h. Set Products Inc., Set Non-Shrink.
i. Stonhard Inc., Stoncrete NM1.
j. Symons Corp., Multi-Purpose Grout.
k. Target Products, Ltd., Portland Expanding Grout (Non-Shrink).
l. U.S. Grout Corp., Five Star Grout.
m. W.R. Meadows, Sealtight 588 Grout.

2.9 INSULATED FLAT-WALL PANEL COMPOSITION

A. Wall Composition for **12 inch thick Precast Wall Panel**:

1. Interior Structural Concrete Face: **6 inch**.
2. Insulation: **2 inch**.
3. Exterior Architectural Sandblast Concrete Face: **4 inch**.

B. Polyisocyanurate Board Insulation: ASTM C 591, **Type III, 3.0 lb/cu. ft.** unfaced, with thickness of **2 inches**.

1. Approximate R-Value: **R6 per foot**.

C. Architectural Sandblast Mix: For areas requiring a sandblasted, exposed aggregate finish, provide a finish to match Architect's approved sample utilizing the following components:

1. Cement: 650# Type III Grey – Ash Grove Cement.
2. Large Aggregate: 1825# Burlington Limestone-Conco Quarries – Willard, Missouri.
3. Fine Aggregate: 848# Burlington Limesand - Conco Quarries - Willard, Missouri.
4. Fine Aggregate: 565# Black Granite Mansand – Irion Mountain Traprock-Ironton, MO
5. Color Additive: 13# Black #620 – Dynamic Color Solutions.

2.10 CONCRETE MIXTURES PROPORTION AND DESIGN

A. Prepare design mixtures for each type of precast concrete required.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218.

D. Concrete Mixtures: Proportion mixes for each type of concrete required by either laboratory trial batch or field test data methods according to ACI 211.1 and ACI 318, with materials to be used on Project, to provide concrete mixes with the following properties:

1. Compressive Strength (28 Days): 5000 psi minimum.
2. Release Strength for Prestressed Units: 3500 psi.

E. Cure compression test cylinders using same methods as for precast concrete Work.

F. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.

G. Admixtures: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116, unless otherwise indicated.

1. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.

2. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the Work.

2.11 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116 and as specified for types of units required.

B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94 and as specified here.

C. A shorter mixing time than that specified in ASTM C 94 may be required during hot weather or under conditions contributing to rapidly setting concrete.

D. When the air temperature is between 85 deg F (30 deg C) and 90 deg F (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.

E. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place to formwork during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement. Do not relocation bearing plate in units unless acceptable by Architect.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

F. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

G. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formula form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

H. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

I. Cast-in openings larger than 10 inches in any dimension in accordance with final Shop Drawings. Do not drill or cut openings or prestressing strand without Architect's approval. Other smaller holes may be field cut by trades requiring them, as acceptable by Architect.

J. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as require.

1. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
2. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.

K. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

L. Prestress tendons for precast structural concrete units by either single-strand method or multiple-strand tensioning method. Comply with PCI MNL 116.

M. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

N. Place concrete in a continuous operation to prevent seams, cold joints, or planes of weakness from forming in precast concrete units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items.

O. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

P. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

Q. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

R. Provide reveal joints (rustication joints) in precast panels in pattern, configuration, spacing and location as shown on the drawings. Joints shall be uniform and align as indicated between adjacent panels.

S. Delay detensioning prestressed units until concrete has attained at least 70 percent of the design stress, as established by test cylinders.

1. If concrete has been heat-cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
2. Detension pre-tensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

T. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

U. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.12 CASTING INSULATED WALL PANELS

A. Cast, screed, and consolidate wythe supported by mold.

B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Cast, screed, and consolidate top wythe to meet required finish.

2.13 LONG-SPAN UNITS

A. Type: Plant-fabricated, precast, prestressed concrete units, produced under rigid, factory inspected process.

B. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide standard finish units as specified.

D. Where ends of strands will not be enclosed or covered, cut flush and cover with high strength mortar bonded to unit with epoxy resin bonding agent.

E. Where used as roof members, provide smooth, flat top finish.

F. Adequately reinforce units to resist transporting and handling stresses.

G. Include cast in weld plates where required for anchorage or lateral bracing to structural steel and adjacent precast members.

H. Coordinate with other trades for installation of items to be cast in long-span units.

I. Provide blockouts for openings in accordance with design drawings or precast unit manufacturers recommendations.

2.14 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.15 COMMERCIAL FINISHES

A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch and fill holes larger than 1/2 inch. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Limit form joint offsets to 3/16 inch.

1. Provide reveal (rustification) joints in pattern, configuration, spacing and location shown on the Drawings. Joints shall be uniform and align as indicated between adjacent panels.
2. Provide chamfered edge at all panel ends.
3. Provide chamfered edge at all panel cast-in openings.

B. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur more than once per 2 sq. in.. Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.

C. Unexposed faces shall receive good float finish.

D. Smooth, “Fresno” steel trowel finish unformed interior surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

E. Provide finish at all exposed exterior faces, smooth and ready for application of elastomeric paint finish, unless otherwise indicated on Drawings.

1. Provide formliner at locations shown on Drawings.
2. Provide sandblasted finish at locations shown on Drawings.

2.16 SOURCE QUALITY CONTROL

A. The Owner may employ an independent testing laboratory to evaluate the precast manufacturer's quality control and testing methods.

B. The precast manufacturer shall allow Owners testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required and outside specified tolerance limits may be subject to additional testing as specified here.

D. Precast units having dimensions greater than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to meet construction conditions.

E. Strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements that may affect the strength of the precast units, including the following conditions:

1. Failure to meet compressive strength tests requirements.
2. Reinforcement, and pre-tensioning and detensioning tendons of prestressed concrete not conforming to specified fabrication requirements.
3. Concrete curing, and protection of precast units against extremes in temperature not as specified.
4. Precast units damaged during handling and erection.

F. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610, ASTM C 1611, ASTM C 1621, and ASTM C 1712. When there is evidence that the strength of precast concrete units may not meet specification requirements, the testing laboratory will take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:

1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect.
2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet when using completed structure.
3. Test cores in an air-dry condition per ACI 318 if concrete will be dry when using completed structure.
4. Strength of concrete for each series of cores will be considered satisfactory if the average compressive strength is at least 85 percent of 28-day design compressive strength.
5. Test results will be made in writing on the same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in the test reports the Project identification name and number, date, name of precast concrete manufacturer, name of concrete testing laboratory; identification letter, name, and type of member or members represented by core tests; design compressive strength, compression breaking strength and type of break (corrected for

length-diameter ratio), and direction of applied load to core with respect to horizontal plane of concrete as placed.

G. Patching: Where core test results are satisfactory and precast units are acceptable for use in Work solidly fill core holes with patching mortar and finish to match adjacent concrete surfaces.

H. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
2. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
3. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Bearing Pads: Install flexible bearing pads as precast units are being erected where indicated. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

D. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

E. Field cutting of precast units is not permitted without approval of Architect.

F. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless otherwise accepted by precast Manufacturer.

G. Welding: Comply with applicable requirements in AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work and including qualification of welders.

1. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
2. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and a compatible primer to painted surfaces.

H. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

I. Grouting or Dry-Packing Connections and Joints: After precast concrete units have been placed and secured, grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself, pack spaces as follows, tamping until voids are completely filled:

1. Cement grout consisting of 1 part Portland cement, 2-1/2 parts sand, and only enough water to properly mix and hydrate.
2. Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation or bleeding.
3. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

J. Bracing and Shoring: Provide temporary supports, bracing, shoring, etc. as required until permanent support is installed, and as designed by installer's engineer. Include temporary concrete pads, welding, materials and all labor as may be required.

3.2 ERECTION TOLERANCES

A. Erect precast structural concrete units without exceeding tolerance limits specified in PCI MNL 127, “Recommended Practice for Erection of Precast Concrete.”

B. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

C. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Erection of loadbearing precast structural concrete members.

B. Testing Agency: Engage an accredited qualified testing and inspecting agency, approved by the Owner, to perform tests and inspections and prepare reports.

1. Field welds will be subject to visual inspections and dye penetrant or magnetic particle testing in accordance with ASTM E 165 and ASTM E 1444. Testing agency shall be qualified in accordance with ASTM E543.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Erector's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.5 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Structural steel.
2. Grout.

B. Related Sections:
1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame not defined as structural steel.
4. Division 09 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator**, BEAM TO BEAM AND BEAM TO COLUMN CONNECTIONS NOT DETAILED IN DRAWINGS SHALL BE SIZED BY STEEL DETAILER AS STANDARD AISC TYPE 2 BEARING CONNECTIONS CAPABLE OF SUPPORTING REACTIONS DEVELOPED BY MAXIMUM UNIFORM LOAD CAPACITY ON A SIMPLE SPAN BEAM AND BEAM SPAN GIVEN.**
B. Construction: Combined system of braced frame and shear walls.

1.5 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.
8. For structural-steel connections indicated to comply with design loads, include structural design data.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source constant current or constant voltage.
2. Electrode manufacturer and trade name, for demand critical welds.

D. Qualification Data: For qualified Installer and fabricator.

E. Welding certificates.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

G. Mill test reports for structural steel, including chemical and physical properties.

H. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

I. Source quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
1. Pre-Qualified Fabricators:

a. Deville Steel Inc. Springfield MO
b. Doing Steel, Springfield MO
c. Steward Steel, Sikeston, MO

d. Jacksonville Steel, Beebe, AR
e. Chillicothe Iron & Steel, Chillicothe, MO
f. HME, Inc. Haas Metal Engineering, Topeka KS
g. Arning Companies of Cassville MO
h. Industrial Services Company, Springfield, MO

2. Alternate Fabricators: Alternate fabricators must submit qualifications for approval to the Architect within 10 days of bid opening and the request shall include experience in the past 5 years with projects of this size and scope and demonstrate ability to set up and keep to a schedule.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.7 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 corrosion and deterioration.
1. 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.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

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

PART 2 - PRODUCTS

2.1 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.

C. Channels, Angles: ASTM A 36.

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, Grade B.
1. Weight Class: Standard.
2. Finish: Black.

G. Welding Electrodes: E70 series ,comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
1. Configuration: Straight.
2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
1. Nuts: ASTM A 563 hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

E. Threaded Rods: ASTM A 36.
1. Nuts: ASTM A 563 hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.

F. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

G. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

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

2.4 GROUT

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

2.5 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 360.
   1. Fabricate beams with rolling camber up.
   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/D1.1M.

C. Bolt Holes: Cut, drill, 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 that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass 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. Baseplate 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.

2.6 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: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime **all** 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. 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 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. 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 surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-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.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

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 that form 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. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 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.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
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 in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Metal ladders.
5. Alternating tread devices.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.

C. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 05 12 00 "Structural Steel Framing."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for mechanical and electrical equipment.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Metal ladders.
5. Alternating tread devices.
6. Loose steel lintels.

C. Delegated-Design Submittal: For ladders and alternating tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders and alternating tread devices.

B. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbfapplied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches.
   2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90coating; 0.079-inch nominal thickness.

H. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

2.3 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inchunless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inchembedment and 2-inchhook, not less than 8 inchesfrom ends and corners of units and 24 incheso.c., unless otherwise indicated.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inchbolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3, except for elevator pit ladders.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:
   1. Space siderails 18 inches apart unless otherwise indicated.
   2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
   3. Rungs: 3/4-inch-diameter steel bars.
   4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
   6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
   7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
   8. Prime exterior ladders, including brackets and fasteners, with zinc-rich primer.

2.8 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
   1. Tread depth shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 9-1/2 inches.
   2. Tread depth shall be not less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 8 inches.
   3. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
   4. Comply with applicable railing requirements in Section 05 52 13 "Pipe and Tube Railings."

B. Prime exterior steel alternating tread devices, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inchesunless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.10 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mildry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 23 "Interior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Roof deck.
   2. Floor Deck

B. Related Sections include the following:
   1. Division 05 Section "Structural Steel Framing".
   2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   3. Division 09 Section “Painting” for repair painting of primed deck and for painting of exposed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. 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."

D. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 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.

2.2 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. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Deck Profile:
      a. Typical Roof Deck: as indicated.
   3. Layout roof deck to have a minimum of three continuous spans where possible. Attach to joist and beams per deck attachment details. Where deck ribs are cut at penetrations, provide deck support angles or deck stiffeners as required.
   4. Side Laps: Overlapped.

2.3 NONCOMPOSITE FORM DECK

A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 (Z180) zinc coating.

   2. Profile Depth: Reference Plans

3. Design Uncoated-Steel Thickness: Reference Plans
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 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, not less than 0.0359-inch 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, of same material and finish as deck, and of thickness and profile indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Repair Paint: Manufacturer’s standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 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. Locate deck bundles to prevent overloading of supporting members.

C. 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.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Attach to joist and beams per deck attachment details in contract drawings.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with ends joints lapped 2 inches minimum.

C. 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 apart with at least one fastener at each corner.

3.4 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:
    a. Attach to joist and beams per deck attachment details in contract drawings.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints lapped 2 inches minimum.

C. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

D. 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.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. 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.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.
   2. Roof rafter framing.
   3. Ceiling joist framing.
   4.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 09 Section “Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand **design loads** without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of **1/600** of member length.
      b. Roof Rafter Framing: Horizontal deflection of **1/360** of the horizontally projected span.
      c. Ceiling Joist Framing: Vertical deflection of **1/360** of the span.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of **1 inch**.
      b.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

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

B.

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2.
D. Welding certificates.
E.
F. Qualification Data: For professional engineer.
G. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Horizontal drift deflection clips
   7. Miscellaneous structural clips and accessories.
   8.
H. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A.
B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
C.
D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
E.
F. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
G.
H. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, **ductility,** and metallic-coating thickness.
I.
J. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
K.
L. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
M.

N. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
   2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   3.

O. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

P.

Q. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A.

B. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

C.

D. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A.

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
   1. Allied Studco.
   2. AllSteel Products, Inc.
   3. California Expanded Metal Products Company.
   4. Clark Steel Framing.
   5. Consolidated Fabricators Corp.; Building Products Division.
   6. Craco Metals Manufacturing, LLC.
   7. Custom Stud, Inc.
   8. Dale/Incor.
   9. Design Shapes in Steel.
   10. Dietrich Metal Framing; a Worthington Industries Company.
   11. Formetal Co. Inc. (The).
   12. Innovative Steel Systems.
   13. MarinoWare; a division of Ware Industries.
   14. Quail Run Building Materials, Inc.
   15. SCAFCO Corporation.
   16. Southeastern Stud & Components, Inc.
   17. Steel Construction Systems.
   18. Steeler, Inc.
   19. Super Stud Building Products, Inc.
   20. United Metal Products, Inc.

2.2 MATERIALS

A.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: **ST50H**.
   2. Coating: **G60**.
   3.

C. Steel Sheet for **Vertical Deflection** Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: **50**, Class 1 or 2.
   2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A.

B. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: **0.0329 inch**.
   2. Flange Width: 1**-5/8 inches**.
   3.

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs, unless noted otherwise.
   2. Flange Width: **1-1/4 inches, unless noted otherwise**.
   3.

D. Vertical Deflection Clips: as indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.
      e.

E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.
   2. Minimum Base-Metal Thickness: **0.0428 inch**.
   3. Flange Width: 2 ½".
   4.

F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: **0.0428 inch**.

b. Flange Width: 2 ½".
2. Inner Track: Of web depth indicated, and as follows:
a. Minimum Base-Metal Thickness: **0.0428 inch**.
b. Flange Width: 1 ¼".
c.

G. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 ROOF-RAFTER FRAMING

A.

B. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: **0.0428 inch**
2. Flange Width: **1-5/8 inches**, minimum.
3.

C. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:
1. Minimum Base-Metal Thickness: **0.0428 inch**.
2. Flange Width: **1-5/8 inches**, minimum.

2.5 CEILING JOIST FRAMING

A.

B. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, **unpunched,** with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: **0.0329 inch**.
2. Flange Width: **1-5/8 inches**, minimum.

2.6 FRAMING ACCESSORIES

A.

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

C.

D. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M
C.
D. Anchor Bolts: ASTM F 1554, Grade **36**, threaded carbon-steel **hex-headed bolts,** and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by **hot-dip process according to ASTM A 153/A 153M, Class C**.
E.
F. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
G.
H. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
I.
J. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
   2.
K. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A.
B. Galvanizing Repair Paint: ASTM A 780.
C.
D. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
E.
F. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
G.
H. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
I.
J. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

A.
B. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
5.

C. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
D.
E. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A.
B. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A.
B. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
C.
D. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
E.
F. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
G.
H. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A.
B. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
C.

D. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

E.

F. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
   2.

G. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
      c.

H. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

I.

J. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

K.

L. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

M.

N. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

O.

P. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

Q.

R. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A.

B. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

C. Fasten both flanges of studs to **top and** bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: **16 inches**, or as indicated on drawings.
2.

D. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

E.

F. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
   4. Connect drift clips to cold formed metal framing and anchor to building structure.
   5.

G. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
      a. Install solid blocking at **96-inch** centers.
   2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
   5.

H. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

A.

B. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

C.

D. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
   3.

E. Space joists not more than 2 inches from abutting walls, and as follows:
   1. Joist Spacing: **16 inches**, or as indicated on drawings.
   2.

F. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

G.
H. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated
   1. Install web stiffeners to transfer axial loads of walls above.
   2.
I. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
   1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
   3.
J. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
K.
L. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

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

3.7 REPAIRS AND PROTECTION

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

END OF SECTION 054000

SECTION 06 1010 - NON-STRUCTURAL ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-structural dimension lumber framing.
B. Wall Sheathing, non-structural only.
C. Miscellaneous framing and sheathing.
D. Communications and electrical room mounting boards.
E. Concealed wood blocking, nailers, and supports.
F. Miscellaneous wood nailers, furring, and grounds.
G. Wall sheathing with factory applied water-resistive and air barrier sheet.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
D. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
E. PS 1 - Structural Plywood 2009.
F. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.
G. PS 20 - American Softwood Lumber Standard 2020.

1.4 SUBMITTALS

A. Product Data: Provide technical data on non-structural wall sheathing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation. Do not stack wood products in contact with ground.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20.
    1. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
    2. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.
B. Moisture Content: S-dry or MC19.
C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
    1. PS 20 dimension lumber, S4S, No. 2 or Standard Grade or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated..

2.3 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
B. Moisture Content: Kiln-dry (15 percent maximum).
C. Surfacing: S4S.
D. Species: Southern Pine.
E. Grade: No. 3, 3 Common, or Standard.

2.4 CONSTRUCTION PANELS

A. Wall Sheathing: Oriented strand board wood panel; PS 2.
   1. Grade: Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 5/8 PERF CAT.
   4. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
   5. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.5 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.
B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

2.6 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA 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 AWPA standards.
B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification Ausing waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with masonry or concrete.
      d. Treat lumber less than 18 inches above grade.
      e. Treat lumber in other locations as indicated.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification Fusing waterborne preservative.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with masonry or concrete.

c. Treat plywood less than 18 inches above grade.
d. Treat plywood in other locations as indicated.

3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification Ausing waterborne preservative.
   a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
   b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.3 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 framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
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. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. Wall Mounted Televisions. .

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearingand staggered, using nails, screws, or staples.
B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

C. Wall Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.

1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.5 CLEANING

A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roofing nailers.
B. Preservative treated wood materials.
C. Fire retardant treated wood materials.
D. Communications and electrical room mounting boards.
E. Concealed wood blocking, nailers, and supports.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
D. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
E. PS 20 - American Softwood Lumber Standard 2020.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.4 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.

1.5 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a two-year period commencing on Date of Substantial Completion.
C. Manufacturer Warranty: Provide two-year manufacturer warranty for [_____] commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 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 (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.
B. Moisture Content: S-dry or MC19.
C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No.2 or Standard Grade.
   2. Boards: Standard or No.3.

2.3 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.4 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA 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 AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, 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 both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Do not use treated wood in direct contact with ground.
   2. Interior Type A: AWPA 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.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing.
      c. Treat plywood in contact with masonry or concrete.
      d. Treat plywood less than 18 inches above grade.

PART 3 EXECUTION

3.1 PREPARATION

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 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. 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.

D. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Towel and bath accessories.
   4. Chalkboards and marker boards.

3.4 ROOF-RELATED CARPENTRY

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

B. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.5 CLEANING

A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.
B. Hardware.
C. Factory finishing.
D. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
B. Section 12 3600 - Countertops.

1.3 REFERENCE STANDARDS

A. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
B. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
C. Product Data: Provide data for hardware accessories.
D. Samples: Submit actual samples of architectural cabinet construction, minimum 8 inches square, illustrating proposed cabinet and shelf unit substrate and finish.
E. Samples: Submit actual sample items of proposed pulls, hinges, and locksets, demonstrating hardware design, quality, and finish.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.8 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Standard: Custom Grade
B. Plastic Laminate Faced Cabinets: Custom grade.
C. Cabinets at all locations:
    1. Finish - Exposed Exterior Surfaces: Decorative laminate.
    2. Finish - Exposed Interior Surfaces: Solid phenolic.
    3. Finish - Semi-Exposed Surfaces: Decorative laminate
    4. Finish - Concealed Surfaces: Manufacturer's option.
    5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
    6. Door and Drawer Front Retention Profiles: Fixed panel.
    7. Casework Construction Type: Type A - Frameless.
    8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
    9. Adjustable Shelf Loading: 50 lbs. per sq. ft.

a. Deflection: L/144.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 LAMINATE MATERIALS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Formica Corporation: www.formica.com.
2. Panolam Industries International, Inc; Nevamar: www.nevamar.com.
3. Wilsonart: www.wilsonart.com/#sle.
4. Pionite Decorative Surfaces: www.panolam.com/pionite
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

C. Provide specific types as follows:
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.4 ACCESSORIES

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

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.
2. Use at all exposed plywood edges.
3. Use at all exposed shelf edges.

C. Fasteners: Size and type to suit application.

D. 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.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic grommets for cut-outs, in color verify color with Architect.

2.5 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using surface mounted metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Fixed Specialty Workstation and Countertop Brackets:
1. Material: Steel.

2. Color: Selected by Architect from manufacturer's standard range.
3. Manufacturers:
   a. A&M Hardware, Inc; Concealed Brackets: http://www.aandmhardware.com/#sle.
   b. Rakks/Rangine Corporation; Inside Wall Flush Mount Brackets: www.rakks.com/#sle

D. Fixed Standard Shelf, Countertop, and Workstation Brackets:
1. Material: Steel.
2. Color: Selected by Architect from manufacturer's standard range.
3. Products:
   a. A&M Hardware, Inc; Standard Brackets: http://www.aandmhardware.com/#sle.

E. Fixed Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets:
1. Material: Steel.
2. Color: Selected by Architect from manufacturer's standard range.
3. Products:
   a. A&M Hardware, Inc ; ADA Vanity Brackets: http://www.aandmhardware.com/#sle.

F. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers.
1. Product: MCPPZ629 manufactured by Miseno.

G. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.

H. Catches: Magnetic.

I. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Heavy Duty grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.

J. Drawer Systems: Integrated drawer slide and side.
1. Side Type: Single Wall.
2. Drawer Side Height: 5-7/8 inches.
3. Drawer Length: 18 inch.
4. Extension Type: Full extension.
5. Static Load Capacity: Heavy Duty grade.
6. Mounting: Side mounted.
7. Stops: Integral type.
8. Features: Provide self closing/stay closed and white epoxy finish type.

K. Hinges: "Institutional Option" (semi-adjustable), 5-knuckle, fixed-pin, hospital tip, 270-degree swing, full wrap-around hinges). Provide one pair of hinges for each door up to 48-inches in height, and 2 pair for doors 72-inches in height or taller., steel with satin finish.

L. Door and Drawer Silencers: BHMA A156.16, L03011.

2.6 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide center matched panels at each elevation.
   2. Provide sequence matching across each elevation.
   3. Carry figure of cabinet fronts to toe kicks.

E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.7 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 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 to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

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

END OF SECTION

SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bituminous dampproofing.
B. Protection boards.

1.2 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).
B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
C. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013.
D. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide properties of primer, bitumen, and mastics.
C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years ofdocumented experienceand approved by manufacturer.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp - Construction Chemicals; Masterseal 610, 614, & 615or comparable product by one of the following:.
B. Other Acceptable Bituminous Dampproofing Manufacturers:
   1. Karnak Corporation: www.karnakcorp.com.
   2. Mar-Flex Systems, Inc www.mar-flex.com/sle.
   3. W. R. Meadows, Inc: www.wrmeadows.com/sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 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. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
   2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 1/16 inch, minimum, wet film.
B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.3 BITUMEN MATERIALS

A. Cold Asphaltic Type:

1. Bitumen: Emulsified asphalt, ASTM D1227with fiber reinforcement other than asbestos (Type II).
2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.4 ACCESSORIES

A. Protection Board: 1/8 inch thick polystyrene foam sheet.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.
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. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.
F. Apply bitumen with a trowel, brush, roller or spray.
G. Apply bitumen in one coat, continuous and uniform, at a rate of 25 sq ft/gal per coat.
H. Apply from 2 inches below finish grade elevation down to top of footings.
I. Seal items watertight with mastic, that project through dampproofing surface.
J. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.
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 1900 - WATER REPELLENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water repellents applied to exterior masonry and concrete surfaces.

1.2 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2020a.

B. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete 2013.

C. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2018).

D. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments 1991 (Reapproved 2013).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Architect.

1.4 SUBMITTALS

A. Product Data: Provide product description.
   1. Include manufacturer's printed statement of VOC content.
   2. Include manufacturer's standard color samples.
   3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate of each separate coat.

B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

C. Sample Warranty: For Special Warranty.

1.5 QUALITY ASSURANCE

A. Owner reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.6 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellants to be applied according to manufacturer's written instructions and warranty requirements:
   1. Concrete surfaces and mortar have cured for not less than 28 days.
   2. Building has been closed in for not less than 30 days before treating wall assemblies.
   3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours minimum.
   4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
   5. Rain or snow is not predicted for 24 hours minimum.
   6. Not less than 24 hours have passed since surfaces were wet.
   7. Windy conditions do not exist that might cause water repellant to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Provide five year manufacturer warranty for repair and replacement of materials that fail to maintain water repellency.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc., Siloxane PD or comparable product by one of the following:
      a. BASF Construction Chemicals.
      b. Pecora Corporation.
      c. Tnemec Company, Inc.
      d. Pecora Corporation.
      e. Sika Corporation.

2.2 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. VOC Content: Less than 400 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
   3. Moisture Absorption When Applied to Masonry: 80 percent minimum reduction, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
   4. Moisture Absorption When Applied to Concrete: 80 percent minimum reduction, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
   5. Moisture Absorption When Applied to Clay Brick: 80 percent minimum reducation, when tested in accordance with ASTM C67 brick sample completely coated with water repellant.
   6. Water Vapor Transmission: Comply with one or both of the following:
      a. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.
      b. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D 1653.
   7. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.
   8. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.
   9. Maintains dry appearance when wetted.
   10. Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry.
   11. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.

PART 3 EXECUTION

3.1 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.

3.2 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. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.3 APPLICATION

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

END OF SECTION

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SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, and over roof deck.
B. Batt insulation[_____] in exterior wall construction.
C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

A. Section 07 2119 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.
B. Section 07 5400 - Thermoplastic Membrane Roofing: Insulation specified as part of roofing system.

1.3 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
B. Protect foam-plastic board insulation as follows:
    1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
    2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
    3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.6 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
C. Insulation in Wall Framing Cavities: Batt insulation with no vapor retarder.
D. Insulation Over Roof Deck: Polyisocyanurate board.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation for use at perimeter foundation walls and on the underside of floor slabs: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type VI, 40 psi (276 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. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   6. Manufacturers:
      a. Dow Chemical Company.
      b. Kingspan Insulation LLC
      c. Owens Corning Corporation.
      d. DiversiFoam Products.

2.3 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: R-value of 13.
   6. Manufacturers:
      a. CertainTeed Corporation
      b. Johns Manvill
      c. Owens Corning Corporation
      d. Knauf Insulation.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

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

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

C. Clean substrate of substances that are harmvul to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.3 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Butt edges and ends tightly to adjacent boards and to protrusions.
B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.
B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
C. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.5 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.
B. Install boards horizontally on walls.
C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
D. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.6 BOARD INSTALLATION AT CONCRETE SLABS

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.
   2. Place insulation under slabs on grade after base for slab has been compacted.
C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
D. Prevent insulation from being displaced or damaged whileplacing vapor retarder and placing slab.

3.7 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.
B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.
C. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

D. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
F. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
G. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
H. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
    1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.8 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.
B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
B. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation 2020.
C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
F. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Provide record of pre-installation meeting in the form of meeting agenda and/or meeting notes. Submit record to Architect as an information submittal.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

1.5 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 work of the type specified, with minimum three years documented experience.

1.6 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

2.1 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, open or closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
   2. 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.

3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.04 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
8. Basis of Design:
   a. Icynene-Lapolla; Icynene ProSeal LE: www.icynene.com/#sle.
9. Other Acceptable Manufacturers:
   a. Accella Polyurethane Systems: www.accellapolyurethane.com/#sle.
   b. BASF Corporation: www.spf.basf.com/#sle.
   c. Henry Company; <>: www.henry.com/#sle.
   d. Johns Manville: www.jm.com/#sle.
   e. Demilec Inc.
10. Substitutions: See Section 01 6000 - Product Requirements.

2.2 ACCESSORIES

A. Primer: As required by insulation manufacturer.
B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes and ICC-ES Evaluation Report.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.
B. Verify that surfaces are clean, dry, and free of matter that are harmful to insulation and insulation adhesion.

3.2 PREPARATION

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

3.3 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 resistant R-Value as indicated in drawings.
D. Apply in multiple passes not to exceed maximum thickness as reccomended and required by manufacturer. Do not spray into rising foam.
E. Patch damaged areas.
F. Where applied to voids and gaps assure that foam has space for expansion to avoid pressure on adjacent materials that may bind operable parts.
G. Trim excess insulation away for applied trim or remove as required for continuous sealant bead.

3.4 FIELD QUALITY CONTROL

A. Inspect and verifyr that insulationand overcoat thickness and density comply with applicable building code and ICC-ES Evaluation Report.

3.5 PROTECTION

A. Do not permit subsequent construction work or harmful weather to disturb applied insulation.

END OF SECTION

SECTION 07 2500 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 2400 - Exterior Insulation and Finish Systems: Water-resistive barrier under exterior insulation.

1.3 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.4 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test 2018.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2020.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

1.5 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct at Project Site.

1.6 SUBMITTALS

A. Product Data: Provide data on material characteristics, performance criteria, and limitations.

B. Shop Drawings: Provide drawings of special joint conditions.

1.7 QUALITY ASSURANCE

A. A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

B. Air Barrier:

1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.
2. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

2.2 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened: Primer is not required on substrate materials.
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 54 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure B.
   3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 120 days of weather exposure.
   5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   6. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   7. Manufacturers:
      a. DuPont Building Innovations; Tyvek Commercial Wrap with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape.
      b. DuPont Building Innovations; Tyvek Commercial Wrap D with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape.
      c. Fiberweb, Inc; Typar MetroWrap.
      d. Fortifiber Building Systems Group; WeatherSmart Commercial: www.fortifiber.com/#sle.
      e. Kingspan Insulation LLC; GreenGuard C2000 Building Wrap: www.trustgreenguard.com/#sle.
      f. National Shelter Products, Inc; DRYLine RainDrain: www.drylinewrap.com/#sle.
      g. National Shelter Products, Inc; DRYLine W: www.drylinewrap.com/#sle.
      h. Substitutions: See Section 01 6000 - Product Requirements.

2.3 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
   2. Manufacturers:
      a. DuPont Building Innovations; FlexWrap NF: www.dupont.com/#sle.
      b. DuPont Building Innovations; StraightFlash: www.dupont.com/#sle.
      c. DuPont Building Innovations; StraightFlash VF: www.dupont.com/#sle.
      d. Fortifiber Building Systems Group; FortiFlash: www.fortifiber.com/#sle.
      e. Fortifiber Building Systems Group; FortiFlash Commercial: www.fortifiber.com/#sle.
      f. Fortifiber Building Systems Group; FortiFlex: www.fortifiber.com/#sle.
      g. Fortifiber Building Systems Group; FortiFlash Butyl: www.fortifiber.com/#sle.
      h. SIGA Cover Inc; SIGA-Wigluv: www.sigacover.com/#sle.

i. Substitutions: See Section 01 6000 - Product Requirements.

C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
1. Manufacturers:
a. BASF Corporation; MasterSeal AWB 900: www.master-builders-solutions.basf.us/#sle.
b. Master Wall Inc; SuperiorFlash: www.masterwall.com/#sle.
c. Pecora Corporation; [_____]: www.pecora.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

D. Stainless Steel Flashing: Flexible flashing with 8 mil, 0.008 inch thick sheet of Type 304 stainless steel, 8 mil, 0.008 inch of butyl adhesive and a siliconized release liner.
1. Roll Length: 50 feet long.
2. Width: 6 inch wide.
3. Overlap joints at least 2 inch.

E. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.
1. Manufacturers:
a. Dow Chemical Company; DOWSIL 778 Silicone Liquid Flashing: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
b. Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
c. Momentive Performance Materials, Inc/GE Construction Sealants; Elemax 5000 Liquid-Applied Flashing: www.siliconeforbuilding.com/#sle.
d. Parex USA, Inc; Parex USA WeatherTECH with WeatherFlash: www.parexusa.com/#sle.
e. Polyglass USA, Inc; PolyFlash 1C One Part Flashing compound: www.polyglass.us/#sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

F. Termite-Resistant Barrier Seam and Window Flashing: Peel and stick flashing membrane; polyethylene film bonded to sealant.
1. Thickness: 40 mil, 0.040 inch overall.
2. Roll Width: 4 inch.
3. Manufacturers:
a. Polyguard Barrier Systems, Inc, a division of Polyguard Products, Inc; TERM Seam and Window Barrier: www.polyguardbarriers.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

G. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
D. Mechanically Fastened Sheets - On Exterior:
    1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
    2. Overlap seams as recommended by manufacturer but at least 6 inches.
    3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
    4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
    5. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant.
    6. Install air barrier and vapor retarder UNDER jamb flashings.
    7. Install head flashings under weather barrier.
    8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
E. Coatings:
    1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
    2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
    3. Use flashing to seal to adjacent construction and to bridge joints.
F. Openings and Penetrations in Exterior Weather Barriers:
    1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
    2. At openings to be filled 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 to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
    4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather 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 weather barrier surface.

3.4 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.
B. Take digital photographs of each portion of the installation prior to covering up.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 4213 - METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels and subgirt framing assembly with related flashings and accessory components.

1.2 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.
B. Section 06 1000 - Rough Carpentry: Wall panel substrate.
C. Section 07 2100 - Thermal Insulation.
D. Section 07 2500 - Weather Barriers: Weather barrier under wall panels.
E. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.
C. Physical Samples: Submit three samples of wall panel and soffit panel, illustrating finish color, sheen, and texture.
D. Sample Manufacturer's Warranty form.
E. Sample Panel Finish Warranty form.

1.5 CLOSEOUT SUBMITTALS

A. Owner's manual and maintenance data.
B. Manufacturer's Warranty form.
C. Panel Finish Warraty form.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum seven years of documented experience.
C. Single Source Responsibility:
    1. Provide system and components for this Section under responsibility of single metal wall panel manufacturer.
    2. Perform metal panel and related flashing and sheet metal work by or under supervision of single installed.
D. Pre-Installation Conference:
    1. Attendance: Contractor, Applicator, Owner, Architect, and those specifically requested to attend.
        a. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
        b. Review methods and procedures related to aluminum metal panel installation, including manufacturer’s written instructions.
        c. Examine support conditions for compliance with requirements, including alignment between and attachment to the structural members.
        d. Review flashings, special details, wall penetrations, openings, and condition of other construction that will affect aluminum wall panels.

e. Review governing regulations and requirements for insurance, certificates, tests, and inspections as applicable.
f. Review temporary protection requirements for aluminum wall panel assembly during and after installation.
g. Review wall panel observation and repair procedures after aluminum wall panel installation.

2. Meeting Time: Minimum 3 weeks prior to commencement of work covered by this Section and related work affecting work covered by this Section.
3. Location: Project Site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing plastic shipping wrap.
B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
C. Prevent contact with materials that may cause discoloration, galvanization, or staining of products.

1.8 WARRANTY

A. Correct defective work within a [____] year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
B. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.1 PERFORMACE REQUIREMENTS

A. Air Penetration: When tested per ASTM E-283 @ 6.24 PSF the air penetration shall be .005 or less when tested in accordance here.
B. Water Penetration: When tested per ASTM E-331 @ 12.48 PSF for the 15 minute test period, the water penetration shall be none.
C. Dynamic Water Penetration: When tested per AAMA 501 @ 15 PSF, the water penetration shall be none.
D. Structural Performance: When tested per ASTM E 1592, withstand the effects of wind loads and deflection limits of the span as indicated on the drawings.
E. Negative Load Testing per ASTM E-330: The panel shall have been tested per ASTM E-330 to show negative wind uplifts at spans of 1’0” through 4’0” spans, both double and triple spans and the Manufacturer shall provide a Negative Wind Uplift Table for this panel at the above-listed spans, with current 2.0 Safety Factor as per IBC current code and 1.65 Safety Factor as per US Corps of Engineer

2.2 PANEL DESIGN

A. Basis-of-Design: Subject to compliance with requirements, provide products manufactured by **Peterson Aluminum Corporation, PAC Precision Series Box Rib 1** or equal approvied by Architect prior to bid date:
1. Provide factory-formed wall panels that shall be concealed attachment in nominal 12" width with 1 3/8" high panel corrugations that are mechanically attached to wall supports and do not have any exposed fasteners on the panel face for attachment to the wall supports. Panels can be specified with extended fastening leg.
2. Color: Selected by Architect from Manufacturer standard range.

2.3 MATERIAL AND FINISHES

A. Preformed metal panels shall be fabricated of .040" thick prime aluminum.

B. Finish shall be Kynar 500 or Hylar 5000 Flurocarbon coating with a top side film thickness of 0.70 to 0.90 mil over 0.25 to 0.31 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

C. Field protection must be provided by the Contractor at the job site so material is not exposed to weather and moisture.

D. Forming: use continuous and rolling method. No “portable rollforming” machines will be permitted on this project; no installer-owned or installer-rented machines shall be permitted. It is the intent of the Architect to provide Factory-Manufactured wall panel systems only for this project.

E. Trim: Trim shall be fabricated of the same material and finish to match the profiled sheeting and press broken in lengths of 10 – 12 feet. Trim shall be formed only by the manufacturer or their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.

F. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the wall panel system.

G. Exposed fasteners shall not restrict free movement of the wall panel system resulting from thermal forces, except at designed points of wall panel fixity. May require the use of PAC factory clips to alleviate thermal movement for panels over 20’ in length. Consult PAC factory on use of wall panel clips.

H. Closures: Use composition or metal profiled closures at top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.

I. Fasteners: Fasteners shall be galvanized steel, dished washers,galvanized steel with bonded neoprene.

J. Zees: Where required by design of primary structural framing system shall be used to span between beams and/or joists.

K. Sealants:
   1. Provide two part polysulfide class “B” non-sag type for vertical and horizontal joints, brand name: NP-1. Geocell 2300, Weathermaster “Titebond” or similar performing caulking.
   2. One part polysulfide not containing pitch or phenolic extenders, or;
   3. Exterior grade silicone sealant recommended by roofing manufacturer, or;
   4. One part non-sag, gun grade, exterior type polyurethane recommended by roofing manufacturer.

2.4 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown and, if not shown, provide manufacturer's standard product fabrication.

B. Fabricate components of the system in factory, ready for field assembly.

C. Fabricate components and assemble units to comply with fire and performance requirements specified.

D. Apply specified finishes in conformance with manufacturer's standards, and according to manufacturer's instructions.

2.5 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
B. Concealed Sealants: Non-curing butyl sealant or tape sealant.
C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
    1. Concealed Sheet Metal Fasteners: Panhead, self-drilling, self-tapping, non-corrosive fasteners, as instructed by panel manufacturer.
    2. Fastener Lengths: Penetrate cold-formed metal framing and subgirts, and other metal framing systems in accordance with the fastener manufacturer's recommendations.
D. Subgirts:
    1. Provide G90 galvanized steel of gauge and spacing required to comply with metal wall panel system's structural requirements as recommended by the panel manufacturer and engineer of record in accordance with approved shop drawings.
    2. To avoid galvanic reaction, separate dissimilar materials.
E. Flashings:
    1. Metal Flashing, Fascias, and Trim:
    2. 0.040 inch minimum thickness.
        a. Material, color, and finish to match adjacent wall panels.
        b. Conform to provisions of Section 07 60 00.
    3. Provide custom metal flashing shapes to suit conditions for watertight installation.
    4. Panel and Flashing Closures: Waterproof, semi-rigid, polyethylene closed cell foam, or solid rubber in size and shape to ensure snug fit to panel configuration.
    5. Cutting and Fitting:
        a. Make all cuts neat, square, and true.
        b. Saw-cut panels, de-burr edges, and clean filings from adjacent surfaces.
F. Field Touch-up Paint: As recommended and required by panel manufacturer and complying with metal wall panel warranty.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building framing members are ready to receive panels.
B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

3.2 PREPARATION

3.3 INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.
B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
C. Fasten panels to structural supports; aligned, level, and plumb.
D. Provide expansion joints where indicated. If not indicated, coordinate joint location with Architect.
E. Seal and place gaskets to prevent weather penetration. Maintain neat finish appearance and functional weather penetration prevention.

3.4 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

3.5 CLEANING

A. Remove site cuttings from finish surfaces.
B. Remove protective material from wall panel surfaces.
C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

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SECTION 07 5400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanically attached system with thermoplastic roofing membrane.
B. Insulation, flat and tapered.
C. Cover boards.
D. Flashings.
E. Roofing stack boots, roofing expansion joints, and walkway pads.

1.2 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets and [_____].
C. Section 07 7200 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.3 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2020.
B. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method 1983 (Reapproved 2018).
C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing 2019.
D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
E. FM (AG) - FM Approval Guide current edition.
F. FM DS 1-28 - Wind Design 2016.
G. NRCA (RM) - The NRCA Roofing Manual 2019.
H. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
    1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, and fasteners.
C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
D. Manufacturer's Qualification Statement.
E. Installer's Qualification Statement.
F. Warranty Documentation:
    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 warranty conditions for waterproof membrane.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
B. Store materials in weather protected environment, clear of ground and moisture.
C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
D. Protect foam insulation from direct exposure to sunlight.

1.9 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.
B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.
C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
   1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com/#sle.
   2. Firestone Building Products, LLC; UltraPly 60 mil: www.firestonebpco.com.
   3. GAF; EverGuard TPO60 mil: www.gaf.com/#sle.
   4. Johns Manville; 60 mil: www.jm.com/#sle.
   5. Versico, a division of Carlisle Construction Materials Inc; VersiWeld TPO: www.versico.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.2 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 60 mil, 0.060 inch, minimum plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
   2. Thickness: 0.060 inch, minimum (60 mils).
   3. Sheet Width: Factory fabricated into largest sheets possible.
   4. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.

5. Solar Reflectance: 0.79, minimum [0.84, minimum Reflexeon white], when tested in accordance with ASTM C 1549.
6. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

D. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.

E. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent.
2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
5. Color: Same as field membrane.

F. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal.

G. Flexible Flashing Material: Same material as membrane.

H. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing.

I. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

J. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick.

K. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed.

L. General Purpose Sealant: EPDM-based, one part, white general purpose sealant.

M. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.

2.3 COVER BOARDS

A. Cover Boards: High Density Polyisocyanurate Cover Board:
1. Thickness: 0.5 inch (12.7mm).
2. R-Value: 2.5 based on ASTM tests C158 and C177.
   a. Attachment: Mechanical through fastening.
3. Surface Water Absorption: <3%, maximum, when tested in accordance with ASTM C 209.
4. Compressive Strength: 120psi, when tested in accordance with ASTM 1621.
5. Density: 5pcf, when tested in accordance with ASTM 1622.
6. Mold Growth Resistance: Passed, when tested in accordance with ASTM D 3273.

2.4 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:
   a. Type II:
      1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.

2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.

2. Board Size: 48 by 96 inch.
3. Board Thickness: 5.25 inch, minimum.
4. Tapered Board: Slope as indicated; minimum thickness 1/4 inch; fabricate of fewest layers possible.
5. Board Edges: Square.

2.5 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
C. Membrane Adhesive: As recommended by membrane manufacturer.
D. Insulation Adhesive: As recommended by insulation manufacturer.
E. Sealants: As recommended by membrane manufacturer.
F. Yellow Safety Strip: To designate areas of caution on the roof or around rooftop objects. 5.5 inches wide (140 mm) by 100 feet long (30 m) strip and nominal 30 mil (0.76 mm) thick yellow TPO membrane laminated to a white, cured, seam tape.
G. Walkway Pads: : Non-reinforced TPO walkway pads, 0.130 inch (3 mm) by 30 inches (760 mm) by 40 feet (12.19 m) long with patterned traffic bearing surface.
1. Composition: Roofing membrane manufacturer's standard.
2. Surface Color: White or yellow.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION - CONCRETE DECK

A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch in height. Verify grout keys are filled flush.
B. Fill surface honeycomb and variations with latex filler.
C. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.
1. Test as Follows:
a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.
b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.3 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
B. Do not apply roofing membrane during cold or wet weather conditions.
C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.4 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation:
   1. Mechanically fastenfirst layer of insulation to deck in accordance with roofing manufacturer's instructionsand Factory Mutual requirements.
   2. Embed second layer of insulation into full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.
B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
C. Lay subsequent layers of insulation with joints staggered minimum 12 inch 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. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches.
H. Do not install more insulation than can be covered with membrane in same day.

3.5 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
B. Shingle joints on sloped substrate in direction of drainage.
C. Fully Adhered Application: Apply adhesive to substrate at rate of 0.02 gal/sq ft. 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. Install uniform bead of sealant to joint edge.
E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 12 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.
   4. Insert flashing into reglets and secure.
F. Around roof penetrations, seal flanges and flashings with flexible flashing.
G. Install roofing expansion joints where indicated. Make joints watertight.
   1. Install prefabricated joint components in accordance with manufacturer's instructions.
H. Coordinate installation of roof drains and sumps and related flashings.

3.6 FINISHING SURFACES

A. Install walkway pads. Space pad joints to permit drainage.

3.7 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.8 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 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
F. CDA A4050 - Copper in Architecture - Handbook current edition.
G. NRCA (RM) - The NRCA Roofing Manual 2019.
H. NRCA (WM) - The NRCA Waterproofing Manual 2005.
I. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
B. Samples: Submit two samples illustrating metal finish color.

1.5 CLOSEOUT

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years ofdocumented experience.

1.7 WARRANTY

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

1.8 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 18 gage, 0.0403 inch thick; plain finish shop pre-coated with modified silicone coating.
    1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
    2. Color: As indicated on drawings.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
G. Fabricate flashings to allow toe to extend 4 inches over roofing substrate. Return and brake edges.

2.3 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.
B. Downspouts: Rectangular profile.
C. Gutters and Downspouts: Sizes indicated.
D. Accessories: Profiled to suit gutters and downspouts.
    1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
    2. Gutter Supports: Straps.
    3. Downspout Supports: Brackets.
E. Downspout Extenders: Same material and finish as downspouts.
F. Seal metal joints.

2.4 METAL ROOF EDGING AND FASCIA

A. Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
    1. Wind Performance:
        a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
        b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
        c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
    2. Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia.
    3. Fascia Face Height:Indicated on Drawings.
    4. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
    5. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
    6. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
    7. Anchor Bar Cleat: 20 gage, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
    8. Curved Applications: Factory modified.
    9. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
    10. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.

11. Scuppers: Welded watertight.
12. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings

2.5 PARAPET COPINGS

A. Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
1. Wind Performance:
2. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
a. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
3. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
4. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
5. Dimensions:
a. Wall Width: As indicated on the drawings.
b. Piece Length: Minimum 144 inches (3650 mm).
6. Anchor/Support Cleats: 20 gage, 0.036 inch (0.9 mm) thick prepunched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72 inches (1820 mm) on center.
7. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm) long legs on corner, intersection, and end pieces.
8. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners

2.6 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal.
B. Primer: Zinc chromate type.
C. Concealed Sealants: Non-curing butyl sealant.
D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
E. Plastic Cement: ASTM D4586/D4586M, Type I.
F. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
C. Apply plastic cement compound between metal flashings and felt flashings.
D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
E. Seal metal joints watertight.
F. Secure gutters and downspouts in place with concealed fasteners.
G. Slope gutters 1/8 inch per 10 feet, minimum.
H. Connect downspouts to downspout boots, and seal connection watertight.
I. Install work per SMACNA (ASMM), NRCA (RM), and NRCA (WM).

END OF SECTION

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment curbs.
B. Equipment rails.
C. Roof penetrations mounting curbs.
D. Roof ladders.

1.2 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.
B. Section 07 7100 - Roof Specialties: Other manufactured roof items.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
D. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used.
    1. Preparation instructions and recommendations.
    2. Storage and handling requirements and recommendations.
    3. Installation methods.
B. Closeout
    1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
C. Warranty Documentation:
    1. Submit manufacturer warranty.
    2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
    3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store products under cover and elevated above grade.

1.6 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
    1. AES Industries Inc.
    2. The Pate Company
    3. LMCurbs
    4. Roof Products & Systems (RPS)

B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
   2. Sheet Metal Material:
      a. Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G90 coating designation; 18 gage, 0.048 inch thick.
   3. Provide layouts and configurations indicated on drawings.

C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
   1. Provide preservative treated wood nailers along top of curb.
   2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
   3. Height Above Finished Roof Surface: 12 inches minimum.

D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
   1. Provide preservative treated wood nailers along top of rails.
   2. Height Above Finished Roof Surface: 12 inches minimum.

E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.
   1. Provide preservative treated wood nailers over entire top surface, for supports that are provided by others.
   2. Height Above Finished Roof Surface: 12 inches minimum.
   3. Style: Provide flat metal covers unless otherwise indicated.
   4. Thermally Broken Hatches: Added insulation to frame and cover; available in each manufacturer's standard, single leaf sizes; special sizes available upon request
   5. For Ladder Access: Single leaf; 30 by 36 inches.
   6. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   7. Hinges: Heavy duty pintle type.
   8. Hold open arm with vinyl-coated handle for manual release.
   9. Latch: Upon closing, engage latch automatically and reset manual release.
   10. Manual Release: Pull handle on interior.
   11. Locking: Padlock hasp on interior.

2.2 ROOF LADDER: FIXED ACCESS

A. General:
   1. Structural Performance of Aluminum Ladders: Ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3, except for elevator pit ladders.
   2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   3. Landing Platforms: Required at 50 ft. (15 240 mm) above bottom of ladder.

B. Schedule of Ladders:

1. Exterior Roof Access Ladders - Basis-of-Design Product: Subject to compliance with requirements, provide O'Keeffe's Inc.; **Model 503/A** or comparable product by one of the following or approved equal by Architect:
   a. Precision Ladders, LLC.

C. Materials:
1. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18-3/8 inches (467 mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides. Rungs shall withstand 1,500 lb (454 kg) load without deformation or failure.
2. ANSI A14.3 and ASME A17.1/CSA B44 minimum spacing is 16 inches (406 mm).
3. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
4. Heavy-Duty Tubular Side Rails: Assembled from two interlocking extensions no less than 1/8-inch (3-mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners; full-penetration TIG welds; and clean, smooth, and burr-free surfaces.
5. Walk-Through Rail and Roof Extension: Not less than 3 ft.-6 inches (1067 mm) above the landing and fitted with deeply serrated, square, tubular grab rails.
6. Landing Platform: 1-1/2 inch (38 mm) or greater diameter, tubular aluminum guard rails, and decks of serrated aluminum treads.

2.3 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
1. Design Loadings and Configurations: As required by applicable codes.
2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
6. Manufacturers:
   a. PHP Systems/Design.
   b. Portals Plus.

B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
2. See relevant piping system specification section for additional requirements.

C. Duct Supports: Provide extruded aluminum supports and sized in accordance with diameter of supported ducts, and with base that is non-penetrating of roofing membrane.

D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
1. Bases: High density polypropylene.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.3 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
C. 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 2013 (Reapproved 2017).
D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
E. ITS (DIR) - Directory of Listed Products current edition.
F. FM (AG) - FM Approval Guide current edition.
G. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
I. UL (DIR) - Online Certifications Directory Current Edition.
J. UL (FRD) - Fire Resistance Directory Current Edition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.5 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the specified 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. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.
   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.

1.7 FIELD CONDITIONS

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

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Firestopping Manufacturers: Subject to compliance with requirements provide products by one of the following:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. A/D Fire Protection Systems Inc: www.adfire.com.
   3. Hilti, Inc: www.us.hilti.com.
   4. Specified Technologies Inc: www.stifirestop.com.
   5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
   6. Thermafiber, Inc.: wwwthermafiber.com..

2.2 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed. Refer to drawings for fire-resistance ratings.

2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall 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 floor or wall, whichever is greater.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

B. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

C. 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.
   1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.4 FIRESTOPPING SYSTEMS

A. Firestopping: Penetrations in Fire-Resistance-Rated Walls.
   1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating equal to fire rating of penetrated assembly andminimum T Rating Equal to F Rating and in compliance with other specified requirements.

B. Firestopping: Penetrations in Horizontal Assemblies.
   1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating of at least one hour, but not less than the fire rating of penetrated assembly andminimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

B. Remove incompatible materials that could adversely affect bond.

3.3 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.

3.4 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestopping sealants.
B. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
C. Section 08 8000 - Glazing: Glazing sealants and accessories.
D. Section 09 2216 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.
E. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.3 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.
B. ASTM C834 - Standard Specification for Latex Sealants 2017.
C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2018.
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.
G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2014.
H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).
I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation conference: Conduct conference at Project Site.

1.5 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
    1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
    2. List of backing materials approved for use with the specific product.
    3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
    4. Substrates the product should not be used on.
    5. Substrates for which use of primer is required.
    6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
    7. Sample product warranty.
B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

1.6 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 the work of this section and with at least three years of documented experience.

1.7 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Dow Chemical Company; [_____]: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Hilti, Inc; [_____]: www.us.hilti.com/#sle.
   3. Master Builders Solutions by BASF; [_____]: www.master-builders-solutions.basf.us/en-us/#sle.
   4. Pecora Corporation; [_____]: www.pecora.com/#sle.
   5. Sherwin-Williams Company; [_____]: www.sherwin-williams.com/#sle.
   6. Sika Corporation; [_____]: www.usa-sika.com/#sle.
   7. Tremco Commercial Sealants & Waterproofing; [____]: www.tremcosealants.com/#sle.
   8. W.R. Meadows, Inc; [_____]: www.wrmeadows.com/#sle.
   9. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. Dow Chemical Company; [_____]: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Master Builders Solutions by BASF; [_____]: www.master-builders-solutions.basf.us/en-us/#sle.
   3. Pecora Corporation; [_____]: www.pecora.com/#sle.
   4. Sika Corporation; [_____]: www.usa-sika.com/#sle.
   5. Tremco Commercial Sealants & Waterproofing; [____]: www.tremcosealants.com/#sle.
   6. W.R. Meadows, Inc; [_____]: www.wrmeadows.com/#sle.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.2 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.

e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. Other joints indicated below.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

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. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
7. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.3 JOINT SEALANTS - GENERAL

A. Colors: As selected by Architect from manufacturer's full range.

2.4 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses NT; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
5. Color: To be selected by Architect from manufacturer's standard range.
6. Cure Type: Single-component, neutral moisture curing.
7. Service Temperature Range: minus 55 to 250 degrees F degrees F.

8. Basis of Design Product: Subject to compliance with requirements, provide Dow Corning Corporation 790 Silicone Building Sealant or comparable product by one of the following:
    a. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction.
    b. Pecora Corporation; <>: www.pecora.com/#sle.
    c. Sika Corporation; Sikasil WS-290: www.usa-sika.com.
    d. Sika Corporation; Sikasil 728NS: www.usa-sika.com/#sle.
    e. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
    f. Tremco Commercial Sealants & Waterproofing; Tremsil 200: www.tremcosealants.com/#sle.
    g. GE Construction Sealants SCS2700 SilPruf LM.
    h. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 1 or comparable product by one of the following:
    a. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
    b. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com/#sle.
    c. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
    d. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
    e. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
    f. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses A, M, T and NT; 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 25 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 2 or comparable product by one of the following:
    a. Sika Corporation: www.usa-sika.com.
    b. Pecora Corporation: www.pecora.com..
    c. Substitutions: See Section 01 6000 - Product Requirements.

D. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.

E. Epoxy Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Hardness Range: 65 to 75, Shore A, when tested in accordance with ASTM C661.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 40 to 180 degrees F.

F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
   3. Manufacturers:
      a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com/#sle.
      b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: www.us.hilti.com/#sle.
      c. Pecora Corporation; <>: www.pecora.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
      e. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke & Sound: www.tremcosealants.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke & Sound Spray: www.tremcosealants.com/#sle.
      g. Substitutions: See Section 01 6000 - Product Requirements.

G. Butyl Sealant: Rubber-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
   1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 13 to 180 degrees F.
   4. Basis of Design Product: Subject to compliance with requirements, provide Pecora Corporation; BC-158 or comparable product by one of the following:
      a. Bostik, Inc.: www.bostik.com..

2.5 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or 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. Color: Gray.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers:
      a. Pecora Corporation; <>: www.pecora.com/#sle.
      b. The QUIKRETE Companies; QUIKRETE® Polyurethane Self-Leveling Sealant: www.quikrete.com/#sle.
      c. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.
      d. Sika Corporation; Sikaflex-2c SL: www.usa-sika.com/#sle.
      e. Substitutions: See Section 01 6000 - 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. Color: To be selected by Architect from manufacturer's standard range.
4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
5. Manufacturers:
   a. Tremco Commercial Sealants & Waterproofing; THC-901: www.tremcosealants.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

C. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.

D. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
1. Manufacturers:
   a. DAP Products Inc; DRAFTSTOP 812 Foam: www.dapspecline.com/#sle.
   b. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam: www.tremcosealants.com/#sle.
   c. Substitutions: See Section 01 6000 - Product Requirements.

E. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multi-component, 100 percent solids by weight.
2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch.
5. Joint Width, Maximum: 1/4 inch.
6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
7. Manufacturers:
   a. Dayton Superior Corporation; [_____]: www.daytonsuperior.com/#sle.
   b. Euclid Chemical Company; EUCO 700: www.euclidchemical.com/#sle.
   c. Nox-Crete; DynaFlex 502: www.nox-crete.com/#sle.
   d. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.

2.6 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
2. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal 920 & 921 or comparable product by one of the following:
   a. Nomaco, Inc: www.nomaco.com.
   b. Adfast Corporation: www.adfastcorp.com..
   c. Alcot Plastics, Ltd.: www.alcotplastics.com

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.
D. 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.
E. Install bond breaker backing tape where backer rod cannot be used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
G. 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.
H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

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SECTION 07 9513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion joint cover assemblies for wall and ceiling surfaces.

1.2 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.
D. ITS (DIR) - Directory of Listed Products current edition.
E. UL (DIR) - Online Certifications Directory Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.4 SUBMITTALS

A. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish, and [_____].
B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, anchorage locations, and [_____].
C. Samples: Submit two samples [____] inch long, illustrating profile, dimension, color, and finish selected.
D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.
E. Expansion Joint Schedule: Prepared by or under the supervision of the supplier. Include the follwing information in tabular form:
    1. Manufacturer and model number for each expansion joint cover assembly.
    2. Expansion joint cover assembly cross-referenced to Drawings.
    3. Nominal, minimum, and maximum joint width.
    4. Movement direction.
    5. Materials, colors, and finishes.
    6. Product options.
    7. Fire-resistance ratings as applicable.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 for additional provisions.

1.5 CLOSEOUT SUBMTITALS

A. Owner's Manuals and Maintenance Instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
    1. BASF Corporation - Watson Bowman Acme Corporation
    2. BASF Watson Bowman Acme Corporation; [_____]: www.wbacorp.com/#sle.
    3. Construction Specialties, Inc; [_____]: www.c-sgroup.com/#sle.
    4. Inpro.
    5. Nystrom, Inc..

2.2 EXPANSION JOINT COVER ASSEMBLY

A. Interior Non-Fire-Rated Wall Joint Subject to Seismic Movement:
   1. Joint coverplate systems shall permit daily thermal expansion and contraction of building elements, minor foundation settlement, and common windsway movements of the structure without disengagement.
      a. Joint system details shall clearly indicate X-axis joint movement capabilities (horizontal contraction/ expansion). Y-axis joint movement (in-plane shear), and Z-axis movement (vertical shear) may be requested of the Manufacturer if applicable.
      b. Movement capabilities shall be clearly defined as a percentage of the nominal joint width or with distinct dimensions defined on product details.
   2. Joint Systems shall allow for seismic movement (if applicable), matching requirements as defined within the Project Specific Structural Specifications.
   3. Fire Rated Assemblies shall be tested by registered Third Party Testing Agencies in accordance with UL2079, ULC S115, or BS 476 classified systems. Expansion joint assembly fire rating shall match or exceed the fire rating of adjacent construction.
   4. Basis-of-Design Product: Subject to compliance with requirements, provide **Inpro 118 Series** or equal product approved by Architect.
      a. Single Flat Seal joint systems:
         1) Recessed and Surface Mount framing systems.
         2) Joint range applications 1-3” [25-75mm].
         3) Joint operating range 25%+- of total nominal joint width.
         4) New and existing construction applications.
         5) Flat Santoprene Seal traits:
            a) Dual durometer extruded Santoprene with Shore Hardnesses of 60 Shore A and 40 Shore D to ensure longevity of installation. Single durometer seals shall not be allowed.
            b) Flat seal must maintain inherent dimensional stability and include structural spine inserts (where applicable) allowing for additional load resistance.
         6) Recessed/ Flush system 118 Series.

B. Interior Non-Fire-Rated Ceiling Joint Subject to Seismic Movement:
   1. Joint coverplate systems shall permit daily thermal expansion and contraction of building elements, minor foundation settlement, and common windsway movements of the structure without disengagement.
      a. Joint system details shall clearly indicate X-axis joint movement capabilities (horizontal contraction/ expansion). Y-axis joint movement (in-plane shear), and Z-axis movement (vertical shear) may be requested of the Manufacturer if applicable.
      b. Movement capabilities shall be clearly defined as a percentage of the nominal joint width or with distinct dimensions defined on product details.
   2. Joint Systems shall allow for seismic movement (if applicable), matching requirements as defined within the Project Specific Structural Specifications.
   3. Fire Rated Assemblies shall be tested by registered Third Party Testing Agencies in accordance with UL2079, ULC S115, or BS 476 classified systems. Expansion joint assembly fire rating shall match or exceed the fire rating of adjacent construction.
   4. Basis-of-Design Product: Subject to compliance with requirements, provide **Inpro 611 Series** or equal product approved by Architect.
      a. Pleated Seal joint systems:
         1) Recessed and Surface Mount framing systems.

2) Joint range applications 1-3” [25-75mm].
3) Joint operating range 25%+- of total nominal joint width.
4) New and existing construction applications.
5) Pleated Santoprene Seal traits:
a)
Overall seal bellows depth requires 5/8" in order to maintain inherent stability and linear lines after application.
b) Seal wall thickness not less than 1/8" for high abrasion resistance.
6) Recessed/ Flush system 611 Series.

C. Exterior Wall Joints Subject Movement:
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Inpro 611 Series** or equal product approved by Architect.
a. Pleated Seal system:
1) Standard Nominal Joint applications 2-24” [50-600mm].
2) Joint operating range 50%+- of total nominal joint width.
3) Integral flexible moisture barrier membrane. 2 ply reinforced EPDM 45 mil thk membrane with nylon mesh reinforcing element.
4) New and existing construction applications.
5) Pleated Santoprene Seal traits:
a) Overall seal bellows depth requires 5/8” [15.875 mm]. in order to maintain inherent stability and linear lines after installation.
b) Seal Wall thickness not less than 1/8” [3.175 mm] for high abrasion resistance.
c) Seal profile requires alignment pin holes to aid in heatwelded seam alignment.
d) Seal durometer of 70 shore A.
e) No EPDM or Neoprene substitutions allowed.
f) Manufacturer must carry a color range of a minimum of (6) six standard color options. Custom seal colors must be available upon request.
6) Recessed/ Flush system 611 Series.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
1. Exposed Finish Outdoors: Natural anodized.
2. Exposed Finish at Floors: Mill finish or natural anodized.
3. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
2. For Pedestrian Traffic Applications: EPDM rubber, Neoprene, or Santoprene; no PVC; Shore A hardness of 40 to 50 Durometer.
3. Color: Gray.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

E. Threaded Fasteners: Aluminum.

F. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.
G. Nonmetallic, shrinkage-resistant grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide as indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.2 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.
B. Repair or grout block cores as required for continuous frame support using non-metallic, shrinkage resistant grout.
C. Align work plumb and level, flush with adjacent surfaces.
D. Rigidly anchor to substrate to prevent misalignment.
E. Install frames in continuous contact with adjacent surfaces. The use of shims is not permitted.
F. Install with hairline mitered corners where expansion joint cover assemblies change direction.
G. Terminate exposed ends of expansion joint cover assemblies with factory-fabricated termination devices when offered by manufacturer. Terminate exposed ends with field-fabricated if manufacturer does not offer termination devices.

3.3 CONNECTIONS

A. Transition Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with reoof expansion joint covers as applicable. Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joist cover assemblies.

3.4 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.
B. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.
C. Fire-rated hollow metal doors and frames.
D. Tornado-resistant hollow metal doors and frames.

1.2 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
C. Section 09 9113 - Exterior Painting: Field painting.
D. Section 09 9123 - Interior Painting: Field painting.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anhorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation
B. Coordinate requirements for installation of door hardware, electricified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.
B. ASCE: American Society of Civil Engineers.
C. HMMA: Hollow Metal Manufacturers Association.
D. NAAMM: National Association of Architectural Metal Manufacturers.
E. NFPA: National Fire Protection Association.
F. SDI: Steel Door Institute.
G. UL: Underwriters Laboratories.

1.6 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (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 2011.
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
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 2020.
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 2018a.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
K. FEMA P-361 - Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms 2015.
L. ICC 500 - ICC/NSSA Standard for the Design and Construction of Storm Shelters; National Storm Shelter Association 2014.
M. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
P. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
S. UL (DIR) - Online Certifications Directory Current Edition.
T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.7 SUBMITTALS

A. See Section 01 3000 - 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 standards/guidelines.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on the Drawings. Coordiante with final door hardware schedule.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
    1. Provide additional protection to prevent damage to factory-finished units.
B. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
C. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
D. Deliver welded frames with two removeable spreader bars across the bottom of frames, tack welded to jambs and mullions.
E. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
    2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
    3. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com.
    4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.

5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
6. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

B. Steel Sheet: Comply with one or more of the following requirements; galvannealed 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. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ATM E 136 for combustion characteristics.

F. Accessibility: Comply with ICC A117.1 and ADA Standards.

G. Fire-Rated Assemblies: Comply with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicted, based on testing at positive pressure according to NFPA 252 or UL 10C.

H. Door Edge Profile: Manufacturers standard for application indicated.

I. Typical Door Face Sheets: Flush.

J. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

K. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.

L. Construct hollow-metal doors and frames to comply with standards indictated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

M. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    e. Zinc Coating: A 40 /ZF 120 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of

450 in accordance with ASTM E84, and completely enclosed within interior of door.

3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
4. Door Thickness: 1-3/4 inch, nominal.
5. Top Closures: Flush with top of faces and edges.
6. Door Face Sheets: Flush.
7. Weatherstripping: Refer to Section 08 7100.
8. Door Type & Finish: As indicated in Door and Frame Schedule.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
2. Fire Rating: As indicated on drawings, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR).
   a. Attach fire rating label to each fire rated unit.
4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Door Thickness: 1-3/4 inch, nominal.
6. Door Face Sheets: Flush.
7. Door Type & Finish: As indicated in Door and Frame Schedule.

D. Type As indicated on Drawings , Tornado-Resistant Doors:
1. Design and size door and frame components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M.
   a. Design Wind Loads: Comply with requirements of authorities having jurisdiction.
   b. Wind-Borne Debris Resistance: Door and frame components shall have FLA (PAD) approval or UL (DIR) approval for Large and Small Missile impact and pressure cycling at design wind loads.
2. Tornado Shelter Application: Comply with ICC 500 standard.
   a. Commercial: Designed and tested to comply with FEMA P-361 community shelter door assembly guidelines.
3. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
4. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
5. Door Thickness: 1-3/4 inch, nominal.
6. Door Face Sheets: Flush.
7. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Factory primed and field finished indicated in Drawings.
C. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   3. Weatherstripping: Separate, see Section 08 7100.
D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
E. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
F. Tornado-Resistant Door Frames: With same tornado resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
   1. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   2. Frame Finish: Factory primed and field finished.
G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
H. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.
I. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
J. Transom Bars: Fixed, of profile same as jamb and head.
K. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
L. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.5 FRAME ANCHORS

A. Frame Anchors: ASTM A879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet comply with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.
B. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24-inches of frame height above 7-feet.
   3. Post-installed Expansion Anchor: Minimum 3/8-inch diameter bolts with expansion shield or inserts, with manufacturer's standard pipe spacer.
C. Floor Anchors: Provide floor anchors for each jamb and mullion that extend to floor.

2.6 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.7 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
C. Astragals for Double Doors: Specified in Section 08 7100.
D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
E. 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.
F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restor exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
B. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
C. Drill and tap doors and frames to receive mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. Install doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
B. Install fire rated units in accordance with NFPA 80.
C. Coordinate frame anchor placement with wall construction.
D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
E. Install door hardware as specified in Section 08 7100.
F. Comply with glazing installation requirements of Section 08 8000.
G. Coordinate installation of electrical connections to electrical hardware items.
H. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Hollow-Metal Frames:
   1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.
   2. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   3. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
   4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.
B. Hollow-Metal Doors:
   1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8 or NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.6 CLEANING AND TOUCH-UP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

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SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flushand flush glazed configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.
B. Section 08 7100 - Door Hardware.
C. Section 08 8000 - Glazing.

1.3 REFERENCE STANDARDS

A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
B. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

1.4 SUBMITTALS

A. See Section 01 3000 - 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 glazing and other details.
D. Samples: For factory-finished veneers.
E. Warranty, executed in Owner's name.

1.5 CLOSEOUT SUBMITTALS

A. Owner's Manual and Maintenance Data.
B. Manufacturer's Warranty Form.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.
B. Accept doors on site in manufacturer's packaging, and inspect for damage.
C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.
D. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
    1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide product indicated in Drawings; or a comparable product by one of the following:
    1. Eggers Industries; <>
    2. Graham Wood Doors
    3. Marshfield DoorSystems, Inc; [____]
    4. VT Industries.
    5. OshKosh Door Company.

2.2 DOORS

A. Doors: See drawings for locations and additional requirements.
   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. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) labeledwithout any visible seals when door is closed.
   3. Wood veneer facing with factory transparent finishas indicated on drawings.

2.3 DOOR CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: As indicated in Drawings, HPVA Grade A, plain sliced (flat cut), with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
   1. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
   2. Transoms: Continuous match to doors.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

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.

2.6 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 indicated on Drawings.
      c. Sheen: Satin.
      d. Grade: Premium.
      e. Effect: Open-grain finish.

B. Factory finish doors in accordance with approved sample.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 1113.

B. Glazing: See Section 08 8000.

C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink styletamper proof screws.

D. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
D. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and hav been installed with level heads and plumb jambs.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Use machine tools to cut or drill for hardware.
D. Coordinate installation of doors with installation of frames and hardware.
E. Coordinate installation of glazing.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.
B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
B. Adjust closers for full closure.
C. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired ar refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for swinging doors.
2. Electrified door hardware.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Details of electrified door hardware.

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

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    b. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

F. Keying Conference: Conduct conference at Owner’s designated site to coordinate Owner’s keying requirements. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Delivery of keys and permanent cores.

1.4 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

B. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

C. Continuous, Gear-Type Hinges: 6063-T6 Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
2. Provide aluminum geared continuous hinges with factory fabricated cut outs for electrified power transfer where specified.

D. Basis-of-Design Products: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; Allegion, PLC, (IVE) or a comparable product by:

1. Hager Companies. (HAG)
2. McKinney Products Company; an ASSA ABLOY Group company. (MCK)
3. Stanley Commercial Hardware; Div. of The Stanley Works. (STA)

2.3 ELECTRIC POWER TRANSFER

A. Manufacturer: Subject to compliance with requirements, provide scheduled product manufactured by Von Duprin; Allegion, PLC, (VON)

B. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.

C. Locate electric power transfer per manufacturer's template and UL requirements.

2.4 MECHANICAL LOCKS AND LATCHES

A. Bored Locks: BHMA A156.2; Grade 1; Series 4000, except tested to exceed 3,000,000 cycles.

B. Product: Subject to compliance with requirements, provide scheduled products manufactured by Schlage Commercial Lock Division; Allegion, PLC (SCH).
1. Substitutions by approval request.

C. Requirements:

1. Latchbolt: Steel with minimum ½" throw deadlatch on keyed and exterior functions; ¾" throw anti-friction latchbolt on pairs of doors.
2. Strikes: Provide manufacturer's standard strike, ANSI curved lip, 1 ¼" x 4 7/8", 16 gauge, with 1" deep box construction, for each lock bolt or latchbolt.

2.5 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Product: Provide extension of current (Schlage) district masterkey system, conventional or interchangeable as required to match existing.

2. Provide construction keying during construction phase. After final cylinders are installed, construction cylinders are to be returned to hardware supplier.

2.6 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Match owner's existing keying, and incorporate decisions made in keying conference.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1; except with extended cycle performance testing certified for minimum 8,000,000 cycles; listed by UL for accident and hazard; and conforming to applicable requirements of NFPA 80 and NFPA 101.

1. Product: Subject to compliance with requirements, provide scheduled products manufactured by Von Duprin; Allegion, PLC. (VON)
   a. Substitutions by approval request.

2. Requirements:

   a. Internal springs: Coil compression type
   b. Provide security dead latching for active latch bolts
   c. Latch Bolts: Self lubricating coating to reduce friction and wear. Plated latchbolts are not acceptable.
   d. Touch Pad: Stainless steel with return stroke fluid dampers and rubber bottoming dampers.
   e. Provide filler plates and shim kits as needed for flush mounting of devices on doors.
   f. Devices with exposed rivets or screws on back of device that would be visible through a glass light are not acceptable.
   g. Concealed vertical exit devices shall be a cable-actuated concealed vertical latch system. Vertical rods are not acceptable.

2.8 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4 Grade 1; except tested to exceed 10 million (10,000,000) full load operating cycles by an independent test laboratory;

1. Product: Subject to compliance with requirements, provide products manufactured by LCN Closers; Allegion, PLC,. (LCN)
   a. Substitutions by approval request.

   b. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use.
   c. Provide factory-sized rack-and-pinion hydraulic type closers that are adjustable to meet field conditions and requirements for opening force.
   d. Provide closers, constructed with high strength cast iron cylinders, forged main arms, and one piece forged steel pistons, with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm.

e. Cylinder Body: 1½" piston diameter with 3/4" journal double heat treated shaft, 5/8" full complement bearing, chrome silicon steel spring.
f. Hydraulic Fluid: ULTRA X ™ fluid with constant temperature control from +120° F (49° C) to -30° F (–35° C).
g. Closers with pressure release valves are not acceptable.

2.9 POWER SUPPLIES

A. Products: Schlage Electronics PS900 series or Von Duprin PS914 series, as appropriate for the application

B. Requirements:

1. Provide power supplies complete with required circuit boards, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.
2. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component using the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.
3. Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; Allegion, PLC, (IVE) or a comparable product by:

a. Hager Companies. (HAG)
b. Rockwood Manufacturing Company. (ROC)

B. Provide door stops for all doors in accordance with the following requirements:

1. Provide convex type wall stops wherever possible.
2. Where wall stops cannot be used, provide floor stops of the proper height.
3. At opening where wall or floor stop cannot be used, provide overhead stop.

2.11 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Basis-of-Design Product: Subject to compliance with requirements, provide scheduled product manufactured by Glynn-Johnson; Allegion, PLC, (GLY) or comparable product by one of the following:

    a. Architectural Builders Hardware Mfg., Inc. (ABH)
    b. Rockwood Manufacturing Company. (ROC)

2.12 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide the scheduled product or comparable product by one of the following:

    a. Hager Companies. (HAG)
    b. National Guard Products. (NGP)
    c. Reese Enterprises, Inc. (REE)
    d. Zero International. (ZER)

2.13 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide the scheduled product or comparable product by one of the following:

    a. Hager Companies.
    b. National Guard Products.
    c. Reese Enterprises, Inc.
    d. Zero International.

2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means

of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.15 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 HARDWARE INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Mounting Heights: Mount door hardware units at heights indicated or as required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

2. Furnish permanent cores to Owner for installation.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections: 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 pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.3 DOOR HARDWARE SCHEDULE

HARDWARE SET: 01

FOR USE ON DOOR #(S):

101-1 101-2

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	CD-99-DT	626	VON
1	EA	PANIC HARDWARE	CD-99-NL	626	VON
1	EA	RIM CYLINDER	AS REQ'D TO MATCH EXISTING	626	SCH
3	EA	MORTISE CYLINDER	AS REQ'D TO MATCH EXISTING	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	PA MOUNTING PLATE	4040-18PA (IF REQ'D)	689	LCN
2	EA	CUSH SHOE SUPPORT	4040-30 (IF REQ'D)	689	LCN
2	EA	BLADE STOP SPACER	4040-61 (IF REQ'D)	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	8197AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER
1	EA	NOTE	WEATHERSTRIP BY DOOR MANUF		B/O

HARDWARE SET: 02

FOR USE ON DOOR #(S):

106-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FEMA FIRE EXIT HARDWARE	WS-9957-L-F-17	626	VON
1	EA	RIM CYLINDER	AS REQ'D TO MATCH EXISTING	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	328AA-S	AA	ZER
1	EA	DOOR SWEEP	8197AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HARDWARE SET: 03

FOR USE ON DOOR #(S):

102-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FEMA FIRE EXIT HARDWARE	WS-9957-L-F-17	626	VON
1	EA	RIM CYLINDER	AS REQ'D TO MATCH EXISTING	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE SET: 04

FOR USE ON DOOR #(S):

105-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80 SPA X MATCH EXIST KEYING	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 05

FOR USE ON DOOR #(S):

111-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70 SPA X MATCH EXIST KEYING	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 06

FOR USE ON DOOR #(S):

128-1 129-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ IND.	L9040 17A 09-544 L283-722	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 07

FOR USE ON DOOR #(S):

107-1 108-1 109-1 110-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA X MATCH EXIST KEYING	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	GASKETING	870AA-S	AA	ZER
1	EA	DOOR BOTTOM	365AA	AA	ZER

END OF SECTION 08 71 00

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-E insulating glazing units.
B. Monolithic float glazing units.
C. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.
C. ASTM C1036 - Standard Specification for Flat Glass 2016.
D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
F. GANA (SM) - GANA Sealant Manual 2008.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film 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. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
E. Samples: Submi two samples 12 inches by 12 inches in size.
F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.
C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 quality assurance

A. Sustainable Design Certification: Glass shall be Cradle to Cradle Certified, minimum Level, Cradle to Cradle Innovation Institute.
B. Fabricator Qualifications: Vitro Certified Fabricator Network, as acceptable to the manufacturer.
C. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level-2 (Senior Glaziers) or Level-3 (Master Glaziers).
D. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: Clear float glass, coated float glass and insulating glass.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. FGIA Publication for Insulating Glass: SFGIA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
   2. NGA Publications: “Laminated Glazing Reference Manual”; “Glazing Manual.”
   3. AAMA: “Sloped Glazing Guidelines.”
   4. FGIA: “Guidelines for Sloped Glazing.”

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.
   3. Fenestration and Glazing Industry Alliance

H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, Fenestration and Glazing Industry Alliance ANSI Z97.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Lites more than 9 sq ft (0.84 sq m) in area are required to be Category II materials.
   3. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sf (0.84 sq m) in area, provide glazing products that comply with Category II materials, and for lites 9 sf (0.84 sq m) or less in area, provide glazing products that comply with Category I or II materials

1.7 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

B. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 PERformance requirements

A. General: Provide glass capable of withstanding thermal movement and wind and impact loads (where applicable) as specified in paragraph B following:

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
2. Design Wind Loads: Determine design wind loads applicable to the Project according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from ambient and surface temperatures changes acting on glass framing members and glazing components.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 1/4 inch (6.0 mm) thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. per h per degree F.
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

2.2 MANUFACTURERS:

A. Glass Fabricators: Subject to compliance with requirements, provide products by one of the following:
1. Trulite Glass & Aluminum Solutions, LLC.
2. Cardinal Glass Industries.
3. Guardian Glass, LLC.
4. Oldcastle Building Envelope.
5. Pilkington North Ameria, Inc.
6. Vitro Architectural Glass.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.3 GLASS MATERIALS

A. Annealed Float Glass: ASTM C1036, Type I - Transparent Flat Glass, Class 1-Clear, Quality - Q3.

B. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.

4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required.

C. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

D. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.

E. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

F. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 2188 / E 2189 for and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Comply with requirements in Section 07920 - Joint Sealants. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements
   a. Spacer Material: Aluminum with mill or clear anodic finish.
   b. Desiccant: Molecular sieve or silica gel, or blend of both.
   c. Corner Construction: Manufacturer's standard corner construction.

2.4 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.5 GLASS SCHEDULE, INSULATING GLASS

A. Type: Low-E Clear Insulating Glass Clear, low-reflective exterior appearance.
1. Sungate 400 (2) Clear + Clear by Vitro Architectural Glass.
2. Performance Values: VLT 76 percent; SHGC 0.60; shading coefficient 0.69; exterior reflectance 14 percent; U-value winter 0.32; U-value summer 0.31.
3. Insulating Glass Unit Construction: 1/4 inch (6 mm) Clear glass, Sungate 400 (sputtered) on second surface (2) + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Clear glass

2.6 GLASS SCHEDULE, MONOLITHIC GLASS

A. Type: Uncoated Ultra-Clear Float Glass. Outdoor Appearance: Ultra-clear.
1. Clear Color: Starphire by Vitro Architectural Glass.
2. Performance Values for 1/4 inch (6 mm) Glass:
3. VLT: 91 percent. U-Value Winter: 1.02. U-Value Summer: 0.93. SHGC: 0.90 Shading Coefficient: 1.03 Outdoor Visible Light reflectance: 8 percent.

2.7 INTERIOR GLAZING UNITS

A. Monolithic Interior Vision Glazing:

1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Heat-strengthened float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.
5. Safety Glazing as indicated on Drawings.

2.8 GLAZING COMPOUNDS

A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected by Architect from manufacturer's full range.

B. Manufacturers:
1. BASF Corporation.
2. Dow Corning Corporation.
3. Momentive Performance Materials, Inc.
4. Pecora Corporation.
5. Sika Corporation.
6. Tremco Commercial Sealants & Waterproofing.

2.9 ACCESSORIES

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Glazing Tape: Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

G. Glazing Clips: Manufacturer's standard type.

H. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 EXECUTION

3.1 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 the minimum required face and edge clearances are being provided.

C. 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.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
B. Place setting blocks at 1/4 points and install glazing pane or unit.
C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.
D. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
B. Remove non-permanent labels immediately after glazing installation is complete.
C. Clean glass and adjacent surfaces after sealants are fully cured.
D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.6 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 0561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
B. Preparation of new and existing concrete floor slabs for installation of floor coverings.
C. Testing of concrete floor slabs for moisture and alkalinity (pH).
D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
E. Remedial floor coatings.

1.2 RELATED REQUIREMENTS

A. Section 01 2200 - Unit Prices: Bid pricing for remediation treatments if required.
B. Section 01 2300 - Alternates: Bid pricing for remediation treatments if required.
C. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
D. Section 03 3000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.
E. Section 03 3000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.3 PRICE AND PAYMENT PROCEDURES

A. Alternates : See Section 01 2300 - Alternates.
B. Alternate for Remedial Floor Coating or Sheet Membrane: Do not include the cost of floor coating or underlayment in the base bid; state on the bid form the total additional cost for the floor coating, installed, in the event such remediation is required.
C. Unit Prices: See Section 01 2200 - Unit Prices.
D. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required.

1.4 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020b.
B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.6 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Adhesive Bond and Compatibility Test Report.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   2. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.7 QUALITY ASSURANCE

A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.9 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
      b. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.

c. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
d. TEC, an H.B. Fuller Construction Products Brand; TEC LiquiDam EZ with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
e. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
f. Spray Lock SCP327.
g. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
B. Do not use solvents or other chemicals for cleaning.

3.3 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
F. Report: Report the information required by the test method.

3.4 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.5 PREPARATION

A. See individual floor covering section(s) for additional requirements.
B. Comply with requirements and recommendations of floor covering manufacturer.
C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
D. Do not fill expansion joints, isolation joints, or other moving joints.

3.6 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.7 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.8 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum wallboard.
F. Joint treatment and accessories.
G. Textured finish system.

1.2 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
B. Section 06 1000 - Rough Carpentry: Building framing and sheathing.
C. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
D. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
E. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.3 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
C. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2019.
D. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
E. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
H. ASTM E413 - Classification for Rating Sound Insulation 2016.
I. GA-216 - Application and Finishing of Gypsum Panel Products 2016.

1.4 SUBMITTALS

A. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.
B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. STC-Rated Assemblies: Provide complete assemblies identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by and independent agency.

2.2 METAL FRAMING MATERIALS

A. Non-structural Steel Framing for Application of Gypsum Board: As specified in Section 09 2216.
B. Structural Steel Framing for Application of Gypsum Board: As specified in Section 05 4000.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum Company; <>: www.americangypsum.com/#sle.
   2. CertainTeed Corporation; <>: www.certainteed.com/#sle.
   3. Continental Building Products; <>: www.continental-bp.com/#sle.
   4. Georgia-Pacific Gypsum; <>: www.gpgypsum.com/#sle.
   5. National Gypsum Company; <>: www.nationalgypsum.com/#sle.
   6. PABCO Gypsum; <>: www.pabcogypsum.com/#sle.
   7. USG Corporation; <>: www.usg.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.
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, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   4. Paper-Faced Products:
      a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
      b. CertainTeed Corporation; Type X Drywall.
      c. Continental Building Products; Firecheck Type X.
      d. Georgia-Pacific Gypsum; ToughRock Fireguard X.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   5. Mold Resistant Paper Faced Products:
      a. Application: For use on vertical surfaces at wet wall locations.
      b. Manufacturers:
         1) American Gypsum Company; M-Bloc Type X.
         2) CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
         3) Continental Building Products; Mold Defense Type X.
         4) Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
         5) National Gypsum Company; Gold Bond XP Gypsum Board.
C. Abuse Resistant Wallboard:
   1. Application: High traffic areas up to 48" in height a.f.f.
   2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.

7. Type: Fire-resistance-rated Type X, UL or WH listed.
8. Thickness: 5/8 inch.
9. Edges: Tapered.
10. Paper-Faced Products:
    a. American Gypsum Company; M-Bloc AR Type X.
    b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech.
    c. Continental Building Products; Protecta AR 100 Type X with Mold Defense.
    d. Continental Building Products; Rapid Deco Level 5 Type X with Protecta.
    e. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant.
    f. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board.
    g. Substitutions: See Section 01 6000 - Product Requirements.

D. Impact Resistant Wallboard:
1. Application: High-traffic areas up to 48" a.f.f.
2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch.
10. Edges: Tapered.
11. Paper-Faced Products:
    a. American Gypsum Company; M-Bloc IR Type X.
    b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.
    c. Continental Building Products; Protecta HIR 300 Type X with Mold Defense.
    d. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
    e. Substitutions: See Section 01 6000 - Product Requirements.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch.
3. Edges: Tapered.
4. Products:
    a. CertainTeed Corporation; Interior Ceiling Drywall.
    b. Continental Building Products; Sagcheck.
    c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
    d. Substitutions: See Section 01 6000 - Product Requirements.

F. Exterior Sheathing Board: As specified in Section 06 1000.

2.4 Gypsum Wallboard ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 2100.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:

a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: www.liquidnails.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, and LC-bead at exposed panel edges.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
1. Expansion Joints:
a. Type: V-shaped PVC with tear away fins.
b. Type: V-shaped metal with factory-installed protective tape.

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.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.
a. Products:
1) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com/#sle.
2) Continental Building Products; <>: www.continental-bp.com/#sle.
3) Substitutions: See Section 01 6000 - Product Requirements.

F. Finishing Compound: Surface coat and primer, takes the place of skim coating.
1. Products:
a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Products:
a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

H. Textured Finish Materials: Latex-based compound; plain.
1. Products:
a. CertainTeed Corporation; Extreme Texture Coat/Acrylic Texture with M2Tech: www.certainteed.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

I. Abuse Resistant Finishes:

J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.3 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.
C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
D. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.4 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.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   6. Level 0: Temporary partitions.
   7. Level 0: Surfaces indicated to be finished in later stage of project.
C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling, and sanding are not required at base layer of double-layer applications.
D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.6 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.7 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition framing.
B. Framing accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings
B. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire rated walls.
C. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
D. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.
E. Section 09 2116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.
F. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for metal framing.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories: Subject to compliance with requirements, provide products by one of the following:
   1. CEMCO: www.cemcosteel.com.
   2. ClarkDietrich Building Systems: www.clarkdietrich.com.
   3. The Steel Network, Inc: www.SteelNetwork.com.
   4. MBA Building Supplies: www.mbastuds.com.
   5. MRI Steel Framing: www.mristeelframing.com.
   6. Phillips Manufacturing Co.: www.phillipsmfg.com.
   7. Telling Industries: www.buildstrong.com.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and tested in accordance with ASTM E 119 by an independent testing agency.
B. Loadbearing Studs: As specified in Section 05 4000.
C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as indicated on Drawings.
   1. Studs: C shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.

3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating.

E. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

2.3 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.
B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.
B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
C. Align and secure top and bottom runners at 24 inches on center.
D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
E. Install studs vertically at spacing indicated on drawings.
F. Align stud web openings horizontally.
G. Secure studs to tracks using fastener method. Do not weld.
H. Stud splicing is not permissible.
I. Fabricate corners using a minimum of three studs.
J. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
K. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
L. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
M. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.
B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.
B. Tile for wall applications.
C. Cementitious backer board as tile substrate.
D. Ceramic accessories.
E. Ceramic trim.
F. Non-ceramic trim.

1.2 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.3 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).
F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2010).
H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).
I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).
J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).
N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
O. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.
T. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
U. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 3000 - 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: Mount tile and apply grout on two plywood panels, minimum 36 by 36 inches in size illustrating pattern, color variations, and grout joint size variations.
D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Tile: 10 square feet of each size, color, and surface finish combination.
    3. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
C. Installer Qualifications:
    1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
    1. Minimum size of mock-up is indicated on drawings. Mock ups to include wall and floor tile.
    2. Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers: [_____]
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Emser Tile, LLC: www.emser.com/#sle.
   4. Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
   5. Fiandre Architectural Surfaces www.granitifiandre.com
   6. Landmark Ceramics www.landmarkceramics.com
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. General: General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
   1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
   2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
   3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

C. Glazed Ceramic Tile, Type WT1 & WT2:
   1. Size: As indicated on Drawings.
   2. Color(s): As indicated on Drawings.
   3. Pattern: As indicated on Drawings.
   4. Products: As indicated on Drawings.

2.2 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturers: Same as tile.

B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, outside and inside.
      d. Transition between floor finishes of different heights.
      e. Floor to wall joints.
      f. Borders and other trim as indicated on drawings.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.

b. Genesis APS International: www.genesis-aps.com/#sle.

2.3 SETTING MATERIALS

A. Mortar Bed Materials
1. Portland cement: ASTM C150, type 1, gray or white.
2. Sand: ASTM C144, fine.
3. Latex additive: As approved.
4. Water: Clean and potable.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Products:
   a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com/#sle.
   b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
   c. TEC, an H.B. Fuller Construction Products Brand; TEC Ultimate Large Tile Mortar: www.tecspecialty.com/#sle.

2.4 GROUTS

A. Standard Grout: ANSI A118.6 standard cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As indicated on drawings.
4. Products: Subject to compliance with requirements provide products by one of the following:
   a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.
   b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.
   c. Mapei Corporation www.mapei.com

B. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
1. Applications: all grout applications.

2.5 Maintenance Materials

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products: Subject to compliance with requirements, provide products by one of the following:
   a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
   b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
   c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.
   2. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.

2.6 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber, Synthetic rubber, Acrylic, or Acrylic.
      b. Thickness: 20 mils, maximum.
      c. Products:
         1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
         2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.

B. Waterproofing Membrane at Floors: 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 1/16 inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 25 mils, minimum, dry film thickness.
      c. Products:
         1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
         3) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
         4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.

C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
   1. Products:
      a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.

PART 3 EXECUTION

3.1 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 sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. 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 the following limits:

1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.

E. Verify that required floor-mounted utilities are in correct location.

3.2 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.
E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
C. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
F. 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.
G. Form internal angles square and external angles bullnosed.
H. Install ceramic accessories rigidly in prepared openings.
I. Install non-ceramic trim in accordance with manufacturer's instructions.
J. Sound tile after setting. Replace hollow sounding units.
K. Keep control and expansion joints free of mortar, grout, and adhesive.
L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
N. 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.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
C. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

3.5 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.6 CLEANING

A. Clean tile and grout surfaces.

3.7 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.
B. Acoustical units.
C. Supplementary acoustical insulation above ceiling.

1.2 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.
C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2020.
D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

1.3 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on suspension system components.
C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.6 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.

1.7 WARRANTY

A. ClimaPlus™ 30 year Warranty Performance: Contains a broad spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag resistance performance

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; <>: www.armstrong.com/#sle.
   2. CertainTeed Corporation; <>: www.certainteed.com/#sle.
   3. USG; <>: www.usg.com/#sle**.**
   4. Chicago Metallic.
   5. Rockfon.
   6. Substitutions: See Section 01 6000 - Product Requirements.
B. Suspension Systems:
   1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Tile Type C2: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Basis-of-Design Product: USG Interiors, LLC; Radar Education High-NRC/High-CAC.
   2. Form: 2, water felted.
   3. Pattern: C & E, perforated, small holes and light texture.
   4. Size: 24"x24"
   5. Thickness: 3/4" inches.
   6. Light Reflectance: not less than 0.84, determined in accordance with ASTM E1264.
   7. NRC Range: 0.55 to 0.70, determined in accordance with ASTM E1264.
   8. Ceiling Attenuation Class (CAC): not less than 35, determined in accordance with ASTM E1264.
   9. Edge: Square.
   10. Surface Color: White.

C. Acoustical Tile Type C1: Plastic [_____] faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
   1. Basis-of-Design Product: USG Interiors, LLC; Mars High-NRC/High-CAC with plant based binder.
   2. Size: 24" by 24" inches.
   3. Thickness: 3/4 inches.
   4. Form: 1 & 2, Nodular and water felted.
   5. Pattern: E & G, smooth and light texture.
   6. Light Reflectance: not less than 0.90, determined in accordance with ASTM E1264.
   7. NRC Range: 0.60 to 0.90, determined in accordance with ASTM E1264.
   8. Ceiling Attenuation Class (CAC): not less than 35, determined in accordance with ASTM E1264.
   9. Edge: Square.
   10. Surface Color: To be selected by Architect from manufacturer's standard line.

2.3 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; heavy-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Finish: White painted.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: ASTM C665 friction fit type, unfaced batts.
   1. Thickness: 2 inch.
   2. Size: To fit acoustical suspension system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions 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. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
F. 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. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
I. Do not eccentrically load system or induce rotation of runners.
J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
    1. Use longest practical lengths.
    2. Overlap and rivet corners.

3.3 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 units after above-ceiling work is complete.
E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
F. Cutting Acoustical Units:
    1. Make field cut edges of same profile as factory edges.
G. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
H. Install hold-down clips on panels within 20 ft of an exterior door.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.
B. Resilient base.
C. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.
C. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.
D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.4 SUBMITTALS

A. See Section 01 3000 - 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 and floor patterns.
D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
E. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 100 square feet of each type and color or 10%, whichever is greater.
    3. Extra Wall Base: 10 linear feet of each type and color, or 10%, whichever is greater.
    4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience and approved by flooring manufacturer.

1.6 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.
D. Protect roll materials from damage by storing on end.
E. Do not double stack pallets.

1.7 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.

1.8 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
B. Construct resilient floor mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Minimum size of mock-up is indicated on drawings.
   2. Approved mock-up may remain as part of the Work.

2.1 PRE-INSTALLATION

A. Pre-installaton meeting required for resilient flooring prior to installation. Date to be indentifed by schedule.

PART 2 PRODUCTS

3.1 TILE FLOORING

A. Vinyl Tile - Type LVT: Surface-decorated, with wear layer.
   1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
      a. Amtico Company; [_____]: www.amtico.com/#sle.
      b. Shaw Industries Group, Inc. www.shawcontract.com
      c. J&J Flooring Group LLC www.jjflooringgroup.com
      d. Interface www.interface.com
   2. Minimum Requirements: Comply with ASTM E648, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Tile Size: As indicated on Drawings.
   5. Layout: As indicated on Drawings.
   6. Total Thickness: 0.125 inch.
   7. Pattern: As indicated on drawings.
   8. Color: As indicated on drawings.
   9. Resistance to Heat: ASTM F1514.
   10. Resistance to Light: ASTM F1515.
   11. Resistance to Chemicals: ASTM F925.
   12. Smoke Density: ASTM E662.
   13. Coefficient of Friction (ASTM D2047, Slip Resistance): less than or equal to 0.5.

3.2 RESILIENT BASE

A. Resilient Base - Type B1: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style A, Straight.
   1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
      a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company; [_____]: www.johnsonite.com/#sle.
      c. Roppe Corp; [_____]: www.roppe.com/#sle.
   2. Basis-of-Design Product: As indicated on Drawings.
   3. Height: As indicated on Drawings.
   4. Length: Roll.

5. Color: As indicated on drawings.
6. Accessories: Premolded external corners and internal corners, or job formed.

3.3 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: Same material as flooring.
   1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
      a. Burke Flooring; [____]: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company; [_____]: www.johnsonite.com.
      c. Roppe Corp; [_____]: www.roppe.com.
   2. Color: Coordinate with Architect unless noted elsewhere.

PART 3 EXECUTION

4.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
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.
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
D. Verify that required floor-mounted utilities are in correct location.

4.2 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.
C. Prohibit traffic until filler is fully cured.

4.3 Installation - General

A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install in accordance with manufacturer's written instructions.
C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.
E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
F. Install flooring in recessed floor access covers, maintaining floor pattern.
G. At movable partitions, install flooring under partitions without interrupting floor pattern.

4.4 Installation - Tile Flooring

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

4.5 Installation - Resilient Base

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
C. Install base on solid backing. Bond tightly to wall and floor surfaces.
D. Scribe and fit to door frames and other interruptions.

4.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean in accordance with manufacturer's written instructions.

4.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sound-absorbing panels.
B. Sound-absorbing ceiling banners.
C. Mounting accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.3 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed data sheets for products specified.
C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.
        a. Provide complete assembly, including mounting devices.
    3. Fabric: For each fabric, color, and pattern installed furnish length equal to 10 percent of amount installed but not fewer than 10 yards.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
B. Store units flat, in dry, well-ventilated space; do not stand on end.
C. Protect edges from damage.

PART 2 PRODUCTS

2.1 FABRIC-COVERED SOUND-ABSORBING WALL UNITS

A. Manufacturers:
    1. Acoustical Panel Systems (APS, Inc.)..

2. AVL Systems, Inc.
3. Golterman & Sabo.
4. Kinetics Noise Control, Inc.
5. MBI Products Company, Inc.
6. Sound Seal
7. Tectum Onc.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Sound Absorbing Units: Prefinished, factory assembled fabric-covered panels.
1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls:
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Golterman & Sabo,** Resolute Plus (RP) or comparable product by an approved manufacturer.
2. High Impact Fiberglass Panels: core of 6 to 7 pcf (96 to 112 kg/cu m) fiberglass, laminated to panel-shaped facing sheet of perforated 0.060 inch (1.5 mm) polyvinyl, with heat-welded corners and edges.
3. Noise Reduction Coefficient (NRC): 1.00 when tested in accordance with ASTM C423
4. Panel Size: As indicated on drawings.
5. Panel Thickness: 2 inches.
6. Edges: Perimeter edges reinforced by a formulated resin hardener.
7. Corners: Square.
8. Fabric: Upgrade, DesignTex Gravity
9. Color: As indicated.
10. Mounting Method: Two-part Z-clips.

D. Fabric-Covered Acoustical Ceiling Baffles:
1. Basis of Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., SOUNDSCAPES Blades or comparable product by an approved manufacturer
2. Baffle Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
3. Acoustical Performance: 1.38 Sabins per square foot.
4. Baffle Size: As indicated on drawings..
5. Baffle Thickness: 2 inches.
6. Corners: Square.
7. Fabric: DuraBrite scrim.
8. Color: As indicated.
9. Mounting: Vertically suspended from ceiling or structure by individual suspension with hanging kit.

2.2 THERMOFORMED PLASTIC SOUND-ABSORBING UNITS

A. Manufacturers:
1. Pinta Acoustic Inc; [_____]: www.pinta-acoustic.com/#sle.
2. Lamvin; Pyramid Diffuser: www.lamvin.com/#sle.
3. Acoustical Solutions; Pyramid Diffuser: www.acousticalsolutions.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermoformed Copolymer Plastic Acoustical Panels for Ceilings:

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Noise Reduction Coefficient (NRC): 0.15 when tested in accordance with ASTM C423 for Type Ceiling and Wall mounting, per ASTM E795.
3. Panel Size: 48 inches by 48 inches.
4. Liner: Manufacturer's standard glass fiber batting.
5. Surface Pattern: Pyramid shapes.
6. Mounting: Back-mounted with mechanical fasteners.
7. Mounting: Lay-in panel for suspended ceiling system, exposed grid.
   a. Suspension System: Specified in Section 09 5100.

2.3 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
   1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
   2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.4 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
   1. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.

B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

C. Suspend ceiling baffles at locations and heights as indicated.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
   1. Plumb and level.
   2. Flatness.
   3. Width of joints.

3.3 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

END OF SECTION

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SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Exterior insulation and finish system (EIFS).
   12. Glass.
   13. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.
B. Section 09 9123 - Interior Painting.

1.3 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
F. SSPC-SP 6 - Commercial Blast Cleaning 2007.
G. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:
   1. Behr Process Corporation; <>: www.behr.com/#sle.
   2. PPG Paints; <>: www.ppgpaints.com/#sle.
   3. Rodda Paint Company; <>: www.roddapaint.com/#sle.
   4. Sherwin-Williams Company; <>: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As indicated on drawings.
   1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Fiber Cement Siding: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
E. Seal surfaces that might cause bleed through or staining of topcoat.
F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
G. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
I. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
K. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
L. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
M. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
E. Apply each coat to uniform appearance.
F. Sand wood and metal surfaces lightly between coats to achieve required finish.
G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - MPI SYSTEMS

A. Substrate: Precast Concrete Vertical Surfaces, Exterior .
   1. MPI System: EXT 3.1P.
   2. Primer: Alkali Resistant Water Based Primer; MPI # 3.
   3. Intermediate Coat: HIPAC Latex; MPI # 315.
   4. Top Coat: HIPAC Latex; MPI # 315.
   5. Sheen: Gloss Level 3/4.
B. Substrate: Concrete Masonry Units, Exterior .
   1. MPI System: EXT 4.2MM.
   2. Primer: Block Filler; MPI # 4.
   3. Intermediate Coat: HIPAC Latex; MPI # 315.
   4. Top Coat: HIPAC Latex; MPI # 315.
   5. Sheen: Gloss Level 3/4.
C. Substrate: Galvanized Metal; Pipes and Ducts, Exterior .
   1. MPI System: EXT 5.3N.
   2. Primer: Water-based Galvanized Primer; MPI # 134.
   3. Intermediate Coat: Alkyd; MPI # 94.
   4. Top Coat: Alkyd; MPI # 94.
   5. Sheen: Gloss Level 5.
D. Substrate: Galvanized Metal; Doors and Frames, Exterior .
   1. MPI System: EXT 5.3M.
   2. Primer: Water-based Galvanized Primer; MPI # 134.
   3. Intermediate Coat: HIPAC Latex; MPI # 311.
   4. Top Coat: HIPAC Latex; MPI # 311.
   5. Sheen: Gloss Level 3/4.

END OF SECTION

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SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.
B. Section 09 9113 - Exterior Painting.

1.3 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.7 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
B. Provide panel, 3 feet long by 5 feet wide, illustrating paint color, texture, and finish.
C. Locate where directed by Architect.
D. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
B. Paints:
   1. Behr Process Corporation: www.behr.com/#sle.
   2. PPG Paints: www.ppgpaints.com/#sle.

3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean concrete according to ASTM D4258. Allow to dry.

H. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

L. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

M. Copper: Remove contamination by steam, high pressure water, or solvent washing.

N. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

O. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

P. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

Q. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - MPI PAINT SYSTEMS

A. Substrate: Concrete Vertical Surfaces, Interior .
   1. MPI System: 3.1P.
   2. Primer: Epoxy High Build; MPI # 108.
   3. Intermediate Coat: Epoxy High Build; MPI # 108.
   4. Top Coat: Epoxy High Build; MPI # 108.
      Sheen: Gloss Level 3

B. Substrate: Gypsum Board, Interior .
   1. MPI System: 9.2B.
   2. Primer: Latex Primer/Sealer; MPI # 50.
   3. Intermediate Coat: HIPAC Latex; MPI # 139.
   4. Top Coat: HIPAC Latex; MPI # 139.
      Sheen: Gloss Level 3

C. Substrate: Concrete Masonry Units, Interior .
   1. MPI System: 4.2B.
   2. Primer: Block Filler, Latex, Int/Ext; MPI # 4.
   3. Intermediate Coat: HIPAC Latex; MPI # 139.
   4. Top Coat: HIPAC Latex; MPI # 139.
      Sheen: Gloss Level 3

D. Substrate: Steel Doors and Frames, Interior .
   1. MPI System: 5.3M.
   2. Primer: Water Based Galvanized Primer; MPI # 134.
   3. Intermediate Coat: HIPAC Latex; MPI # 141.
   4. Top Coat: HIPAC Latex; MPI # 141.
      Sheen: Gloss Level 3

E. Substrate: Structural Steel and Metal Fabrications, Interior .
   1. MPI System: 5.1S.
   2. Primer: Rust Inhibitive Water Based Primer; MPI # 107.
   3. Intermediate Coat: Rust Inhibitive Water Based Primer; MPI # 107.
   4. Intermediate Coat: Institutional Low Odor/Low VOC; MPI # 145 .
   5. Top Coat: Institutional Low Odor/Low VOC; MPI # 145.
      Sheen: Gloss Level 3

END OF SECTION

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SECTION 10 1400 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cash allowance for signs.
B. Room and door signs.
C. Interior directional and informational signs.
D. Cast dimensional characters.
E. Cutout dimensional characters.
F. Fabricated channel dimensional characters.
G. Building identification signs.
H. Metal plaques.
I. Panel signs.

1.2 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.
B. Allowance amount covers purchase and delivery but not installation.

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.4 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.
B. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    2. Submit for approval by Owner through Architect prior to fabrication.
D. Samples: Submit two samplesof each type of sign, of size similar to that required for project, illustrating sign style, font, any exposed accessories, and method of attachment.
E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Verification Samples: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
    1. Dimensional Characters: [Full-size Sample] [Half-size Sample] of each type of dimensional character.
    2. Exposed Accessories: [Full-size Sample] [Half-size Sample] of each accessory type.

G. Show signage mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
H. Sample Warranty: For special warranty.
I. Delegated-Design Submittal: For [signs indicated in "Performance Requirements" Article] .
   1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.
J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: [Manufacturer of products] [An entity that employs installers and supervisors who are trained and approved by manufacturer].

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signage that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from Substantial Completion.

1.10 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in [the USDOJ's "2010 ADA Standards for Accessible Design"] [the ABA standards of the Federal agency having jurisdiction] [and] [ICC A117.1] .
B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of [rooftop] [dimensional character] sign type(s) according to structural performance requirements.
C. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
   1. Uniform Wind Load: [As indicated on Drawings] < Insert design load>.
   2. Concentrated Horizontal Load: [As indicated on Drawings] < Insert design load>.
   3. Other Design Load: [As indicated on Drawings] < Insert design load>.
   4. Uniform and concentrated loads need not be assumed to act concurrently.

D. Thermal Movements: For exterior [fabricated channel dimensional characters] < Insert item>, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces] < Insert temperature change>.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MANUFACTURERS

A. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
   1. Best Sign Systems, Inc; <>: www.bestsigns.com/#sle.
   2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
   3. FASTSIGNS; <>: www.fastsigns.com/#sle.
   4. Inpro; <>: www.inprocorp.com/#sle.
   5. Mohawk Sign Systems, Inc; <>: www.mohawksign.com/#sle.
   6. Seton Identification Products; <>: www.seton.com/aec/#sle.
   7. Signs & Decal Corp.
   8. Vista System

B. Curved Signs:

C. Dimensional Letter Signs:
   1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
   2. FASTSIGNS; <>: www.fastsigns.com/#sle.
   3. Inpro; <>: www.inprocorp.com/#sle.

D. Plaques:
   1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
   2. FASTSIGNS; <>: www.fastsigns.com/#sle.

2.3 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 <>, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with applied character panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 3 inches, unless otherwise indicated.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
   7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.

C. Building Identification Signs: Non-Illuminated Exterior Sign
   1. Use individual metal letters.
   2. Mount on outside wall in location indicated on drawings.

D. Other Dimensional Letter Signs: Wall-mounted.

E. Plaque: See drawings for details.

2.4 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
   1. Sizes: As indicated on drawings.
   2. Finish: Natural (clear) anodized.
   3. Sign Orientation: Curved in horizontal section.
   4. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.

C. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: As selected by Architect from manufacturer full line of colors..
   4. Character Color: Contrasting color. As selected by Architect.

2.5 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.

B. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/8 inch.
   2. Letter Thickness: 1/8 inch.
   3. Letter Edges: Square.

2.6 PLAQUES

A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Plaque Material: Cast [aluminum] [brass] [bronze] [zinc] .
   2. Plaque Thickness: As indicated on Drawings.
   3. Size: [_____] inches by [_____] inches.
   4. Text and Typeface:
      a. Character Font: Helvetica, Arial, or other sans serif font.
      b. Character Color: Contrast with background color.
   5. Border Style: As indicated on drawings.
   6. Background Texture: Ripple.
   7. Surface Finish: Brushed, satin.
   8. Painted Background Color: Light oxide stain.
   9. Protective Coating: Manufacturer's standard clear coating.
   10. Finishes:
      a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
      b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
      c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample]

[as selected by Architect from manufacturer's full range] .

d. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .

11. Background Texture: [Smooth] [Pebble] [Leatherette] [Matte] [Stipple] [Match Architect's sample] [As selected by Architect from manufacturer's full range] .
12. Integrally Cast Border Style: [As indicated on Drawings] [Square cut without border] [Square single line, polished] [Square double line, polished] [Plain bevel, brushed] [Plain bevel, polished] [Projected bevel] [Raised flat band] [Double-raised line border] .
13. Applied Frame Material, Style, and Finish: [As indicated on Drawings] < insert description>.
14. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] .
15. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [Typeface as indicated by manufacturer's designation] [Typeface matching Architect's sample] [Typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]

B. Etched Plaque: Chemically etched or photochemically engraved metal sheet or plate with texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Cast [aluminum] [brass] [bronze] [zinc] .
2. Plaque Thickness: As indicated on Drawings.
3. Finishes:
   a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
   b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
   c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
   d. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .
4. Integral Edge Style: [As indicated on Drawings] [Square cut, polished] [Plain bevel, brushed] .
5. Applied Frame Material, Style, and Finish: [As indicated on Drawings] < insert description>.
6. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] .

7. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [Typeface as indicated by manufacturer's designation] [Typeface matching Architect's sample] [Typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]

2.7 PLAQUE MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
D. Brass Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C85200 (high-copper yellow brass)] .
E. Brass Sheet (Yellow Brass): ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C26000 (yellow brass)] .
F. Bronze Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C86500 (No. 1 manganese bronze)] .
G. Bronze Plate: ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C22000 (commercial bronze)] .
H. Copper Sheet: ASTM B 152/B 152M.
I. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, [Type 304,] [Type 316,] stretcher-leveled standard of flatness.
J. Zinc Castings: ASTM B 240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
K. Zinc Sheet: [ASTM B 69] < Insert standard>, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

2.8 PANEL SIGNS

A. Panel Sign as indicated on Drawings: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
B. Solid-Sheet Sign[and Returns] [, Returns, and Back] : [Aluminum] [Brass] [Bronze] [Copper] [Steel] [Stainless-steel] [Acrylic] [Fiberglass] [PVC] sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
   1. Thickness: Manufacturer's standard for size of sign.
   2. Surface-Applied, Flat Graphics: Applied vinyl film.
   3. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
C. Sign-Panel Perimeter: Finish edges smooth.
   1. Edge Condition: As indicated on Drawings.

2. Corner Condition in Elevation: As indicated on Drawings.

D. Mounting: Manufacturer's standard method for substrates indicated, surface mounted to wall with concealed anchors, adhesive, or two face tape.

E. Surace Finish and Applied Graphics:
1. Integral Acrylic
2. Sheet Color: As selected by Architect from full range of industry colors.

F. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [typeface as indicated by manufacturer's designation] [typeface matching Architect's sample] [typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]

G. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus [1/16 inch] < insert dimension> measured diagonally from corner to corner.

2.9 PANEL SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.10 DIMENSIONAL CHARACTERS

A. Cast Characters as indicated on Drawings: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
1. Character Material: Cast Aluminum.
2. Character Height: As indicated on Drawings.
3. Thickness: As indicated above.
4. Finishes:
   a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
5. Mounting: Projecting studs.
6. Typeface: Coordinate with School District for typeface.

B. Fabricated Channel Characters : Metal face and side returns formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows:
1. Character Material: Sheet or Plate Aluminum.
2. Character Height and Depth: As indicated on Drawings.
3. Thickness: As indicated on Drawings.
4. Finishes:
   a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
   b. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample]

[as selected by Architect from manufacturer's full range] .

5. Mounting: Projecting studs.
   a. Hold characters at manufacturer's recommended distance from wall surface.
6. Typeface: Coordinate with School D.

2.11 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
D. Copper Sheet: ASTM B 152/B 152M.

2.12 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   6. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
   1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [to match sign-background color] [to match Architect's sample] color unless otherwise indicated
   2. Stainless-Steel Brackets: Factory finish brackets [to match sign background] [to match Architect's sample] [with No. 4] finish unless otherwise indicated.
C. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
2. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.

D. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

2.13 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.14 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.

2.15 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.

2.16 CLEAR ORGANIC COATING FOR COPPER-ALLOY FINISHES

A. Clear Organic Coating: Clear, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of methyl methacrylate copolymer with benzotriazole to prevent breakdown of the film in UV light; shop applied in two uniform coats according to manufacturer's written instructions, with interim drying between coats and without runs or other surface imperfections, to a total dry film thickness of 1 mil.

2.17 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish [nonferrous-metal] [stainless-steel] [or] [hot-dip galvanized] devices unless otherwise indicated

F. Exposed Metal-Fastener Components, General:
1. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
2. Fastener Heads: For nonstructural connections, use [flathead] [or] [oval countersunk] screws and bolts with tamper-resistant [Allen-head] [spanner-head] [or] [one-way-head] slots unless otherwise indicated

G. Sign Mounting Fasteners:
1. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
2. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
3. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
C. Proceed with installation only after unsatisfactory conditions have been corrected.
D. Verify that electrical service is correctly sized and located to accommodate signs.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Plaques Used for Room Identification [and Other Accessible Plaques]: Install in locations on walls [as indicated on Drawings] [and] [according to accessibility standard] .

C. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
3. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of signage and of suitable quantity to support weight of signage after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as signage is applied and to prevent visibility of cured adhesive at signage edges. Place signage in position, and push to engage adhesive. Temporarily support signage in position until adhesive fully sets.
6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
7. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using [method specified above] .

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

E. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

F. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and plaques that do not comply with specified requirements. Replace signage with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. Upon completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Corner guards.

1.2 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).
B. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2014.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
D. Maintenance Data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.4 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 conformance with manufacturer's recommendations for each type of item.
E. Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

1.5 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Corner Guards:
   1. Babcock-Davis; <>: www.babcockdavis.com/#sle.
   2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   3. Inpro; <>: www.inprocorp.com/#sle.
   4. Koroseal Interior Products; <>: www.koroseal.com/#sle.
   5. Nystrom, Inc; <>: www.nystrom.com/#sle.
   6. Trim-Tex, Inc; <>: www.trim-tex.com/#sle.

2.2 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for conformance to applicable provisions of ASTM D256 and/or ASTM F476.

2.3 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Vinyl: Snap on cover of .080" (2mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

2. Aluminum: Continuous aluminum retainer of .070" (1.8mm) thickness shall be fabricated from 6063-T5 aluminum, with a mill finish.
3. Width of Wings: 3 inches.
4. Corner: Square.
5. Color: As selected from manufacturer's standard colors.
6. Length: One piece 96 inches
7. Preformed end caps.
8. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

2.4 FABRICATION

A. Fabricate components with tight joints, corners and seams.
B. Pre-drill holes for attachment.
C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
B. Verify that substrate surfaces for adhered items are clean and smooth.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
B. Position corner guard 4 inches above finished floor to [____] inches high.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.
B. Utility room accessories.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
E. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2018.
F. ASTM C1036 - Standard Specification for Flat Glass 2016.
G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
H. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

PART 2 PRODUCTS

2.1 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
    1. Grind welded joints smooth.
    2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
B. Keys: Provide two (2) keys for each accessory to Architect; master key lockable accessories.
C. Stainless Steel Sheet: ASTM A666, Type 304.
D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
F. Zinc Alloy: Die cast, ASTM B86.
G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
H. Adhesive: Two component epoxy type, waterproof.
I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.2 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.3 Commercial Toilet Accessories

A. Toilet Paper Dispenser: Double roll, surface mounted, horizontal orientation, for coreless type rolls.
   1. Basis-of-Design: Subject to compliance with requirements, provide Georgia-Pacific Compact Vertical 56796 toilet paper dispenser or comparable product. Provide substitution request during bidding for review and determination of comparable product status.

B. Mirrors: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: 24" x 36".
   3. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   4. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-165 2436 or comparable product by one of the following:
      a. AJW Architectural Products
      b. American Specialties, Inc.
      c. Bradley Corporation
      d. Gamco

C. Grab Bars: Satin stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
   2. Push/Pull Point Load: 250 pound-force, minimum.
   3. Dimensions: 1 1/2" inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
   4. Finish: Satin.
   5. Length and Configuration: 18", 36", and 42" as indicated on drawings and located complying with ADA requirements.
   6. Basis-of-Design: Subject to compliance with requirements, provide Bobrick Model 6806 Series grab bars or product by one of the following:
      a. AJW Architectural Products
      b. American Specialties, Inc.
      c. Bradley Corporation
      d. Gamco USA

2.4 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: 2, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   4. Length: Manufacturer's standard length for number of holders/hooks.
   5. Basis-of-Design: Subject to compliance with requirements, provide American Specialties, Inc. 1315-3 utility shelf/mop and broom holder or comparable product by one of the following:
      a. AJW Architectural Products
      b. Bradley Corporation
      c. Gamco USA

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
D. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

A. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations and as indicated on drawings.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.
B. Fire extinguisher cabinets.

1.2 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
B. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).
C. UL (DIR) - Online Certifications Directory Current Edition.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions for each type of product.
C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business: www.ansul.com.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com.
   3. Nystrom, Inc: www.nystrom.com/sle.
   4. Amerex..
   5. JL Industries, Inc.; a division of the Activar Construction Products Group.
   6. Larsens Manufacturing Company.
   7. Guardian Fire Equipment, Inc.
B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com.
   3. Larsen's Manufacturing Co: www.larsensmfg.com.
   4. Nystrom, Inc: www.nystrom.com/sle.
   5. Guardian Fire Equipment, Inc..

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.
B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; MP10 or comparable product by one of the manufacturers listed above.
   2. Class: A:B:C type.
   3. Size: 10 pound.
   4. Finish: Baked polyester powder coat, red color.
   5. Temperature range: Minus 65 degrees F to [___] degrees F.

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; WC-6L or comparable product by one of the manufacturers listed above.
   2. Class: K type.
   3. Size: 1.6 gallons.
   4. Finish: Polished stainless steel.
   5. Temperature range: Minus 20 degrees F to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
B. Cabinet Construction: Non-fire rated.
C. Fire Rated Cabinet Construction: One-hour fire rated.
D. Cabinet Configuration: Recessed type with multipurpose dry chemical fire extinguisher.
   1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R2 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
   2. Size to accommodate accessories.
   3. Trim: Flat edge.
   4. Trim and Door Material: Steel sheet.
   5. Door Glazing: Clear transparent acrylic sheet.
   6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
      a. Location: Applied to cabinet door.
      b. Application process: Pressure-sensitive vinyl letters.
      c. Lettering color: Red.
      d. Orientation: Vertical.
E. Cabinet Configuration: Semi-recessed type with multipurpose dry chemical fire extinguisher.
   1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R7 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
   2. Size to accommodate accessories.
   3. Trim: Square edge.
   4. Trim and Door Material: Steel sheet.
   5. Door Glazing: Clear transparent acrylic sheet.
   6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
      a. Location: Applied to cabinet door.
      b. Application process: Pressure-sensitive vinyl letters.
      c. Lettering color: Red.
      d. Orientation: Vertical.
F. Cabinet Configuration: Semi-recessed type with multipurpose dry chemical fire extinguisher.
   1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R4 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
   2. Size to accommodate accessories.
   3. Trim: Square edge.

4. Trim and Door Material: Steel sheet.
5. Door Glazing: Clear transparent acrylic sheet.
6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    a. Location: Applied to cabinet door.
    b. Application process: Pressure-sensitive vinyl letters.
    c. Lettering color: Red.
    d. Orientation: Vertical.

G. Cabinet Configuration: Surface mounted type with multipurpose dry chemical fire extinguisher.
1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-SM Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
2. Size to accommodate accessories.
3. Trim: Not applicable.
4. Trim and Door Material: Steel sheet.
5. Door Glazing: Clear transparent acrylic sheet.
6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    a. Location: Applied to cabinet door.
    b. Application process: Pressure-sensitive vinyl letters.
    c. Lettering color: Red.
    d. Orientation: Vertical.

H. Cabinet Configuration: Recessed type with wet chemical fire extinguisher.
1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-R Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
2. Size to accommodate accessories.
3. Trim: Flat edge.
4. Trim and Door Material: Steel sheet.
5. Door Glazing: Clear transparent acrylic sheet.
6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    a. Location: Applied to cabinet door.
    b. Application process: Pressure-sensitive vinyl letters.
    c. Lettering color: Red.
    d. Orientation: Vertical.

I. Cabinet Configuration: Semi-recessed type with wet chemical fire extinguisher.
1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-RK Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
2. Size to accommodate accessories.
3. Trim: Square edge.
4. Trim and Door Material: Steel sheet.
5. Door Glazing: Clear transparent acrylic sheet.
6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    a. Location: Applied to cabinet door.

b. Application process: Pressure-sensitive vinyl letters.
c. Lettering color: Red.
d. Orientation: Vertical.

J. Cabinet Configuration: Surface mounted type with wet chemical fire extinguisher.
1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-SM Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
2. Size to accommodate accessories.
3. Trim: Not applicable.
4. Trim and Door Material: Steel sheet.
5. Door Glazing: Clear transparent acrylic sheet.
6. Indentification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
a. Location: Applied to cabinet door.
b. Application process: Pressure-sensitive vinyl letters.
c. Lettering color: Red.
d. Orientation: Vertical.

K. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and levelin wall openings, 60 inches from finished floor to top of cabinet, confirm height acceptable to authorities having jurisdiction.
C. Secure rigidly in place.
D. Place extinguishers in cabinets.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.2 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

1.3 REFERENCE STANDARDS

A. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
B. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
C. PS 1 - Structural Plywood 2009.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.
C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers: Subject to compliance with requirements provide products by one of the following:
         1) Formica Corporation: www.formica.com.
         2) Lamin-Art, Inc: www.laminart.com.
         3) Panolam Industries International, Inc Nevamar: www.nevamar.com.
         4) Panolam Industries International, Inc Pionite: www.pionitelaminates.com.
         5) Wilsonart: www.wilsonart.com.
      b. Laminate Core Color: Same as decorative surface.
      c. Finish: Matte or suede, gloss rating of 5 to 20.

d. Surface Color and Pattern: As indicated on drawings.

2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
3. Back and End Splashes: Same material, same construction.
4. Fabricate in accordance with manufacturer's standard requirements.

2.2 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
D. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.
C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
C. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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DIVISION 22 – PLUMBING

22-1 CONTRACT DOCUMENTS:

a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Plumbing Contractor and his subcontractors and material suppliers.

22-2 SPECIFICATION FORM AND DEFINITIONS:

a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.

b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.

c) “Provide” means furnish and install.

d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.

e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.

f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield, Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: James Couch.

g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.

h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.

i) Plumbing Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.

j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

22-3 GENERAL EXTENT OF WORK:

a) Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which M/C could have informed himself before bids were taken.

b) M/C shall familiarize himself with equipment provided by other contractors, which require mechanical connections and controls.

22-4 LOCAL CONDITIONS:

a) Visit site and determine existing local conditions affecting work in contract.

b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

22-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other Authorities Having lawful Jurisdiction (AHJ).

b) Conform to latest editions and supplements of the following codes, standards, or recommended practices as adopted by the AHJ.

1. CITY CODES:

   A. 2012 International Plumbing Code.

   B. 2012 International Mechanical Code.

   C. 2012 International Building Code.

   D. 2012 International Fire Code.

2. SAFETY CODES:

   A. National Electric Safety Code Handbook H30 – National Bureau of Standards.

   B. Occupational Safety and Health Standards – Department of Labor.

   C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

   A. NFPA 54 Gas Appliance and Gas Piping Code.

   B. NFPA 70 National Electric Code – 2017 Edition.

   C. NFPA 89M Clearances, Heat Producing Appliances.

   D. NFPA 90A Air Conditioning and Ventilation Systems.

   E. NFPA 91 Blower and Exhaust Systems.

   F. NFPA 101 Life Safety Code – 2012 Edition.

c) Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:

1. AGA – The American Gas Association Laboratories.

2. ASME – American Society of Mechanical Engineers.

3. NSF – National Sanitation Foundation.

4. UL – Underwriters Laboratories Inc.

d) Drawings and Specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, Contractor shall execute work in accordance with such ordinances, laws, codes, rules, or regulations without increased cost to Owner, but not until he has referred such variances to A/E for approval.

e) M/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

22-6 CONTRACT CHANGE:

a) Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.

b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.

c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustment factors. If proposals are not itemized, they will be rejected and returned for proper submittal.

d) The maximum allowable profit for any change order shall be ten percent (10%).

e) See Example below:

PRICING SHEET

Project:	Boiler Room Repairs for ABC Company			Date:	Jan 1, 2019
Location:	Springfield, Missouri			Estimator:	Jane Doe
Labor Rate:	$22.00				

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hours	Material Total
6” tee	1	ea.	$45.00	2.000	2.0	$ 45.00
Less 6” ell	1	ea.	$30.00	0.000	0.0	$ 30.00
6” sch 40 pipe	22	ft.	$10.43	0.253	3.8	$ 56.46
6” cap	1	ea.	$11.00	1.500	1.5	$ 11.00
6” hanger	1	ea.	$12.00	0.400	0.4	$ 12.00
4” saddle weld	1	ea.	$0.00	1.200	1.2	$ 0.00
4” sch 40	18	ft.	$4.44	0.183	3.3	$ 79.92
4” ell	3	ea.	$13.39	2.000	6.0	$ 40.17
4” hanger	3	ea.	$8.00	0.300	0.9	$ 24.00
4” weld	1	ea.	$3.00	1.000	1.0	$ 3.00
1.5” cond sch 80	21	ft.	$1.63	0.080	1.7	$ 34.23
1.5” ell	3	ea.	$4.00	0.400	1.2	$ 12.00
1.5” tee	1	ea.	$5.00	0.600	0.6	$ 5.00
1.5” weld	1	ea.	$3.00	0.400	0.4	$ 3.00
0.75” F & T trap	1	ea.	$73.00	0.500	0.5	$ 73.00
0.75” strainer	1	ea.	$12.00	0.500	0.5	$ 12.00
0.75” XH nipples	4	ea.	$7.70	0.100	0.4	$ 30.80
0.75” unions	2	ea.	$3.18	0.300	0.6	$ 6.36
0.75” cap	1	ea.	$0.65	0.100	0.1	$ 0.65
0.75” pipe sch 80	10	ft.	$0.72	0.400	0.4	$ 7.20
0.75” tee	1	ea.	$1.50	0.300	0.3	$ 1.50
0.75” ell	3	ea.	$0.95	0.200	0.6	$ 2.85

0.75" hanger	2	ea.	$2.50	0.200	0.4	$ 5.00
SUBTOTAL					28.74	$618.47
SALES TAX				6.125%		$37.88
LABOR	28.4	MH	$22.00			$624.80
5% OVERHEAD						$64.06
8% PROFIT						$107.62
TOTAL						$1,452.83

22-7 LOCATIONS AND INTERFERENCES:

a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of other contractors, access requirements for installation and maintenance, and to approval of A/E.

b) Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.

c) Any pipe, apparatus, appliance, or other item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the Contractor, his subcontractor, or his workmen shall be restored as specified for new work.

d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

22-8 SYSTEM PERFORMANCE:

a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment and all required programming installed under this Specification.

b) Contractor shall be responsible for all work as required by phasing of construction for intended use by the owner as applicable.

22-9 WARRANTY:

a) M/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this Specification Division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.

b) Where manufacturers' warranties expire during the one (1) year warranty period, one (1) year warranty period is defined as year after date of substantial completion. M/C shall include provisions for extending warranty for the full one (1) year period and shall cost for warranty extension in his base bid.

c) M/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at M/C's expense.

d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these Specifications.

e) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

22-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

a) The intent of these Specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.

c) In general, these Specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and Specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these Specifications or in subsequent addenda. Where other than first named products are used for M/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, that will meet or exceed the Specifications and are acceptable to the D/E.

d) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.

e) **PRIOR TO RECEIPT OF BIDS, IF M/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.**

f) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

g) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.

h) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, M/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, M/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

i) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if; 1) request is received within 30 days after contract date and request includes

statement showing credit due Owner, if any, if substitution products are used, or 2) Owner requests consideration be given to substitute brands.

22-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

a) Unless noted differently in the general requirements of the specifications, M/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, Engineer will retain one (1) set.

b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc. that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these Specifications, or plan sheet number, when item does not appear in Specifications. Where equipment submitted does not appear in base Specifications of specified equivalent, mark submittals with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

c) M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet Specification and/or drawing requirements. M/C's submittal review shall specifically check for, but not limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.

d) No shop drawing submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's review. All comments or minor notations on shop drawings shall be flagged as follows to indicate originator of comment or notation: 1 Contractor, 2 Construction Manager, 3 Architect, and 4 Engineer.

e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without M/C's review and approval stamp. A letter will be sent to M/C by either the Architect or Engineer indicating receipt of an improper submittal. M/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by M/C or supplier for 22 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.

f) A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing to Owner or his representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.

a) Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.

2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.

3. Contractor shall provide all final documents including drawings, shop drawings, etc. in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this Specification, will also be required at closeout.

22-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. To determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

b) Where the contractor proposes to use different equipment that results in significant difference in routing or space considerations than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

22-13 CAD/BIM FILE REQUESTS:

a) CAD files and/or BIM models (only where created as part of the project design) are the property of the D/E and are only available upon documented written request. Prior to receiving any CAD files or models, the contractor shall submit a drawing cost fee of $50/drawing up to a maximum $1500 (BIM models are $1500). In addition, the contractor must sign a Third Party User Agreement and Drawing Request Form which must be forwarded to the D/E office prior to any CAD files being released. This form is available from the D/E upon request.

22-14 CUTTING AND PATCHING:

a) M/C shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect’s approval and in a manner approved by him.

b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.

c) Drilling and cutting of openings through building materials requires Architect’s review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

22-15 MUTILATION:

a) Mutilation of building finishes, caused by installation of mechanical equipment, fixtures, piping, and other mechanical devices shall be repaired at M/C’s expense to approval of Architect.

22-16 EXCAVATION AND BACKFILL:

a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these Specifications, and in compliance with OSHA Safety Standards.

b) Excavate trenches of sufficient width to allow ample working space, and a minimum of 6”, and no deeper than necessary, for installation work.

c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.

d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.

e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation in base bid.

f) Trenches shall be installed to have a bedding of natural or artificial graded fixture of crushed gravel or sand with 100% passing a 1 inch sieve and not more than 8% passing a #200 sieve. All depressions shall be filled with tamped and sand backfill. Place and compact backfill of sub-base material free of particles larger than 1" over piping. Compact each 6" layer at 85% density. Install warning tape directly above piping outside the building at 12" below grade.

g) All buried PVC DWV piping systems shall be installed in accordance with ASTM D 2321. Submit pictures of the underground pipe installation to the design engineer prior to backfilling.

h) Gravel for use of backfill will not be accepted unless approved by Engineer.

i) Notify Engineer two (2) business days prior to plumbing inspection by AHJ so that Engineer can visually inspect piping prior to backfill.

22-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

a) Work shall include mounting, alignment, and adjustment of systems and equipment.

b) Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified, or required by E/M's installation instructions.

c) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for required base type and size. Provide 3.5-inch high base where base is not shown on drawings.

22-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

a) M/C shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

22-19 PAINTING OF MATERIALS AND EQUIPMENT:

a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.

b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

c) Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

d) Paint all exterior natural gas piping with one (1) primer coat and two (2) finish coats.

22-20 MAINTENANCE OF SYSTEMS:

a) M/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

22-21 STERILIZATION OF DOMESTIC WATER SYSTEM:

a) After final pressure testing of distribution system, thoroughly flush entire system with water until free of dirt and construction debris. Fill system with solution of liquid chlorine or hypochlorite of not less than 50 ppm. Retain treated water in system until tests indicate non spore-forming bacteria have been destroyed or for 24 hours, whichever is greater.

b) All points in system shall have at least 10 ppm of solution at end of retention period.

c) When time and concentration have been met, drain system and flush with fresh domestic water until residual cleaning solution is less than 1.0 ppm. Open and close each value in system six (6) times during flushing operation.

d) Test samples taken from several points in system shall indicate absence of pollution for 48 hours. Repeat sterilization as required. Acceptance of system will not be given until satisfactory bacteriological results are obtained.

22-22 PIPING IDENTIFICATION:

a) Identify piping in mechanical rooms, above ceilings, open pipe chases, tunnels and other places where piping is accessible for operation and maintenance by painting with identification colors and with pressure sensitive pipe markers.

b) Place piping markers so they can be easily read from operating position and floor.

c) Mark piping with marker and a 3-inch-wide bank of identification color around circumference of pipe in lieu of painting complete pipe or pipe covering.

d) Lettering on marker shall be at least 1-inch-high block type in contrasting color. An arrow indicating flow direction shall be painted next to each marker. Where markers occur on parallel groups of piping, they shall be neatly lined up.

e) See Schedule.

PIPING IDENTIFICATION SCHEDULE

Service	Letter Wording	Marker Color	Letter Color
Domestic Cold Water	Domestic Cold Water	Green	White
Domestic Hot Water	Domestic Hot Water	Yellow	Black
Domestic Hot Water Return	Hot Water Return	Yellow	Black
Natural Gas	Natural Gas	Yellow	Black

22-23 VALVE IDENTIFICATION:

a) Mark all valves located above ceiling with designation on ceiling tile directly below the valve as directed by the owner.

22-24 PIPE SLEEVES:

a) Provide proper type and size pipe sleeves and install in walls or floors and where otherwise noted. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for

cast iron soil pipe passing through concrete slab on grade except where penetrating a membrane waterproof floor. Sleeves shall not be provided in rated floors requiring fire seals.

b) Each sleeve shall be continuous through wall, floor, or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved. Sleeves shall be required through floors subject to flooding such as toilet rooms, equipment rooms, and kitchens. The contractor shall have the option of:

1. Providing a cast iron sleeve with integral flanges extending 1-inch above finished floor. Sleeve shall be cast in concrete when floor is poured. Annular space between sleeve and pipe shall be filled with Kaowool.

   or

2. Provide core-drilled opening in concrete with Thunderline Link-Seal or Calpico Sealing Linx between piping and opening.

c) Sleeves passing through floors with waterproof membranes shall be core-drilled and sealed with Thunderline Link-Seal or Calpico Sealing Linx.

d) Sleeves passing through walls with waterproof membranes shall be sealed with Thunderline Link-Seal or Calpico Sealing Linx.

e) Pipe insulation shall run continuous through pipe sleeves with 0.25-inch minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors, and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 0.375-inch-wide band. Provide Kaowool fire master bulk packing between sleeve and metal jacket. Packing thickness shall be sized per manufacturer's recommendation for maintaining the integrity of the fire wall/floor or smoke partition. Fire protection system shall be rated per ASTM E 119. Equivalents to Kaowool are 3M, Flame Stop, or Flame Safe.

f) Where piping passes through walls serving as air plenums or chases, seal annular space between pipe and sleeve air tight with Kaowool Firemaster Bulk Packing.

22-25 WELDING:

a) Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society AWS B3.0 and ANSI Z49.1.

b) Welding shall be done only be welders who have successfully passed welder qualification tests in previous 12 months for type of welding required. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three (3) copies of a list of welders who will work on project listing welder's code, date, and types of latest qualification tests passed by each welder.

c) Welded joints shall be fusion welded in accordance with Level AR3 of AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing." Welders qualified under National Certified Pipe Welding Bureau will be acceptable.

d) Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

22-26 PIPING MATERIALS AND FITTINGS:

a) Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturer's name and weight. All materials listed may not be required on this project. See piping material schedules, on drawings, for materials to be used for each piping system. Piping materials shall be as follows:

1. Carbon Steel Pipe (0.5 inches through 2.5 inches):

   A. Provide continuous weld or electric resistance welded carbon steel pipe conforming to ASTM A120 or A53, as scheduled.

   B. Pipe joints shall be threaded conforming to ANSI B2.1, beveled for welding, or grooved for use with Victaulic couplings.

   C. Pipe by Armco, Youngstown, United States Steel, or equal.

2. Carbon Steel Pipe (3 inches and above):

   A. Provide seamless continuous or electric weld carbon steel pipe conforming to ASTM A120 or A53, as scheduled.

   B. Pipe ends shall be beveled for welding or grooved for use with Victaulic couplings.

   C. Pipe by Armco, Youngstown, United States Steel, or equal.

3. Polyvinyl Chloride (PVC) Pipe:

   A. Provide Type 1, Grade 1 PVC pipe conforming to requirements of current ASTM D 1785 for pressure piping as scheduled. Pipe shall be approved by NSF for potable water.

   B. Provide Type 1, Grade 1 PVC pipe conforming to requirements of current ASTM D 2665 for DWV piping as scheduled. Cellular core PVC piping will not be approved.

   C. Piping for pressure piping shall have plain ends for socket type fittings.

   D. Pipe by Chemtrol, Charlotte, Tyler, Pipelife, Cabot, or equal.

4. Copper Tube:

   A. Provide hard temper copper water tube conforming to requirements of current ASTM B 88. Tubing shall be Type K, L, or M as listed in schedule.

   B. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.

   C. Pipe by Cerro, Chase, Mueller, Revere Copper, or equal.

5. Copper Tube Type ACR:

   A. Provide hard temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B 88. Tube shall be Type L or K as listed in schedule.

   B. Tubing joints shall be brazed or grooved joints shall be manufactured to copper-tube dimensions. (Flaring tubing ends to accommodate alternate sized couplings is not allowed.)

   C. Pipe by Cerro, Mueller, or equal.

6. Cross-linked Polyethylene PEX:

   A. Provide cross-linked polyethylene (PEX) tubing and ASTM F1960 cold expansion fittings conforming to the requirements of ASTM F876 and F877 and ANSI standards 14 and 61. Fittings shall comply with ASTM F1960.

   B. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required

      i. 200°F (93°C) at 80 psi (551 kPa)

      ii. 180°F (82°C) at 100 psi (689 kPa)

      iii. 73.4°F (23°C) at 160 psi (1,102 kPa)

   C. All horizontal tubing hangers and riser clamps shall be epoxy-coated with clips supplied by the tubing manufacturer with minimum of 32” horizontal and 60” vertical. Protect all tubing with sleeves or grommets through masonry or metal studs.

   D. All piping shall be installed as required by the PEX tubing manufacturer with minimum horizontal supports installed not less than 32” apart. Maintain clearance distances as recommended with min of 18” from water heaters and 12” from light fixtures.

   E. Tubing by Wirsbo, Watts, Uponor, Zurn and Viega.

7. PE Pipe: ASTM D2513, SDR 11.

   A. See Evaluations for discussion of service-line risers. Retain one of first two subparagraphs below for anodeless or transition service-line risers for PE pipe.

   B. Anodeless Service-Line Risers: Factory fabricated, and leak tested.

      i. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
      ii. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
      iii. Aboveground Portion: PE transition fitting.
      iv. Outlet shall be threaded or suitable for welded connection.
      v. Tracer wire connection.
      vi. Ultraviolet shield.
      vii. Stake supports with factory finish to match steel pipe casing or carrier pipe.

   C. Transition Service-Line Risers: Factory fabricated, and leak tested.
      i. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
      ii. Outlet shall be threaded or suitable for welded connection.
      iii. Bridging sleeve over mechanical coupling.
      iv. Factory-connected anode.
      v. Tracer wire connection.
      vi. Ultraviolet shield.
      vii. Stake supports with factory finish to match steel pipe casing or carrier pipe.

22-27 PIPE FITTINGS:

a) Pipe fittings used throughout project shall be proper type for installation method used and shall be compatible with piping system materials. Fittings listed in piping material schedule shall conform to the following specifications:

1. Carbon Steel Welding Fittings:

   A. Provide carbon low alloy seamless steel welding fittings conforming to current ANSI B16.9 and ASTM A234.

   B. Fittings by Grinnell, Midwest, or equal.

2. Branch Connection Welding Fittings:

   A. Provide carbon steel weldolet fittings conforming to ANSI B16.9, B16.11, B31.1.0, and ASTM A105, Grade 11.

   B. Fittings by Bonney Forge or equal.

3. Branch Connection Welding to Screwed Fitting:

   A. Provide carbon steel threadolet fitting conforming to ANSI B16.9, B16.1.1, B31.1, and ASTM A105, Grade 11.

   B. Fittings by Bonney Forge or equal.

4. Carbon Steel Flanges:

   A. Provide carbon steel flanges conforming to ASTM A 181, Grade 1 and ANSI B16.5

   B. Flanges by Grinnell, Midwest, or equal.

8. Wrought Copper Fittings:

   A. Provide wrought solder joint copper tube fitting conforming to ANSI B16.22.

   B. Fittings by Chase, Nibco, or equal.

9. Cast Bronze Fittings:

   A. Provide cast bronze solder joint fittings conforming to ANSI B16.18.

   B. Fittings by Chase, Nibco, or equal.

10. PVC, DWV Fittings:

    A. Provide PVC, DWV socket fittings conforming to ASTM D 3311 and D 2661.

    B. Solvent cement of socket fittings shall conform to ASTM D 2235.

    C. Fittings by Chemtrol, Charlotte, Tyler, or equal.

11. PVC, Schedule 40 Pressure Fittings:

    A. Provide NSF rated, Schedule 40, PVC socket fittings conforming to ASTM D 2466.

B. Solvent cement of socket fittings shall conform to ASTM D 2564.

C. Fittings by Tyler, Charlotte, or equal.

12. Pipe Flange Gaskets:

A. Gaskets by Durable Manufacturing Co., Garlock Co., or equal.

13. PEX Fittings:

A. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions. ProPex expansion or compression fitting allowed for application. Fittings shall comply with ASTM E84, E814, F877, F1960, F1807, F2159 and NSF/ANSI 61 for domestic water.

B. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

C. Fittings by Wirsbo, Watts, Uponor, Zurn, and Viega.

14. PE Pipe Fittings:

A. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.

B. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

22-28 INSULATING UNIONS AND FLANGES:

a) Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturer's name and pressure class rating. Unions and flanges shall be as follows:

1. Steel pipe to steel pipe screwed end:

A. Provide Stockham malleable iron No. 693-0.5 insulating union with high dielectric strength insulating sleeve and gasket.

2. Steel pipe to steel pipe flanged end:

A. Provide two (2) weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.

3. Iron or steel pipe to copper pipe:

A. Provide Epco dielectric union or flange with screwed or solder joint as required. Union shall have 250 psi rating and flange 175 psi rating at 190 deg F. Equal by Capitol Manufacturing, Central Plastics and Watts Regulator.

B. Dielectric nipples shall not be used.

22-29 STRAINERS:

a) Install strainers upstream from automatic control valves, steam traps, and pumps. Where strainers are an integral part of these items or incorporated in accessory equipment directly upstream, individual line strainers will not be required. Strainers shall be same size as piping. Provide strainers with proper isolation and blow down valves to allow basket removal for cleaning.

1. General: Provide Zurn “Y” Type with self-cleaning strainers with FIPT blow-off outlet, flanges or screwed end with pressure rating as required by piping system. Provide strainers with removable stainless steel or Monel screens with perforations as follows:

TYPE OF SERVICE	STRAINERS SIZE, INCHES 0.25 to 2	2.5 to 6	8 to 24
Water	0.005	0.0625	0.125

b) Equivalent strainers by Armstrong, Metraflex, Trane, Nibco, Victaulic, Dunham Bush, Musseco, Paget, or Spirax Sarco.

22-30 UNIONS:

a) Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.

b) Provide Stockham brass seat unions of material and pressure rating required by piping system.

c) Where piping systems of dissimilar materials are jointed together, provide proper insulating union as specified under this Specification.

22-31 BACKFLOW PREVENTERS:

a) Provide on all water connections to kitchen, equipment, and faucets a Watts SD-3 dual check, backflow preventer with atmospheric vent and drain routed to nearest floor drain or sink. Equal by Febco, Hershey, Ames, or Wilkins will be acceptable.

22-32 PIPING INSTALLATION:

a) Piping systems materials and installation shall conform to the following standards and codes:

1. System: Natural Gas Piping Code: ANSI Standard B31.2 "Fuel Gas Piping"

2. System: Plumbing System Piping Code: International Association of Plumbing and Mechanical Officials "Uniform Plumbing Code"

b) Pipe sizes indicated on plans and as specified refer to nominal size in inches for steel pipe, cast iron pipe, and copper tubing unless otherwise indicated. In no case shall piping smaller than size specified be used.

c) Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc. as recommended by manufacturer and as specified and detailed on drawings. Verify construction types and provide proper hangers, inserts, and supports in accordance with manufacturer’s load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and supports where pipe travel exceeds manufacturer’s recommendations for fixed hanger and supports. Provide copper plated hangers and supports for suspension of un-insulated copper tubing lines.

d) Provide escutcheon plates on all piping penetrations of exposed walls. Paint to match exposed surface.

e) Install all piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping systems. All piping shall be concealed unless noted otherwise. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves, and fittings used are not exceeded during normal operation or testing of piping system.

f) Provide piping materials and wall thickness for specific piping systems as listed in piping schedules in Section 22. Steel piping systems 2.5 inches and under shall be threaded pipe fittings. Steel pipe systems 3 inches and above shall be welded end pipe and fittings unless required otherwise by Code.

g) Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line. Provide unions on identical sizes of equipment for which one replacement item to be installed between unions without making any piping changes.

h) Piping fitting materials for specific piping systems shall be as listed in piping schedule. Fittings shall be approved factory made type with threaded or weld ends as required. Fitting pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.

i) All pipe threads shall meet ANSI B2.1 for taper threads. Lubricate pipe threads with Astroseal Teflon thread sealant and lubricating compound applied full strength. Powdered or made up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.

j) Welded pipe joints shall be made by qualified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe fitting ends shall be beveled a minimum of 30 degrees prior to welding.

k) Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.

l) Soft soldered socket type joints shall be made with 95-5 tin-antimony solder as required by temperature and pressure rating of piping systems. Solder socket joints shall be limited to systems containing nonflammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock or vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.

m) Make changes in piping size and direction with approved factory made fittings. Steel pipe and fittings suitable for at least 125 psi working pressure or of pressure rating required for maximum working pressure of system, whichever is greater.

n) Where pipe sizes of header or branch water supply piping do not appear on drawings, size piping to plumbing fixtures as follows:

FIXTURE TYPE	MAXIMUM QUANTITY OF FIXTURES	PIPE CW	SIZE HW
Water Closet (Flush Valve)	1	1.25”	--
Water Closet (Flush Valve)	2	1.5”	--
Lavatory	1	0.5”	0.5”
Lavatory	3	0.75”	0.75”

22-33 VALVES AND INSTALLATION:

a) Install necessary valves within piping systems to provide required flow control and to allow isolation for inspection, maintenance, and repair of each piece of equipment or fixture, and on each main and branch service loop. For application of specific valve types see Section 22 of this Specification.

b) Valves 2.5 inches and smaller have solder, socket weld, flanged, or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within 2 feet of each screw end valve unless valve can be otherwise easily removed from line. Optional Victaulic grooved valves may be used where scheduled.

c) Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance.

d) Non-rising stem valves shall not be installed at any point in the piping systems. With permission of A/E, non-rising stem valves may be installed at particular points where space is restricted.

e) Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.

f) Valves shall be the same size as piping shown on drawings. Do not reduce valve size.

g) Equivalent plug valves listed on current comparison charts of specified valve manufactured by Crane, Centerline, NIBCO, Kennedy, Keystone, Powell, or Victaulic will be acceptable.

h) Equivalent balancing valves by Taco, Flowset, Thrush, or Illinois will be acceptable.

i) Equivalent globe style silent check valves listed on current comparison charts of specified valve manufactured by NIBCO F-910-B or equal by Combination Pump Valve Co., Pagent, or Williams will be acceptable.

j) Equivalent automatic flow control valves by Flow Design, Hays Fluid Control, Griswold and Siemens.

22-34 VALVES:

a) Ball valves shall be scheduled as Type “BLV” valves. Valve specifications by type number shall be as follows:

TYPE NO	SPECIFICATION
BLV-1	2.5-inch valves and smaller for domestic water: Apollo Series 77CLF-X40, bronze (MSS SP-110, IAPMO IGC-157 or NSF/ANSI 61-8) (lead-free) full port ball valve 600 psi-WOB, Teflon seats, 316 stainless steel ball and stem with insulated handle and soldered, grooved or screwed ends. Provide stem extension for handle as required for insulation of valve body.
BLV-3	1-inch valves and smaller for gas: Apollo Series 77G-UL, bronze (MSS SP-110, UL-MHKZ, YSDT and YRBX Listed) full port ball valve 600 psi-WOB, multi-fill PTFE seats and seals, brass ball, stem with insulated handle with screwed ends.

b) Plug valves shall be scheduled as Type “PLV” valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
PLV -1	1-inch valves and smaller: Hays 7400 Series iron body gas cock, 175 psi-WOG bronze plug washer and nut, screwed ends.
PLV-2	1.25-inch valves through 2.5-inch valves: Homestead Fig. 651, semi-steel lubricated plug valve, 200 psi-WOG, coated plug, short pattern screwed ends. Provide complete with standard pattern cast handle.

c) Balancing valves shall be scheduled as Type “BAV” valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
BAV-1	4-inch valves and smaller: Bell and Gossett Model CB circuit setter balance valve, bronze body, 125 psi-WP at 250 deg F precision machined orifice calibrated position indicator, meter connections with built-in check valves flanged. Provide complete with polyurethane insulation cover.

d) Silent check valves shall be scheduled as Type “SCV” valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
SCV-1	2-inch valves and smaller: NIBCO T-480-Y bronze check valve, 250 psi-WOG, stainless steel spring, stainless steel stem, Teflon disc and seat ring, screwed or solder ends.

e) Automatic flow control valves shall be scheduled as Type “AFV” valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
AFV-1	2-inch valves and smaller: Flow Design Inc. AutoFlow, Model AC automatic flow control valve, brass body, 400 psi-WP at 250 deg F with electroless nickel and steel wear surfaces with stainless steel spring, built-in strainer, pressure/temperature ports, and shut-off valve with Teflon packing. Provide complete with polyurethane insulation cover.

22-35 PIPE HANGERS AND SUPPORTS:

a) Provide and be responsible for location of piping hangers, supports, and inserts, etc. required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of MSS SP-58.

b) Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being inducted into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.

c) Factory made hangers, attachments and supports to be by Tolco, ZSI, or Anvil and must be installed per manufacturer’s requirements. All other hangers, attachments and supports must be approved by A/E prior to installation.

d) Hangers, strut, clamps and supports located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. If located in a corrosive area, hangers, strut and clamps shall be type 304 (316) stainless steel with stainless steel hardware.

e) Clamps on all cold and hot water piping shall be fully insulated equal to an Anvil Cush-A-Therm. Cushioned or bare clamps that are not fully insulated are not allowed. Insulation material and thickness shall match specified material.

f) Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments so that rod is vertical in hot position. Hangers shall not become disengaged by movements of support pipe.

g) Provide sufficient hangers to adequately support piping system at specified spacing at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustments to maintain pitch required for proper drainage and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.

h) Hangers in direct contact with copper pipe or tubing shall be copper or plated coated with copper-colored epoxy paint.

i) Unless indicated otherwise on drawings, support horizontal steel piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
0.5” to 0.75”	0.375”	6’
1” to 1.25”	0.375”	8’
1.5”	0.375”	9’
2”	0.375”	10’

j) Unless indicated otherwise on drawings, support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1”	0.375”	6’
1.25” And 1.5”	0.375”	6’
2”	0.375”	9’

k) Support horizontal cast iron soil pipe with one hanger for each joint located close to hub.

l) Support plastic piping as recommended by piping manufacturer.

m) Provide continuous thread hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subjected to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe-supports indicating pipe sizes, service, and support details to A/E for review prior to fabrication.

n) Provide Tolco or Anvil pipe hangers for vertical pipe risers per MSS Type 8 or 42:

Type 8: Tolco Fig. 6 or Anvil Fig. 261.
Type 42: Tolco Fig. 14 or Anvil Fig 295.

o) Provide Tolco Fig. 30 steel wall brackets for piping suspended or supported from walls. Brackets shall be carbon steel and selected to meet the load. Finish to be hot dip galvanized in outdoor applications and type 304 (316) stainless steel in corrosive areas.

p) Where hangers are placed outside the jackets of pipe insulation, provide galvanized metal shields. Minimum 12” Long per MSS-SP-58.

q) Mount hangers for insulated piping on outside of pipe, hangers sized to allow for full thickness of pipe insulation. Shield shall support lower 180 degrees of pipe insulation. Omit copper plating on hangers mounted outside insulation on copper tubing.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
0.5" to 1.5"	12”	18
2" to 6"	12”	18

r) Where roller hangers are required and heat loss must be kept to minimum, use Tolco Fig. 260 – Fig. 265 as required by insulation thickness and pipe size.

s) Structural attachments for pipe hangers shall be as follows:

1. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18. Tolco Fig. 309 or Anvil Fig. 282.

2. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19. Tolco Fig. 68 or Anvil Fig. 94.

3. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 27. Tolco Fig. 336 or Anvil Fig. 14.

4. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21. Tolco Fig. 62 or Anvil Fig. 133.

5. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22. Tolco Fig. 305 or Anvil Fig. 66.

6. For attachment to structural shapes: C-clamps, MSS Type 23. Tolco Fig. 64 or Anvil Fig. 95.

7. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beam clamps, MSS Type 25. Tolco Fig. 335 or Anvil Fig. 217.

8. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut for pipe size 12”and smaller MSS Type 28. Tolco Fig. 62 or Anvil Fig. 133. For pipe size 14” and larger MSS Type 29 Tolco Fig. 297SP or Anvil Fig. 292L

9. Provide Tolco Fig. 506 vibration control hangers at locations on piping to prevent vibrations from being transmitted to building structure by conventional hangers. Apply hangers within their load supporting range and per the following:

   A. All pipe supports on lines that are connected directly to rotating equipment that have no flexible connection between equipment and piping.

   B. All pipe supports within the first 50 lineal feet after a flexible connection to rotating equipment. All supports between the flexible connection and the rotating equipment.

   C. All pipe supports that are attached to piping that is not connected to rotating equipment is exempt from vibration isolation.

t) Provide Anvil International, Inc. Fig. 45 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIAL	PIPE SIZE	CLAMP NO.	ROLLER NO.

PIPE MATERIAL	PIPE SIZE	CLAMP NO.	ROLLER NO.
Copper	0.375” though 4”	PS1100	PS1901
Steel	0.375” through 6”	PS1100	PS1902

u) Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Anvil International, Inc. Fig. 259 or equivalent by Advanced Thermal Systems. Where racks and supports are not detailed on drawings, submit detailed support drawings to A/E for review prior to fabrication.

v) Provide Control Devices HGR Series vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.

w) Provide TOLCO fig 318A and 316T combination pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

x) Provide Tolco Fig. 20 or Anvil Fig. 262 short strap for attaching pipe tight to ceilings as noted on plans.

y) Provide necessary structural steel and attachment accessories for installation of pipe hangers and supports. Where heavy piping loads are to be attached to building structure, verify structural loading with A/E prior to installation.

z) Equivalent hangers and supports by Tolco, Anvil, PHD, Anvil International, Inc., or Fluorcarbon Company.

22-36 CONCRETE INSERTS AND ANCHORS:

a) Provide concrete inserts for attaching piping and equipment as follows:

1. In new construction where attachment points can be predetermined, provide PHD Fig. 950 continuous concrete insert of Fig. 950N Universal Steel Concrete insert.

2. In existing construction or new construction where attachment points cannot be located before setting concrete forms, provide McCullock Kwik-Bolt or Phillips red head concrete anchors of proper type for attachments.

b) Equals by ITW, Masterset, MKT Fastening, and Power Fastening.

22-37 TESTING PROCEDURES:

a) Test all lines and systems before they are insulated, painted, or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor, and equipment required for tests.

b) Where entire system cannot be tested before concealment, test system in sections. Upon completion, each system shall be tested as entire system.

c) Repair or replace defects, leaks, and materials failures revealed by tests and then retested until satisfactory. Make repairs with new materials.

d) Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests.

e) Test methods are pressures shall be as follows:

1. Hydrostatic Test (Closed System):

   A. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for systems or 220 percent of operating pressure where not specified.

2. Pneumatic Test:

   A. Test entire system with compressed air. Systems operating above 2 psi shall be tested at 75 psi or 220 percent of operating pressure, whichever is greater.

   B. Allow at least 1 hour after test pressure has been applied before making initial test.

   C. During test, completely isolate entire system from compressor or other sources of air pressure.

3. Pressure Relief and Safety Valve:

   A. Before installation test pressure temperature and safety relief valves to confirm relief settings comply with Specifications.

   B. Tag items that pass test with date of test, observed relief pressure setting, and inspector's signature.

   C. Items installed in systems without test tag attached will be rejected.

f) All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.

g) Upon completion of testing submit five (5) copies of typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time, and all failures with corrective action taken.

h) For test pressures see piping material schedule.

22-38 PIPING AND EQUIPMENT INSULATION:

a) Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.

b) Provide insulation materials manufactured by Certain Teed, Knauf, Dow Chemical Company, Johns Manville, or Owen/Corning Fiberglass or Aerocel.

c) Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

d) Provided insulation accessories such as adhesives, mastics, cements, tape, and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

e) Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.

f) Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

g) Where glass is specified in the following insulation methods, provide resin impregnated with open weave glass fabric with 10/20 thread count.

h) Abbreviations for manufacturers of adhesives, mastics, and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.

i) Provide piping systems scheduled for metal insulation jacket with insulation system type specified except omit factory applied jackets on plastic foam or calcium silicate insulation unless indicated otherwise in schedule. Secure insulation with 1.5-inch-wide pressure sensitive type bands on plastic foam insulation and with galvanized tie wire on calcium silicate insulation system with stucco embossed aluminum vapor barrier metal jacket and matching aluminum fitting covers by Childers Products Co., Harren Metals Inc., or Premetco International. Lay fitting covers 2 inches over adjacent insulation jacket and apply 4-inch butt joint strips secured with stainless steel bands Jacket thickness shall be as scheduled with interior surfaces of metal fitting covers factory or field coated with not less than 10 mil thickness of C.M. No. 16-110 or B.F. No. 30-36 mastic coating. Jacket length shall be 3 or 4 feet applied with longitudinal and circumferential joints sealed with 0.125-inch bead of butyl or elastomeric sealant and lapped 2 inches over adjacent cover. Secure cover on piping 12 inches OD and smaller on 2-inch OD and above piping. Bands shall have thumb seals and be coated on 6-inch centers on piping 6-inches OD and smaller and on 12-inch centers on piping 8 inches and larger. Attach bands on aluminum jackets that cover insulation without vapor barrier jacket with one pop rivet, secure bands on aluminum jackets that cover insulation with vapor barrier jackets by cutting diagonal cut in longitudinal lap adjacent on piping within 6 feet of floor shall be 0.020-inch-thick or double jacket of 0.016-inch thickness.

j) Piping insulation materials and application methods by type shall be as follows:

1. TYPE 2-PC: Insulation for cold surface piping system with minus 50 deg F to plus 220 deg F operating temperature range shall be Armstrong AP Armaflex Elastomeric pipe insulation average thermal conductivity shall not exceed 0.27 BTU/Hr. at 75 deg F mean temperature. To greatest extent possible apply insulation without longitudinal joint by slipping insulation over piping. Seal all seams and butt joints with Armstrong 520 adhesive. Thickness shall be per manufacturer's recommendations using a maximum severity of 90 deg F and 80 percent RA. Insulate fittings as follows:

   A. Insulate exposed and concealed valves fittings with miter-cut pieces of AP/Armaflex pipe insulation equal to thickness of adjoining pipe insulation. Insulate fittings too large to cover with pipe insulation with insulation from fabricated/Armaflex sheet insulation using Armstrong templates. Join and seal all fittings joints with Armstrong 520 adhesive. Finish insulation as soon as possible with two coats of Armstrong Armaflex water-based, latex enamel finish in color selected by Architect. All insulation used outdoors shall be painted to prevent ultra violet deterioration of insulation.

k) Insulation materials and application methods for piping hangers supports, anchors, guides, expansion joints, etc. shall be as follows:

a) Insulate hangers and supports from direct contact with cold surfaces with ITW Trymer Supercel Phenolic inserts or equal of half or full sections of pre-molded pipe insulation equal in thickness to adjoining insulation. Provide inserts with vapor barrier jacket for lapping 2 inches over adjacent pipe insulation jacket. Protect insulation with insulation shields supporting lower 180 degree of pipe insulation sized so that pipe compressive load does not exceed one-third of insulation insert compressive strength. Seal joints with vapor barrier sealer specified for insulation type used. Materials shall meet the ASTM E84 burn characteristics of 25/50.

1. Insulate pipe anchors in direct contact with cold piping for a distance of 12 inches or as detailed on drawings form contact point with piping. Anchor insulation shall be one-half the thickness of adjoining pipe insulation with vapor barrier. Seal and finish joints with vapor barrier sealer specified for insulation type used.

2. Insulate pipe guides from direct contact with cold surfaces piping with Styrofoam HD-300 plastic foam full section inserts of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Provide inserts with vapor barrier jacket for overlapping 2 inches over adjoining pipe insulation. Insert jacket shall be equal in performance and appearance to adjacent insulation jacket. Seal and finish joints with vapor barrier sealer specified for insulation type used.

3. Insulate pipe expansion joints on cold surface piping with over-sized section of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Cover shall float free one end with expansion and contraction of piping system. Seal free end with 4 mil thick PVC vinyl sheet attached to adjoining insulation. Provide sufficient slack in vinyl material to allow for maximum pipe movement.

4. Where piping hanger cannot be isolated from cold pipe surfaces, insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to a point 12 inches above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer specified for insulation type used.

5. Insulate floor supports in direct contact with cold surface piping with Armstrong 0.5-inch-thick Armstrong FR/Armaflex pipe or sheet insulation as required by surface. Insulate supports from pipe to floor plate and seal insulation joints with Armstrong No. 520. Finish insulation with Armstrong Armaflex vinyl-lacquer finish.

6. All pipe insulation shall be continuous through walls, ceiling, or floor openings or sleeves except where firestop or firesafing materials are required.

b) Insulation of removable heads and valves, manhole access covers, plumbing pumps, etc. shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

c) Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this Specification for a period of one (1) year after date of final acceptance or through one (1) heating season and one (1) cooling season, whichever is longer, shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at M/C's expense at no cost to Owner.

22-39 ELECTRICAL REQUIREMENTS:

a) Consult Section 26 of electrical Specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.

b) Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Section 26 shall be included in M/C's base bid proposal.

c) The cost of larger wiring, conduit, control, and protective devices resulting from installation of equipment which was not used for basis of design as outlined in Section 22-10g of Specifications shall be paid by M/C at no cost to owner or A/E.

d) M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking, and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

e) Furnish six (6) complete sets of electrical wiring diagrams to A/E and three (3) complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.

f) M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on approval form which shall be presented monthly, or on request, to E/C. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, and locked current to allow E/C to order electrical equipment required in his contract.

g) Safety-disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is specified with these devices installed as part of factory built control systems.

22-40 RECORD DOCUMENTS:

a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing “field” condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheers into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.

b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, the following:

   1. Piping.

   2. Conduits.

c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a disk or CD shall be provided to the Owner as a permanent record.

d) As-built documents shall be submitted for approval prior to final payment. Copies of “in-progress” as-built drawings shall be submitted at each pay request.

22-41 PIPING SYSTEMS MATERIALS:

a) Refer to Section 22 of this specification for piping material specifications and installation instructions.

b) See schedule for specific piping materials and joining methods for systems installed under this section.

22-42 PIPING SYSTEMS VALVES:

a) Refer to Section 22 of this specification for valve type specifications and installation instructions.

b) See schedule for valve types to be installed under this section.

Service	Size	Stop	Check	Balance
Domestic Water	Up to 2.5”	BLV-1	--	--
Domestic Water	Up to 2”	--	SCV-1	--
Domestic Water	Up to 4”	--	--	BAV-1
Natural Gas	Up to 1”	PLV-1/BLV-3	--	--
Natural Gas	1.25” to 2.5”	PLV-2	--	--

22-43 PIPING SYSTEM INSULATION:

a) Refer to Section 22 for insulation type specifications and installation instructions.

b) See schedule for insulation types and thickness for piping installed under this section

c) Per 2012 International Code:

Service	Size	Type	Thickness
Domestic Cold Water	All	2-PC	0.5”
Domestic Hot Water	Up to 1.25”	2-PC	1”
Domestic Hot Water Return	Up to 1.25”	2-PC	1”
A/C Condensate Drain	Up to 2”	2-PC	0.5”

22-44 SCHEDULE OF FIXTURE BRANCHES:

a) Connection to individual plumbing fixtures shall be as follows:

Item	Waste	Vent	Cold	Hot
Water Closet – Flush Tank	4”	2”	0.5”	--
Lavatory	2”	1.25”	0.5”	0.5”
Drinking Fountain	2”	1.25”	0.5”	--
Janitor Basin	3”	1.5”	0.5”	0.5”
Sink	2”	1.5”	0.5”	0.5”

22-45 ADJUSTMENT AND BALANCING:

a) Adjust flush valves to minimum volume and balance flow in hot water returns as required to maintain proper water temperature in all branches circulated.

22-46 DRAINS, FLOOR SINKS, DOWNSPOUT NOZZLES, ETC.:

a) Floor Drains: Block out floor prior to pouring of concrete and then level floor drain after pour is set, remove forms, and grout level:

1. Type “A” floor drain shall be J.R. Smith Model 2010-A.

2. All floor drains in finished areas shall have nickel-bronze strainers except at showers where they shall be chrome-plated strainers.

3. Provide each drain that does not have an integral “P” trap with a cast iron “P” trap in connecting piping.

4. See Architectural plans for floor drain top elevations and floor drainage.

5. Floor drains shall be as manufactured by Wade, Josam, Watts or Zurn.

6. Sioux Chief shall be allowed on PVC piping systems only.

b) Trap Seal Primers – Pressure Drop Type:

1. MIFAB Model M2-500 pressure drop activated brass trap seal primer, with inlet opening of 1/2-inch (13) male NPT and outlet opening of female 1/2-inch (13) NPT. Complete with four view holes and removable filter screen. Serves up to 3 floor drain traps and requires no adjustments and no air pre-charge.

2. Provide waterless, inline trap seal protection with UV resistant frame and silicone sealing ribs.

22-47 CLEANOUTS:

a) Provide cleanouts full size of soil pipe up to and including 4-inch ID. Provide cleanouts at base of stacks, end of sewer main, and at elbows over 45 degrees and in any horizontal run of piping exceeding 100 feet at 50-foot intervals. Block out floor prior to pouring of concrete and then level cleanout after pour is set, remove forms, and grout level. Install cleanouts so they are accessible by extending them through walls, floors, and above or to outside of building, as required. Cleanouts shall be as follows:

b) Wall Type Finished Areas: J.R. Smith No. 4532 cast iron cleanout “T” with cleanout plug and stainless steel access cover.

c) Floor Type Hard Flooring Areas: J.R. Smith 4023 with round chrome plated scoriated cover.

d) Finish Grade Cleanout: J.R. Smith 4223 cast iron with extra duty cast iron top. Install in 18x18x7 concrete pad with #3 rebar and chamfered edges.

e) Equivalent cleanouts by Wade, Watts, Zurn, Josam or Jonespec will be acceptable.

f) Verify floor materials used from Architectural plans.

22-48 HYDRANTS AND HOSE BIBBS:

a) Wall Hydrants: Woodford No. 67 freeze proof with vacuum breaker equivalent by Prier, Wade, Zurn, or J.R. Smith will be acceptable.

22-49 SHOCK ABSORBERS:

a) Provide Josam Absorbotron shock absorbers, or approved equal, on all plumbing fixture batteries where shown on plans sized in accordance with the Plumbing and Drainage Institute Standards PDI WH201. Equivalent shock absorbers by Zurn, Wade, Sioux Chief, or J.R. Smith will be acceptable.

22-50 PLUMBING FIXTURES:

a) Provide plumbing fixtures as shown on drawings as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware, without pit holes or blemishes, and outlines shall be generally true. Architect reserves right to reject any piece which, in his opinion, is

faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fitting shall be chrome plated.

b) Set fixtures true and level with all necessary supports for fixtures installed before plastering is done. Nipples through wall to fixture connection shall be chrome plated brass. Contractor may use copper stub outs to stops under lavatories, provided deep escutcheons are used and no copper is visible in lieu of chrome nipples.

c) Equivalent fixtures and accessories by the following manufacturers will be acceptable:

1. Fixtures: American Standard, Eljer, Kohler, Toto, Crane, or Zurn.

2. Toilet Seats: Church, Olsonite, Toto, Bemis, American Standard, Kohler or Beneke.

3. Fittings, Carriers, and Supports: Josam, J.R. Smith, Zurn, or Wade.

4. Faucets: Sloan, Zurn, Toto, American Standard, Kohler, Delta, Chicago Faucets, or Moen.

5. Flush Valves: Sloan, Zurn, Delany, Toto or American Standard.

6. Traps, Supplies, and Stops: Dearborn, Sanitary Dash, BrassCraft, or as specified under plumbing fixtures:

   A. Lavatory Supplies and Stops: McGuire LF170, 0.5-inch compression inlet with angle compression stop and 0.375-inch OD risers in length required. Provide deep chrome plated brass escutcheons.

   B. Water Closet Supplies and Stops: McGuire LF187, 0.5-inch compression inlet with angle compression stop and 0.5-inch OD risers in length required. Provide deep chrome plated brass escutcheons.

   C. Traps: McGuire 8912C (1.5-inch) and/or 8872C (1.25-inch) cast brass body with cleanout “P” trap. Provide deep chrome plated brass escutcheon with set screw. Provide offset tailpieces as required for ADA compliance.

7. See Schedule for fixture type to be installed under this section.

d) Refer to architectural plans for exact locations and elevations of all plumbing fixtures. Trip levers on all ADA water closets shall be opposite the grab bar installed beside the water closet.

22-51 IN-LINE PUMPS:

a) Provide in-line pumps with capacities as shown on plans. Pumps shall be in-line type, close-coupled, single-stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.

b) Pump casing shall be of Class 30 cast iron or as specified. The impeller shall be of cast iron bronze, enclosed type, dynamically balanced, keyed to the shaft, and secure by a locking cap screw. All domestic water pumps shall be low lead/lead free bronze or brass unless otherwise specified.

c) The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring; suitable for continuous operation at 225 deg F. A bronze shaft sleeve shall completely cover the wetted area under the seal.

d) Pumps shall be rated for minimum of 175 psi working pressure. The pump case shall have gauge tappings at the suction and discharge nozzles and will include vent and drain ports.

e) Motor shall meet NEMA specifications and shall be the size, voltage, and enclosure called for on the plans. It shall have heavy-duty grease lubricated ball bearings, completely adequate for the maximum load for which the pump is designed.

f) Each pump shall be factory tested per Hydraulic Institute Standards. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

g) Pumps shall be manufactured by ITT Bell & Gossett, Armstrong, Peerless, Aurora or Taco.

22-52 OPENINGS:

a) This Contractor shall include the installation of all boxes and sleeves for openings required to install this work, excepting only structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. He shall set and verify the location of sleeves as shown on structural plans that pass through beams, only if so shown.

b) Penetrations in walls for sheet metal ducts shall be sealed by the M/C by stuffing glass fiber into the cracks between the walls and floors, and the ducts. The exposed joints shall then be caulked on each side with non-hardening caulking such as “Tremco Acoustical Sealant.” This work applies to all walls in buildings.

22-53 ACCESS PANELS:

a) Access panels shall be provided wherever necessary to provide access to valves, traps, etc., located in concealed spaces. Each fire damper, automatic splitter damper, etc., shall have an access panel. Size shall be adequate for inspection and removal of equipment and none shall be less than 12-inch by 6-inch.

22-54 SANITARY SEWER SERVICE:

a) New sewer shall tie into existing sewer on site per the plans. Seth Nelson at the City of Cabool is the sewer utility contact.

b) Coordinate with the general contractor that all fees, charges, and costs incurred by the utility are included in the base bid.

22-55 DOMESTIC WATER SERVICE:

a) Existing water service shall be utilized for project. Current building service has a 2” water meter, and approximate available service pressure is 45 PSI (at the main) and 38 PSI (at the water tower). Seth Nelson at the City of Cabool is the water utility contact.

b) Coordinate with the general contractor that all fees, charge, and costs incurred by the utility are included in the base bid**.**

22-56 NATURAL GAS SERVICE:

a) The existing gas service shall be remain for this project. The existing meter has a service pressure of 2 PSI. Jordan Clayton at Summit Gas is the gas utility contact. Contractor shall include all fees, costs and charges incurred by the utility in the base bid.

END OF DIVISION 22

DIVISION 23 –HVAC

23-1 CONTRACT DOCUMENTS:

a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Mechanical Contractor and his subcontractors and material suppliers.

23-2 SPECIFICATION FORM AND DEFINITIONS:

a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.

b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.

c) “Provide” means furnish and install.

d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.

e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.

f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Elizabeth Hargrave.

g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.

h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.

i) Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.

j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

23-3 GENERAL EXTENT OF WORK:

a) Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which M/C could have informed himself before bids were taken.

b) M/C shall familiarize himself with equipment provided by other contractors, which require mechanical connections and controls.

23-4 LOCAL CONDITIONS:

a) Visit site and determine existing local conditions affecting work in contract.

b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

23-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other Authorities Having lawful Jurisdiction (AHJ).

b) Conform to latest editions and supplements of the following codes, standards, or recommended practices as adopted by the AHJ.

1. CITY CODES:

   A. 2012 International Plumbing Code.

   B. 2012 International Mechanical Code.

   C. 2012 International Building Code.

   D. 2012 International Fire Code.

2. SAFETY CODES:

   A. National Electric Safety Code Handbook H30 – National Bureau of Standards.

   B. Occupational Safety and Health Standards – Department of Labor.

   C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

   A. NFPA 54 Gas Appliance and Gas Piping Code.

   B. NFPA 70 National Electric Code – 2017 Edition.

   C. NFPA 89M Clearances, Heat Producing Appliances.

   D. NFPA 90A Air Conditioning and Ventilation Systems.

   E. NFPA 91 Blower and Exhaust Systems.

   F. NFPA 101 Life Safety Code – 2012 Edition.

c) Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:

1. AGA – The American Gas Association Laboratories.

2. ASME – American Society of Mechanical Engineers.

3. NSF – National Sanitation Foundation.

4. UL – Underwriters Laboratories Inc.

d) Drawings and Specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, Contractor shall execute work in accordance with such ordinances, laws, codes, rules, or regulations without increased cost to Owner, but not until he has referred such variances to A/E for approval.

e) M/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

23-6 CONTRACT CHANGE:

a) Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.

b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.

c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustment factors. If proposals are not itemized, they will be rejected and returned for proper submittal.

d) The maximum allowable profit for any change order shall be ten percent (10%).

e) See Example below:

PRICING SHEET

Project: Boiler Room Repairs for ABC Company Date: January 1, 2019
Location: Springfield, Missouri Estimator: Jane Doe
Labor Rate: $22.00

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hours	Material Total
6” tee	1	ea.	$45.00	2.000	2.0	$45.00
Less 6” ell	1	ea.	$30.00	0.000	0.0	$ 30.00
6” sch 40 pipe	23	ft.	$10.43	0.253	3.8	$ 56.46
6” cap	1	ea.	$11.00	1.500	1.5	$ 11.00
6” hanger	1	ea.	$12.00	0.400	0.4	$ 12.00
4” saddle weld	1	ea.	$0.00	1.200	1.2	$ 0.00
4” sch 40	18	ft.	$4.44	0.183	3.3	$ 79.92
4” ell	3	ea.	$13.39	2.000	6.0	$ 40.17
4” hanger	3	ea.	$8.00	0.300	0.9	$ 24.00
4” weld	1	ea.	$3.00	1.000	1.0	$ 3.00
1.5” cond sch 80	21	ft.	$1.63	0.080	1.7	$ 34.23
1.5” ell	3	ea.	$4.00	0.400	1.2	$ 12.00
1.5” tee	1	ea.	$5.00	0.600	0.6	$ 5.00
1.5” weld	1	ea.	$3.00	0.400	0.4	$ 3.00
0.75” F & T trap	1	ea.	$73.00	0.500	0.5	$ 73.00
0.75” strainer	1	ea.	$12.00	0.500	0.5	$ 12.00
0.75” XH nipples	4	ea.	$7.70	0.100	0.4	$ 30.80
0.75” unions	2	ea.	$3.18	0.300	0.6	$ 6.36
0.75” cap	1	ea.	$0.65	0.100	0.1	$ 0.65
0.75” pipe sch 80	10	ft.	$0.72	0.400	0.4	$ 7.20
0.75” tee	1	ea.	$1.50	0.300	0.3	$ 1.50
0.75” ell	3	ea.	$0.95	0.200	0.6	$ 2.85

0.75” hanger	2	ea.	$2.50	0.200	0.4	$ 5.00
SUBTOTAL					28.74	$618.47
SALES TAX				6.125%		$37.88
LABOR	28.4	MH	$22.00			$624.80
5% OVERHEAD						$64.06
8% PROFIT						$107.62
TOTAL						$1,452.83

23-7 LOCATIONS AND INTERFERENCES:

a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of other contractors, access requirements for installation and maintenance, and to approval of A/E.

b) Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.

c) Any pipe, apparatus, appliance, or other item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the Contractor, his subcontractor, or his workmen shall be restored as specified for new work.

d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

23-8 SYSTEM PERFORMANCE:

a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment and all required programming installed under this Specification.

b) Contractor shall be responsible for all work as required by phasing of construction for intended use by the owner as applicable.

23-9 WARRANTY:

a) M/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this Specification Division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.

b) Where manufacturers’ warranties expire during the one (1) year warranty period, one (1) year warranty period is defined as year after date of substantial completion. M/C shall include provisions for extending warranty for the full one (1) year period and shall cost for warranty extension in his base bid.

c) M/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at M/C’s expense.

d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these Specifications.

e) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

23-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

a) The intent of these Specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.

c) In general, these Specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and Specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these Specifications or in subsequent addenda. Where other than first named products are used for M/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, that will meet or exceed the Specifications and are acceptable to the D/E.

d) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.

e) **PRIOR TO RECEIPT OF BIDS, IF M/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.**

f) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

g) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.

h) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, M/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, M/C shall submit

manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

i) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if; 1) request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or 2) Owner requests consideration be given to substitute brands.

23-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

a) Unless noted differently in the general requirements of the specifications, M/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, Engineer will retain one (1) set.

b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc. that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these Specifications, or plan sheet number, when item does not appear in Specifications. Where equipment submitted does not appear in base Specifications of specified equivalent, mark submittals with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

c) M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet Specification and/or drawing requirements. M/C's submittal review shall specifically check for, but not limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.

d) No shop drawing submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's review. All comments or minor notations on shop drawings shall be flagged as follows to indicate originator of comment or notation: 1 Contractor, 2 Construction Manager, 3 Architect, and 4 Engineer.

e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without M/C's review and approval stamp. A letter will be sent to M/C by either the Architect or Engineer indicating receipt of an improper submittal. M//C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by M/C or supplier for 23 working days after date of receipt. If not picked up by the 26th working day, submittals will be disposed of by A/E.

f) A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing to Owner or his representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.

a) Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.

2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.

3. Contractor shall provide all final documents including drawings, shop drawings, etc. in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this Specification, will also be required at closeout.

23-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

b) Where the contractor proposes to use different equipment that results in significant difference in routing or space considerations than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

23-13 CAD/BIM FILE REQUESTS:

a) CAD files and/or BIM models (only where created as part of the project design) are the property of the D/E and are only available upon documented written request. Prior to receiving any CAD files or models, the contractor shall submit a drawing cost fee of $50/drawing up to a maximum $1500 (BIM MEP models are $500). In addition, the contractor must sign a Third Party User Agreement and Drawing Request Form which must be forwarded to the D/E office prior to any CAD files being released. This form is available from the D/E upon request.

23-14 CUTTING AND PATCHING:

a) M/C shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.

b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.

c) Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete-hole-saw or concrete drill. Do not use star drill or air hammer for this work.

23-15 MUTILATION:

a) Mutilation of building finishes, caused by installation of mechanical equipment, fixtures, piping, and other mechanical devices shall be repaired at M/C's expense to approval of Architect.

23-16 EXCAVATION AND BACKFILL:

a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these Specifications, and in compliance with OSHA Safety Standards.

b) Excavate trenches of sufficient width to allow ample working space, and a minimum of 6", and no deeper than necessary, for installation work.

c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.

d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.

e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation in base bid.

f) Trenches shall be installed to have a bedding of natural or artificial graded fixture of crushed gravel or sand with 100% passing a 1 inch sieve and not more than 8% passing a #200 sieve. All depressions shall be filled with tamped and sand backfill. Place and compact backfill of sub-base material free of particles larger than 1" over piping. Compact each 6" layer at 85% density. Install warning tape directly above piping outside the building at 12" below grade.

g) Gravel for use of backfill will not be accepted unless approved by Engineer.

h) Notify Engineer two (2) business days prior to plumbing inspection by AHJ so that Engineer can visually inspect piping prior to backfill.

23-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

a) Work shall include mounting, alignment, and adjustment of systems and equipment.

b) Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified, or required by E/M's installation instructions.

c) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for required base type and size. Provide 3.5-inch high base where base is not shown on drawings.

23-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

a) M/C shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

23-19 PAINTING OF MATERIALS AND EQUIPMENT:

a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.

b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

c) Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

d) Paint all exterior natural gas piping with one (1) primer coat and two (2) finish coats.

23-20 MAINTENANCE OF SYSTEMS:

a) M/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

23-21 FILTERS:

a) Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems, remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment for final acceptance inspection by A/E.

b) Unless shown or specified otherwise 2" AP-Thirteen, MERV 13 minimum filter efficiency in all rooftop and air handling units. All units 2,000 cfm and greater shall be provided with MERV 8 pre-filters and MERV-13 final filters.

c) Unless shown or specified otherwise, provide Farr filters. MERV 8 minimum filter efficiency in all fan coil units, VRF units and fan terminal units.

23-22 CLEANING OF HVAC SYSTEM AND EQUIPMENT:

a) After pressure testing of systems and equipment and before operational test, thoroughly clean interiors of ductwork and equipment.

b) Clean equipment as recommended by manufacturers. Where specific instructions are not provided by equipment manufacturer, clean equipment systems as follows:

1. Air Handling System: Before starting any air system, clean all debris, foreign matter, and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blowers, etc. with throwaway filters specified under this Specification. After cleaning air system, install temporary filters and run continuously for eight (8) hours at full volume. Replace temporary filters with final filters immediately prior to testing and balancing.

23-23 PIPING IDENTIFICATION:

a) Identify piping in mechanical rooms, above ceilings, open pipe chases, tunnels and other places where piping is accessible for operation and maintenance by painting with identification colors and with pressure sensitive pipe markers.

b) Place piping markers so they can be easily read from operating position and floor.

c) Mark piping with marker and a 3-inch-wide bank of identification color around circumference of pipe in lieu of painting complete pipe or pipe covering.

d) Lettering on marker shall be at least 1-inch-high block type in contrasting color. An arrow indicating flow direction shall be painted next to each marker. Where markers occur on parallel groups of piping, they shall be neatly lined up.

e) See Schedule.

PIPING IDENTIFICATION SCHEDULE

Service	Letter Wording	Marker Color	Letter Color
A/C Condensate Drain	Drain	Green	White
Refrigerated Liquid	Refrigerated Liquid	Yellow	Black
Refrigerated Suction	Refrigerated Suction	Yellow	Black

23-24 PIPE SLEEVES:

a) Provide proper type and size pipe sleeves and install in walls or floors and where otherwise noted. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab on grade except where penetrating a membrane waterproof floor. Sleeves shall not be provided in rated floors requiring fire seals.

b) Each sleeve shall be continuous through wall, floor, or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved. Sleeves shall be required through floors subject to flooding such as toilet rooms, equipment rooms, and kitchens. The contractor shall have the option of:

1. Providing a cast iron sleeve with integral flanges extending 1-inch above finished floor. Sleeve shall be cast in concrete when floor is poured. Annular space between sleeve and pipe shall be filled with Kaowool.

   or

2. Provide core-drilled opening in concrete with Thunderline Link-Seal or Calpico Sealing Linx between piping and opening.

c) Sleeves passing through floors with waterproof membranes shall be core-drilled and sealed with Thunderline Link-Seal or Calpico Sealing Linx.

d) Sleeves passing through walls with waterproof membranes shall be sealed with Thunderline Link-Seal or Calpico Sealing Linx.

e) Pipe insulation shall run continuous through pipe sleeves with 0.25-inch minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors, and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 0.375-inch-wide band. Provide Kaowool fire master bulk packing between sleeve and metal jacket. Packing thickness shall be sized per manufacturer's recommendation for maintaining the integrity of the fire wall/floor or smoke partition. Fire protection system shall be rated per ASTM E 119. Equivalents to Kaowool are 3M, Flame Stop, or Flame Safe.

f) Where piping passes through walls serving as air plenums or chases, seal annular space between pipe and sleeve air tight with Kaowool Firemaster Bulk Packing.

23-25 WELDING:

a) Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society AWS B3.0 and ANSI Z49.1.

b) Welding shall be done only be welders who have successfully passed welder qualification tests in previous 12 months for type of welding required. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three (3) copies of a list

of welders who will work on project listing welder's code, date, and types of latest qualification tests passed by each welder.

c) Welded joints shall be fusion welded in accordance with Level AR3 of AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing." Welders qualified under National Certified Pipe Welding Bureau will be acceptable.

d) Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

23-26 PIPING MATERIALS AND FITTINGS:

a) Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturer's name and weight. All materials listed may not be required on this project. See piping material schedules, on drawings, for materials to be used for each piping system. Piping materials shall be as follows:

1. Copper Tube:

   A. Provide hard temper copper water tube conforming to requirements of current ASTM B 88. Tubing shall be Type K, L, or M as listed in schedule.

   B. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.

   C. Pipe by Cerro, Chase, Mueller, Revere Copper, or equal.

2. Copper Tube Type ACR:

   A. Provide hard or annealed temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B 280. Tubing 2" and larger shall be hard temper.

   B. Tubing joints shall be brazed or grooved joints shall be manufactured to copper-tube dimensions. (Flaring tube endings to accommodate alternate sized couplings is not allowed.)

   C. Pipe by Cerro, Mueller, or equal.

23-27 PIPE FITTINGS:

a) Pipe fittings used throughout project shall be proper type for installation method used and shall be compatible with piping system materials. Fittings listed in piping material schedule shall conform to the following specifications:

1. Carbon Steel Welding Fittings:

   A. Provide carbon low alloy seamless steel welding fittings conforming to current ANSI B26.9 and ASTM A234.

   B. Fittings by Grinnell, Midwest, or equal.

2. Branch Connection Welding Fittings:

   A. Provide carbon steel weldolet fittings conforming to ANSI B26.9, B26.11, B31.1.0, and ASTM A105, Grade 11.

B. Fittings by Bonney Forge or equal.

3. Branch Connection Welding to Screwed Fitting:

A. Provide carbon steel threadolet fitting conforming to ANSI B26.9, B26.1.1, B31.1, and ASTM A105, Grade 11.

B. Fittings by Bonney Forge or equal.

4. Wrought Copper Fittings:

A. Provide wrought solder joint copper tube fitting conforming to ANSI B16.22.

B. Fittings by Chase, Nibco, or equal.

23-28 INSULATING UNIONS AND FLANGES:

a) Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturer's name and pressure class rating. Unions and flanges shall be as follows:

1. Iron or steel pipe to copper pipe:

A. Provide Epco dielectric union or flange with screwed or solder joint as required. Union shall have 250 psi rating and flange 175 psi rating at 190 deg F. Equal by Capitol Manufacturing, Central Plastics and Watts Regulator.

B. Dielectric nipples shall not be used.

23-29 UNIONS:

a) Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.

b) Provide Stockham brass seat unions of material and pressure rating required by piping system.

c) Where piping systems of dissimilar materials are jointed together, provide proper insulating union as specified under this Specification.

23-30 PIPING INSTALLATION:

a) Piping systems materials and installation shall conform to the following standards and codes:

1. System: Heating and Air Conditioning Piping Code: ANSI Standard B31.9 "Power Piping"

b) Pipe sizes indicated on plans and as specified refer to nominal size in inches for steel pipe, cast iron pipe, and copper tubing unless otherwise indicated. Pipes are sized to nearest half-inch. In no case shall piping smaller than size specified be used.

c) Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc. as recommended by manufacturer and as specified and detailed on drawings. Verify construction types and provide proper hangers, inserts, and supports in accordance with manufacturer's load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and

supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports. Provide copper plated hangers and supports for suspension of un-insulated copper tubing lines.

d) Provide escutcheon plates on all piping penetrations of exposed walls. Paint to match exposed surface.

e) Install all piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping systems. All piping shall be concealed unless noted otherwise. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves, and fittings used are not exceeded during normal operation or testing of piping system.

f) Install piping so that systems can be completely drained. Provide piping systems with valved drain connections at all low points and ahead of all sectionalizing valves whether shown on plans or not. Drain lines shall be as follows:

PIPE SIZE	DRAIN SIZE
0.75" THROUGH 2"	0.75"

g) Pitch all piping and where possible make connections from horizontal piping so that air can be properly vented from system. Provide air vents as specified at all system high points and at drops in piping in direction of flow. Use eccentric reducers where necessary to avoid air pockets in horizontal piping.

h) Provide piping materials and wall thickness for specific piping systems as listed in piping schedules in Section 23.

i) Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line. Provide unions on identical sizes of equipment for which one replacement item to be installed between unions without making any piping changes.

j) Piping fitting materials for specific piping systems shall be as listed in piping schedule. Fittings shall be approved factory made type with threaded or weld ends as required. Fitting pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.

k) All pipe threads shall meet ANSI B2.1 for taper threads. Lubricate pipe threads with Astroseal Teflon thread sealant and lubricating compound applied full strength. Powdered or made up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.

l) Welded pipe joints shall be made by qualified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe fitting ends shall be beveled a minimum of 30 degrees prior to welding.

m) Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.

n) Soft soldered socket type joints shall be made with 95-5 tin-antimony solder as required by temperature and pressure rating of piping systems. Solder socket joints shall be limited to systems containing nonflammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock or vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.

o) Make changes in piping size and direction with approved factory made fittings. Steel pipe and fittings suitable for at least 125 psi working pressure or of pressure rating required for maximum working pressure of system, whichever is greater.

23-31 PIPE HANGERS AND SUPPORTS:

a) Provide and be responsible for location of piping hangers, supports, and inserts, etc. required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of MSS SP-58.

b) Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being inducted into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.

c) Factory made hangers, attachments and supports to be by Tolco, ZSI, or Anvil and must be installed per manufacturer's requirements. All other hangers, attachments and supports must be approved by A/E prior to installation.

d) Hangers, strut, clamps and supports located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. If located in a corrosive area, hangers, strut, and clamps shall be type 304 (326) stainless steel with stainless steel hardware.

e) Clamps on all hydronic piping shall be fully insulated equal to an Anvil Cush-A-Therm. Cushioned or bare clamps that are not fully insulated are not allowed. Insulation material and thickness shall match specified material.

f) Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments so that rod is vertical in hot position. Hangers shall not become disengaged by movements of support pipe.

g) Provide sufficient hangers to adequately support piping system at specified spacing at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustments to maintain pitch required for proper drainage and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.

h) Hangers in direct contact with copper pipe or tubing shall be copper or plated coated with copper-colored epoxy paint.

i) Unless indicated otherwise on drawings, support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	0.375"	6'
1.25" And 1.5"	0.375"	6'
2"	0.375"	9'

j) Provide continuous thread hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subjected to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe-supports indicating pipe sizes, service, and support details to A/E for review prior to fabrication.

k) Provide Tolco or Anvil pipe hangers for vertical pipe risers per MSS Type 8 or 42:

Type 8: Tolco Fig. 6 or Anvil Fig. 261.

Type 42: Tolco Fig. 14 or Anvil Fig 295.

l) Provide Tolco Fig. 30 steel wall brackets for piping suspended or supported from walls. Brackets shall be carbon steel and selected to meet the load. Finish to be hot dip galvanized in outdoor applications and type 304 (326) stainless steel in corrosive areas.

m) Where hangers are placed outside the jackets of pipe insulation, provide galvanized metal shields. Minimum 12" Long per MSS-SP-58.

n) Mount hangers for insulated piping on outside of pipe, hangers sized to allow for full thickness of pipe insulation. Shield shall support lower 180 degrees of pipe insulation. Omit copper plating on hangers mounted outside insulation on copper tubing.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2" to 1-1/2"	12"	18
2" to 6"	12"	18

o) Where roller hangers are required and heat loss must be kept to minimum, use Tolco Fig. 260 – Fig. 265 as required by insulation thickness and pipe size.

p) Structural attachments for pipe hangers shall be as follows:

1. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18. Tolco Fig. 309 or Anvil Fig. 282

2. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19. Tolco Fig. 68 or Anvil Fig. 94

3. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 27. Tolco Fig. 336 or Anvil Fig. 14.

4. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21. Tolco Fig. 62 or Anvil Fig. 133.

5. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22. Tolco Fig. 305 or Anvil Fig. 66.

6. For attachment to structural shapes: C-clamps, MSS Type 23. Tolco Fig. 64 or Anvil Fig. 95.

7. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beam clamps, MSS Type 25. Tolco Fig. 335 or Anvil Fig. 217.

8. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut for pipe size 12"and smaller MSS Type 28. Tolco Fig. 62 or Anvil Fig. 133. For pipe size 14" and larger MSS Type 29 Tolco Fig. 297SP or Anvil Fig. 292L

9. Provide Tolco Fig. 506 vibration control hangers at locations on piping to prevent vibrations from being transmitted to building structure by conventional hangers. Apply hangers within their load supporting range and per the following:

    A. All pipe supports on lines that are connected directly to rotating equipment that have no flexible connection between equipment and piping.

    B. All pipe supports within the first 50 lineal feet after a flexible connection to rotating equipment. All supports between the flexible connection and the rotating equipment.

C. All pipe supports that are attached to piping that is not connected to rotating equipment is exempt from vibration isolation.

q) Provide Anvil International, Inc. Fig. 45 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIAL	PIPE SIZE	CLAMP NO.	ROLLER NO.
Copper	0.375" though 4"	PS1100	PS1901

r) Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Anvil International, Inc. Fig. 259 or equivalent by Advanced Thermal Systems. Where racks and supports are not detailed on drawings, submit detailed support drawings to A/E for review prior to fabrication.

s) Provide Control Devices HGR Series vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.

t) Provide TOLCO fig 318A and 326T combination pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

u) Provide Tolco Fig. 20 or Anvil Fig. 262 short strap for attaching pipe tight to ceilings as noted on plans.

v) Provide necessary structural steel and attachment accessories for installation of pipe hangers and supports. Where heavy piping loads are to be attached to building structure, verify structural loading with A/E prior to installation.

w) Equivalent hangers and supports by Tolco, Anvil, PHD, Anvil International, Inc., or Fluorcarbon Company.

23-32 CONCRETE INSERTS AND ANCHORS:

a) Provide concrete inserts for attaching piping and equipment as follows:

1. In new construction where attachment points can be predetermined, provide PHD Fig. 950 continuous concrete insert of Fig. 950N Universal Steel Concrete insert.

2. In existing construction or new construction where attachment points cannot be located before setting concrete forms, provide McCullock Kwik-Bolt or Phillips red head concrete anchors of proper type for attachments.

b) Equals by ITW, Masterset, MKT Fastening, and Power Fastening.

23-33 TESTING PROCEDURES:

a) Test all lines and systems before they are insulated, painted, or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor, and equipment required for tests.

b) Where entire system cannot be tested before concealment, test system in sections. Upon completion, each system shall be tested as entire system.

c) Repair or replace defects, leaks, and materials failures revealed by tests and then retested until satisfactory. Make repairs with new materials.

d) Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests.

e) Test methods are pressures shall be as follows:

1. Hydrostatic Test (Closed System):

   A. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for systems or 230 percent of operating pressure where not specified.

2. Hydrostatic Test (Open System):

   A. Test entire system with 10 feet of head water. Where system is tested in sections, each joint in building except uppermost 10 feet of system shall be submitted to at least 10 feet head of head water. Water shall be held in system for 23 minutes before inspection starts. System shall hold test pressure without leaks.

3. Pneumatic Test:

   A. Test entire system with compressed air. Systems operating above 2 psi shall be tested at 75 psi or 230 percent of operating pressure, whichever is greater.

   B. Allow at least 1 hour after test pressure has been applied before making initial test.

   C. During test, completely isolate entire system from compressor or other sources of air pressure.

4. Refrigerant Piping:

   A. Test piping by pneumatic test using carbon dioxide or dry nitrogen. Test high and low side of refrigerant system for minimum leakage as specified in ANSI B9.1 for refrigerant used.

   B. System shall successfully hold test pressure for 24 hours without pressure drop. Following pressure test, evacuate entire system to an absolute pressure of 5,000 microns at ambient temperature of not less than 55 deg F. System shall hold vacuum for two (2) hours with absolute pressure increase of not more than 25 microns.

   C. Following successful completion of vacuum test, immediately charge system with refrigerant.

5. Pressure Relief and Safety Valve:

   A. Before installation test pressure temperature and safety relief valves to confirm relief settings comply with Specifications.

   B. Tag items that pass test with date of test, observed relief pressure setting, and inspector’s signature.

   C. Items installed in systems without test tag attached will be rejected.

f) All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.

g) Upon completion of testing submit five (5) copies of typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time, and all failures with corrective action taken.

h) For test pressures see piping material schedule.

23-34 PIPING AND EQUIPMENT INSULATION:

a) Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.

b) Provide insulation materials manufactured by Certain Teed, Knauf, Dow Chemical Company, Johns Manville, or Owen/Corning Fiberglas.

c) Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

d) Provided insulation accessories such as adhesives, mastics, cements, tape, and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

e) Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.

f) Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

g) Where glass is specified in the following insulation methods, provide resin impregnated with open weave glass fabric with 10/20 thread count.

h) Abbreviations for manufacturers of adhesives, mastics, and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.

i) Provide piping systems scheduled for metal insulation jacket with insulation system type specified except omit factory applied jackets on plastic foam or calcium silicate insulation unless indicated otherwise in schedule. Secure insulation with 1.5-inch-wide pressure sensitive type bands on plastic foam insulation and with galvanized tie wire on calcium silicate insulation system with stucco embossed aluminum vapor barrier metal jacket and matching aluminum fitting covers by Childers Products Co., Harren Metals Inc., or Premetco International. Lay fitting covers 2 inches over adjacent insulation jacket and apply 4-inch butt joint strips secured with stainless steel bands Jacket thickness shall be as scheduled with interior surfaces of metal fitting covers factory or field coated with not less than 10 mil thickness of C.M. No. 26-110 or B.F. No. 30-36 mastic coating. Jacket length shall be 3 or 4 feet applied with longitudinal and circumferential joints sealed with 0.125-inch bead of butyl or elastomeric sealant and lapped 2 inches over adjacent cover. Secure cover on piping 12 inches OD and smaller on 2-inch OD and above piping. Bands shall have thumb seals and be coated on 6-inch centers on piping 6-inches OD and smaller and on 12-inch centers on piping 8 inches and larger.

Attach bands on aluminum jackets that cover insulation without vapor barrier jacket with one pop rivet, secure bands on aluminum jackets that cover insulation with vapor barrier jackets by cutting diagonal cut in longitudinal lap adjacent on piping within 6 feet of floor shall be 0.020-inch-thick or double jacket of 0.026-inch thickness.

j) Piping insulation materials and application methods by type shall be as follows:

1. TYPE 2-PC: Insulation for cold surface piping system with minus 50 deg F to plus 220 deg F operating temperature range shall be Armstrong AP Armaflex Elastomeric pipe insulation average thermal conductivity shall not exceed 0.27 BTU/Hr. at 75 deg F mean temperature. To greatest extent possible apply insulation without longitudinal joint by slipping insulation over piping. Seal all seams and butt joints with Armstrong 520 adhesive. Thickness shall be per manufacturer's recommendations using a maximum severity of 90 deg F and 80 percent RA. Insulate fittings as follows:

   A. Insulate fittings with miter-cut pieces of AP/Armaflex pipe insulation equal to thickness of adjoining pipe insulation. Insulate fittings too large to cover with pipe insulation with insulation from fabricated/Armaflex sheet insulation using Armstrong templates. Join and seal all fittings joints with Armstrong 520 adhesive. Finish insulation as soon as possible with two coats of Armstrong Armaflex water-based, latex enamel finish in color selected by Architect. All insulation used outdoors shall be painted to prevent ultra violet deterioration of insulation.

k) Insulation materials and application methods for piping hangers supports, anchors, guides, expansion joints, etc. shall be as follows:

1. Insulate hangers and supports from direct contact with cold surfaces with ITW Trymer Supercel Phenolic inserts or equal of half or full sections of pre-molded pipe insulation equal in thickness to adjoining insulation. Provide inserts with vapor barrier jacket for lapping 2 inches over adjacent pipe insulation jacket. Protect insulation with insulation shields supporting lower 180 degree of pipe insulation sized so that pipe compressive load does not exceed one-third of insulation insert compressive strength. Seal joints with vapor barrier sealer specified for insulation type used. Materials shall meet the ASTM E84 burn characteristics of 25/50.

2. Insulate pipe anchors in direct contact with cold piping for a distance of 12 inches or as detailed on drawings form contact point with piping. Anchor insulation shall be one-half the thickness of adjoining pipe insulation with vapor barrier. Seal and finish joints with vapor barrier sealer specified for insulation type used.

3. Insulate pipe guides from direct contact with cold surfaces piping with Styrofoam HD-300 plastic foam full section inserts of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Provide inserts with vapor barrier jacket for overlapping 2 inches over adjoining pipe insulation. Insert jacket shall be equal in performance and appearance to adjacent insulation jacket. Seal and finish joints with vapor barrier sealer specified for insulation type used.

4. Insulate pipe expansion joints on cold surface piping with over-sized section of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Cover shall float free one end with expansion and contraction of piping system. Seal free end with 4 mil thick PVC vinyl sheet attached to adjoining insulation. Provide sufficient slack in vinyl material to allow for maximum pipe movement.

5. Where piping hanger cannot be isolated from cold pipe surfaces, insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to a point 12 inches above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer specified for insulation type used.

6. Insulate floor supports in direct contact with cold surface piping with Armstrong 0.5-inch-thick Armstrong FR/Armaflex pipe or sheet insulation as required by surface. Insulate supports from pipe to floor plate and seal insulation joints with Armstrong No. 520. Finish insulation with Armstrong Armaflex vinyl-lacquer finish.

7. All pipe insulation shall be continuous through walls, ceiling, or floor openings or sleeves except where firestop or firesafing materials are required.

l) Insulation of removable heads and valves, manhole access covers, HVAC and plumbing pumps, etc. shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

m) Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this Specification for a period of one (1) year after date of final acceptance or through one (1) heating season and one (1) cooling season, whichever is longer, shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at M/C's expense at no cost to Owner.

23-35 DUCTWORK INSULATION:

a) Provide necessary materials and accessories for installation of interior and exterior ductwork insulation as specified and/or details on drawings. Insulation type and thickness for specific ductwork systems shall be as listed in insulation schedule in Section 23 of this Specification.

b) Provide insulation materials manufactured by Owens-Corning, John Manville, CertainTeed, or Knauf.

c) Insulation and application adhesives, except where specified otherwise, shall have fire and smoke hazard rating as tested by ASTM E 84 procedure not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

d) Abbreviations for manufacturers of adhesives, insulating cements, and coating specified shall be C.M. for Chicago Mastic Company, B.F. for Benjamin Foster Company and 3M for 3M Company. Average thermal conductivity is expressed in BTU/hr./sq.ft./deg F/in.

e) Install interior duct liner insulation cut to insure tight fitting corner and longitudinal joints. Apply liner to sheet metal with 100 percent coverage of C.M. No. 17-477, B.F. No. 81-18, or 3M manufacturer's recommended application rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18 inches or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:

1. Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3 inches of leading edge of each section 12 inches OC around joint perimeter and 3 inches from longitudinal joints at 12 inches OC. Elsewhere space fasteners 18 inches OC except not more than 6 inches from longitudinal joints nor 12 inches from corner break.

f) Provide concealed round ductwork with exterior thermal insulation of type and thickness listed in schedule. Apply insulation to duct with C.M. No 17-477 or B.F. No. 85-20 adhesive. Provide mechanical fasteners 18 inches OC on duct width 30 inches and greater. Butt insulation joints tightly together and lap facing 2 inches over adjacent insulation and seal with vapor barrier adhesive. Seal all breaks with vapor barrier adhesive and vapor barrier tape matching insulation facing.

g) Provide exposed rectangular ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply with mechanical fasteners spaced 12 inches OC with minimum of two (2) rows per duct side. Seal fasteners, joint breaks, and punctures with vapor barrier adhesive reinforced with 3-inch-wide vapor barrier tape matching insulation facing.

h) Provide exposed round sheet metal ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply insulation with joints tightly butted together with vapor barrier adhesive. Insulate fittings with insulation thickness to equal adjoining insulation with cover overlapping 2 inches onto adjacent covering.

i) Duct insulation materials by type shall be as follows:

1. TYPE 1-DIL: Internal acoustical and thermal duct insulation for low velocity ductwork shall be CertainTeed 2-pound density Toughgard R duct liner with 0.24 BTUH thermal conductivity at 75 deg F mean temperature. Facing shall have a maximum water vapor sorption rate of 3 percent by weight. Approved for use in return air plenums, conforms to ASTM E84 requirements and withstands temperatures of 250˚.

2. TYPE 4-DEW: External thermal insulation for rectangular or round duct shall be CertainTeed, type 100, 1.0-pound per cubic foot density standard duct insulation complying with ASTM C 1290 and ASTM C 553 and 0.26 BTUH thermal conductivity at 75 deg F mean temperature. Provide foilscrim-kraft facing, FSK, meeting the requirements of ASTM C1136 with a maximum vapor transmission rate of 0.02 perms.

3. TYPE 6-DEW: External thermal insulation for rectangular or round duct shall be Armacell, Armatuff Plus, 3-pound density, closed-cell elastomeric insulation with a white thermoplastic rubber membrane and 0.25 BTUH thermal conductivity at 75 deg F mean temperature with 0.2% water absorption. Insulation shall meet ASTM C 534 requirements and the joints shall be sealed with Armatuff 25 seal tape. Equals by prior approval only.

4. TYPE 7-DEB: External thermal insulation for rectangular duct Dow Styrofoam Square Edge, extruded polystyrene with a 5.0 BTUH thermal resistance per inch at 75 deg F mean temperature. Facing shall have a maximum vapor transmission rate of 1.1 perms. Insulation shall only be used on the exterior of the building.

23-36 ELECTRICAL REQUIREMENTS:

a) Consult Section 26B of electrical Specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.

b) Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Section 26B shall be included in M/C's base bid proposal.

c) The cost of larger wiring, conduit, control, and protective devices resulting from installation of equipment which was not used for basis of design as outlined in Section 23-A-10g of Specifications shall be paid by M/C at no cost to owner or A/E.

d) M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking, and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

e) Furnish six (6) complete sets of electrical wiring diagrams to A/E and three (3) complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.

f) M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on approval form which shall be presented monthly, or on request, to E/C. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, and locked current to allow E/C to order electrical equipment required in his contract.

g) Safety disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is specified with these devices installed as part of factory built control systems.

23-37 CAPACITORS:

a) See Section 26B of the electrical section of these Specifications regarding capacitors.

b) Cost of additional capacitance beyond that specified shall be borne by the Contractor providing the motor.

23-38 RECORD DOCUMENTS:

a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing “field” condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheers into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.

b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, the following:

1. Piping.

2. Conduits.

3. Ductwork.

c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a disk or CD shall be provided to the Owner as a permanent record.

d) As-built documents shall be submitted for approval prior to final payment. Copies of “in-progress” as-built drawings shall be submitted at each pay request.

23-39 PIPING SYSTEMS MATERIALS:

a) Refer to Section 23 of this specification for piping material specifications and installation instructions.

b) See schedule for specific piping materials and joining methods for systems installed under this section.

23-40 PIPING SYSTEM INSULATION SCHEDULE:

a) Refer to Section 23 for insulation type specifications and installation instructions.

b) See schedule for insulation types and thickness for piping installed under this section.

c) Per 2012 International Codes:

PIPING INSULATION SCHEDULE

Service	Size	Type	Thickness
Refrigerant Lines (Interior)	All	2-PC	0.5”
Refrigerant Lines (Exterior)*	All	2-PC	0.5”
A/C Condensate Drain	Up to 2”	2-PC	0.5”

*All exterior piping insulation shall be painted with ultraviolet-resistant paint. Color as selected by architect.

**Provide 0.024” thick, aluminum jacket on all exterior piping.

23-41 DUCTWORK INSULATION SCHEDULE:

a) Refer to Section 23 for ductwork insulation specifications and installation instructions.

b) See schedule for insulation for ductwork to be insulated under this section.

c) **Ductwork scheduled for internal lining is NOT sized on the drawings to include the lining. Size shown on the drawing is the inside duct measurement.**

DUCTWORK INSULATION SCHEDULE

System	Type	Thickness
Supply Air – Rectangular-Low Velocity	1-DIL	0.5”
Supply Air – Round	4-DEW	1.5”
Return Air – Rectangular	1-DIL	0.5”
Return Air – Round	4-DEW	1.5”
Exhaust Air – Rectangular	1-DIL	0.5”
Exhaust Air – Round	4-DEW	1.5”
Outdoor Air Intake – Rectangular	4-DEW	1.5”
Exterior Ducts – Rectangular*	1-DIL/6-DEW	1”/1”
Exterior Ducts – Rectangular*	7-DEB	2”

(1) At contractor’s option, AQC Industries, R12, double-panel, pre-insulated QDuct with 2.3 mil, internal aluminum facing and 7.9 mil, external aluminum facing may be used for a SMACNA Leakage Class 1 ducts not exceeding 6,000 FPM velocity as installed per manufacturer’s specifications. Equal by Thermaduct.

*Provide 0.024” thick, aluminum jacket over insulation.

23-42 OPENINGS:

a) This Contractor shall include the installation of all boxes and sleeves for openings required to install this work, excepting only structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. He shall set and verify the location of sleeves as shown on structural plans that pass through beams, only if so shown.

b) Penetrations in walls for sheet metal ducts shall be sealed by the M/C by stuffing glass fiber into the cracks between the walls and floors, and the ducts. The exposed joints shall then be caulked on each side with non-hardening caulking such as “Tremco Acoustical Sealant.” This work applies to all walls in buildings.

23-43 ACCESS PANELS:

a) Access panels shall be provided wherever necessary to provide access to valves, traps, etc., located in concealed spaces. Each fire damper, automatic splitter damper, etc., shall have an access panel. Size shall be adequate for inspection and removal of equipment and none shall be less than 12-inch by 6-inch.

b) Duct Access Doors: Doors shall be equivalent to CESCO Model HDD. Frame shall not be less than 22-gauge galvanized steel, with 24-gauge door panels. Doors shall have minimum 1-inch-thick insulation, PVC foam tape gaskets; zinc plated steel continuous type hinge and latches. Equivalent by American Warming and Ventilating, Cesco, Flexmaster, Greenheck, McGill Airflow, Milcor, Pottorff, Ward and Nailor will be acceptable.

c) Fire Rated Wall/Ceiling Access Door: Doors shall be equivalent to Milcor UFR. Frame shall be 26-gauge galvanized bonderized steel and 20-gauge galvanized bonderized steel. Hinges shall be continuous, galvanized steel with stainless steel pin and a key operated latch. Provide automatic type door closure. Door shall have a UL rating to match rating of wall/ceiling rating. Equals by Acudor, Babcock-Davis, Cesco, Elmdor, Karp, MiFab and Nystrom.

23-44 SHEET METAL WORK:

a) Provide G90 commercial quality prime, bright spangled galvanized sheet steel on all ductwork. Sheet metal shall be manufactured in the United States of America.

b) Construct ductwork as detailed on drawings and as detailed in the latest edition of the Sheet Metal and Air Conditioning Contractor’s Association (SMACNA) Duct Manual. Details shown on project plans shall indicate specific construction methods to be used on this project, and shall be used in lieu of any alternate methods shown in SMACNA Duct Manual.

c) Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building structural framing.

d) Each duct system shall be constructed for the specific duct pressure classifications shown on the contract documents or in equipment fan schedule listed as external total static pressure.

e) All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1 inch or 2 inches in height and width of ductwork to accommodate insulation thickness. Mount duct specialties such as turning vanes, damper, etc., to ductwork with the section insulated “Build Outs” to maintain continuity of thermal barrier.

f) Construct ductwork system to conform to SMACNA Manual 23d H C Air Duct Leakage Test Manual.

g) Where dimensions, sizes, and arrangements of elements of duct assembly and support systems are not provided herein, the Contractor shall select such to be suitable for the service. All methods and devices shall be subject to the review and approval from Engineer.

h) Make ductwork transitions with sides sloped not to exceed a maximum of 20 degrees, 40 degrees included angle for diverging air flow and 30 degrees, 60 degrees included angle for converging air

flow. Factory fabricated reduced fittings of ASME short flow nozzle design will be acceptable for round ductwork.

i) Provide turning vanes in all elbows over 20 degrees unless otherwise noted.

j) The Contractor shall follow the applications recommendations of the manufacturer of all hardware and accessory items and make selections of such consistent with the duct classification and services.

k) Elbows for round ductwork shall be die formed though 8-inch diameter and 5 sections elbow 9 inches and above in diameter.

l) Ducts shall be sealed in accordance with Table1-2 of SMACNA Manual 1 5d. The allowable air leakage shall be in compliance with SMACNA standards for each respective duct pressure class and duct seal class. Duct sealing shall meet the following:

1. Seal level "A" requirements shall include all transverse joints, longitudinal seams, and duct wall penetrations. Pressure-sensitive tape shall not be used.

2. Seal level “B” requirements shall include all transverse joints and longitudinal seams. Pressure-sensitive tamp shall not be used.

3. Seal level “C” requirements shall include transverse joints only.

4. Spiral lock seams in round or flat oval ducts need not be sealed.

5. Minimum duct sealant levels shall be as follows:

	DUCT SEALANT LEVEL		
Duct Location	Supply	Exhaust	Return
Outdoors	A	C	A
Unconditioned Spaces	B	C	B
Conditioned Spaces	C	B	C

m) All exposed round ductwork and fittings shall be double-wall, galvanized steel, spiral lock seam, with1-inch fiberglass insulation. Provide perforated inner liner instead of solid inner liner when noted on plans. Outer shell shall be “paint-grip” sheet metal. Provide double-wall round ductwork and fittings as manufactured by United McGill or approved equal.

n) At Contractor’s option, ductwork may be joined with prefabricated galvanized “Ductmate” sections. The joint packing material and joint construction details using this method shall be submitted to the Engineer for review.

o) All duct pressure classes shall be same as the external static pressure (ESP) of the equipment supplying the duct. The equipment ESP shall be the pressure class for the entire supply duct system.

23-45 SHEET METAL SPECIALTIES:

a) Specialties shall be factory fabricated items designed for low, medium, or high velocity systems as indicated on contract documents. Submit shop drawings on all specialties required with shop drawings of ductwork layout. Specialties shall be as follows:

1. Turning Vanes: Aero-Dyne or equal 26-gauge HEP high efficiency profile air foil vanes mounted 2.125 inches OC on 24-gauge runners. Equals by DuctMate and Duro Dyne.

2. Control Dampers (Round – Velocities 4000 FPM and less): Provide Ruskin Model CDRS25 dampers suitable for use in temperatures from minus 50 deg F to 200 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel for dampers up to 24-inch diameter. Damper blades shall be two (2) layers, 14-gauge galvanized steel, and include a full-circumference neoprene seal. Leakage through damper in closed position shall not exceed 0.15 cfm per inch of blade circumference at a pressure differential of 4.0" W.G. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame.

3. Control Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model CD36 standard dampers suitable for use in temperatures from minus -25 deg F to 180 deg F. Frames shall be 5-inch by 1-inch x 16-gauge galvanized steel hat channel. Blades shall be roll formed, triple-V-groove 16-gauge galvanized steel, maximum of 6-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 72 inches high. Provide extended shaft with bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting. Blade edge seals shall be extruded dual durometer vinyl. Jamb seals shall be flexible metal, compression type. Leakage through damper in closed position shall not exceed 10 cfm per square foot of damper area at a pressure differential of 4.0" W.G.

4. Manual Volume Dampers (Round – Velocities 1000 FPM and less): Provide Ruskin Model MDRS25 dampers suitable for use in temperatures from minus 50 deg F to 250 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel. Damper blades shall be 20-gauge galvanized steel. Leakage through damper in closed position shall not exceed ratings published by Ruskin. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame. All parts not protected shall be given one coat of aluminum paint. Provide 2" extended stand-off bracket and locking hand quadrant.

5. Manual Volume Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model MD-35 standard dampers suitable for use in temperatures from minus 0 deg F to 240 deg F. Frames shall be 3-inch wide x 22-gauge or 5-inch by 1-inch x 18-gauge galvanized steel channel. Single blades shall be 22-gauge. Multiple blades shall be roll formed, triple-V-groove 18-gauge galvanized steel, maximum of 8-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 48 inches high. Provide 2" extended stand-off bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting.

6. Dampers shall be Carnes, CESCO, Greenheck, Nailor, Prefco, Titus, United McGill, Louvers & Dampers Co., Pottorff or equal.

7. Counterbalanced Backdraft Dampers: Unless backdraft dampers have been specified with a piece of equipment, provide Ruskin Model CBD2 counterbalanced backdraft dampers suitable for use in temperatures to 200 deg F and pressure differentials of 40-inch W.G. for 48-inch damper widths, 6-inch W.G. for 36-inch widths, 10-inch W.G. for 24-inch widths, and 16-inch W.G. for 12-inch widths. Damper frame shall be 0.125 wall thickness 6063T5 extruded aluminum with 12-gauge steel brace at each corner. Axles shall be 0.5-inch diameter plated steel supported by ball bearings pressed into frame. Counterbalance weights shall be adjustable and mounted outboard of frame. Finish shall be mill galvanized.

8. Backdraft Dampers: Provide Ruskin Model BD2/A2 backdraft dampers suitable for use in temperatures to 250 deg F and pressure differentials of 40inch for 48-inch widths. Damper frame shall be 6063T5 extruded aluminum, 0.090 inch wall thickness, mitered corners. Blades shall be 6063T5 extruded aluminum, 0.070-inch wall thickness, and extruded vinyl edge seals.

9. Flexible Connections: Ventfabrics Ventglas prefabricated flexible indoor connection of 3.25-inch-wide heat and fire resistant neoprene coated glass fabric complying with UL standard 214 with two (2) 3-inch-wide 24-gauge metal strips attached to each edge. Provide stainless steel strips on acid exhaust fans. Indoor connector fabric shall have a minimum tensile strength of 480 lbf/inch in the warp. Ventfabrics Ventlon prefabricated flexible outdoor connection of 3.25-inch-wide heat and UV resistant Hyphalon coated glass fabric complying with UL standard 214 with two (2) 3-inch-wide 24-gauge metal strips attached to each edge. Indoor connector fabric shall have a minimum tensile strength of 530 lbf/inch in the warp and a weather-proof synthetic rubber resistant to UV rays and ozone. Provide Ventfabrics Ventel glass fabric connection with stainless steel strips on acid exhaust fans. Duro-Dyne Corporation, Ductmate, Ward Industries or approved equal will be acceptable.

10. Access Doors: Provide access doors in ductwork for access to fire dampers, smoke dampers, etc., installed under this contract. Doors and frames shall be furnished in prime coat of gray rust inhibitive paint. Frames shall be seamless one-piece galvanized mild steel. The doors shall be outer and inner panels one-piece galvanized mild steel. The door insulation shall be a minimum of 1-inch-thick. Gasket shall be positive seal and fasteners progressive action cam locks type (zinc plated). Access doors shall be Nailor, Higgins, Milcor, CESCO, or equal.

11. Low-pressure, flexible duct for connection to diffusers shall be Flex Master Type 1M flexible duct in accordance with NFPA, BOA, NFPA 90B, and UL 181, Class I Air Duct. Duct shall be factory insulated with flexible fiberglass insulation with a minimum R-value of 4.2 at a mean temperature of 75 deg F. The insulation shall be covered with a reinforced aluminum metalized vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, Procedure A. Flexible duct shall be rated for a velocity of at least 4000 feet per minute and suitable for operating temperatures of at least 250 deg F. Internal working pressure rating shall be at least 10 inches W.C. positive and 5 inches W.C. negative. Equivalent flexible ducts by ATCO, McGill AirFlow, Ward Industries, or approved equal. Maximum flexible duct length of run shall be 5 feet unless shown otherwise. Connections shall be either stainless steel bands or nylon straps. Provide vertical flexible ductwork elbows at diffusers with external support: Thermaflex Flexflow Elbow or approved equivalent. Contractor shall submit acoustic performance factors for flexible duct. Performance factors shall be equivalent to the flexible duct specified.

12. Round take-off fittings without dampers from medium, high, and low pressure rectangular ductwork shall be made with Buckley BMD or equal bell mouth fittings. HET (High Efficiency Takeoffs), Buckley Model 3300 or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or greater than the round branch duct size. Round take-off fittings with dampers from medium, high, and low pressure rectangular ductwork shall be made with Buckley HD-BMD or equal bell mouth fittings. HET (High Efficiency Takeoffs), Buckley Model 3300-D-HD or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or greater than the round branch duct size. All dampers shall be provided with extended stand-off bracket, locking handle, square damper bar, and a minimum of two U-bolts. Equivalent by Barrington, SEMCO, McGill and SMC.

13. Fire Dampers (Wall/Floor): Provide at locations shown on plans, dynamic rated fire dampers constructed and tested in accordance with UL 555. Each fire damper shall have a 1.5 hour fire protection rating, 212 deg F fusible links, and shall include a UL label in accordance with established UL labeling procedures. Damper manufacturer's literature submitted for approval prior to installation shall include comprehensive performance data developed from testing in accordance with AMCA 500 and shall illustrate pressure drops for all sizes of dampers required at all anticipated air flow rates. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles, other materials, and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. Refer to plans for thin-line, out-of-

wall, or grille access models are required. Equivalent manufacturers shall be CESCO, Prefco, Louvers & Dampers, Nailor, Pottorff or Greenheck.

A. Low Velocity Round Dampers – Dampers for installation in round ducts shall be equal to area. Ruskin FDR25 dynamic rated to 2000 feet per minute velocity at 4.0" w.g. static pressure. At contractor's option, a Ruskin DIBD2, rectangular damper with round transitions may be provided.

B. Low Velocity Rectangular Dampers – Dampers for installation in low velocity rectangular ducts shall be equal to a Ruskin DIBD2 dynamic rated to 2000 feet per minute velocity at 4.0" w.g. static pressure with style B, folding type blade with 100 percent free area.

14. Louvers (Stationary): Provide Ruskin ELF375DX, 6-inch deep weather louvers. Frame and blades shall be 0.081-inch thick 6063T5 alloy extruded aluminum. Blades shall be 35 deg drainable-type and spaced at 3.5-inch centers. Jambs shall be constructed with integral downspouts for carrying water from the blades to the louver sill. Screens shall be provided on the interior of the louver and shall consist of 0.5-inch mesh 0.063-inch diameter aluminum wire mounted in aluminum frame. Louvers shall pass 1100 FPM free area velocity with less than 0.19-inch water pressure drop and shall carry less than0.1 oz/sf of water during a 15 minute period when tested in accordance with AMCA 500. Louvers shall bear the AMCA certified ratings. Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Ruskin, Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.

15. Louvers: (FEMA Rated) Provide Ruskin XP500, Chevron blade FEMA 361 Grille, 5.5" deep on all FEMA shelter intake and outlets. Frame and blades shall be 0.25" thick extruded aluminum. Blades shall be chevron style with a minimum free area of 46%. Louver shall have screen 5/8" x 0.04" flattened aluminum bird screen in removable frame to meet FEMA 361 standard. Louvers shall bear the AMCA certified ratings, and FEMA 361 design and construction for community shelters Zone IV criteria (15 lb. 2x4 impact at 100 mph for Tornado's). Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.

23-46 GRILLES, REGISTERS, AND DIFFUSERS:

a) Provide grilles, registers, and diffusers as shown on drawings and hereinafter specified. Set all units with rubber gaskets for air tight connection with mounting surface. Unless specified or noted otherwise, grilles and registers mounted on ducts shall have standard margins. See drawings for size and quantity.

b) Install all registers with curve of louver away from line of sight to avoid seeing into space behind louver.

c) Install all registers in masonry construction so that bottom of register starts with masonry construction joint. Support all grilles, registers, and diffusers from Tee bars or structure so as not to stress ceiling tile. Provide proper mounting supplied and arrangements for areas shown. Check Architectural drawings for ceiling and wall construction.

d) All grilles, registers, and diffusers shall be submitted with the following information for Engineers approval prior to installation. Any submittal found delinquent of requested information shall be returned for resubmittal:

1. Airflow.

2. Static Pressure Drop (maximum of 0.08-inch allowed).

3. Noise Criteria Rating (maximum of 30 NC allowed).

4. Throw – 230 FPM, 100 FPM, and 50 FPM.

e) All dimensions indicated on drawings for diffuser neck sizes, face sizes, etc., are generic in nature and should be verified with equipment manufacturer prior to bid letting. Contractor shall be held responsible for compliance with specification. Should a change be required to remain in compliance with specifications, all costs incurred shall be paid by M/C.

f) All registers and grilles shall have angled blades.

g) Equivalent by Titus, Krueger, Anemostat, Carnes, Price, Nailor, or Tuttle & Bailey will be acceptable.

h) See grille, register, and diffuser schedule.

23-47 REFRIGERANT LINES:

a) Contractor shall provide all refrigerant lines. Sizing and installation of refrigerant lines shall be as recommended by E/M. All accessories required due to excessive lengths or heights shall be provided by M/C. Contractor shall submit refrigerant line sizing calculations and routing drawings/risers with equipment shop drawings.

b) All refrigerant lines shall either by Type ACR copper or pre-charged lines. Pre-charged lines shall be supplied by Refrigeration Equipment manufacturer.

c) All refrigerant lines shall be tested. Contractor shall evacuate piping system with vacuum pump, charge with refrigerant to a pressure of 10 psig, and then admit dry nitrogen until the pressure is 230 psig. Final pressure shall be left on system for a minimum of four (4) hours. After system is found to be leak free, double evacuate system the final evacuation on system a minimum of 12 hours prior to charging. Pre-charged lines need not be tested except where leaks are suspected.

23-48 EXHAUST FANS:

a) Provide exhaust fans as indicated on drawings and schedule.

b) Provide accessories as indicated on schedule.

c) All belt driven fans shall be provided with a factory installed, automatic belt tensioner to maintain proper belt tension.

d) All fans shall be AMCA certified for air and sound ratings.

e) Equivalents by Carnes, Acme, Greenheck, Jenn Industries, Loren Cook, TwinCity Fan & Blower, or Penn Ventilation.

f) See exhaust fan schedule.

23-49 ROOFTOP UNITS:

a) General: Units shall meet all capacities based on conditions scheduled. Include all noted accessories on plans and with the specification.

b) Quality Assurance:

1. Fabricate and label refrigeration system to comply with ASHRAE 23, “Safety Code for Mechanical Refrigeration.”

2. Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, “Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.”

3. Listing and Labeling: Provide electrically operated components specified in this section that are listed and labeled:

   A. The rooftop unit(s) shall be certified in accordance with UL 1995 and ANSI Z21.47.

   B. The rooftop unit(s) shall be safety certified by an accredited testing laboratory and the nameplate shall carry the label of the certification agency.

c) Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, one (1) year unit, five (5) year compressors, five (5) year heat exchanger, provided manufacturer’s written instructions for installation, operation, and maintenance have been followed. Warranty period shall start at the date of substantial completion of the project.

d) Controls:

1. All units shall have controls provided as scheduled. Coordinate all requirements for interface with controls contractor as applicable.

e) Rooftop Unit Curbs:

1. Roof curbs shall be constructed of galvanized steel, be insulated, and a minimum of 16” high unless noted otherwise. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support, and air seal for the unit. Curb gasketing shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting on the rooftop unit.

f) Rooftop Units:

1. Description:

   A. Factory assembled and tested; designed for roof or slab installation; and consisting of compressor, condenser, evaporator coil, condenser and evaporator fans, refrigeration and temperature controls, gas heater, filters, and dampers.

2. Construction:

   A. Unit shall be provided from the manufacturer with the supply and return air opening for connections as required on plans.

   B. Unit shall be specifically designed for outdoor rooftop application with a fully weatherproof cabinet.

   C. All cabinet walls, access doors, and roof shall be constructed with G90 galvanized steel with the exterior construction 20-gauge or heavier painted:

      i. The unit shall be insulated with a minimum 0.5-inch-thick, 1 pound density insulation.

D. Access to filters, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn latches. Door fastening screws are not acceptable.

E. Access doors shall have full perimeter gaskets.

F. The unit shall be furnished with a stainless steel or PVC drain pan, sloped to drain connection.

3. Supply Fan:

A. Blower shall be self-contained for service and removal from cabinet.

B. Blower and motor shall be dynamically balanced.

C. The motor shall have permanently lubricated ball bearings and built-in thermal overload protection.

D. Belt drives as provided shall be adjustable with orating of 140 percent of motor nameplate.

4. Condenser Coil:

A. The air cooled condenser coil shall be fabricated of copper tubes with aluminum fins. Hail guards shall be provided for all these units,

5. Filters: See Division 23 for filter requirements.

6. Refrigeration System:

A. Compressor shall be provided with internal thermal overload protection and mounted on the compressor manufacturer’s recommended rubber vibration isolators.

B. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.

C. Unit shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.

D. Units shall be provided with Type 410A or 407 refrigerants.

E. Unit shall be equipped with refrigerant liquid line driers as required.

F. Units over 7 tons shall be multiple stage with minimum of two stages of control.

7. Gas Heat Section:

A. Unit shall heat using natural gas fuel and with a minimum one stage of heat capacity with minimum of 80 percent efficiency.

B. Unit shall be provided with a gas heating furnace consisting of a heat exchanger, an induced draft blower, and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established.

C. Unit shall be provided with a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

8. Power Requirement:

   A. Unit shall be provided with a factory installed and wired internal disconnect switch with an access handle on the exterior of the cabinet. Provide convenience receptacle that retains power when disconnect to unit is switched off.

9. Provide economizer as scheduled. Outside air economizer shall be fully modulating economizer providing differential enthalpy control for free cooling. The outside air damper and return air damper assembly shall be constructed of extruded aluminum, blades with rubber edge seals, and aluminum end seals. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.

10. Provide staged hot gas reheat or other accessories as scheduled.

11. Equivalent units by Aaon, McQuay, Trane, York, or Carrier.

23-50 TESTING AND BALANCING PREPARATION:

a) The M/C shall prepare the system for test and balance as follows:

1. Install, start-up, check out, and adjust all HVAC systems per drawings and specifications and have fully operational with all deficiencies corrected on or before Owner's substantial completion date.

2. Verify that M/C has installed new filters no more than one day prior to starting test and balance procedure.

3. Verify that all ductwork is clean and sealed tight against leaks.

4. Verify that all controls, dampers, and actuators are installed, adjusted, and calibrated.

5. Secure control dampers after test and balance.

b) The following checks shall be performed on each system installed under this contract:

1. Air Handling Systems:

   A. Clear system of all foreign objects and clean system.

   B. Verify fan rotation.

   C. Check bearing condition and lubrication.

   D. Check fan wheel clearances and fan alignment.

   E. Check motor security to mounting base.

   F. Check alignment of drive.

   G. Check vibration isolator adjustment.

H. Verify that proper filter media is installed.

I. Verify that all control dampers are installed and operable without binding or sticking.

J. Confirm that all fire, smoke, and volume dampers are installed and in full open position.

K. Verify that all air re-heat coils and fan coil units are installed.

L. Confirm that all air openings in walls above ceilings have been provided.

M. Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils. Air leaks shall not exceed SMACNA parameters for system pressure.

N. Verify that all ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.

c) The M/C shall make changes in pulleys, belts, dampers, etc., as required by the balance contractor, at no additional cost to the Owner.

d) The M/C shall install new filters in the air handlers and clean all strainers in the water system just prior to the beginning of the test and balancing.

e) The control manufacturer, or his representative, shall assist the balance contractor in setting automatic dampers, valves, etc., as required:

1. Bring all fans to design RPM.

2. Bring air volume in each air handling system to the design air volume using Pitot tube transverse method within a minimum of 26 traverse points.

3. Test and record fan motor data.

4. Test and record static pressure and air volume in high velocity duct extremities.

5. Bring air diffusers and registers to design CFM.

6. Make recommendations for system modifications and adjustments required to facilitate proper system balancing as determined by preceding test.

7. Retest and readjust all system segments affected by system modifications.

8. Bring water systems, including pumps, to design flows.

9. Adjust return air flows where dampers are provided.

23-51 AIR AND WATER SYSTEM TESTING AND BALANCING:

a) All air supply, return and exhaust systems, domestic hot water, and hot and chilled water systems shall be balanced and adjusted to meet capacity and condition shown in construction documents. This work shall be performed by an independent testing and balancing agency certified by AABC or NEBB.

b) M/C shall submit name of testing and balancing agency to A/E for approval prior to bid performance of work.

c) Balancing shall be performed and report in accordance with latest specification for testing and balancing for air systems and hot water systems, as it pertains to systems installed on this project.

d) Balancing and test reports shall be submitted on standard AABC or NEBB forms.

e) The following balancing contractors will be accepted for this project. No other contractors shall be allowed unless approved by Engineer:

1. Systems Testing and Analysis – Richard Miller (314) 567-6011.
2. Miller Certified Air – David Miller (314) 352-8981.
3. Precisionaire of the Midwest, Inc. – David Keller (816) 847-1380.
4. TABCO – Harry Gaines (417) 443-4430.
5. Total Air Balance – Bill Trotter (417) 207-9999.
6. Pro Balance – Duke Yokum (816) 228-7800.
7. C&C Group – Steve Corte (417) 429-4160.

23-52 DUCTLESS SPLIT SYSTEMS:

a) Equivalent manufacturers for ductless systems are Daikin, LG, Trane, Carrier, Mitsubishi, EMI, and Sanyo.

b) Provide evaporators, and condensing units as specified below and as scheduled. All equipment shall be manufactured by the same manufacturer.

c) Cooling coils and condensing units shall have matched ratings as indicated in schedules.

d) M/C shall provide all refrigerant lines and accessories to allow for complete operating system.

e) Minimum SEER shall be 13.0 as rated under standard ARI conditions.

23-53 CONDENSATE DRAINS

a) Provide as shown on drawings with materials as indicated in schedule. Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

b) Piping shall be no smaller than the drain connection of the device and at least 0.75” in diameter. Piping shall not decrease in size from the drain pan to the place of condensate disposal.

c) Horizontal runs shall slope at least 1/8” per foot in the direction of discharge.

d) Piping shall be supported as required for pipe size and material to eliminate pipe sagging.

e) Provide a capped, 0.75”, cleaning port with flair fitting at each equipment connection for cleaning of drain lines.

END OF DIVISION 23

DIVISION 26 – ELECTRICAL

26-1 CONTRACT DOCUMENTS:

a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Electrical Contractor and his subcontractors and material suppliers.

26-2 SPECIFICATION FORM AND DEFINITIONS:

a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.

b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.

c) “Provide” means furnish and install.

d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.

e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.

f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants LLC., 3333 E. Battlefield Suite 1000 Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Anthony G. Beier

g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.

h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.

i) Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.

j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

26-3 GENERAL EXTENT OF WORK:

a) Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which E/C could have informed himself before bids were taken.

b) E/C shall familiarize himself with equipment provided by other contractors, which require electrical connections and controls.

c) Make required electrical connections to equipment provided under Architectural and mechanical divisions of this project, except where shown or specified otherwise. All temperatures control conduits and boxes shall be part of division 26. Wiring and connections of control systems for equipment provided by G/C or M/C shall be included in base bid of each respective contractor.

d) Check electrical data and wiring diagrams received from M/C for compliance with project voltages, wiring, controls, and protective devices on electrical drawings. Promptly bring discrepancies found to attention of A/E for a decision.

e) Provide safety disconnect switches, contactors, and manual and magnetic motor starters (starters are required for any motor 3/4hp or larger) for all mechanical and electrical equipment requiring such devices, whether specifically scheduled or shown on the drawings or not – no adds shall be paid for this equipment required for proper operation of the equipment after the bid. Coordinate with the M/C and omit these devices only where they are included as part of the equipment, unless scheduled otherwise on the drawings, and only where approved by the A/E. Where approval has not been obtained from the A/E prior, include all costs for this equipment in the base bid. With exception of factory installed devices, provide safety disconnect switches, contactors, and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.

f) Coordinate closely with M/C and P/C for all mechanical, plumbing and/or HVAC equipment overcurrent protection. Where the provided equipment is listed with a 'Maximum Fuse Size', a fused disconnect switch shall be provided with fuses sized per the manufacturer's listing, regardless of what is shown on the drawings. Where the equipment is listed with a 'Maximum Overcurrent Protection (MOCP)', a fused or non-fused disconnect switch shall be provided as indicated and scheduled on the drawings. Include all costs as necessary for coordination with the M/C and including appropriate disconnecting means as required. Where overcurrent or disconnecting means sizes on the electrical drawings do not match the mechanical or plumbing drawings or the provided equipment, the E/C shall include costs for the larger sizes (including upsizing wiring and conduit to match overcurrent size) in the base bid. Notify the A/E in all instances.

g) Coordinate closely with M/C and P/C for all mechanical, plumbing and/or HVAC equipment electrical connection. Disconnecting means as indicated on the drawings is shown schematically. E/C shall verify mounting location and equipment connection points with the M/C and connect all equipment per the manufacturer's requirements. E/C shall verify mounting location of all disconnecting means with the E/M and install per those requirements and so as not to impact equipment performance, access, operation and/or warranty. Disconnecting means shall be installed in an accessible location as required by the National Electric Code. Provide structural supports securely attached to the building structure separate from mechanical equipment and/or supports for mounting of disconnecting means as required and include costs for all such supports and associated equipment in the base bid. Maintain all conduit and conductor feeds to equipment concealed inside the building or below grade, and stub up at the equipment inside the curb or at equipment supports. Unistrut shall <u>not</u> be allowed for any roof penetrations.

h) Coordinate closely with G/C, M/C and P/C for all electrical, lighting, mechanical, plumbing and/or HVAC equipment locations. Refer to the mechanical, plumbing and architectural plans for exact locations and quantities of all hvac equipment, plumbing equipment, smoke dampers, fire/smoke dampers, pumps, miscellaneous equipment, etc. Locations and quantities shown on the electrical drawings are approximate and may not reflect final position or quantity. The electrical contractor shall be responsible for familiarizing himself with all drawings and specifications in the construction documents, not just the electrical drawings. The electrical contractor shall provide final connection to all equipment and lighting. Where equipment or lighting is shown on the mechanical, plumbing or architectural plans but not shown on the electrical plans, electrical contractor shall provide power to the equipment based on equipment requirements as scheduled or noted, specified and/or per the manufacturer's requirements and include all costs in the base bid. Location shown of electrical connection to mechanical, plumbing or other equipment is schematic and may not reflect actual connection points. Rough-in and connection to the equipment shall be per the equipment manufacturer's requirements, the National Electric Code and as required to keep electrical connections concealed from view. All rough-in requirements shall be verified with the respective contractor and equipment manufacturer prior to any work being performed.

i) Electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

j) All electrical work as required to provide temporary power for construction shall be the responsibility of the electrical contractor. Include all costs as required in the base bid. Coordinate and verify all requirements with the general contractor.

26-4 LOCAL CONDITIONS:

a) Visit site and determine existing local conditions affecting work in contract.

b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

26-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and
Federal Governments and other authorities having lawful jurisdiction.

b) Conform to latest editions and supplements of the following codes, standards, or recommended practices.

1. CITY CODES:

   A. 2012 International Building Codes

   B. 2012 International Fire Code

2. SAFETY CODES:

   A. National Electric Safety Code Handbook H30 – National Bureau of Standards.

   B. Occupational Safety and Health Standards – Department of Labor.

   C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

   A. NFPA No. 70 – National Electric Code – 2014 Edition.

   B. NFPA No. 101 – Life Safety Code – 2012 Edition.

4. UNDERWRITERS LABORATORIES, INC.:

   A. UL 508 – Standards for Industrial Control Equipment.

   B. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

c) Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, E/C shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if E/C proceeds with work knowing it to be contrary to any ordinances, laws, rules, and

regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

d) E/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

26-6 CONTRACT CHANGE:

a) Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.

b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.

c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.

d) All submitted breakdowns shall be broken out individually for labor and material for each separate line item in the respective supplemental instruction, contract change directive, or proposal request. Items submitted with lump sums will be returned unreviewed.

e) The maximum allowable profit for any change order shall be ten percent (10%).

f) See Example below:

PRICING SHEET

Project: Project Name
Location: Project Location
Labor Rate: $22.00
Date: August 1, 2020
Estimator: Jane Doe

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hours	Materials Total
Add						
Drill & Patch Holes	1	lot	$1,285.00	3.000	3.00	$1,285.00
4” LB w/cover	6	ea	$105.23	2.750	16.50	$631.38
4” Compr. Conn	6	ea	$87.70	1.000	6.00	$526.20
4” GRC	40	ea	$9.04	0.280	11.20	$361.57
4” cut & thread labor	4	ea	$0.00	1.600	6.40	$0.00
4” GRC-PVC Adptr.	16	ea	$4.70	0.675	10.72	$75.20
4” GRC 90 Ell	4	ea	$56.34	1.500	6.00	$225.36
4” Sch 40 PVC	460	ea	$2.25	0.600	27.60	$1,034.03
Resocking Fee 20%	1	lot	$212.26	0.00	0.00	$212.26
Return Freight	1	lot	$26.40	0.000	0.000	$26.40
Deduct						
4” EMT	-330	ea	$2.46	0.045	(14.85)	($812.79)
4” EMT 90 Ell	-6	ea	$26.64	1.100	(6.60)	($159.84)
4” EMT Cplg	--39	ea	$2.27	0.270	(10.53)	($88.66)
SUBTOTAL					55.44	$3316.12
SALES TAX				6.125%		$203.11
LABOR	55.4	MH	$21.74			$1,205.27
5% OVERHEAD						$236.23

8% PROFIT	396.86
TOTAL	$5357.59

26-7 LOCATIONS AND INTERFERENCES:

a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by electrical drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer's shop drawings.

b) Study and become familiar with contract drawings of other trades and in particular the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.

c) Any conduit, apparatus, appliance, or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the E/C, his subcontractor, his workmen, or by any cause whatsoever, shall be restored as specified for new work.

d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

26-8 SYSTEM PERFORMANCE:

a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

26-9 WARRANTY:

a) E/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.

b) Where manufacturers' warranties expire before or during the one-year warranty period as specified in item a, the E/C shall include provisions for extending the manufacturer's warranty as required to match the one-year period from substantial completion and shall include cost for warranty extension in his base bid.

c) E/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at E/C's expense.

d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.

e) Keeps an itemized list of all equipment warranties listing equipment by name, mark, and type along with length and expiration date of each warranty. Submit two (2) copies to A/E with request for final inspection.

f) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

26-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

a) The intent of these specifications is to allow ample opportunity for E/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.

c) In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to meet or submit equipment which meets all of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for E/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.

d) Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.

e) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.

f) PRIOR TO RECEIPT OF BIDS, IF E/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.

g) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

h) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including (but not limited to) adjustments in mechanical, electrical, plumbing, controls, fire alarm and/or any other service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.

i) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, E/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, E/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

j) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if:

1. Request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or

2. Owner requests consideration be given to substitute brands.

26-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

a) E/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, A/E will retain two (2) sets.

b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

c) E/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear E/C approval stamp which shall indicate that E/C has reviewed submittals and that they meet specification and/or drawing requirements. E/C's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting E/C's approval shall be returned to his supplier for resubmittal.

d) No shop drawing submittals will be considered for review by the A/E without E/C's approval stamp, or that have extensive changes made on the original submittal as a result of E/C's review.

e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without E/C's review and approval stamp. A letter will be sent to E/C by either the Architect or Engineer indicating receipt of an improper submittal. E/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by E/C or supplier for 15 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.

f) A/E's review of shop drawings will not relieve E/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or his representative, nor shall it relieve E/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be E/C's responsibility.

g) Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.

2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.

3. Contractor shall provide all final documents including drawings, shop drawings, etc., in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this specification, will also be required at closeout.

26-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

b) Where the contractor proposes to use different size equipment, feeders, feeder materials, circuit breakers, fuses or significant difference in routing of feeders or branches than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

26-13 CAD FILE REQUESTS:

a) CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office. Prior to receiving any CAD files, the contractor shall submit a drawing cost fee of $50 per construction drawing up to a maximum $1500. In addition, the contractor must sign a Second Party User Agreement and Drawing Request Form (available upon request from our office) which must be forwarded back to the D/E office prior to any CAD files being released. BIM/Revit models will not be made available.

26-14 CUTTING AND PATCHING:

a) Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.

b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.

c) Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

26-15 MUTILATION:

a) Mutilation of building finishes, caused by installation of electrical equipment, fixtures, outlets, and other electrical devices shall be repaired at E/C's expense to approval of Architect.

26-16 EXCAVATION AND BACKFILL:

a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc., as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

b) Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.

d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.

e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation. Where rock is indicated, list unit cost for rock excavation in base bid.

26-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

a) Work shall include mounting, alignment, and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified. Level, shim, and grout equipment bases as recommended by E/M. Mount motors, align and adjust drive shafts and belts according to E/M's instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by E/C at no cost to Owner.

b) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for require base type and size. Provide 3.5-inch high base where base is not shown on drawings.

c) Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized practice. E/C shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.

d) Supports and/or support wires for electrical equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

26-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

a) E/C shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

b) E/C shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending, and the total hours given each individual.

c) E/C shall report in person to Owner's operating engineer at end of first month of operation and thereafter at end of sixth and 12th months after date of substantial completion of building to check operation of equipment that was installed under contract. Contractor shall answer operating personnel's questions regarding system operation and shall ascertain that systems are operating normally and are being properly maintained by Owner. If E/C finds that systems are not being operated and maintained as designed, he shall inform the building engineer/Owner and A/E in writing.

d) After each inspection, E/C shall submit written report to A/E indicating condition of equipment and including any recommended changes in operation of system or other information which will be helpful to Owner.

26-19 PRE-FINAL AND FINAL CONSTRUCTION REVIEW:

a) At E/C's request, A/E will make pre-final construction review to determine if, to the best of their knowledge, project is completed in accordance with plans and specifications. Items found by A/E as not complete or not in accordance with requirements of contract will be outlined in report to E/C. After completion and/or correction of these items, E/C shall notify Architect project is ready for final review.

b) At same time of final construction review, E/C and his major subcontractors shall be present or be represented by a person of authority. Each contractor shall demonstrate, as directed by A/E, that his work complies with purpose and intent of plans and specifications. Each contractor shall provide labor, services, instruments, or tools necessary for such demonstrations and tests.

26-20 MAINTENANCE OF SYSTEMS:

a) E/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

26-21 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT:

a) It shall be E/C's responsibility to protect and prevent damage to all electrical materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.

b) Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is <u>not</u> considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.

c) Where job conditions, or work of other contractors produce the potential for damage to electrical systems and equipment, E/C shall immediately notify the G/C so that corrective action can be taken.

d) E/C shall take extra precautions to protect electrical equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by E/C with new equipment at no cost to Owner.

e) E/C shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.

f) Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.

g) All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.

h) E/C shall keep a written record listing systems and equipment cleaned. Where special procedures or chemicals were used or where partial or complete disassembly of factory assembled equipment was necessary, E/C shall list special procedures and/or disassembly required and equipment components affected. Prior to final inspection, E/C shall submit two (2) copies of cleaning record to A/E for their records.

26-22 PAINTING OF MATERIALS AND EQUIPMENT:

a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) coat colors in finish areas shall be selected by A/E.

b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

c) Where extensive refinishing of factory applied finishes is required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

26-23 RECORDING AND REPORTING TESTS AND DATA:

a) Record nameplate horsepower, amperes, volts, phase service factor, and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.

b) Record motor starter catalog number, size, rating, and/or catalog number of thermal-overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specification instructions for proper sizing of thermal-overload units.

c) Record amperes-per-phase at normal or near-normal loading of each item of equipment furnished and/or connected.

d) Record current readings of each feeder conductor after energized and normally loaded, and again after balancing of feeder loads as required by current readings.

e) Record voltage and amperes-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load. This reading shall be taken continuously for a 24-hour period and recorded on permanent tape and submitted to A/E.

f) Record voltage and amperes at transformer secondary and primary stations, at normal loading. Record transformer percentage “taps” finally selecte4d. Transformers shall be connected to produce voltage at building service entrance equipment as follows:

Nominal System Voltage	Service Entrance Voltage
200	208

g) Submit at least two (2) copies of data noted above to A/E for review prior to final inspection.

h) Keep a record of all deviations made from routes, locations, circuiting, etc., shown on contract drawings. Prior to final inspection, submit one (1) new set of project drawings with all deviations and change clearly indicated.

26-24 IDENTIFICATION OF WIRING AND EQUIPMENT:

a) Provide identification and warning signs to wiring and equipment as listed in schedule. Signs and tags shall be as follows:

TYPE 1	Laminated phenolic plastic with black Gothic-condensed lettering by Seaton or Wilco. Signs shall be weatherproof and securely attached to equipment.
TYPE 2	Self-sticking 0.5-inch-wide flexible nylon tape with high gloss surface and typed smear proof, chemical/solvent resistant lettering by Brady or Dymo.
TYPE 3	Self-sticking polyester sign with wording and size conforming to ANSI Z35.1 – 1964 and OSHA 19.0.144iii (2) specifications, by Brady or as approved.
TYPE 4	Self-sticking flexible vinyl with oil resistant adhesive for minus 20 deg F to 300 deg F temperatures by Brady or as approved.

b) Provide lighting and power panelboards with Type 1 sign 1.25 inches by 6 inches indicating panel designation, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number.

c) Provide disconnect switches, time switches, lighting contactors, motor starters, and controllers with Type 1 sign 1.25 inches by 6 inches indicating equipment served, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number.

d) Provide feeders and branch circuit home runs with Type 4 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

e) Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type, and AWG size. Tape shall be located to be easily read with conductors installed.

f) All electrical equipment, such as switchboards, panelboards, distribution panelboards, load centers, industrial control panels, meter socket enclosures, C/T cabinets and motor control centers shall be provided with a Type 1 sign warning persons of potential electric arc fault hazards. The sign shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. Sign shall include at a minimum the orange ‘WARNING’ label with exclamation point symbol, and the wording “ARC FAULT HAZARD. APPROPRIATE PPE REQUIRED. FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY. REFER TO NFPA 70E.”

g) All electrical equipment, such as switchboards, panelboards, distribution panelboards, load centers, industrial control panels, meter socket enclosures, C/T cabinets, motor control centers and disconnect switches shall be provided with a Type 1 sign indicating the maximum available fault current. The sign shall include the date at which the calculation was performed. This sign shall be separate from other required signs so that it is more easily replaced in the future when changes are made.

26-25 SLEEVES:

a) Provide proper type and size sleeves for electrical ducts, busses, conduits, etc., passing through building construction. Where sleeves are installed by others, supervise installation to ensure proper sleeve location. Unless indicated or approved, install no sleeves in structural members. Sleeves shall be installed in concrete or masonry walls or floors and where otherwise noted.

b) Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved. Sleeves shall be required through floors subject to flooding such as toilet rooms, equipment rooms, and kitchens. The contractor shall have the option of:

1. Providing a PVC sleeve with integral flanges extending 1-inch above finished floor. Sleeve shall be cast in concrete when floor is poured. Annular space between sleeve and pipe shall be filled with Kawool. This option can only be used where sleeve does bit communicate with supply or return air plenum.

or

2. Provide core-drilled opening in concrete with ThunderlineUnk-Seal or Calpico Sealing Linx between piping and opening.

c) Sleeves passing through floors and exterior walls with waterproof membranes shall be core-drilled (floors only) and sealed with Thunderline Link-Seal or Calpico Sealing Linx.

d) Where electrical ducts, busses, conduits, wiring, etc., pass through fire walls, floors, and smoke partitions, seal annular space between sleeve and item passing through with Kaowool Fire Master Bulk Packing. Packing thickness shall be sized per manufacturer's recommendation for maintaining the integrity of the fire wall/floor or smoke partition. Fire protection system shall be rated per ASTM E 119. Equivalents to Kaowool are 3M, Flame stop, or Flame Safe.

e) Where piping passes through walls serving as supply or exhaust air plenums or chases, seal annular space between pipe and sleeve air tight with Thunderline Link-Seal or Calpico Sealing Linx.

26-26 RECORD DOCUMENTS:

a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.

b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, conduits, floor boxes, etc.

c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a flash drive or CD shall be provided to the Owner as a permanent record.

d) As-built documents shall be submitted for approval prior to final payment. Copies of "in-progress" as-built drawings shall be submitted at each pay request.

26-27 CIRCUITING:

a) Follow circuiting shown on drawings for lighting, power, and equipment connections.

b) Shared neutrals are not allowed for any circuits fed through a dimming system.

26-28 CONDUIT APPLICATION:

a) All wiring shall be in steel conduit unless otherwise noted in this section.

b) Provide EMT conduit for the following applications:

1. All panelboard feeders above grade.

c) Non-metallic conduit shall be allowed only for the following applications:

1. Electrical service feeders below grade. Transition to steel conduit shall be made prior to coming up from below grade.

2. Branch circuits below grade. Transition to steel conduit shall be made prior to coming up from inside the concrete.

d) MC Cable shall be allowed for the following applications only (all homeruns shall be in EMT conduit):

1. Light fixture whips (maximum of 6').
2. Branch wiring to receptacles located concealed in walls.

e) Where MC cable is noted above as allowed, it shall be installed as follows:

1. MC cable shall be allowed for light fixture whips and branch circuit wiring where concealed as allowed by NEC.

f) Minimum homerun conduit size shall be 0.75"

g) All low voltage wiring systems (including, but not limited to temperature controls, security, access control, telephone/data, television, audio/video, fire alarm, lighting control, etc.) shall be provided with junction boxes and conduit up to above accessible lay-in ceilings, where open, plenum-rated wiring is allowed only above lay-in and/or sheetrock ceilings where wiring will be concealed from view. Where there is no ceiling (exposed structure), conduits shall be provided to conceal all wiring and all conduits shall be concealed in the building construction – exposed conduits are not allowed anywhere on the project. Temperature control wiring, security, access control, telephone/data, television, audio/video, fire alarm, lighting control, etc. wiring shall be bundled together by system and supported from the structure at regular intervals with J-hooks and additionally as required by code and the manufacturer where routed as open wiring above ceilings. Wiring shall not be routed unsupported or with straps. Fire alarm wiring shall be allowed to be open wiring as allowed by the National Electric Code above areas with lay-in or sheetrock ceilings. Provide conduit for all fire alarm wiring in all mechanical/electrical rooms, janitor's closets and storage/electrical rooms.

26-29 STEEL CONDUIT:

a) Rigid Conduit: Provide steel conduit meeting current ANSI C80.1 with hot-dipped galvanized and clear lacquer finish.

b) Electrical Metallic Tubing (EMT): Provide thinwall conduit meeting current ANSI C80.3 with electro-galvanized and clear lacquer finish.

c) Rigid Conduit and EMT Fittings: Provide Appleton Form 35 non-thread malleable iron unilets. Equivalent by CrouseHinds or Pyle National.

d) Rigid Conduit Connectors and Couplings: Provide steel NO-THREAD-TYPE. Rain and concrete tight shall be used for exterior or below grade applications. Equivalent by Thomas and Betts, Appleton, O-Z Gedney, Raco, Crouse Hinds, or Steel City.

e) EMT Connectors and Couplings: Provide insulated COMPRESSION EMT TYPE. Provide insulated, concrete tight and rain tight where required for application. Equivalent by Thomas and Betts, Appleton, O-Z Gedney, Raco, Crouse Hinds, or Steel City.

f) Liquid-Tight Flexible Conduit Fittings: Appleton "STB" series insulated connectors. Equivalent by Raco, Thomas and Betts, or Crouse Hinds.

g) Provide insulated throat fittings when Type THHN/THWN conductors are installed.

h) Short runs of flexible galvanized steel conduit may be used where permitted by code. Lengths greater than 6 feet require review by Engineer.

i) Make conduit connections to motors and equipment mounted on resilient mounts or vibration isolators with Type U.A. liquid-tight flexible conduit manufactured by Anaconda, or "Liquatite" by Electric-Flex Company.

j) Where conduits cross building expansion joints, provide O-Z expansion fitting Type "AX," "TE," "EX," or "EXE" as required.

k) Set screw type conduit fittings will not be allowed.

26-30 PLASTIC CONDUIT:

a) The following are general requirements for installation of plastic conduit which apply only where such plastic conduit is specifically allowed by applicable section in Division 26.

b) Normal duty applications in concrete slabs or underground without concrete encasement. Conduit shall be CarlonPlus 40 or Carlon Plus 80, rated for use with 90 deg C conductors, UL Listed or approved equal. Material shall comply with NEMA TC-2 (conduit), TC-3 (fittings) and UL 651 (conduit) and UL514B (fittings). Conduit shall be listed UL 651 for underground and exposed use.

c) All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer.

d) Normal duty exterior underground applications direct burial: Provide semi-rigid polyvinyl chloride (PVC) Type DB plastic duct meeting current NEMA TC-6 and Western Underground Committee Specifications.

e) Normal exterior underground applications encased burial: Provide semi-rigid polyvinyl chloride (PVC) Type A plastic conduit meeting current NEMA and Western Underground Committee Specifications.

f) Provide matching plastic conduit fittings by E/M. Fittings shall meet the same standards and specifications as the conduit on which it is installed.

g) Joining and bending of conduit and installation of fittings shall be done only by methods recommended by E/M.

h) Provide conduit support spacing as recommended by E/M for the highest ambient temperature expected.

i) Provide interlocking conduit spacers by E/M or multiple runs of underground conduits installed in the same trench.

j) Ends of feeder conduit terminating at transformers, switchgear, manholes, etc., shall be terminated with bell ends to protect conductor insulation.

k) Install no plastic conduit in areas where ambient temperature may exceed 150 deg F under normal conditions nor on heat producing equipment such as boilers, incinerators, etc. Install no plastic conduit in a return air or supply air plenum for the HVAC systems.

l) Provide expansion couplings on conduits located in areas where ambient temperatures are constantly changing and on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from E/M's published charts or tables.

m) All below grade PVC conduit shall be provided with tracer wire.

n) Plastic conduit and fittings shall be by Carlon, Allied, ABB or equal.

26-31 CONDUIT INSTALLATION:

a) In general, conceal conduit within walls, floors, roof construction, or furred spaces. Expose only feeders and short connections to equipment in equipment rooms unless noted otherwise. Install exposed conduit parallel or at right angles to building lines.

b) Install conduit to requirements of structure, other work on project and clear of openings, depressions, pipes, ducts, reinforcing steel, etc. Install conduit in concrete forms so that strength of structure will not be affected.

c) Align conduit terminations at panelboard, switchboards, motor control equipment, junction boxes, etc., and install true and plumb. Provide supports or templates to hold conduit alignment during rough-in stage of work.

d) Install conduit continuous between outlet boxes, cabinets, and equipment. Make bends smooth and even without flattening or flaking conduits. Radius of bends shall not be shorter than radius listed in NEC chapter 9, table 2. Long radius elbows may be used where necessary.

e) Ream and clean conduit before installation and plug or cover openings and boxes to keep conduit clean during construction.

f) Install no conduits or other raceways sized smaller than permitted in applicable NEC tables. Where conduit sizes shown on drawings are smaller than permitted by code, E/C shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of A/E. Fasten conduit securely in place with approved straps, hangers, and steel supports. Provide O-Z cable support to support conductors in vertical raceways as required by NEC Table 300-1 9(a). Where special hangers are required, submit hanger details to A/E for review before installation.

g) Where conduits cross expansion joints in building construction, the conduit system shall be provided with a means of allowing expansion/contraction in the conduit system.

h) Where a conduit or conduits enter a building from underground or from the exterior, they shall be sealed in accordance with the NEC section 300.5(G). Spare or unused conduits shall also be sealed. Sealants shall be identified for use with the cable insulation, shield or other components. Conduits (or sleeves) which will be subjected to different temperatures (such as where passing from interior to exterior, or at coolers/freezers, etc.), the conduit (or sleeve) shall be filled with an approved material to prevent the circulation of warm air to a colder section.

26-32 INSERTS AND HANGERS:

a) Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box, where plastic conduit is used follow E/M's recommended hanger spacing.

b) Insert multiple runs of conduits as follows:

1. Where a number of conduits are to be run exposed and parallel, group and support trapeze hangers.

2. Fasten hanger rods to structural steel members with suitable beam clamps and to concrete structures with inserts set flush with surface. Install concrete inserts with reinforced rod through opening provided in inserts.

3. Inserts shall be Grinnell Figure 279, 281, 282, or 285 or equivalent as required by load and concrete thickness.

4. Provide beam clamps suitable for structural members and conditions.

5. Provide 0.375-inch minimum diameter steel hanger rods galvanized or cadmium-plated finish.

6. Trapeze hangers shall be Kindorf Series 90 channel with fittings and accessories as required.

7. Attach each conduit to trapeze hanger with Steel City No. C01 05 clamps for rigid conduit and Steel City No. C-1 06 clamps for EMT.

c) Install clamps for single conduit runs as follows:

1. Support individual runs by approved pipe straps, secured by approved pipe straps, secured by toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. Use of perforated strap not permitted.

2. Install exposed conduits in damp locations with clamp backs under each conduit clamp to prevent accumulation of moisture around conduits.

3. Individual conduits suspended from ceiling shall be supported by Steel City No. C-1 49 hangers.

d) Provide inserts, hangers, and accessories with finish as follows:

1. Galvanized: Concrete inserts and pipe straps.

2. Galvanized or Cadmium Plated: Steel bolts, nuts, washers, and screws.

3. Painted with Prime Coat: Individual hangers, trapeze hangers, and rods.

e) Equivalent hanger and support systems by Grinnell, Fee and Mason, B-Line, Caddy, or Unistrut.

f) Supports and/or support wires for electrical equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

26-33 BUSHINGS AND LOCKNUTS:

a) Enter outlet boxes squarely and securely clamp conduit to outlet box with bushing on inside and locknut on outside. Provide Steel City BG series or equivalent threaded die-cast zinc insulated throat grounding bushings.

b) Terminate metallic conduits at switchboards, panelboards, control cabinet, etc., with Steel City BG series or equivalent malleable iron grounding type insulation bushings. Ground bushings to equipment grounding bus.

26-34 OUTLET BOXES:

a) Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures, and switches with Steel City, Raco, or equivalent 4-inch code gauge steel knockout boxes galvanized or sheradized of required depth for service or device.

b) Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.

c) Provide 0.375-inch or larger fixture stud in each outlet box scheduled to receive lighting fixture. Select covers with proper opening for device installed in outlet box.

d) Use of utility or “Handy” boxes acceptable only where single gang flush outlet box in masonry is “dead-end” with only one conduit entering box from end or back.

e) Use no sectional outlet boxes.

f) Provide Appleton FS or FD unilets for surface mounted exterior work. Provide complete with proper device cover and gasket. Provide blank cover and gasket when used as junction box.

g) Install boxes to maintain all fire ratings, as required by the building code and NEC. At all boxes installed in fire walls throughout the project, provide fire-rated sealing assembly (refer to the other specification sections for additional locations – refer to the architectural specifications for specification of all fire-rated penetration sealing materials and/or assemblies). Putty pads and/or other fire-rated sealing assemblies, where provided, shall fully seal all boxes and conduit entries (including at the penetration into the top of the wall) and shall be installed per the manufacturer’s instructions (including minimum/maximum ambient temperatures at time of install and after installation). Submit fire penetration materials and information with the shop drawings to the architect. Refer to the other specification sections for additional requirements. Putty pads and/or fire-rated sealing assemblies shall have a minimum STC rating per the architectural specifications.

h) For telephone, data or A/V junction boxes, provide the Hubbell HBL260 or HBL263 large capacity wall-boxes for all outlets. Provide complete with necessary mud-rings and components for a complete installation. Refer to plan notes for any additional requirements.

26-35 LOCATION OF OUTLET BOXES:

a) Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations.

b) Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from bench marks, columns, walls, or floors. Rough-in lighting fixtures and appliance outlet boxes to general locations before installation of walls and furring, and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building.

c) Install outlet boxes accessible. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork.

d) Install light switch or lighting control junction boxes at 48 inches above floor to the top of the box unless otherwise called for or required by Wainscot, counter, moulding, etc – coordinate with millwork contractor and G/C prior to any rough-in. All electrical light switches shall be located as close to door frame as possible. Under no circumstances should switches be located more than 12 inches from the edge of door frames.

e) Install centerline of receptacle outlet boxes 18 inches above floor unless otherwise called for on drawings.

f) All thermostats, temperature sensors and HVAC controls shall be installed at 48" above finish floor to the top of the thermostat or sensor, on the room side of light switches where shown in the same location. None of the controls shall be higher than 48" above finish floor to the operating or visible parts.

g) Maintain minimum clearances for all boxes for proper operation of equipment (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) after they are installed – coordinate installation requirements with M/C, temperature controls contractor, owner's A/V contractor, lighting control manufacturer and owner's telephone/data and television system contractors prior to any rough-in to allow adequate space for all equipment. Where conflicts occur with other building components (or with light switches below these devices), notify A/E of conflict and get approval to modify box location, height or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system.

h) If a wiring device (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) is shown to be installed in or on a column, it shall be centered on the column unless noted otherwise.

i) Locate associated data, telephone and television outlets at the same height as adjacent, associated receptacles, within 6 inches of the associated receptacles, where shown side-by-side on the plans and not noted otherwise.

j) Where wall-mounted telephone outlets are shown on the drawings in the same location as light switches, the telephone outlet shall be installed to the room side of the light switches at 48" above finish floor to the top of the telephone controls (no part of the telephone controls shall be higher than 48" above finish floor. Coordinate phone requirements with the owner prior to any rough-in).Do not locate phone outlet above the switches – locate 8" from the end of the light switches to allow clearance of the phone.

k) Where wall-mounted volume controls, A/V controls, and/or screen switches are shown on the drawings in the same location as light switches, these controls shall be installed on the room side of light switches at 48" to the top of the box.

l) Contractor shall be responsible for coordination of all box locations with millwork, wall treatments (mats, chair rails, paneling, special systems, etc.), finishes and architectural elements to maintain full accessibility per NEC and to facilitate installation and operation of all systems. Where conflicts occur with other building components, notify A/E of conflict and get approval to modify box location or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system.

m) Install clock and other outlet boxes at elevations indicated on drawings or as directed by A/E. Center bracket lights over mirrors with 2-inch clearance above the mirror to the bottom of the installed fixture.

n) Provide Alwalt, Keystone, Universal, or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform to NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc., as required.

o) Special items may be fabricated locally to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.

p) Where devices are installed in masonry, coordinate with A/E prior to any rough-in to allow adjustments for masonry joint locations.

26-36 PULL BOXES, WIREWAYS, AND GUTTERS:

a) Provide Alwalt, Keystone, Universal, or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform with NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc., as required.

b) Special items may be fabricated locally to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.

c) Provide sectional covers for easy removal.

26-37 CONDUCTORS:

a) Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform to color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller shall be solid.

b) Use no conductors smaller than No. 12 gauge unless specifically called for or approved by D/E. Size wire for 120 volt branch circuits for 3 percent maximum voltage drop. Size feeder circuits for 2 percent maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5 percent maximum.

c) Provide conductors for listed applications as follows:

1. Lighting and Receptacle Circuits: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.

2. Power Circuits and Feeders: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.

3. Low Voltage and Line Voltage Conductors Sizes No. 16 and No. 18 AWG: Type TFFN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.

4. Underground Circuits and Feeders: Type THHN/TWHN, 600 volt, 75 deg C (167 deg F) wet rating and 90 deg C (194 deg F) dry rated thermosetting filled insulating cable.

d) Provide conductors by Encore Wire and Cable, Southwire, Senator Wire and Cable, and Cerro Wire or equivalent.

26-38 CONDUCTOR INSTALLATION:

a) Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.

b) Neatly route, tie, and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.

c) Make circuit conductor splices with Buchanan B- Cap nylon insulated connectors or equivalent by Ideal or 3M.

d) Make fixture and device taps with Scotchlock self-stripping electrical tap connectors.

e) Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sa-Kon insulated terminals and connectors or equivalent by API/AMP Blackburn, Buchanan, or Scotchlock.

f) Where a total of six (6) or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks, provide mounting channel and see-through covers. Equivalent terminal blocks by General Electric, Square D, or approved equal.

g) Wrap conductor taps and connections requiring additional insulation with a minimum of three (3) overlapped layers of 3M Scotch vinyl plastic electrical tape No. 88 or equivalent.

26-39 CONDUCTOR COLOR CODING:

a) Provide continuous color coding for feeder, branch, and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not available in larger wire sizes, color code conductor at all accessible locations with Scotch 35 all-weather color code tape.

b) Identify the same phase conductor with same color throughout.

c) Provide conductors with color coding indicated. Where more than one standard voltage system is installed, provide same colored conductors with indicated tape or stripe to indicate system voltage.

SYSTEM VOLTAGE	CIRCUIT	INSULATION COLOR
120/208	Neutral	White
120/208	Phase A	Black
120/208	Phase B	Blue
120/208	Phase C	Red
120/208	Phase A Switch	Brown
120/208	Phase C Switch	Yellow
120/208	Control	Pink
120/208	3-Way Sw Runner	Purple
120/208	Control	Pink
120/208	Equip. Ground	Green
120/208	Isolated Ground	Green with Yellow stripe

26-40 FUSES:

a) Provide fuses of same manufacturer and characteristics as scheduled to insure selective coordination of power system. Fuses shall be Bussmann or equivalent by Ferraz Shawmut, Eaton, Littelfuse, or Brush.

b) Install fuses only after installation is complete and final tests and inspections have been made. Label fuses, switches, and other fused devices with warning labels affixed in prominent location indicating type and size of fuse installed and fuse manufacturer’s catalog number. Labels are supplied in fuse cartons.

c) Furnish Owner with spare fuses of each size and type installed on job as follows:

601 Amps or larger	Three (3) of each size and type.
600 Amps or less	10% with minimum of three (3) of each size and type.

d) Obtain receipt from Owner's representative showing date, quantity, and size of spare fuses delivered to Owner. Submit two (2) copies of receipt to A/E and bind one (1) copy in Owner's shop drawing manual.

e) Provide fuses with casings to match fuse holder dimensions. Fuse reducers shall not be used without prior approval of D/E.

f) Fuse shop drawings shall contain a schedule listing fuse type and size to be provided in each switch or fuse block. Also, provide a list indicating type, size, and quantity of spare fuses to be provided to Owner.

g) Fuse types shown in equipment schedules are Bussmann type designations unless otherwise indicated.

26-41 SAFETY SWITCHES:

a) Provide heavy duty and general duty horsepower rated safety switches rated in accordance with NEMA enclosed Switch Standard KS1 and UL 98 and as scheduled.

b) Enclosure shall be NEMA type required by switch location and environment. Enclosure door shall have latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity, and application information.

c) Line terminals shall be permanently marked and shielded. Contacts shall be tin plated, equipped with arc chutes, and have moving contacts visible in off-position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break, spring driven, anti-tease mechanism, and be integral part of box. All current carrying parts shall be plated.

d) Fuse holders for 1 to 600 amperes shall be high pressure type for use with Class R current limiting fuses. Fuse holders shall be completely accessible from front of switch.

e) Provide switches by Eaton/Cutler-Hammer, General Electric, ITE/Siemens, or Square D.

f) See schedule.

26-42 MAGNETIC MOTOR STARTER:

a) Provide 600 volt, 60 hertz AC across-the-line magnetic type rated in accordance with NEMA standards and listed and labeled in accordance with UL 508.

b) Enclosures shall be NEMA type required by starter location and environment.

c) Starter shall have permanently affixed to inside of enclosure cover in easy to read wiring diagram including alternate control variations and also a warning sign indicating maximum current limiting fuses size that may be in disconnect switch which will limit fault current to starters withstand rating with 100,000 RMS fault current available at disconnect switch.

d) Starter contacts shall be silver alloy double break replacement without removal of power wiring or starter from enclosure.

e) Provide starter with melting alloy type overload relays on all phases. Bi-metallic type overload relays will not be approved. Overload thermal unit shall be one piece interchangeable construction non-adjustable. Starter shall be inoperative with thermal unit removed. Starters shall not be furnished to E/C with jumper straps in overload units.

f) Thermal units' ampere rating for overload relays shall be selected by multiplying motor nameplate running amperes at connected voltage by 0.90 for motors with 1.0 service factor and by 0.95 for motors with 1.15 service factor. Use resulting amperes to enter manufacturers' overload selection tables.

g) Provide starter with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required. When starter voltage exceeds 120 volts, provide 120 volt control circuit transformer with Fusetron Dual Element Fuses in transformer primary. Where starters are noted to be controlled by another control system (including, but not limited to temperature controls, fire alarm, boiler controls, kitchen hood controls, etc.), it shall be the E/C's responsibility to coordinate required control voltage with associated system prior to ordering starter and order appropriate accessories to allow proper control and function.

h) Starter shall be suitable for additional of at least four electrical interlocks of any arrangement of normally open or closed contacts.

i) Provide starter with accessories such as auxiliary contacts, pilot lights, start-stop, or HOA switches as required to obtain control sequence shown on drawings or specified. Accessories shall be available as kit for field installation or modification.

j) Starter applications requiring disconnect switch at starter shall be combination type motor starters in lieu of separate devices. Where four (4) or more starters are installed at one (1) location, starter disconnect means shall be installed in group control panels in lieu of separate devices.

k) Provide magnetic starters by Allen-Bradley, Eaton/Cutler-Hammer, ITE/Siemens, Square D, or General Electric.

l) See schedule.

26-43 COMBINATION MAGNETIC MOTOR STARTERS:

a) Provide 600 volt, 60 hertz AC across-the-line fusible magnetic type rated in accordance with NEMA standards and listed and labeled in accordance with UL 508.

b) Starter NEMA enclosure type shall be required for starter location and environment.

c) Disconnect switch and magnetic starter shall meet requirements of Articles SAFETY SWITCHES and MAGNETIC MOTOR STARTER of this specification.

d) Combination starter shall be a factory assembled unit with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required.

e) Provide combination starter by Allen-Bradley, Eaton/Cutler-Hammer, ITE/Siemens, or Square D.

f) See schedule.

26-44 MANUAL MOTOR CONTROL:

a) Provide 300 volt, 60 cycle, AC manually operated motor starting switch meeting current NEMA standards with proper NEMA enclosure required by starter location and environment.

b) Starter shall have heavy silver alloy contacts with quick-break mechanism manually operated by toggle switch.

c) Thermal unit shall be melting alloy type, resettable, one piece interchangeable construction.

d) Provide starter with all accessories such as pilot light, HOA, or two (2) speed switches required to provide control sequence shown on drawings or specified. Selector switches contacts shall have same ampere rating as starter switch.

e) Provide starter by Allen-Bradley, Eaton/Cutler-Hammer, Furnas, Challenger, Square D, or General Electric.

f) See schedule.

26-45 LIGHTING CONTACTORS:

a) Provide 600 volt, 60 cycle mechanically or electrically held lighting contactors with proper NEMA enclosure required by contactor location and environment.

b) Contactors shall have silver alloy, double break power contacts replaceable without removing power wiring or contactor from enclosure.

c) Coils shall be molded case construction permanently marked with coil voltage and frequency and be replaceable without removing contactor from enclosure.

d) Provide contactor with internal wiring and control circuits prewired with only line, load, and external control circuits wiring connections required. Provide contactor with built-in clearing interlocks to allow control from either momentary or maintained pilot devices.

e) Contactor shall be suitable for addition of at least two (2) electrical interlocks of any arrangement of normally open or closed contacts.

f) Provide contactor with accessories such as auxiliary contacts, pilot lights, on-off, or HOA switches required to obtain control sequence shown on plans or specified. Accessories shall be available as kits for field installation or modification.

g) Where three (3) or more contactors are installed at one location, contactors may be installed in group control panel in lieu of separate devices.

h) Contactors by Allen-Bradley, Eaton/Cutler-Hammer, ITE/Siemens, Square D, or General Electric.

i) See schedule.

26-46 WALL SWITCHES:

a) Provide Leviton switches with compound handles compliant with FS W-S-896 and UL20. Install groups of switches under one (1) coverplate.

b) Provide switches in colors as selection by A/E.

c) Switches controlling loads of 1800 watts or less shall be as follows unless specified otherwise:

TYPE	CATALOG #	AMP	VOLTAGE
Single Pole	LE 1221-2	20	120/277
Three Way	LE 1223-2	20	120/277
Four Way	LE 1224-2	20	120/277
Pilot Light	LE 1221-PL	20	120/277
Momentary Contact	LE 1257	20	120/277
Double Pole	LE 1222-2	20	120/277
Occupancy	HU AD2000(1/2)	20	120/277
Occupancy/Dimmer	HU LHD-IRS-3	20	120/277

d) Weatherproof switch shall have Leviton Gray coverplate and press-switch combination as follows:

TYPE	CATALOG #	AMP	VOLTAGE
Single Pole	LE 1432	15	120

e) Mount weatherproof switches in proper size FS box.

f) Where switches are shown side-by-side in the same location, or shown in the same location on the lighting and power plans separately, gang all switches together in the same box with a single coverplate (whether detailed specifically on the drawings, or not).

g) Where wall dimmers are indicated, provide on/off with slide dimmer switch, rated for the load and load type served. Follow the manufacturer's requirements. Color of switch and coverplate shall match other wiring devices.

h) Equivalent switches by Cooper Wiring, Hubbell, Pass & Seymour, Bryant, Lutron or Leviton.

i) Electric timer switches shall be Leviton Model LTB30-1LZ or Watt Stopper Model TS-200 in color to match other wiring devices.

26-47 RECEPTACLES:

a) Provide Leviton specification grade NEMA WD-1 – 1974 grounding receptacles with color as selected by A/E (Isolated ground receptacles shall be white in color with green triangle designation; receptacles wired on circuits fed by the emergency generator shall be red in color where labeled on the contract documents):

TYPE	NEMA	CAT. #	AMP	VOLTAGE
Duplex	5-20R	LE 5353	20	125
Dual Voltage	5-20R/6-20R	LE 5842	20	125/250
Ground Fault	5-20R	LE 6899-A	20	125
Isolated Ground	5-20R	LE 5363-IG	20	125
GFI/TR	5-20R	LE G5362	20	125
Tamper Resistant	5-20R	LE 5362-SG	20	125
USB	5-20R	LE T5832	20	125

b) Provide Leviton weatherproof receptacles as follows:

1. Install device in Leviton No. 4992 gray lift coverplate for weatherproof (WP).

2. Install device in Leviton No. 5977-GY gray "While-In-Use" cover for weatherproof in use (WPI).

c) Provide Wiremold Plugmold 2000 multi-outlet system in series as follows:

TYPE	SERIES	DESCRIPTION
1	GB	3-wire, 1-circuit; insulated grounding conductor.
2	GB2	4-wire, 2-circuit; outlets wired alternately; insulated grounding conductor.
3	DGB	3-wire, 1-circuit; duplex outlets; insulating grounding conductor.
4	IG	3-wire, 1-circuit; insulated-isolated grounding conductor.

1. Outlet spacing and length shall be as indicated on drawings.

d) Provide recessed wall boxes for all wall mounted television/monitor locations. Wall box shall be 2-gang and shall include duplex receptacle and data connection equal to Legrand TV2MW or Hubbell Flat Panel Connection Enclosure.

e) Provide recessed wall boxes for all wall mounted AV computer hook-up locations with 2-gang (or 4-gang as required) recessed wall box with Duplex receptacle, HDMI, Cat 6, and other connection as noted on plans. Box shall be equal to Legrand Evolution EFSB2 (EFSB4).

f) Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.

g) Provide Leviton grounding receptacles as follows:

TYPE	NEMA	CAT. #	AMP	VOLTAGE
Combination	10-30	LE 278	30	125/250
Combination	10-50	LE 279	50	125/250

h) GFCI receptacles, where indicated or required by code, shall be installed in accessible locations. They shall not be installed concealed behind equipment, in attics, above ceilings, inside electric water cooler housings, etc… Where a GFCI receptacle is shown on the drawings where it may be concealed, the contractor shall provide a GFCI circuit breaker in the panel.

26-48 FLUSH WALLPLATES:

a) Provide Leviton Type 302 stainless steel wallplates conforming to UL, NEMA and Federal Specification WP-455A.

b) Provide wallplates for all switches, receptacles, blanks, telephone, computer, and special purpose outlets.

c) Plates shall be modern design, having rounded edges and corners complete with finish-matching mounting screws.

d) Provide flush wallplates on wiremold switch and receptacle boxes.

e) Provide factory engraved wallplates where indicated. Where engraved text is not outlined, submit two (2) copies of proposed text to A/E for review and approval prior to engraving.

f) Wallplates shall not support wiring devices. Provide wiring device accessories as required to properly install devices and wallplates.

g) Provide wallplates of one design throughout the building.

h) Provide designs and finishes equivalent to above specification where wallplates for special devices are available only from manufacturer of device.

i) Verify with A/E finish of any plate where is may be apparent a special finish or color should have been specified.

j) Provide narrow wallplates as indicated.

k) Ganged wiring devices shall have a single wallplate.

l) Provide wallplates manufactured by same company as wiring devices.

26-49 LIGHTING FIXTURES:

a) Provide fixtures complete with lamps and accessories required for hanging. E/C shall ensure that lamps, reflectors, lens, and trim are clean at time of final inspection. Mount recessed fixtures with trim flush to ceilings, free of gaps or cracks.

b) Coordinate mounting of ceiling mounted lighting fixtures with G/C. Where additional ceiling or fixture supports are required due to fixture location or weight they shall be provided by E/C, unless otherwise specified under ceiling specifications.

c) Fixture lamps shall be lamp type recommended by E/M. Lamp no fixtures above E/M's recommended maximum wattages.

d) For all light fixtures in food preparation areas, the fixtures shall be provided with lensed covers or lamps that are coated and labeled as shatter resistant. Where not specifically included in the specification, the contractor shall include all provisions to comply with this requirement.

e) Consult Architectural plans for ceiling types and provide recessed fixtures and mounting components accordingly. All light fixture installation in fire rated ceilings shall comply with UL listing for rated assembly. Fixture model number shown in the schedule may not reflect correct ceiling mounting requirements – E/C shall verify with A/E prior to ordering any fixtures and include all costs in the base bid.

f) Fixture supports shall comply with NEC 410-30 and 410-36. Provide fixture securing clips as required.

g) The light fixture manufacturer shall provide a linear disconnecting means complying with NEC 410.130 for all fluorescent and double ended lamp fixtures.

h) The contractor shall replace any lamps that are not operational or burn out within first 30 days after substantial completion.

i) LED fixtures, modules, and drivers shall be listed by ANSI and tested per IESNA and ANSI for solid state lighting sources.

j) Dimmers, where required, shall be provided such that they are compatible with the LED drivers and fixtures. Provide additional wiring required between the dimming drivers and the dimmer switch/dimming system as required for proper operation (verify wiring with manufacturer from what is shown on the drawings – provide additional wiring as required and include in the base bid). Coordinate compatibility requirements with the dimming system manufacturer and lighting fixture manufacturer prior to ordering any equipment or fixtures

k) See fixture schedule.

26-50 CIRCUIT BREAKER PANELBOARDS:

a) Provide dead-front panelboards with bolt-in or plug-on molded case circuit breakers. Panelboards shall comply with NEMA Publication PB1, UL 67 and UL50.

b) Boxes shall be galvanized steel standard width and depth except where scheduled otherwise. Fronts shall be code gauge steel finish with rust inhibiting primer and based enamel finish. Fronts shall have flush doors with flush cylinder tumbler-type locks, spring loaded door pulls, and concealed door hinges. Provide doors higher than 48 inches with three (3) point catch. Panel door locks shall be keyed alike. Provide fronts designed for flush or surface mounting as indicated and attached to box by adjustable trim clamps. Verify cover type and installation with plans and install cabinet plumb and rigid.

c) Provide tin-finished copper bars full length of panel with rating listed in schedule. Bus bar connections to branch circuit breakers shall be "Phase Sequence" type designed and assembled so circuit breakers can be replaced without disturbing adjacent breakers or without removing main bus or branch circuit connectors. Provide bus bars with wire lugs suitable or copper or aluminum conductors. Provide each panel with equipment grounding bus grounded to box and neutral bus insulated from box.

d) Branch circuit breakers shall be quick-make, quick-break with trip indication. Circuit breakers shall operate both manually for normal switch functions and automatically under overload and short circuit conditions. They shall provide circuit and self protection when applied within their rating. Operating mechanisms shall be entirely trip free so that contacts cannot be held closed against a short circuit. Operating handle of circuit breaker shall simultaneously open and close all poles of a multiple breaker. Circuit breakers shall conform to UL489 and NFPA70. Circuit breaker shall have a thermal magnetic trip unit for each pole for inverse time delayed overload protection and an instantaneous magnetic element for short circuit protection. Trip elements shall operate a common internally connected trip bar to open all poles in case of overload or short circuit through any one (1) pole. Panel shall provide for branch circuit breakers up to 100 amperes, and unless indicated otherwise, shall have 10,000 RMS short circuit amperes symmetrical interrupting capacity. Breakers shall be one, two, or three pole types as indicated in panel schedule.

e) Provide breaker as type and accessories per schedule. All heat trace or electric heating circuit breakers shall be 30mA GFEP class B type breakers. All kitchen and breakroom receptacles shall be GFI or wired to GFI circuit breaker. Provide filler plate in any unused spaces.

f) Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed circuit directory listing loads corresponding to branch circuit numbers. All panels shall have labels and arc fault indication as required in other sections of this specification.

g) Provide one spare 0.75 inch conduit for every three (3) spaces and/or blank spaces with a minimum of three (3) spare conduits per panel. Terminate conduit above ceilings unless indicated otherwise.

h) Panelboard shall be General Electric, ITE/Siemens, Square D, or Eaton/Cutler-Hammer.

i) See schedule.

26-51 CAPACITORS:

a) Provide indoor dust-proof or outdoor weatherproof capacitors of capacity and rating listed in schedule.

b) Capacitor, KVAR listed are nominal size required to provide 95 percent power factor for motor speed and horsepower specified. E/C shall verify with E/M of motors provided, the required KVAR to correct motor power factor to 95 percent. Cost for additional capacitor KVAR above KVAR specified shall be responsibility of contractor providing motor.

c) Capacitors on 208 volt systems shall be rated at 208 volts and have KVAR at 208 volts listed on name plate.

d) Provide capacitors with solderless line and ground terminal connectors mounted inside a bolt-on terminal compartment with gasketed cover.

e) Provide each capacitor with internal discharge resistor conforming to NEMA standards. Residual voltage (after circuit is de-energized) shall be less than 50 volts within one minute.

f) Provide capacitors meeting above specification by General Electric, Sprague, or Westinghouse.

g) See schedule.

26-52 GROUNDING:

a) Supplement grounded neutral of secondary distribution system with equipment grounding system, installed so that metallic structures, enclosures, raceways, junction boxes, cabinets, machine frames, portable equipment, and other conductive items operate continuously at ground potential and provide

low impedance path for ground fault currents. System shall comply with NEC section 250, modified as indicated on drawings as specified.

b) Provide equipment ground bus in base of low voltage switchgear or switchboard. Braze or otherwise adequately connect ground system to at least three (3) 0.75-inch diameter by 10-foot ground rods. Where extra rods are necessary to meet requirements of specified tests, E/C shall be reimbursed for additional cost. Rods shall be located a minimum of 6 feet from each other of any other electrode and shall be interconnected by a minimum 3/0 bare copper conductor brazed to each ground rod below grade. Ground rods shall be driven 2" below finish floor or grade unless otherwise indicated.

c) Ground all metallic water piping systems (domestic water, chilled/hot water, condenser water, etc.) in the building to electrical service ground with a minimum 3/0 or as required green insulated copper ground conductor, in conduit. Where a dielectric fitting is installed anywhere in the system, or where a non-conductive fitting is installed, the piping system on each side of the fitting shall be separately bonded. On the main water service, connect ground conductor to building side of dielectric water fittings. Do not install jumpers around dielectric water fittings. Bond piping to ground conductor at each end. Provide 3/0 jumper with ground clamps around water meter. Coordinate with mechanical contractor and include all associated costs in the base bid.

d) Connect system neutral ground and equipment ground system to common ground bus.

e) Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with NEC. Provide each service disconnect enclosure with neutral disconnecting means which interconnect with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

f) Required equipment grounding conductors and straps shall be sized in compliance with NEC Table 250-66. Equipment grounding conductors shall be provided with green Type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus.

g) Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or 3-phase feeder and each branch circuit except as specified herein. Where more than one branch circuit is installed in a common raceway only one grounding conductor is required. Grounding conductor shall be sized for largest branch circuit overcurrent device serving common raceway.

h) Single phase 120 and 277 volt branch circuits for lighting shall consist of phase and neutral conductors installed in common metallic conduit which shall serve as grounding conductor. Provide flexible metallic conduit utilized in conjunction with above singe phase branch circuits with suitable green insulated grounding conductors. Single phase branch circuits required for special equipment, such as X-ray, etc., feeders and branch circuits in non-metallic conduits shall be provided with separate grounding conductor. Install grounding conductor in common conduit with related phase and/or neutral conductors. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

i) E/C shall provide equipment grounding bars for termination of equipment grounding conductors in panelboards and other electrical equipment. In addition to active circuits, provide pressure connectors for panel spares and blank spaces. E/C/ responsible for grounding of all CATV, phone, and telecommunication systems per NEC. Coordinate with system provider.

j) Provide electrical expansion fitting with an external flexible copper ground securely bonded by approved grounding straps on each end of fitting except where UL approved built-in copper grounding device is provided.

k) Provide non-metallic conduits or ducts with equipment grounding conductors except for conditions as follows:

1. Where medium voltage multi-conductor (2.3 KV and above) cable is equipped with a metallic sheath, or cable is provided with ground conductors and bonded to non-current carrying metallic equipment at both ends.

2. Where ducts are for telephone or communication uses only.

l) Connect each cable rack system to equipment grounding system with insulated conductor with size determined by largest power conductor in rack. Minimum size shall be No. 6 and maximum size shall not exceed equivalent capacity of number 4/0 copper conductor. Ground conductor shall be bonded to rack system, enclosed in conduit, and connected to common ground bus.

m) Provide electric devices such as air cleaners or heater control switches, etc., installed in air ducts with insulated equipment ground conductor sized on rating of overcurrent device supplying unit. Bond conductor to each unit, air duct, and to ground in panelboard.

n) Provide electric immersion type water heater or surface heating cables with insulated equipment ground conductor sized on rating of overall device supplying unit. Bond conductor to water piping at unit and to ground bar in panelboard.

o) Provide steel and aluminum conduits which terminate without mechanical connection to metallic housing of electrical equipment with ground bushing and connect each bushing with bare copper conductor to ground bus in electrical equipment. Electrically non-continuous metallic conduits containing ground wiring only shall be bonded to ground wire at both conduit entrance and exit.

p) Ground and bond exterior mounted light poles, radio and television masts and flag poles with No. 6 or larger bare copper wire connected to 96-inch long, 0.75-inch copper clad ground rod driven in ground.

q) Test complete equipment grounding system to each service disconnect enclosure ground bar in accordance with IEEE81. Submit certified test reports of compliance with 5 ohm measured ground resistance value.

r) Provide a No. 6 ground conductor to all telephone/computer/television/audio/visual racks in all telephone equipment rooms (and where indicated in the contract documents) whether specifically shown or noted on the drawings. Provide a minimum of 60 inches of free wire at the termination for connection to owner-provided racks. Coordinate exact location and requirements with the owner prior to any rough-in. Provide 0.25”x4” grounding bus bar with holes 0.28 holes spaced 1.125” apart for all main IT rooms. Include mechanical type, cast silicon bronze, solderless terminals and UL891 listed stand-off insulators rated for 600V.

s) All equipment and panel grounds shall be bonded to a common building ground system per the National Electric Code, whether specifically shown on the electrical riser diagram or not. This includes all of the separately derived systems in the building (transformers) that are required to bond to the nearest grounding electrode. This shall be provided per section 250.30 of the NEC, by the electrical contractor and included in the base bid. Comply with all requirements be local authority having jurisdiction.

26-53 OCCUPANCY SENSORS:

a) Work Included:

1. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

b) System:

1. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

2. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

3. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor. Submit any interconnection diagrams per major subsystem showing proper wiring.

c) Products:

1. Wall switch sensors: Wall switch sensors shall be dual technology or infrared or ultrasonic sensors as indicated.

2. Ceiling mount sensors: Ceiling mount sensors shall be dual technology or ultrasonic or passive infrared technology for motion detection as indicated. Sensors shall be located to minimize coverage in unwanted areas. Provide circuit control hardware to interface sensors between lighting circuits and low voltage ceiling occupancy sensor. Where (2) sensors are shown in one room sensors shall be wired so that motion detected by any sensor in that room energizes all light fixtures in the room.

3. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

4. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

5. Sensors shall be equipped with adjustable time delay and sensitivity sensors. Contractor shall adjust setting per owner requirements after installation and before occupancy.

6. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

7. All sensors shall have UL rated, 94V-0 plastic enclosures.

d) Installation:

1. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

2. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems. Locations shown on plans are schematic and shall be modified as required in field to accommodate obstructions and undesired exposures.

3. Equivalent manufacturer by Wattstopper, Leviton, Greengate, and Hubbell or by prior approval only.

26-54 TIME SWITCHES:

a) Provide astronomical electrical 7-day programmable time switches as indicated on drawings and in schedule.

b) Equivalent by Intermatic, Tork, or Rainbird.

c) See time switch schedule.

26-55 FIRE ALARM SYSTEM:

a) Related Documents:

1. Drawings and general provisions of the contract including general and supplementary conditions and Division 1 specification sections, apply to this section.

2. New fire alarm equipment shall interface with existing Honeywell IFP-300 fire alarm panel.

3. Requirements of the following Division 26 sections apply to this section.

   A. “26 – Electrical Requirements.”

   B. The complete installation is to conform to the applicable sections of NFPA 72 and the NEC with particular attention to Article 760.

   C. NFPA 101 – Life Safety Code.

b) Summary:

1. This section includes fire alarm systems, including manual stations, detectors, notification appliances, signal equipment, controls, smoke control and devices.

2. Work covered by this specification section includes the furnishing of labor, equipment, materials, and complete operational performance required for installation of the fire alarm system as shown on the drawings, as specified, and as directed by the A/E.

3. The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.

4. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:

   A. Fire alarm and detection operations.

   B. Interconnect with existing building fire alarm system for off-premise notification.

c) System Descriptions:

1. General: Complete, non-coded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation. Fire signal initiation shall be from pull stations, heat detectors, smoke detectors, duct smoke detectors, gas detectors, flow switch, tamper switches, etc as required by code and indicated on plans. Notification shall operate notification appliances, identify initiating devices, transit signals to remote receiving location, release fire/smoke doors held by magnetic holders, activate alarm/voice system as applicable, and control any hvac equipment controls or dampers, smoke control systems or any other applicable systems in the building. Include all work and notification for supervisory and trouble signals per NFPA.

2. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.

3. The system shall have the capability of loading software operations from a single node to all other nodes on the network.

4. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

d) Submittals:

1. General: Submit the following according to conditions of contract and Division 26 specification sections.

2. Product Data for System Components: Include dimensioned plans and elevations showing minimum clearances and installed feature and devices. Include list of materials and NRTL-listing data.

3. Submissions to Authority Having Jurisdiction: In addition to routine submissions of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated contract drawings as required to depict component locations to facilitate review. Upon receipt of comments from the authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval. Submit all required battery calculations, performance parameters, equipment layout and wiring per recommendations per NFPA 72.

4. The submittal shall also include one set of plans with all devices located on the plans and numbered individually. It shall also include a detailed riser diagram with all devices and wiring requirements indicated on the plans. The fire alarm shop drawings shall not be approved without this submittal.

5. Provide as-built documentation and device address list to owner.

e) Quality Assurance:

1. Installer Qualifications: A factory-authorized installer is to perform the work of this section and shall have NICET certified personnel.

2. Compliance with Local Requirements: Comply with the applicable building code, local ordinances and regulations, and the requirements of the authority having jurisdiction.

3. All work shall be in compliance with applicable sections of NFPA.

4. All items of the fire alarm system shall be listed as a product of a single US manufacturer or division under the appropriate category of UL shall be the UL label.

f) Manufacturers:

1. Base bid shall be Honeywell with equals by Firelite, Notifier, Simplex, Siemens. Request for substitutions shall be in accordance with Section 26.

g) Extra Materials:

1. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

   A. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.

   B. Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

   C. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.

   D. Detector or Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

h) Products:

1. Fire Alarm Extender-Panel (FACP):

   A. General: Comply with UL 864, “Control Units for Fire-Protective Signaling Systems.”

   B. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the systems are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of units as well as field wiring. Identify each enclosure by an engraved, red-laminated, phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1-inch high.

   C. Systems: Alarm and supervisory systems are separate and independent in the FACP. The alarm-initiating zone boards in the FACP consist of plug-in modules. Construction requiring removal of field wiring for module replacement is not acceptable.

   D. Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions.

   E. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FACP and addressable system components, including annunciation, supervision, and control. A display with a minimum of 80 characters displays alarm, supervisory, and component status messages and indicates control commands to be entered into the system for control of smoke detector sensitivity and other parameters. Arrange keypad for use in entering and executing control commands.

   F. Instructions: Printed or typewritten instruction card mounted behind a LEXAN plastic or glass cover in a painted steel or aluminum frame. Install the frame in a location observable from the

FACP. Include interpretation and appropriate response for displays and signals; and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

G. Power panel with 120V input power, sealed, lead acid battery and charging circuits, fused disconnect, auxiliary relay, and all required power supplied for devices and 25% future capacity. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

H. Addressable Network:

i. Communication with Addressable Devices: The system must provide communication with initiating and control devices individually. All of these devices will be individually annunciated at the control panel.

ii. All addressable devices shall have the capability of being disabled or enabled individually.

iii. A minimum of 10,000 total feet of twisted, shielded 18 AWG wire may be connected to channel. Maximum distance from the panel to the farthest device shall be 2,500 feet.

I. Historical event logs shall be available from the LCD display or shall be capable of being printed.

J. Minimum panel capacity shall be 75 addressable devices, with provisions for expansion modules to support existing buildings and future additions.

K. New fire alarm equipment shall have all required interconnects, cards and equipment to interface with existing Honeywell IFP-300 fire alarm panel.

2. Manual Pull Stations:

A. Description: Addressable single- or double-action type, red LEXAN, with flush mounting plate and molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

3. Smoke Sensors:

A. General: Comply with UL 268, “Smoke Detectors for Fire Protective Signaling Systems.” Include the following features:

i. Factory Nameplate: Serial number and type identification.

ii. Operating Voltage: 24 VDC, nominal.

iii. Addressability: Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP.

Detectors that store the device address in the head shall be acceptable. Sensors do not require resetting or readjustment after actuation to restore normal operation.

iv. Each sensor twist lock base shall contain an LED that will flash each time it is scanned by the control unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.

v. Each sensor base shall contain a magnetically actuated test switch to provide for an easy alarm testing at the sensor location.

vi. Each sensor shall be scanned by the control unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a “wrong device,” the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5 percent obscuration for photoelectric sensor, 135 deg F and 15 deg F rate-of-rise for heat sensor, but shall indicate a “wrong device” trouble condition.

vii. The sensor’s electronics shall be immune from false alarms caused by EMI and RFI.

viii. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Photoelectric Smoke Detectors: Include the following features and characteristics:

i. An infrared detector light with matching silicon cell receiver and actuated by the presence of visible products of combustion. Must have seven sensitivity settings and transmit actual values to the FACP.

C. Ionization-Type Smoke Detector: Include the following features and characteristics:

i. Multiple-chamber-type operating on the ionization principle and actuated by the presence of invisible products of combustion.

D. Duct Smoke Detector: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applicable. Required on the return for all units over 2000cfm and supply and return side of all AHU over 15,000 CFM.

i. The addressable duct smoke sensors shall be photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.

ii. The duct housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single “Form C” contact rated at 7A at 28 VDC or 120 VAC resistive. This auxiliary relay output shall be fully programmable.

iii. Duct housing shall have a relay control trouble indicator yellow LED, and a magnetic test area and red sensor status LED.

iv. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

v. Each duct detector shall have a remote test station with an alarm LED and test switch located in an accessible location. Coordinate with electrical contractor.

4. Other Detectors:

   A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

      i. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

      ii. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

      iii. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

   B. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies and carbon monoxide as indicated. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

5. Addressable Circuit Interface Modules:

   A. Addressable Circuit Interface Modules: Arrange to monitor one (1) or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems. Provide connection for all devices provided by sprinkler contractor whether indicated on drawings or not.

   B. Addressable circuit interface modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or separate 2-wire pair running from an appropriate power supply as required.

   C. The circuit interface module shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

6. NAC Power Extender:

   A. The Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.

   B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.

   C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The Extender Panel when connected to an addressable panel shall connect to the host panel.

D. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.

E. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

7. Alarm Notification Appliances:

A. Notification Appliances: The Contractor shall furnish and install non-addressable notification appliances and accessories to operate on compatible signaling line circuits (SLC).

B. Addressable notification appliance operation shall provide power, separate control, and supervision of horns, speakers, and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with capacitance rate of less than 60 pf/ft and a minimum of three (3) twists per foot.

C. All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows "On the fly" program operation changes for Mass Notification alerting and fire alarm notification.

D. Class B (Style 4) notification appliances shall be wired without requiring in/out wiring methods.

E. Visible/Only (V/O): Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang, or 4-inch square electrical box without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of three (3) twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15, 30, 75 and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific V/O appliance.

F. Audible/Visible (A/V): Combination A/V notification appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system meeting requirements listed above. The horn shall have a minimum sound pressure level of 80 dBA at 24 VDC. The A/V enclosure shall mount directly to standard single gang, double gang, or 4-inch square electrical box without the use of special adapters or trim rings.

G. Appliances shall be wired with UTP conductors, having a minimum of three (3) twists per foot. The appliance shall be capable of 2-wire synchronization to provide synchronized strobe with steady or coded pattern on horn.

H. Provide fire alarm fan shut down relays for all fan terminal units in the building whether specifically shown on the drawings or not. Activation of any building smoke detector or duct detector shall cause all fan terminal units and their associated fans to shut down.

I. Provide weatherproof housing for all devices installed at the exterior of the building.

i) Installation – General:

1. Install system according to NFPA standards referenced in Parts 1 and 2 of this section.

2. Fire Alarm Power Supply Disconnect: Shall be painted red and labeled “FIRE ALARM.” Provide with a lockable handle or cover.

3. All wiring shall be in conduit.

j) Equipment Installation:

1. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

2. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

3. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

k) Wiring Installation:

1. Wiring Method: Install wiring in metal raceway according to this specification and per NEC and NFPA. Conceal raceway except in unfinished spaces as indicated.

2. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

3. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

4. Provide all ethernet connections to panel. The electrical contractor shall coordinate and ensure proper Ethernet connections occur at the fire alarm control panel and other designated equipment locations prior to system turnover.

l) Grounding:

1. Ground equipment and conductor and cable shields as specified by the equipment manufacturer. For audio circuits minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5 ohm ground at main equipment location. Measure, record, and report ground resistance.

m) Field Quality Control:

1. Manufacturer’s Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

2. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the

requirements of the drawings and specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

3. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

4. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

5. Minimum Systems Tests: Test the systems according to the procedures outlined in NFPA 72.

6. Retesting: Correct deficiencies indicated by tests and complete retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.

7. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

8. Tag all equipment, stations, and other components at which tests have been satisfactorily completed. Final test, certificate of completion, and certificate of occupancy.

9. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Demonstrate that the system meets the specifications and complies with applicable standards. This final test shall be witnessed by a representative of the Authority Having Jurisdiction and a factory authorized service representative.

n) Cleaning and Adjusting:

1. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

2. Occupancy Adjustments: When requested within one-year of date of substantial completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three (3) visits to the site for this purpose.

o) Training:

1. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

2. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours training.

3. Schedule training with the Owner at least seven days in advance.

END OF DIVISION 26

SECTION 311000 - SITE CLEARING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: clearing and grubbing the site of undesirable material such as grass, shrubs, trees, other plant life, and debris in preparation for grading activities.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
2. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
3. Division 02 Section “Site Demolition.”
4. Division 31 Section “Excavation and Fill.”

1.2 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.3 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 EXISTING CONDITIONS

A. Site conditions, as depicted on the project drawings, are shown based on available information. The Contractor shall visit the site to familiarize themselves with the existing conditions and verify existing conditions as depicted on the project drawings. The Contractor shall notify the Owner or the Owner’s Representative of any discrepancy between plan and field conditions and shall assume full responsibility for conditions encountered.

1.5 PROTECTION

A. Adjacent Properties: Protect adjacent properties during site clearing operations. Site clearing shall be limited to Owner's property; any clearing which takes place outside of the Owner's property shall be the Contractor's responsibility to repair, at no additional cost to the Owner. The Contractor shall also protect existing structures on adjacent properties; including by not limited to fences, utility lines, manholes, catch basins, valve boxes, poles, guys and other appurtenances. Damage done to structures on adjacent properties shall be the Contractor's responsibility to repair, at no additional cost to the Owner.

B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing shall consist of: cutting, removing, and disposing of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth; clearing shall also include the preservation of trees, shrubs, and vegetative growth, which are not designated to be removed.

B. Grubbing shall consist of the removal and disposal of wood or root matter below the ground surface remaining after clearing and shall include stumps, trunks, roots, or root systems greater than two inches in diameter to a depth of two feet below the natural ground surface.

C. All surface vegetation, trees, stumps, roots, and other protruding objects shall be cleared and grubbed, including required mowing. Undisturbed and sound stumps and nonperishable solid objects located more than two feet below subgrade and slope embankments may remain in place. When authorized, stumps and nonperishable solid objects that are located more than one foot below the ground line may remain if they are located outside the construction limits of excavation and embankment areas.

D. Depressions and cavities resulting from removal of obstructions shall be backfilled and compacted with suitable material as outlined in the project drawings, specifications, and/or Geotechnical Engineering Report, unless further excavation or earthwork is indicated.

E. Disposal of material and debris shall be done under applicable Federal, State, County, and City laws, ordinances, and regulations.

F. Stumps and large timbers shall be removed from the site and legally disposed of by the Contractor.

G. Tree Removal: In general, do not remove existing trees, whether shown on the project drawings or not, that are not in any way of the work or any future installation. Before proceeding with actual clearing operations, identify by an appropriate and clearly recognizable marker trees specifically intended to be preserved. Notify the Owner in writing when trees to remain have been marked; do not remove any trees until the Owner has approved proposed tree protection and planned removal.

H. Coordination: Complete clearing of the site before topsoil stripping operations are begun. Do not leave loose sticks, roots, branches, or any other debris on the site. Avoid mixture of foreign matter with the topsoil.

3.2 PROTECTION OF EXISTING TREES

A. Throughout construction, properly protect existing trees and vegetation, which are to remain, to be relocated, or which overhang the property line.

B. Do not cut low hanging branches on trees to be saved, unless approved by the Owner. Cut branches which must be cut to eliminate obstructions. Immediately and properly trim any cuts, or accidental injuries to the bark or trunk, and properly trim and paint with a protective tree wound and sealing compound.

C. Permit no stripping of topsoil, cutting or filling, dumping of materials, storage of materials or equipment of any kind, or use by personnel for any activities, whether on or off duty, within the drip line of trees to remain.

END OF SECTION 311000

SECTION 312300 - EXCAVATION AND FILL

PART 1 – GENERAL

1. SUMMARY

A. Section includes, but is not limited to, excavation, filling, compacting, and grading in the areas shown on the project drawings to obtain the required subgrade surface properly prepared to receive rock surfacing, pavements, walks, building floor slabs, utilities, drainage structures, or topsoil.

B. Section includes the spreading of topsoil in sufficient quantities to backfill islands, medians, roadway shoulders, and open graded areas.

C. Related Sections include the following:

1. Division 01 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
3. Division 31 Section "Erosion and Sedimentation Controls" for temporary erosion and sedimentation control measures.
4. Division 31 Section "Turf Base and Drainage" for turf base preparation.
5. Division 32 Section "Turf and Grasses."

2. DEFINITIONS

A. Backfill: Soil materials placed over bedding to fill a trench or used to fill and excavation.

B. Base Course: Layer placed between the subgrade and paving.

C. Bedding: Aggregate materials placed over the excavated subgrade in a trench before laying pipe and placed beside and over pipe in a trench; including haunches to support sides of pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect/Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction of Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at the Contractor's expense.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material ¾ cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other mam-made, stationary features above or below the ground surface.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage course, or topsoil materials.

K. Utilities include on-site, underground pipes, conduits, ducts, and cables.

3. SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated.
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

B. Material Certifications: Gradations from manufacturer for subbase, base, engineered fill, bedding, drainage fill, and/or filler material as necessary.

4. QUALITY ASSURANCE

A. Standards:

   1. American Society of Testing and Materials (ASTM):

      D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft)

      D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

      D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3(2,700 kN-m/m3))

      D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

      D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

      D 2937 - Standard Test Method for Density of Soil in Place by the Drive Cylinder Method

D 4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

D 4718 - Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

2. American Association of State Highway and Transportation Officials Standard Method of Test (AASHTO):

T-96 - Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact by the Los Angeles Machine.

T-99 - The Moisture-Density Relations of Soils Using a 2.5 kG (5.5 lb) Rammer and a 305 mm (12 in) Drop.

T104 - Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate Test.

B. Testing:
   1. If needed per the Owner's sole judgment, a qualified geotechnical testing agency shall be retained to perform all required field and laboratory soil testing necessary to demonstrate compliance with this specification as outlined below in Field Quality Control.
   2. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient quantities of satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: As defined by the Geotechnical Engineering Report. In the absence of a Geotechnical Engineering Report the following shall be considered satisfactory soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols, free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: As defined by the Geotechnical Engineering Report. In the absence of a Geotechnical Engineering Report the following shall be considered unsatisfactory soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Base: Aggregate for base shall be essentially limestone or dolomite. The aggregate shall not contain more than 15 percent deleterious rock and shale. Sand may be added only for the

purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt and clay and any deleterious rock and shale shall be uniformly distributed throughout the material. The fraction passing the No. 40 sieve shall have a maximum plasticity index of six (6). The aggregate shall be in accordance with the following gradation requirements: 100 percent passing the 1 inch sieve, 60-90 percent passing the 1/2 inch sieve, 35-60 percent passing the No. 4 sieve, and 10-35 percent passing the No. 30 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2 inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding: Embedment for ordinary trench conditions is compacted, dense graded, clean, manufactured and processed aggregates described as angular crushed stone, crushed rock, crushed gravel, or crushed stone/sand mixtures containing little or no fines with 100 percent passing a 1 inch sieve, 55-90 percent passing a 1/2 inch sieve, 8-40 percent passing a No. 4 sieve, 0-15 percent passing a No. 10 sieve, and 0-4 percent passing a No. 200 sieve.

H. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate Size 57; with 100 percent passing a 1-1/2 inch sieve, and 0-5 percent passing a No. 8 sieve.

I. Filler Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1 inch sieve and 0-5 percent passing a No. 4 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

K. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of four (4) percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

2.2 SOIL STABILIZATION MATERIALS

~~A. Typical Materials: Code L, Quicklime, Cement, Fly ash~~

B. Shot Rock: Mixture of crushed or blasted stone. Gradation can vary with maximum stone diameter 6-inches or less.

C. Clay Cap: Lean Clay (CL) with a liquid limit of less than 50. Material shall be submitted to a qualified testing agency for evaluation prior to use.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section “Site Demolition” and Division 31 Section “Site Clearing.”

C. Protect subgrades and foundations soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

D. Provide erosion control measures as specified in Section 312500 Erosion and Sedimentation Controls.

3.2 TOPSOIL STRIPPING

A. Remove topsoil from areas within limits of excavation, trenching, borrow and areas designed to receive embankment or compacted fill.

B. Scrape areas clean of all brush, grass, weeds, roots, and other unsuitable materials before stripping topsoil.

C. Strip topsoil to a minimum depth of 6 inches, and to a sufficient depth to remove excessive roots in heavy vegetation or brush areas and as required to segregate topsoil.

D. Stockpile topsoil reasonably free of subsoil, debris, and stones larger than 2 inch diameter. Place stockpile such that it does not interfere with construction operations and existing facilities.

Proper drainage of the stockpile shall be maintained. The stockpile shall be protected by erosion control BMPs to prevent sedimentation during runoff. Cover to prevent windblown dust.

E. The Contractor should anticipate that any topsoil stripped from the site and not required to complete site improvements is to be hauled off site and disposed of. However, the Owner retains the right to retain any topsoil prior to removal.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.

c. 6 inches outside of minimum required dimensions of concrete cast against grade.

d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches beneath bottom of concrete slabs on grade.

f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.

c. 6 inches outside of minimum required dimensions of concrete cast against grade.

d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches beneath bottom of concrete slabs on grade.

f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate area adequate to permit erection and removal of forms.

B. Trim to neat lines where concrete is to deposited against earth.

C. Excavate by hand in areas where space and access will not permit use of machines.

D. Restore bottom of excavation to proper elevations in areas over excavated as follows:
   1. For structures supported by piles or caissons, with compacted embankment.
   2. For structures supported by concrete footings or mats, with concrete.

E. Excavate rock, where encountered, to a distance of at least three (3) feet away from outside of structure walls. Bench additional rock excavation required for stability during construction to maintain vertical cuts. Perform such additional excavation and furnish any additional backfill subsequently required at no extra cost to Owner.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations. Excavate trenches to allow installation of top of pipe below the frost line.

B. Do not open more trench in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is shorter) shall be the maximum length of open trench permitted on any line under construction.

C. Excavate trenches to uniform widths to provide a working clearance on each side of the pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than the top of pipe or conduit unless otherwise indicated.

D. Excavate trenches six (6) inches deeper than bottom of pipe elevation to allow for bedding. Hand excavate for bell of pipe if applicable

E. Trench bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.7 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the Project site and surrounding areas.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavations as temporary drainage ditches.
   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
   3. Discharge removed water to approved drains or channels. Contractor shall obtain State or local permits for discharge if such are required. Water discharge into streams shall be free of silt or other objectionable materials. Discharge water so that the work in progress and other properties are not damaged. Do not interfere unduly with the use of streets, alleys, private drives, or entrances.
   4. Remove unsuitable, excessively wet materials and replace with approved material.

3.8 SUBGRADE PREPARATION

A. Excavate or place embankment as required to construct subgrades to elevations and grades indicated.

B. Remove all unsuitable material and replace with approved embankment material. Perform all wetting, drying, shaping, and compacting required to prepare a suitable subgrade.

C. Roughen subgrade for embankment by discing or scarifying and wet or dry the top 6 inches as required to ensure bond with embankment.

D. Extend subgrade the full width of surfaced areas plus one foot.

E. Compact the top 12 inches of subgrades for traffic areas and slabs on grade to 95 percent of maximum density (ASTM D 698).

F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect/Engineer, without additional compensation.

G. Proof-roll subgrade after moisture conditioning and compaction to identify soft or disturbed areas. Do not proof-roll wet or saturated subgrades. Proof-rolling will conform with the following:

1. Use a fully loaded tandem axle dump truck or equipment providing an equivalent loading of not less than 20 tons for proof-rolling.
2. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction.
3. Limit vehicle speed to 3 mph.
4. Undercut and replace soft areas, identified by proof-rolling, with approved fill material.

3.9 EMBANKMENT

A. Place embankment to the contours and elevations indicated in the project drawings. Place embankment material in lifts not exceeding eight (8) inches, uncompacted depth.

B. When rocks larger than four (4) inches are present, they shall be scattered and thoroughly consolidated with sufficient compacted soil to completely fill all voids between rocks. Exclude rocks larger than one half the depth of the lift from the top two (2) feet of the embankment.

C. Uniformly moisten or aerate each lift before compaction to within two (2) percent optimum moisture content. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by two (2) percent and is too wet to compact to specified density.

D. Embankment shall be compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 698.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, damp-proofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact initial bedding on trench bottoms and where indicated. Shape bedding to provide continuous support for bells, joints, and barrels of pipes and for joints fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Place and compact bedding materials, to a minimum height of 6 inches over the utility pipe or conduit.

D. Carefully compact material under pipe haunches and bring bedding evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utility testing.

F. Fill voids with approved backfill materials while shoring and braking, and as sheeting is removed.

G. For areas not under pavement, place and compact final backfill of satisfactory soil material to final subgrade.

H. No rock greater than one (1) foot, measured in any direction, shall be placed within two (2) feet of the top of a pipe in any backfill. No rocks greater than one (1) foot will be allowed in the backfill above service line terminations, tees, or wyes.

I. For areas under pavement, place and compact final backfill using bedding material to final subgrade.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavement and slabs.

3.12 SOIL FILL

A. Disk, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations with satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 0 to 4 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3. Under lawn or unpaved areas, scarify and compact each layer of backfill or fill soil material at 90 percent. Do not compact top 12 inches.

4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

5. Moisture content at the time of placement shall be maintained between 0 and +4 percent of optimum moisture.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.1 feet.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.12 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a six (6) inch course filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches of filter material and wrap in drainage fabric, overlapping sides and ends at least six (6) inches. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least six (6) inches. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698. Place and compact impervious fill material over drainage backfill to final subgrade.

3.13 BASE COURSE

A. Under pavements and walks, place base course on prepared subgrade and as follows:
   1. Place base course material over compacted subgrade.
   2. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
   3. Shape base to required crown elevations and cross-slope grades.
   4. When thickness of compacted base course is six (6) inches or less, place materials in a single layer.
   5. When thickness of compacted base course exceeds six (6) inches, place materials in equal layers, with no layer more than six (6) inches thick or less than three (3) inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.14 DRAINAGE COURSE

A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
   3. When compacted thickness of drainage course is six (6) inches or less, place materials in a single layer.

4. When compacted thickness of drainage course exceeds six (6) inches, place materials in equal layers, with no layer more than six (6) inches or less than three (3) inches thick when compacted.

3.15 TOPSOIL PLACEMENT

A. Prior to the start of finish grading, the soil shall be fine graded. The grade shall be smooth without high spots or low spots and shall be free of construction debris. The site shall be weed free and ready for finish grading.

B. Place topsoil on all disturbed areas not scheduled to receive permanent surfacing.

C. Clear areas to receive topsoil of vegetation heavy enough to interfere with proper grading and tillage operations.

D. Clear surfaces of all stones or other objects larger than 3 inches in thickness or diameter, all roots, brush, wire, grade stakes, or other objectionable material.

E. Loosen subgrade by discing or scarifying to a depth of 2 inches wherever compacted by traffic or other causes to permit bonding of the topsoil to the subgrade.

F. Distribute topsoil over required areas without compaction other than that obtained with spreading equipment.

G. Place not less than four (4) inches of top soil over areas to receive topsoil.

H. Shape cuts, fills, and embankments to contours indicated in project drawings.

I. Grade to match contours of adjacent areas and permit good natural drainage.

J. Grade a gentle mound over trenches.

K. After spreading topsoil, clear surface of stones or other objects larger than two (2) inches in thickness or diameter and of objects that might interfere with planting and maintenance operations.

3.16 FIELD QUALITY CONTROL

A. Owner shall engage geotechnical engineer to perform field quality control testing. Contractor shall allow geotechnical testing agency to inspect and test subgrades and each embankment, fill, or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

B. At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at a minimum at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three (3) tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two (2) tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two (2) tests.

D. When testing agency reports that subgrades, fills, embankments, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 MAINTENANCE AND REPAIR

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Settling or erosion shall be filled, repaired and grades reestablished to elevations and slopes indicated.

C. Correction of Settlement:
   1. Settlement of embankments, backfill, or trenches occurring within the one-year correction period after Final Acceptance shall indicate defective work and shall be promptly corrected.
   2. Contractor shall correct settlement and damages arising from or attributable to the settlement.
   3. Make repairs within thirty (30) days from and after due notification by Owner of embankment or backfill settlement and resulting damage.
   4. Make own arrangements for access to the site for purposes of correction and maintenance of corrected areas.

3.18 DISPOSAL

A. Remove surplus soil and waste material, including unsatisfactory soil, trash and debris and legally dispose of it off Owner's property.

3.19 BLASTING

A. Blasting will not be permitted on this project.

END OF SECTION 312300

SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: temporary and permanent management practices as shown on the project drawings, and indicated in the Storm Water Pollution Prevention Plan (SWPPP), and as directed by the Owner during the life of the Contract to control erosion, storm water runoff, and sedimentation.

B. Coordinate temporary erosion control provisions with permanent erosion control features to assure economical, effective, and continuous erosion, sedimentation, and pollution control throughout the construction and stabilization period.

C. Management practices required are not limited to the measures shown on the project drawings and indicated on the SWPPP. Provide additional practices necessitated by actual conditions and methods.

D. Silt and pollution leaving the site and any effects of the release are the sole and total responsibility of the Contractor as Primary, Secondary, or Tertiary Permittee or Operator.

E. Provide Subcontractors with a copy of the Erosion Control Plan and the SWPPP. Post notices requiring Subcontractors to review and comply with the Erosion Control Plan and the SWPPP.

1.2 RELATED DOCUMENTS

A. Conform to the Federal Clean Water Act, as well as the State clean water and erosion control regulations, and the rules and regulations promulgated to each of these Acts.

1.3 DEFINITIONS

A. This partial list of definitions is provided for the Contractor's convenience only. Obtain copies of the reference documents and learn appropriate terms required to fully implement the Erosion Control Plan and SWPPP.

B. Terms Defined:
   1. Best Management Practices (BMPs): Schedules of activities, prohibitions or practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State and/or the United States of America. BMPs include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
   2. General Contractor: The operator of the common development or site.

3. Nephelometric Turbidity Unit (NTU): A numerical unit of measure based upon photometric analytical techniques for measuring the light scattered by fine particles of a substance in suspension.
4. NPDES: National Pollution Discharge Elimination System.
5. Operator: The entity that has the primary day-to-day operational control of those activities at the facility necessary to ensure compliance with Erosion Control Plan and SWPPP requirements and permit conditions.
6. Primary Permittee: The Owner and the operator of a tract of land for a common development, or of a stand-alone facility that is not part of a common development; or a utility company when it is the only entity conducting a construction activity on a piece of property.
7. Qualified Personnel: A person who has successfully completed an erosion and sediment control short course eligible for continuing education units, or an equivalent course approved by EPD ant the State Soil and Water Conservation Commission.
8. Sediment: Solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its site of origin by, wind, water, ice, or gravity as a product of erosion.
9. Waters of the State: Rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, wetlands, and other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the state which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

1.4 QUALITY ASSURANCE CRITERIA

A. Project Review: Prior to the preconstruction conference, the Contractor shall review in detail the Erosion Control Plan and the SWPPP.

B. Preconstruction Conference: At the preconstruction conference submit for acceptance a detailed schedule for accomplishment of temporary and permanent erosion control work and installation of BMPs, for clearing and grubbing, grading, construction, paving, and other project activities. Submit for acceptance a proposed method of erosion control for haul roads and borrow pits and a plan for disposal of waste material. Do not begin work until the erosion control schedules and methods of operations have been accepted by the Owner.

C. Provide qualified personnel to supervise provision and maintenance of management practices.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Silt Fence

1. Filter Fabrics: Use filter fabric composed of strong, rot-proof synthetic fibers formed into a fabric of either woven or non-woven type. Use fabric free of any treatment or coating which might significantly alter its physical properties. Use fabric containing

stabilizers or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat. Use a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other. Finish the edges of the fabric to prevent the outer yarn from pulling away from the fabric. Use fabric free of defects or flaws which significantly affect its physical and/or filtering properties. Use fabric with a minimum width of 36 inches. Sew or bond sheets of fabric together. No deviation from any physical requirements will be permitted due to the presence of the seam.

2. Woven Wire Fence: Wire fence fabric at least 32 inches high, with at least 6 horizontal wires. Vertical wires spaced 6 inches apart. Top and bottom wires at least 10 gage. Other wires at least 14 gage.
3. Posts: Straight steel posts, 1.33 pounds per linear foot min., 5 feet long, at 4 feet max. o.c., 1-3/4 inches wide, which have projections for fastening the wire to the fence.
4. Wire staples: Wire No. 9 staple at least 1 ½ inches long.

B. Silt Socks

1. Silt Sock shall be SiltSoxx® by Filtrexx® or approved equal.

C. Mats and Blankets

1. Jute or Hemp Mat: Woven, 76 to 80 warpings per 4 foot width, 39 to 43 weftings per 3 foot length, 0.9 pounds per square yard minimum, 1.5 pounds per square yard maximum.
2. Excelsior Blanket: 80% of fibers 6” min. length, smolder resistant, photo-degradable plastic mesh, maximum 1-1/2 x 3 inches, ¼ inch min. thickness, 0.8 pounds per square yard.
3. Coconut Fiber Blanket: 100% coconut, ¼” min. thickness, 48” min. width, 0.5 pounds per square yard, photo-degradable plastic mesh 5/8” x 5/8” maximum.
4. Wood Fiber Blanket: Free of germination inhibitors, photo-degradable plastic mesh, 5/8” x ¾” max. spacing, 0.35 pounds per square yard minimum dry weight.

D. Polymers

1. Anionic polyacrylamide soil binding agents, environmentally benign, 0.05% monomer by weight.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install BMPs in accordance with the Erosion Control Plan and SWPPP.

B. Maintain BMPs throughout construction and until the site is finally stabilized.

C. Implement or assist the Owner with implementation of the SWPPP.

D. Submit reports as required by the local jurisdiction, state, and federal government.

E. Retain records as required by local, state, and federal authorities.

F. Submit or assist the Owner with submittals of applicable permits and termination of permits.

3.2 SCHEDULE

A. Temporary construction entrance(s), silt fences, straw bale dikes, or other initial sediment controls shown on the project drawings must be installed prior to any other work.

B. Sediment basins must be installed within 10 calendar days after construction begins or as soon as 2 or more acres are disturbed, whichever comes first.

3.3 METHODS

A. Several methods of controlling dust and other pollutants include, but are not limited to, the following:

1. Exposing the minimum area of erodible earth.

2. Applying temporary mulch with or without seeding.

3. Using water sprinkler trucks.

4. Using covered haul trucks.

5. Using dust palliatives or penetration asphalt on haul roads.

6. Using plastic sheet coverings.

7. Using gravel.

3.4 AUTHORITY OF ENGINEER

A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, and borrow and fill operations.

B. The Engineer has the authority to direct the Contractor to provide immediate permanent or temporary erosion control measures to minimize loss of soil due to erosion and contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.

3.5 CONSTRUCTION

A. Prior to clearing and grubbing operations for the project. Contractor shall identify all areas where the potential for loss of soil due to erosion exists, and shall line the downhill side of the construction site within these areas with straw bales or silt fences to minimize eroded materials from leaving the site. These shall be maintained throughout the construction period and removed when the permanent ground covering is established.

B. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available.

C. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

D. When erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.

E. The Contractor will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. If disturbance occurs outside scheduled areas or anticipated work zones, or if weather conditions delay permanent control measures, temporary erosion control measures shall be taken immediately.

3.6 MAINTENANCE

A. Maintain temporary management practices until no longer needed or permanent management practices are provided and the site is stabilized. Remove temporary materials.

B. In the event that temporary management practices are required due to negligence, carelessness, or failure to provide permanent management practices as a part of work as scheduled, provide at no cost to the Owner.

C. When silt deposited in sediment basins occupies more than 30% of the basin capacity, remove the silt. Remove the silt from the site unless otherwise permitted by the Owner. Restore the basin to the conditions and grades as shown on the Drawings.

END OF SECTION 312500

SECTION 31 3116 - TERMITE CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chemical soil treatment.

1.2 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2006.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
C. Include the EPA Registered Label for termiticide products.
D. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.4 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide three year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain termite control products from single source from single manufacturer.

2.2 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
B. Manufacturers:
   1. Bayer Environmental Science Corp; [____]: www.backedbybayer.com/pest-management/#sle.Bayer Environmental Science Corp; [____]: www.backedbybayer.com/pest-management/#sle.Bayer Environmental Science Corp; [____]: www.backedbybayer.com/pest-management/#sle.
   2. BASF Corporation
   3. Ensystex, Inc.
C. Mixes: Mix toxicant to manufacturer's instructions.
D. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
B. Verify final grading is complete.

3.2 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be

applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

3.3 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

C. Apply toxicant at following locations:

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.

D. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

E. Re-treat disturbed treated soil with same toxicant as original treatment.

F. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

G. Post warning signs in areas of application

3.4 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION

SECTION 321100 - CAST-IN-PLACE CONCRETE FOR SITEWORK

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
   1. Roads, parking lots, sidewalks, curbs and gutters, etc.
   2. Sanitary Structures, Wet Wells, Valve Vaults, Meter Pits, etc.

1.2 RELATED SECTIONS

A. Division 31 Section “Excavation and Fill”

1.3 REFERENCES

A. American Concrete Institute:

1.	ACI 301	Specifications for Structural Concrete
2.	ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3.	ACI 305R	Hot Weather Concreting
4.	ACI 306R	Cold Weather Concreting
5.	ACI 306.1	Standard Specification for Cold Weather Concreting
6.	ACI 308	Standard Practice for Curing Concrete
7.	ACI 347	Guide to Formwork for Concrete

B. American Society for Testing & Materials:

1.	ASTM B 221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
2.	ASTM C 33	Concrete Aggregate
3.	ASTM C 94	Ready-Mixed Concrete
4.	ASTM C 150	Portland Cement
5.	ASTM C 260	Air Entraining Admixtures for Concrete
6.	ASTM C 494	Chemicals Admixtures for Concrete
7.	ASTM C 595M	Blended Hydraulic Cements (Metric)
8.	ASTM C 1017	Chemical Admixtures for Use in Producing Flowing Concrete
9.	ASTM C 1107	Packaged Dry, Hydraulic Cement Grout (Nonshrink)
10.	ASTM D 994	Performed Expansion Joint Filler for Concrete
11.	ASTM D 1190	Concrete Joint Sealer, Hot-Poured Elastic Type
12.	ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving
13.	ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving

1.4 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. Shop Drawings: 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. Mill Certificates: Steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel, when requested.

E. Construction Joint Layout: Submit a Joint Plan, showing type and location, no smaller than the scale of the project drawings. Joint Details, including dowels, where appropriate. Sealer manufacturer's information.

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. Joint-filler strips
   7. Waterstops
   8. Repair Materials

G. Contractor should be aware that other submittal requirements (i.e. shop drawings) are contained in other applicable sections of these specifications.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: a qualified installer who employs on the 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 and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician Grade 1, according to ACI CP-1 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 and 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 single source, and obtain admixtures from single source from a single manufacturer.

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on shop drawings.

B. Store reinforcement at the job site in a manner to prevent damage and accumulation of dirt and excessive rust.

C. Handle reinforcement in such a way to prevent bending and damage.

PART 2 – PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and High-density overlay, Class 1 or better.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

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

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or water-proofing.

2.2 STEEL REINFORCMENT

A. Reinforcing Bars: Comply with ASTM A 305, Deformed Bars. Conforming to ASTM 615, Grade 60, or ASTM 706, Grade 60 as indicated on the project drawings.

B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Plain Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, grade 60, plain steel bars, cut true to length with ends square and free of burrs.

B. Supports for Reinforcement: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than the concrete 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.

2.4 MATERIALS

A. Cementitious Materials:

1. Cement shall be a standard brand Portland cement which shall conform to ASTM C 150. Type I cement with Fly Ash conforming to ASTM C 618, Class F.
2. Use cement of the same type, brand, and source throughout the project.

B. Water: ASTM C 94/C 94M and potable.

C. Fine Aggregate:

1. Fine Aggregate shall consist of natural sand, manufactured sand, or a combination thereof. The gradation requirements of fine aggregate shall be as follows: 100 percent passing the 3/8 inch sieve, 95-100 percent passing the No. 4 sieve, 40-80 percent passing the No. 16 sieve, 5-30 percent passing the No. 50 sieve, and 0-10 percent passing the No. 100 sieve.
2. Fine Aggregate shall conform to the requirements of ASTM C 33 with respect to deleterious substances, soundness, and abrasion.

D. Course Aggregate:

1. Course Aggregate shall consist of crushed stone or crushed gravel of uniform quality. The gradation requirements of course aggregate shall be as follows: 100 percent passing the 1 inch sieve, 90-100 percent passing the 3/4 inch sieve, 40-60 percent passing the 1/2 inch sieve, 10-30 percent passing the 3/8 inch sieve, and 0-5 percent passing the No. 4 sieve.
2. Course Aggregate shall conform to the requirements of ASTM C 33 with respect to deleterious substances, soundness, and abrasion.

E. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.

2. Chemical:
    a. ASTM C 494 Type A – Water Reducing
    b. ASTM C 494 Type B – Retarding
    c. ASTM C 494 Type C – Accelerating
    d. ASTM C 494 Type D – Water Reducing and Retarding
    e. ASTM C 494 Type E – Water Reducing and Accelerating
    f. ASTM C 494 Type F – Water Reducing, High Range
    g. ASTM C 494 Type G – Water Reducing, High Range and Retarding

3. Plasticizing: ASTM C 1017.

4. Use only admixtures that have been tested and accepted in mix designs and with Engineer's approval.

5. Comply with ACI 212.1 R "Admixture for Concrete" and ACI 212.2R-81 "Guide for Use of Admixture in Concrete.

F. Waterstops

1. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        i. Greenstreak.
        ii. Williams Products, Inc.
    b. Profile: Flat dumbbell without center bulb.
    c. Dimensions: 4 inches by 3/16 inch thick, non-tapered.

G. Curing Materials:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:
    a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
    b. BASF Construction Chemicals - Building Systems; Confilm.
    c. ChemMasters; SprayFilm.
    d. Conspec by Dayton Superior; Aquafilm.
    e. Dayton Superior Corporation; Sure Film (J-74).
    f. Edoco by Dayton Superior; BurkeFilm.
    g. Euclid Chemical Company (The), an RPM company; Eucobar.
    h. Kaufman Products, Inc.; Vapor-Aid.
    i. Lambert Corporation; LAMBCO Skin.
    j. L&M Construction Chemicals, Inc.; E-CON.
    k. Meadows, W. R., Inc.; EVAPRE.
    l. Metalcrete Industries; Waterhold.
    m. Nox-Crete Products Group; MONOFILM.
    n. Sika Corporation; SikaFilm.
    o. SpecChem, LLC; Spec Film.
    p. Symons by Dayton Superior; Finishing Aid.
    q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.

r. Unitex; PRO-FILM.

s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

4. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.

b. BASF Construction Chemicals - Building Systems; Kure 200.

c. ChemMasters; Safe-Cure Clear.

d. Conspec by Dayton Superior; W.B. Resin Cure.

e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).

f. Edoco by Dayton Superior; Res X Cure WB.

g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.

h. Kaufman Products, Inc.; Thinfilm 420.

i. Lambert Corporation; AQUA KURE - CLEAR.

j. L&M Construction Chemicals, Inc.; L&M Cure R.

k. Meadows, W. R., Inc.; 1100-CLEAR.

l. Nox-Crete Products Group; Resin Cure E.

m. Right Pointe; Clear Water Resin.

n. SpecChem, LLC; Spec Rez Clear.

o. Symons by Dayton Superior; Resi-Chem Clear.

p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.

q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

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

I. Contractor Joint Sealing Compound shall be one of the following:

1. Cold pour polymer fortified crack fill material generally conforming with ASTM D 1190.
2. Hot pour polymer rubber asphalt sealer meeting the requirements of ASTM D 3405. A certification will be required from the Contractor certifying that the joint sealer meets this specification.

J. Accessories:

1. Vapor Retarder: 10-mil thick clear polyethylene film/mildew resistant, type recommended for below grade application. Overlap (8 inch min.) and watertight-seal all joints.
2. Non-Shrink Grout: CDC-C 588, factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,000 psi in 48 hours and 7,000 psi in 28 days.
3. Non-Shrink Grout, Non-Metallic Grout: Factory premixed grout conforming to CRD-C-621-80, "Corps of Engineers Specification for Non-Shrink Grout."
    a. Acceptable Manufacturers:
    EUCO NS, The Euclid Chemical Company
    Sonogrout, Sonneborn-Contech
    Masterflow 713, Master Builders
    Duragrout, L & M Construction Chemical Co.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows: Fly Ash: 20 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

E. Use admixtures according to manufacturer's written specifications.

2.6 CONCRETE MIXTURES

A. Roads, Parking Lots, Sidewalks, Curbs & Gutters:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum Water-Cementitious Material Ration: 0.45.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: Between 5 and 7 percent at point of delivery.

B. Sanitary Structures, Wet Wells, Valve Vaults, Meter Pits, etc.:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum Water-Cementitious Material Ration: 0.44.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: Between 5 and 7 percent at point of delivery.

2.7 FABRICATING REINFORCEMENT

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

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 degrees F (29.4 and 32.2 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F (32.2 degrees C), reducing mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the work, indicating project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in the project.

PART 3 – EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain framework according to ACI 301 and ACI 347.

B. Limit concrete surface irregularities, the maximum deviation of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from planned alignment.

C. Construct forms tight enough to prevent loss of concrete mortar. Retighten forms and bracing before placing concrete, as required, to prevent concrete mortar leaks and maintain proper alignment.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

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

F. Forms shall have a depth equal to greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section or form shall be uniform and free from undesirable bends or warps.

G. Every ten (10) foot length of form shall have at least three (3) form braces which shall be spaced at intervals of not more than five (5) feet, having the end brace not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork may be removed after concrete has achieved at least 70 percent of its 28-day design compressive strength. Concrete has to be hard enough to not be damaged by form removal operations and curing and protection operations as outlined below.

B. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged from-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 Engineer.

3.3 VAPOR RETARDERS & BARRIERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and fully seal with manufacturer's recommended tape.
   2. Tape around all penetrations & lap edges up over top of foundation wall a min. of 4".

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.4 STEEL REINFORCEMENT

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

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.

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

E. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.

F. The maximum angle bar that is intended to be straight may be bent or offset shall be at a slope of 6:1, longitudinal to transverse dimension.

G. If clearances for reinforcing require hooks shorter than standard hooks, fabricator shall be responsible for providing shorter hooks, as required to meet ACI requirements.

H. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheets widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 CONCRETE PLACEMENT, GENERAL

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and subgrade preparation are complete and that required inspections and tests have been performed.

B. Do not add water to concrete during delivery, at project site, or during placement operations unless approved by the Engineer.

C. Before test sampling and placing concrete, water may be added at the project site, subject to the limitations of ACI 301.

D. 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 place continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

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 pavement surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces as required in project drawings.

5. Limit durations of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 degrees F (4.4 degrees C) for three consecutive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. 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 degrees F (32.2 degrees C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provide water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete in 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.

G. No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

3.6 INSTALLATION TOLERANCES

A. Surface Smoothness for Field Event Surfaces shall fall within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
    1. 1/8 inch max in any direction, checked with a 10 foot straight edge

3.7 JOINTS

A. General: : Construct expansion, weakened ¬plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened Plane (Contraction) Joints: Provide weakened plane (contraction) joints, sectioning concrete into areas as shown on drawings or as indicated below. Construct weakened ¬plane joints for a depth equal to at least 1/4" wide x 1/4 of concrete thick¬ness, as follows:
    1. Tooled Joints: Form weakened plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawed Joints: Sawed joint WILL NOT BE ALLOWED.
3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.
4. Unless indicated otherwise on the drawings. Weakened-plane joints shall be placed at maximum 5 ft. intervals each direction and located to conform to bay spacing wherever possible, or as shown on drawings.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than ½ hour, except where such placements terminate at expansion joints.
   1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
   2. Pinned Joints:
      a. Expansion joints, joints between new and existing (old) concrete shall be suitably pinned together prevent vertical misalignment.
      b. Joints between sidewalks and building or canopy slabs shall be suitably pinned together to prevent vertical misalignment.
   3. Provide preformed galvanized steel keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
   4. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
   5. Provide tie bars at sides of paving strips where indicated.
   6. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Expansion Joints: Use ASTM D 1751, non-extruding premoulded joint filler, 3/4" thick, composed of fiberboard impregnated with asphalt, for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

E. Expansion Joints: At ramps and walks, use ASTM D 1751, non-extruding premoulded material, ½" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt.

F. Locate expansion joints at intervals not greater than 50' unless indicated otherwise.

G. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

H. Furnish joint fillers in one piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

I. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

J. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.8 FINISHING

A. Mechanical Finishing Machine Method:

1. The concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the elevations as shown on project drawings.
2. A depth of excess concrete shall be carried in front of the strike off screed for the full width of the slab, whenever the screed is being used to strike off the pavement.
3. The finishing machine shall be provided with a screed, which will consolidate the concrete by pressure.
4. The concrete shall be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine.
5. The edges of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb.
6. Hand finishing tools shall be kept available for use in case the finishing machine breaks down.

B. Hand Finishing Method:

1. The concrete shall be struck off and consolidated by a vibrating screed or other approved equipment to the elevations shown on the project drawings.
2. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off and not be allowed to idle in the concrete.
3. Internal mechanical vibration shall be used alongside all formed surfaces.
4. Vibration operation shall be completed prior to final hand finishing.

C. Floating, Straightening, and Edging:

1. After concrete has been struck off and consolidated, it shall be further smoothed by means of a wood or aluminum float at least five (5) feet wide with a handle long enough to reach the entire width of the slab being placed.
2. The float shall be operated so as to remove any excess water and laitance, as well as surface irregularities. After floating operation, the pavement surface should be within the specific tolerances.
3. While concrete is still plastic, the pavement surface shall be tested for smoothness with a ten (10) foot straight edge swung from handles three (3) feet longer than one half the width of the pavement.
4. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than five (5) foot intervals transversely. After each test, the straight edge shall be moved forward one half its length and the operation continued.
5. When irregularities are discovered, they shall be corrected by adding or removing concrete.

6. All disturbed areas shall be again floated with the wooded float and again straight edged.
7. The pavement shall have no depression in which water will stand.
8. Before final finishing is completed and before concrete has taken its initial set, the edges of the pavement shall be carefully finished with an edger of the radius shown on the project drawings.

D. Final Surface Finish:

1. A broom finish shall be used as the final finishing method. A hard bristle broom shall be used, which shall be kept clean and used in such a manner as to provide a uniform texture surface.
2. The final surface of the concrete pavement shall have a uniform gritty texture, free from excessive roughness and true to the grades and cross sections shown on the project drawings.
3. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

3.9 PROTECTING AND CURING

A. 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 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. Begin curing immediately after finishing concrete as soon as marring of the concrete will not occur.

D. 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 (7) 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 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, and sealed by waterproof tap or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.
    a. Removal: after curing period had elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to pavement indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspection: Engage a qualified testing and inspection agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement. Contact the Engineer a minimum of 24 hours prior to the placement of concrete for his approval and observation of the placement of all reinforcing.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength.

C. Concrete Tests: Testing of composite samples of fresh concrete shall be obtained according to ASTM C 172 and as follows:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five (5) compressive strength tests for each concrete mixture, testing shall be conducted from at least five (5) 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 hourly test when air temperature is 40 degrees F (4.4 degrees C) and below or when air temperature is 80 degrees F (26.7 degrees C) or above; and one test for each composite sample.

5. Compressive-Strength Testing: ASTM C 39/C 39M.
    a. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test result shall be the average compressive strength from a set of two specimens obtained from the same composite sample and tested at the age indicated.
6. 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 values falls below specified compressive strength by more than 500 psi.
7. Test results shall be reported, in writing, to Engineer, 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 inspection agency, location of concrete batch in work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, an type of break for both 7 and 28-day tests.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer, but will not be used as sole basis for approval or rejection of concrete.
9. 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 Engineer. 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 the Engineer.
10. Additional testing and inspection, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 321100

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.

B. Related Sections:
1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Pavement-Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

G. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

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

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Crafco Inc., an ERGON company; RoadSaver Silicone.
      b. Dow Corning Corporation; 888.

c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Pecora Corporation; Urexpan NR-200.

2.3 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place joint sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
   1. Remove excess joint sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement.
    1. Joint Location:
        a. Expansion and isolation joints in cast-in-place concrete pavement.
        b. Contraction joints in cast-in-place concrete slabs.
        c. Other joints as indicated.
    2. Silicone Joint Sealant for Concrete: Single component, self-leveling.
    3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
    4. Joint-Sealant Color: As selected by Architect from manufacturer's full range

B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
    1. Joint Location:
        a. Joints between concrete and asphalt pavement.
        b. Joints between concrete curbs and asphalt pavement.
        c. Other joints as indicated.
    2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 321373

SECTION 329200 - TURF AND GRASSES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: installation of the lawns and native grasses, and guarantee/warranty as shown on the project drawings and as specified herein.

B. Related Sections:
   1. Section 312300 Excavation and Fill contains Topsoil requirements.
   2. Section 312500 Erosion and Sedimentation Controls contains Erosion Control Blanket requirements.

1.2 GENERAL CONDITIONS

A. All scaled dimensions are approximate. Check and verify all site dimensions and receive Engineer's approval prior to proceeding with work under this section.

B. Coordinate installation of all sodding and seeding with Engineer, General Contractor and Irrigation Contractor, if applicable, to avoid interference with other construction.

C. Keep the premises clean and free of excess equipment, materials and debris incidental to work.

D. Protect work and work of others at all times in performance of work, Contractor shall be responsible for any damage to irrigation lines during construction

E. Carefully note all finish grades before commencing work. Restore any finish grade changed during the course of this work to original or intended grades.

F. All disturbed areas shall be hydroseeded except for sodded areas, surfaced areas and solid rock. Disturbed areas outside of authorized construction limits shall be hydroseeded, or sodded at the Contractor's expense.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage and experienced installer who has a minimum of ten years of experience in the sod and seeding industry and native grass industry. Installer shall have completed seeding work similar in material (size and quantity), design and extent to that indicated for this project and with a record of successful established seeded lawns and native grasses. Installer shall provide references of similar project size within the last five years.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Engineer's satisfaction, based on evaluation of agency-submitted criteria

conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the work.

C. Topsoil Analysis: Furnish a soil analysis made by a qualified and approved independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand) deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus and potash nutrients and any limestone, aluminum sulfate or other soil amendments to be added to produce satisfactory topsoil.

D. The Contractor or his authorized representative shall be on site at the time of each site inspection or review. If contractor requests a site inspection or review and the site is not found to be in an acceptable condition to hold the review, the hourly fees of the personnel called for the site visit shall be paid by the Contractor.

1.4 SUBMITTALS

A. Sod: The Contractor shall furnish to the Engineer a certification of the seed mixture of the sod, identifying sod source, including name and telephone number of supplier.

B. Seed: The Contractor shall furnish to the Engineer that dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety for approval, prior to seeding.

C. Organic Compost: The Contactor shall submit to the Engineer a certificate signed by the manufacturer of the organic compost certifying that the compost used during the seeding process complies with specified requirements.

D. Certification and mix composition of all seed and sod including seed and sod sources and rate of application, and name of supplier.

E. Qualification date for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, name and address of Engineers and Owners, and other information.

F. Material test reports from qualified and approved independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
1. Analysis of existing surface soil.
2. Analysis of imported topsoil.

G. Sodding and seeding schedule(s) indicating anticipated dates and locations for work to be completed.

H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.5 DELIVERY, STORAGE AND HANDLING

A. All sod must be delivered to the job within twenty-four hours after being cut. Sod shall not be permitted to dry out or not before installation.

B. Seed shall be delivered to the site in bags sealed by vendor, bearing bags tags for seed analysis and date of testing. Contractor shall keep all bag tags on file for the Engineer verification of seed type, quality, and quantity. All seed shall be stored in a manner which does not impair the quality and effectiveness of the seed.

C. Sod: Harvest, deliver, store and handle sod according to the requirements of the American Sod Producers Association's (ASPA) specifications for Turf Grass Sod Materials and Transplanting/Installing.

1.6 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner that will avoid damage. Hand excavate, as required. Maintain grade stakes until parties concerned mutually agree upon removal.

B. Excavation: When conditions detrimental to seeding and sod establishment are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before proceeding.

C. Finish grading shall be done in preparation for seeding. Any weed growth shall be removed prior to seeding.

1.7 GUARANTEE

A. General Guarantee: The Contractor shall guarantee the production of a close stand of the specified grass, acceptable to the Owner. All repairs, reseeding and resodding are to be done as part of the Contract and at no additional cost to Owner.

PART 2 – PRODUCTS

2.1 SODDING MATERIALS

A. Turfgrass Sod: Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specification for Turfgrass Sod Materials" in its "Guideline Specification to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species shall match existing sod found on site unless none is present, in which case sod of grass species as follows, with not less than 95 percent germination not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
    1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
    2. Sun and Partial Shade: Proportioned by weight as follows:
        a. 50 percent Kentucky bluegrass (Poa pratensis).
        b. 30 percent chewings red fescue (Festuca rubra variety).
        c. 10 percent perennial ryegrass (Lolium perenne).
        d. 10 percent redtop (Agrostis alba).
    3. Shade: Proportioned by weight as follows:
        a. 50 percent chewings red fescue (Festuca rubra variety).
        b. 35 percent rough bluegrass (Poa trivialis).
        c. 15 percent redtop (Agrostis alba).

2.2 SEEDING MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology: Rules for Testing Seeds" for purity and germination.

B. Lawn Seed Species: Seed of grass species shall match existing grass found on site unless none is present, in which case seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
    1. Full Sun: Bermudagrass (Cynodon dactylon)
    2. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
    3. Sun and Partial Shade: Proportioned by weight as follows:
        a. 50 percent Kentucky bluegrass (Poa pratensis).
        b. 30 percent chewings red fescue (Festuca rubra variety).
        c. 10 percent perennial ryegrass (Lolium perenne).
        d. 10 percent redtop (Agrostis alba).
    4. Shade: Proportioned by weight as follows:
        a. 50 percent chewings red fescue (Festuca rubra variety).
        b. 35 percent rough bluegrass (Poa trivialis).
        c. 15 percent redtop (Agrostis alba).

C. Meadow Seed Species: Fresh clean, dry, new seed, mixed species as follows:
    1. 20 percent Fescue
    2. 15 percent Little Bluestem
    3. 15 percent Side Oats Gramma
    4. 10 percent Broom Sedge
    5. 10 percent Purple Prairie Clover
    6. 10 percent Annual Rye
    7. 10 percent Perennial Ryegrass
    8. 5 percent Orchard Grass
    9. 5 percent Timothy

D. Organic Compost:

1. All ingredients shall be known and fully disclosed.
2. Compost shall contain no human sludge or yard waste.
3. At least 99% of all nitrogen in compost shall be in organic form.
4. The Carbon: Nitrogen Ratio of the compost shall be less than 30:1 to eliminate Nitrogen starvation.
5. Compost shall have a pH level between 6.0 and 7.5.
6. Compost shall have moisture content no greater than 40%.
7. Compost shall be registered as a fertilizer in the state of Missouri.
8. Contractor shall submit an analysis and sample of the compost to the Owner's Representative for review and approval prior to installation.

E. Mulches:

1. Straw Mulch: Provide air-dried, clean, mildew and seed free, salt hay or threshed straw of wheat, rye, oats or barley.
2. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, non- toxic, free of plant growth inhibitors or germination inhibitors, with maximum moisture content of 15 percent and a pH of 4.5 to 6.5.
3. Asphalt Emulsion Tackifier: Asphalt emulsion ASTM 0977, Grade SS-inhibitors.
4. Nonasphaltic Tackifier; Colloidal tackifier (Stay-Soil) recommended by fiber-mulch manufacturer for slurry application, non-toxic and free of plant growth inhibitors or germination inhibitors.

PART 3 – EXECUTION

3.1 PREPARATION

A. Sod Bed Preparation:

1. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1/2 inch in any dimension and other objects that may interfere with planting or maintenance operations.
2. Moisten prepared lawn areas before planting when soil is dry, Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

B. Seed Bed Preparation:

1. Repair any eroded areas and make minor grading adjustments to provide good drainage and to meet grade at all walks and paved surfaces.
2. Clean seed bed surface of all stones larger than 1/2 inch in diameter and all of existing vegetation, roots, brush, wire, grade stakes, and any other deleterious materials.

3. Using a rear tine tiller or other approved tiller uniformly combine a 2-inch layer of organic compost into existing soil. Drag lawn areas with approved equipment to insure a smooth surface to all lawn areas.
4. For areas that will be seeded, pre-treat existing lawn with herbicide and reapply to kill off remaining vegetation, if present, prior to seeding.

3.2 INSTALLATION

A. Sodding New Lawns:

1. Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen.
2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to sub-grade or sod during installation. Tamp and roll lightly to ensure contact with sub-grade, eliminate air pockets and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
3. Lay sod across angle of slopes exceeding 3:1.
4. Anchor sod on slopes exceeding 6:1 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
5. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below the sod.
6. Upon completion of the above work, the surface of the sodded areas shall coincide with the finished grade, shall be flush with other seeded or turfed areas, and shall meet the established grade adjacent to any paved areas. Care should be taken in sodding to preserve the finish grade elevations, so that there will be no depressions or uneven places in the surface of the sodded turf areas.

B. Seeding New Lawns:

1. Apply seed mixture simultaneously with application of organic top dressing layer at a rate of 8 lbs. per 1,000 sf.
2. Top dressing with seed shall be applied in a uniform 1/2 inch layer over lawn areas. In areas of existing lawns use a slit seeding method to apply appropriate seed mix.
3. Keep organic top dressing and seed out of plant beds and off of walks, structures and areas not to be seeded.
4. Protect seeded slopes exceeding 4:1 against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.
5. Protect seeded slopes exceeding 6:1 against erosion with jute or coil-fiber erosion control mesh installed and stapled according to manufacturer's recommendations.
6. Protect seeded areas with slopes less than 6:1 against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre to form a continuous blanket 1-1/2 inches loose depth over seeded areas. Spread by hand, blower or other suitable equipment.
    a. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.

b. Anchor straw mulch by spraying with asphalt-emulsion tackifier at the rate of 10 to 13 gal. per 1000 sq.ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas.

C. Hydroseeding:

1. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application
2. Mix slurry with asphalt-emulsion tackifier.
3. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch as a minimum rate of 1500-lb/acre dry weight but less than the rate required to obtain specified seed-sowing rate.

D. Reseeding:

1. Bare Patches or washouts due to heavy rains, prior to establishment and acceptance of the new turf, shall be regraded as needed, reseeded and watered, as often as necessary at Contractor’s expense.

3.3 LAWN MAINTENANCE

A. The maintenance of the lawns shall begin immediately after seeding and sodding and continue until Final Acceptance, but not less than 30 calendar days. The sodded turf area shall be watered daily for the next 10 days after installation to keep soil moist. Then reduce watering to 2 to 3 days per week until turf is well established. Any sod not surviving the first month shall be replaced with new sod from the same source.

B. The maintenance of the seeded turf shall be the Contractor's responsibility until the new grass is 4 inches high and thick enough to receive its first mowing by the Owner and for a minimum of 30 days. The Contractor shall protect and restore seeded areas by watering, fertilizing, removing weeds, and reseeding as necessary, to ensure a uniform stand of established grass until Final Acceptance of the seed lawn by the Owner's Representative.

C. Mowing of sod lawn is the responsibility of the Contractor until Final Acceptance. The first mowing will not be attempted until the lawn is 4 inches high and thick enough to receive its first mowing. Mow to a height of 3" returning clippings to the lawn. Never mow off more than 1/3 of the grass leaves.

D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

E. Use fertilizer that will provide actual nitrogen of at least 1 lb. per 1,000 sq. ft. to lawn areas.

3.4 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of Contractor's warranty period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Satisfactory Sodded Lawns: At end of Contractor's warranty period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

C. Reestablish lawns that do not comply with the above requirements and continue to maintenance until lawns are satisfactory.

3.5 PROTECTTION

A. Protection of seeded and sodded areas shall begin immediately after the Contractor completes the seeding and sodding work. Contractor shall protect newly graded, seeded and sodded areas from erosion, damage due to landscaping operations, operations by other contractors and trades and trespassers. Contractor shall repair all damaged areas prior to final acceptance.

END OF SECTION 329200

SECTION 333100 - SEWER UTILITY SEWERAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: requirements and specifications necessary to install the sanitary sewer piping, valves, and other accessories, excluding manholes, as shown on the project drawings.

B. Testing of the installed system is incidental to the work.

C. Provide construction staking in accordance with generally accepted practice for layout of underground utilities.

D. The work includes coordination with building plumbing contractors and building plumbing plans.

E. Fees related to sewer service installation, whether tap, meter or other fees will be paid by the Contractor. Identify fees for installation of sewer services and provide written report to the Owner.

F. Connections between the new construction and existing mains may be made by the Local Jurisdiction. Sewer service may be brought to the property line by the Local Jurisdiction. Contractor shall verify the extent to Local Jurisdiction work and coordinate the work with the work of the Local Jurisdiction.

1.2 RELATED SECTIONS

A. Section 312300 Excavation and Fill for trenching, bedding, and backfill requirements.

B. Section 333900 Sanitary Utility Sewerage Structures for manhole requirements.

1.3 GENERAL CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do no interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated. Notify property owner not less than two days in advance of proposed utility interruptions.

1.4 SUBMITTALS

A. Product Data for the following:
   1. Pipe and Fittings

2. Valves and cleanouts.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 **DELIVERY, STORAGE, AND HANDLING**

A. Preparation for Transport: Prepare valves according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flanged faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:
   1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” Article for applications of pipe and fittings materials.

2.2 PIPE AND FITTINGS

A. Ductile Iron Pressure Pipe: AWWA C151.

   1. Standard-Pattern, Ductile Iron Fittings: AWWA C110, ductile or gray iron, buried or flooded pipe shall have mechanical joints, interior or exposed pipe shall be flanged unless otherwise indicated or specified.
   2. Gaskets: AWWA C111, Rubber.
   3. Flanges: Ductile Iron, conforming to ANSI B16.1 and shall be drilled class 125.
   4. Flange Bolts: Bolts shall conform to ASTM A307 Grade B.

5. Flange Gaskets: Shall be 1/8” thick, full-faced synthetic rubber.

B. Ductile Iron Gravity Sewer Pipe: ASTM A 746, for push-on joints.

1. Standard-Pattern, Ductile Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Gaskets: AWWA C111, Rubber.

C. PVC Pressure Pipe: AWWA C900, Class 200 or ASTM 2241, 200 psi, SDR 21, for gasketed joints.

1. Ductile Iron, Compact Fittings: AWWA C153, for push-on joints.
2. Gaskets for Ductile Iron Fittings: AWWA C111, Rubber.

D. PVC Gravity Sewer Pipe and Fittings: As specified on project drawings and according to the following:

1. SDR 35 and SDR 21 PVC Sewer Pipe and Fittings: ASTM D 3034, gasketed joints. Gaskets are to conform to ASTM F 477, elastomeric seals.
2. Schedule 40 and Schedule 80 PVC Sewer Pipe and Fittings: ASTM D 3034. Solvent-cemented joints. Solvent Cements are to conform to ASTM D 2564 and ASTM D 2855.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for non-pressure joints.

1. Sleeve material for cast-iron soil pipe: ASTM C 564, rubber.
2. Sleeve material for plastic pipe: ASTM F 477, elastomeric seal.
3. Sleeve material for dissimilar pipe: Compatible with pipe materials being joined.
4. Bands: Stainless steel, at least one at each pipe insert.

B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe for non-pressure joints.

1. Material for cast-iron soil pipe: ASTM C 564, rubber.
2. Material for plastic pipe: ASTM F 477, elastomeric seal.
3. Sleeve material for dissimilar pipe: Compatible with pipe materials being joined.

C. Pressure-Type Pipe Couplings: AWWA C 219, iron-body sleeve assembly matching OD of pipes to be joined, with AWWA C 111 rubber gaskets, bolts, and nuts. Include PE film, pipe encasement.

D. Ductile Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical joint ends complying with AWWA C 110 or AWWA C 153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated. Include PE film, pipe encasement.

E. Ductile Iron, Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C 110 or AWWA C 153. Include rating for 250-psig minimum working pressure and for up to 15 degrees deflection. Include PE film, pipe encasement.

F. Ductile Iron, Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C 110 or AWWA C 153. Include rating for 250-psig minimum working pressure and for expansion indicated. Include PE film, pipe encasement.

2.4 VALVES AND ACCESSORIES

A. Non-rising Stem, Resilient-Seated Gate Valves, 3 inch NPS and larger: AWWA C 509, gray or ductile iron body and bonnet; with bronze or gray or ductile iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig minimum working pressure design, interior coating according to AWWA C 550, and buried valves shall be mechanical-joint with a 2 inch operating nut, exposed or interior valves shall have flanged ends and have hand wheel operators. Valves shall open counter clockwise. Valve stems shall use double “O” ring seals.

B. Check Valves: AWWA C 508, with 175-psig working pressure rating. Include interior coating according to AWWA C 550. Valve hinge pins shall be stainless steel. Valve disc shall be full opening with a composition to metal seal. Valve shall be flanged unless noted otherwise on the project drawings. Valves shall be equipped with an external lever that is spring assisted. The spring tension shall be field adjustable by a hex nut. The lever arm shall be keyed to the valve hinge shaft.

C. Check Valves – Cushioned: AWWA C 508, with 175-psig working pressure rating, with addition of exterior cushion chamber. Include interior coating according to AWWA C 550. Swing disc type with stainless steel shaft and flanged body. Flanges shall be ANSI B16.1, Class 125. Valve disc shall be external lever and adjustable counterweight to initiate closure. Valves shall be a metal to composition seat.

D. Eccentric Plug Valves:

1. Plug valves shall be quarter-turn non-lubricated eccentric type with resilient faced plug. Alternate seat and plug materials may be considered provided the specification is met and, in addition, the manufacturer must prove prior to approval that the valve meets AWWA C 504 “proof of design tests” (10,000 cycles) in both directions. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 150 for diameter and drilling. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C 111. Port areas for valves smaller than 20-inch shall be at least 80 percent of full pipe area. Port areas for valves 24-inch and larger shall be at least 70 percent of full pipe area.
2. Materials and Construction:
    a. Bodies shall be of ASTM A 136, Class B cast iron.
    b. Valve plug shall be ASTM A 126, Class B cast iron or ASTM A 536 ductile iron. Resilient plug facing shall be synthetic rubber, neoprene or Buna N compound suitable for use with water and wastewater applications.
    c. Seats shall be a raised welded overlay of 90 percent pure nickel, a minimum of 0.125 inch thick and 0.50 inch wide, conforming to AWWA C 504. When the plug is in the closed position, the resilient plug facing shall contact only nickel. Sprayed or plated mating seat surfaces are not acceptable for resilient plugs.
    d. Bearings shall be replaceable. Sleeve bearings in the upper and lower journals shall be permanently lubricated 316 stainless steel per ASTM A 743 Grade CF-8M. Nonmetallic journal bearings shall not be acceptable. Thrust bearings shall be Teflon.
    e. Shaft seals shall be self-adjusting chevron-type conforming to AWWA C 504. Valve shall be designed so it can be repacked while the valve is in

line and under pressure without removing the actuator. O-ring seals shall not be acceptable in vales larger than 3 inches.

f. All exposed fastened hardware shall be zinc plated or stainless steel. Provide stainless steel bolting on buried service valves.

3. Manual Operators:
   a. All valves shall open counterclockwise.
   b. Provide indicators to show position of plug except on buried operators.
   c. Actuators: manual valves shall have lever or worm gear actuators with handwheels, chainwheels, tee wrenches, extension stems, floorstands, etc., as shown on the plans or as called for in the valve schedule. Lever actuators shall be furnished for valves 8 inches or smaller where the maximum shutoff pressure is 25 psi or less as indicated on the plans or in the valve schedule. Worm gear actuators shall be furnished for all valves 4 inches or larger where the maximum reverse shutoff pressure is greater than 25 psi. Worm gear actuators shall be sized for 150 psi. all gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. This adjustable stop shall be the only adjustment necessary to set the clearance between the valve plug and the seat while the valve is in line and under pressure. Handwheel and chainwheel sized for worm gear actuators shall be no smaller than 6 inches in diameter and no larger than twice the diameter of the actuator's gear sector. All exposed nuts, bolts, and washers shall be zinc plated. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator convers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gaskets seals. All exposed nuts, bolts, springs, and washers shall be stainless steel.
   d. Handwheels shall be located for easy access on exposed valves.
   e. Buried valves shall be operated by a 2 inch AWWA nut with valve box.
4. Testing: Furnish certified copies of results of tests prior to shipment. All valves shall be subjected to an AWWA C 504 procedure leak test at 150 psi against the face of the plug and a body hydrostatic test at 300 psi. Valves shall be capable of providing drip-tight shutoff up to the full leak test rating with pressure in either direction.

E. Ball Valves (Polymer Service and Non-Potable Water 2 inch and smaller):

1. Ball valves shall be PVC true union with either solvent socket or threaded pipe connections. Pressure rating shall exceed 230 psi.
2. Seats shall be PTFE with backing rings. Backing rings and seals shall be Ethylene-propylene-diene-monomer rubber (EPDM).
3. PVC shall meet or exceed cell classification 12454B, ASTM D 1784.
4. Socket end connections shall conform to ASTM D 2467. Threaded pipe connections shall conform to ANSI B2.1.
5. Exposed valves shall be operated by a 2 inch AWWA nut. Valve shall not be buried.

F. Backwater Valves:

1. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
   a. Horizontal Type: With swing check valve and hub-and-spigot ends.

b. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
c. Terminal Type: With bronze seat, swing check valve, and hub inlet.

2. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

G. Air Release Valves: Shall be A.R.I. model D-025 combination air valve for sewage.

H. Appurtenances:

1. Trace Wire: Magnetic detectible conductor (#12 copper).

2.5 POLYETHYLENE PLASTIC (PE) FILM, PIPE ENCASEMENT

A. ASTM A 674 or AWWA C 105; PE film, tube, or sheet, 8-mil thickness.

2.6 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Piping Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.7 DETECTABLE WARNING TAPE

A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum six (6) inches wide and four (4) mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored green for sewer systems.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on the project drawings.

3.2 EARTHWORK

A. Excavation, trenching, bedding, and backfilling are specified in Section 31 23 00 Excavation and Fill.

B. Hand trim excavations to required elevations. Correct over excavation with bedding material.

C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 IDENTIFICATION

A. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.4 PIPING APPLICATIONS

A. General: Include watertight joints.

B. Refer to Part 2 of this Section for detailed specifications for piping and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.

C. Gravity-Flow Piping: As indicated on the project drawings:

1. NPS 4 and NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints. (4 inch pipe is allowed on gravity service laterals from building to main only. All gravity sewer mains must be a minimum of 6 inches in diameter).
2. NPS 8 and NPS 10: PVC sewer pipe and fittings, or gaskets and gasketed joints.
3. NPS 12 and NPS 15: PVC sewer pipe and fittings, or gaskets and gasketed joints.

D. Force-Main Piping: As indicated on the project drawings:

1. NPS 4 to NPS 8: Ductile Iron sewer pipe; standard or compact-pattern, ductile iron fittings; gaskets; and gasketed joints.
2. NPS 4 to NPS 8: PVC pressure pipe, PVC pressure fittings, gaskets, and gasketed joints.

3.5 SPECIAL PIPE AND COUPLING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for non-pressure applications:
    a. Sleeve type to join piping, of same size, or with small difference in OD.
    b. Increase/reducer-pattern, sleeve type to join piping of different sizes.
    c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force main joints. Include PE film, pipe encasement.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.6 INSTALLATION, GENERAL

A. General Locations and Arrangements: Project drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Molded Tees shall be used for all "tee" connections for new construction of gravity sewers. Inserta-Tees® (or approved equal) shall be used on all tap connections to existing gravity sewer pipes.

E. Install ductile iron, force main piping according to AWWA C 600.

F. Install PVC force main piping according to AWWA M 23.

G. Location of Sewers with respect to Water Mains:

1. Horizontal Separation: Whenever possible, any sanitary sewer shall be laid at least 10 feet, horizontally, from a water main. When local conditions prevent a separation of 10 feet, the Missouri Department of Natural Resources (MoDNR) may allow a sanitary sewer to be laid closer than 10 feet to a water main provided that the sanitary sewer is laid at least 18 inches below the bottom of the water main. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical or slip-on joint ductile iron pipe and should be pressure tested to assure watertightness before backfilling. Both of these alternatives must be specifically approved by MoDNR on a case-by-case basis.

2. Vertical Separation: Whenever sanitary sewers must cross water mains, the sewer shall be laid at such an elevation that the bottom of the water main is no closer than 18 inches above the top of the sewer. The vertical separation shall be maintained for that portion of the sanitary sewer located within 10 feet, horizontally, of any water main it crosses. The crossing shall be arranged so that the sewer joints will be equal distance and as far as possible from the water main joints.

3. Unusual Conditions: Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the sewer line to pass over a water main, the sewer line shall be laid with slip-on mechanical joint ductile iron pipe, and the sewer line shall extend on each side of the crossing a distance from the water main of at least 10 feet. In making such a crossing, a full length of ductile iron pipe must be centered over or under the water main to be

crossed so that the joints will be equidistant from the water main and as remote therefore as possible. The water main must also be constructed of ductile iron pipe with slip-on or mechanical joints until the nominal distance from the sewer line to the water main is at least 10 feet. Where a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and the top of the water main shall be maintained, with adequate support, especially for the larger sized sewer lines, to prevent them from settling on and breaking the water main. The sewer shall be constructed of ductile iron pipe for a distance of 10 feet on either side of the crossing, or other suitable protection as approved by the MoDNR.

H. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

I. All gravity sewer lines shall be installed with minimum slopes according to the following table:

Sewer Size	Minimum Slope (feet per 100 feet)
6 in.	0.60
8 in.	0.40
9 in.	0.33
10 in.	0.28
12 in.	0.22
14 in.	0.17
15 in.	0.15
16 in.	0.14
18 in.	0.12
21 in.	0.10
24 in.	0.08
27 in.	0.067
30 in.	0.058
36 in.	0.046

3.7 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Ductile Iron Sewer Pipe with Ductile Iron Fittings: According to AWWA C 600. Install PE film, pipe encasement over ductile iron sewer pipe and ductile iron fittings according to ASTM A 674 or AWWA C 105.

C. PVC Pressure Pipe and Fittings: Join and install according to AWWA M 23.

D. PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.

E. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

F. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

G. Install with top surfaces of components, except piping, flush with finished surface.

3.8 REACTION ANCHORAGE AND BLOCKING

A. All unplugged bell and spigot or all-bell tees, Y-branches and bends deflecting 11-1/4 degrees or more with are installed in piping subject to internal hydrostatic heads in excess of 15 feet in exposed, or 30 feet in buried applications, shall be provided with suitable reaction blocking, struts, anchors, clamps, joint harness, or other adequate means for preventing movement of the pipe cause by unbalanced internal liquid pressure.

B. Trench Installation: Where in trench, the forgoing designated fittings shall be provided with concrete thrust blocking between the fitting and solid, undisturbed ground in each case, except where solid ground blocking support is not available. At the tops of slopes vertical angle bends shall be anchored by means of steel strap or rod anchors securely embedded in or attached to a mass of concrete of sufficient weight to resist the hydraulic thrust at the maximum pressures to which the pipe will be subjected. All concrete blocking and anchors shall be installed in such a manner that all joints between pipe and fittings are accessible for repair.

C. The bearing area of concrete reaction blocking against the ground or trench bank shall be as shown by the plans or as directed be the Engineer in each case. In the even that adequate support against undisturbed ground cannot be obtained, metal harness anchorages consisting of steel rods or bolts across the joint and securely anchored to pipe and fittings or other adequate anchorage facilities approved by the Engineer shall be installed to provide the necessary support. Should the lack of a solid vertical excavation face be due to careless or otherwise improper trench excavation, the entire cost of furnishing and installing metal harness anchorages in excess of the contract value of the concrete blocking replaced by such anchorages shall be borne by the Contractor.

D. For other locations: Reaction blocking, struts, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the project drawings or as directed by the Engineer.

E. Protection of meal surfaces: All steel clamps, rods, bolts and other metal accessories used in reaction anchorages or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be adequately protected from corrosion with not less than two coats of Koppers "Bitumastic No. 50", or approved equal, heavy coal tar coating material, applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within

structure shall be painted with two coats (in addition to a primer coat) of paint approved by the Engineer.

F. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.9 BACKWATER VALVE INSTALLATION

A. Install horizontal units in piping where indicated.

B. Install combination units in piping and in structures where indicated.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow of sewer.

B. Set cleanout frames and covers in earth, set with tops a minimum of one (1) inch above surrounding grade.

C. Set cleanout frames and covers in pavement flush with pavement surface.

3.11 AIR RELEASE FACILITIES

A. Air release valves shall be A.R.I. model D-025 combination air valve for sewage.

B. Air release facilities shall be located at the high points of all pressure sewer systems and shall be properly sized to prevent buildup of air or gasses that will impede flow of the wastewater.

C. Air release valves must be automatic and designed to prevent wastewater solids and grease from reaching the valve operating mechanism.

D. Provisions for cleaning the valve by back flushing should be provided.

3.12 TAP CONNECTIONS

A. Tap connections to existing sanitary sewer mains shall be made in accordance with the Local Jurisdiction's requirements and specifications. It is the Contractor's responsibility to coordinate tap connections with the Local Jurisdiction and to verify that local requirements and specifications are followed. If no such specifications exist, tap connections shall be made as outlined below:

1. Use Inserta-Tee® (or approved equal) to make branch connections into existing piping, NPS 4 to NPS 20.
2. Make branch connections from side into existing piping, NPS 21 or larger, or to underground structures by cutting opening into existing unit large enough to allow three (3) inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or

structure wall, encase entering connection in six (6) inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 3,000 psi 28-day compressive strength.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

3. Protect existing piping and structures to prevent concrete or other debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.13 CLOSING ABANDONED SANITARY SEWER PIPE

A. Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping has been closed. Use either procedure below:

1. Close open ends of piping with at least eight (8) inch thick brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

3.14 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at the completion of the project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged pipe.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

3.15 FIELD TESTING

A. General:

1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

B. Pressure Tests:

1. The Contractor shall furnish all pumps, piping, labor, and other materials and services necessary to bring the piping up to the specified test pressure.
2. All pipes shall be pressure tested. Pipes which will be pressurized under normal operating conditions shall conform to the requirements of the hydrostatic pressure test. All other piping shall meet the requirements of the air leakage test.
3. Pipe in the sections to be tested shall be backfilled or center loaded with thrust blocks installed and completely backfilled. Interior pipe supports and restraint systems shall be completely installed prior to testing.

C. Hydrostatic Pressure Test:

1. Test connections shall be made and the pipe filled with water. Unless otherwise specified, a pressure of not less than 1.25 times the normal operating pressure (for the lowest point on the pipe line) but not less than 100 psi or not more than the rated working pressure of the pipe shall be used for testing.
2. After air removal, water shall be pumped in to bring the pipe to the specified pressure. The hydrostatic test shall be of at least a 2-hour duration. Test pressure shall not vary by more than plus or minus five (5) psi for the duration of the test. After two hours, additional water shall be drawn from a container of known volume. The amount of water required to return the system to the specified pressure shall not exceed the amount determined by the following formula:

$$Q = SD(P)^{1/2}/133200 \qquad \text{(Equation 1)}$$

Where

Q = Total allowable leakage in gallons per hour.
S = Length of section tested, feet.
D = Nominal pipe diameter, inches.
P = Test pressure, psi.

3. The allowable leakage must not exceed the volumes specified below for each 1,000 feet of the particular diameter of pipe being tested (table has been calculated based on Equation 1):

Hydrostatic Testing Allowance per 1,000 ft of Pipeline – gph

(AWWA C 600)

Avg. Test Pressure	Nominal Pipe Diameter (in)										
(psi)	1.5	2	3	4	6	8	10	12	14	16	18
100	0.11	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35
125	0.13	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51
150	0.14	0.18	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66
175	0.15	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79
200	0.16	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91

4. All exposed pipe, fittings, valves, and joints shall be inspected and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by excavation where the pipe has been covered with backfill. Should the leakage test results exceed allowable leakage, the test pressure shall be maintained for an additional period of time as directed by the Engineer to facilitate location of leaks.
5. All pipe, fittings, valves, pipe joints, and other materials which are found to be defective when the pipe line is tested shall be removed from the line immediately and replaced with new and acceptable material by and at the expense of the Contractor. The pressure test shall be repeated after repairing leaks and other defective work until the pipe line installation conforms to specified requirements and is accepted by the Engineer.

D. Air Leakage Test:

1. Contractor shall perform air tests for all pipe sizes.
2. Air leakage testing shall be performed on lies as specified and on the following lines:
    a. Outfall line
    b. Drain lines
    c. Sanitary sewer lines
3. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over-pressurization, and all miscellaneous items required.
    a. The pipe plug for introducing air in to the line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fitting to accept a pressure test gauge indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.
    b. The pressure test gauge shall meet the following minimum specifications:
        i. Size (diameter) 4-1/2 inches
        ii. Pressure Range 0-15 psi
        iii. Figure Intervals 1 psi increments
        iv. Minor Subdivisions 0.05 psi
        v. Pressure Tube Burdon Tube or diaphragm

	Accuracy	+ 0.25% of maximum scale reading
vi.	Dial	White coated aluminum with black lettering, 270 degrees arc and mirror edge
vii.	Pipe Connection	Low male 1/2 inch NPT

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air test are performed.

4. Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
5. Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than shown in the table below, the pipe shall be presumed to be free of defects.

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q=0.0015
(ASTM F 1417, Table 1)

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 t
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the pressure air test.

6. In areas where ground water is known to exist, install a one-half inch diameter capped pipe nipple approximately 10 inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

E. Deflection Tests:

1. Deflection tests shall be performed on all flexible sewer pipe by the Contractor using a mandrel pull. The mandrel shall have not less than seven (7) arms. The mandrel pull cannot be performed any sooner than 30 days after the reach being tested has been installed and final backfill has been placed.
2. A section of sewer line reach shall be deemed as failed when the mandrel cannot be moved through it with reasonable force. The tests shall be performed without mechanical pulling devices.
3. At the conclusion of the mandrel pull, the Contractor, at his expense, shall be required to remove and replace all pipe which fails the test.
4. The mandrel diameter shall be based on 95 percent of the actual inside pipe diameter.

F. Alignment Tests:

1. At the Owner’s or Engineer’s instruction the Contractor shall check the alignment of a sewer line using either a laser beam or lamping methods.

END OF SECTION 333100

APPENDIX A:
BID DOCUMENTS

BID PROPOSAL FORM

OWNER/PROJECT INFORMATION:

Owner: **Cabool R-IV School District**
Project Name: **Middle School Tornado Safe Room**
Design Professional: Paragon Architecture, 637 W. College Street, Springfield, MO 65806

BIDDER INFORMATION:

Legal Entity Name:

_____

Address:

_____

Phone Number:

_____

Contact Email Address:

_____

BIDDERS REPRESENTATION:

THE UNDERSIGNED HEREBY REPRESENTS that by making this bid, the bidder has: (1) read and understood the proposed Construction Documents, which include the General Conditions, Supplementary Conditions, Division-01 General Requirements, the Specifications, and the Drawings; and that this Bid is made in accordance therewith, including all quantities and requirements; (2) visited the project site, has familiarized him or herself with the local conditions under which the Work is to be performed including qualified labor availability, and that he/she has correlated his observations with the requirements of the proposed Construction Documents; and (3) has made this Bid based upon the materials, systems, assemblies and equipment required by the proposed Construction Documents.

THE UNDERSIGNED ACKNOWLEDGES that in signing this Bid, he waives all rights to plead any misunderstandings regarding the same. The Undersigned understands that his competence and responsibility and that of his proposed subcontractors, the time of completion, as well as other factors of interior to the Owner, may be consideration in making the award of this Contract. The Undersigned acknowledges that the Owner reserves the right to reject any or all bids, and to waive any informality or irregularity concerning the bids received as may be in the Owner's interest.

BASE BID COST PROPOSAL:

INDICATE AMOUNTS BELOW in both words and figures. In the case of a discrepancy between the words and the figures, the words will govern.

THE BIDDER HEREBY AGREES AND AFFIRMS to enter into a construction Contract to provide all labor, materials, equipment and services necessary to perform the Work described in the Contract Documents, including all addenda issued thereto, for the Base Bid Sum of:

Written amount: _____ DOLLARS
Numeric amount: $ _____.00

BASE BID CONTRACT TIME PROPOSAL:

Work will be Substantially Completed) By the following date: _____
b) Not later than the following number of calendar days (including Saturdays, Sundays and Holidays) from the date of Commencement of Work:

(Written)_____ (Numeric)_____

- - - - - - - - - - -

The Bidder agrees that if awarded the Contract, the Bidder will mobilize within (Written)_____(Numeric)_____ calendar days from date of Commencement of Work identified in **A101-2017, Article 3.1.**

ALTERNATES:

THE UNDERSIGNED PROPOSED the following amounts as additions to or deductions from the Base Bid Sum indicated above, in accordance with **Section 01 23 00 – Alternates** for descriptions of the alternative Work to be included. The Owner reserves the right to accept or reject alternates as deemed to be in his best interest, in any order or sequence, and to reject all alternates. Except for "Optional" Alternates, a Bidder's failure to provide an alternate cost proposal may be consideration for rejection of the Bid Proposal, as being un-responsive:

ALTERNATE #1 – ADD CASEWORK, SINKS AND ASSOCIATED PLUMBING TO ART ROOM:
ADD the following amount:

Written amount: _____DOLLARS

Numeric amount: $ _____.00

ALTERNATE #2 – ADD UTILITY SCREEN AROUND GROUND-MOUNTED PACKAGED UNITS:
ADD the following among:

Written amount: _____DOLLARS

Numeric amount: $ _____.00

ALTERNATE #3 – SOUND-ABSORBING WALL PANELS AND DIFFUSERS:
ADD the following among:

Written amount: _____DOLLARS

Numeric amount: $ _____.00

ALTERNATE #4 – ROOF ACCESS LADDER:

ADD the following among:

Written amount: _____ DOLLARS

Numeric amount: $ _____ .00

UNIT PRICES:

THE UNDERSIGNED PROPOSES the following amounts as Unit Prices, to be applied against such itemized changes to the Scope of Work, in accordance with **Section 01 2200 – Unit Prices**. In the event it is found necessary to perform such changes, the Work will be paid for as extra or credited to the Contract amount on the basis of the following unit prices, which are to include all direct and indirect costs, overhead, profit, taxes, insurance and bonds, if applicable.

ITEM NO.	WORK CATEGORY	Per UNIT	UNIT COST AMOUNT
A	General excavation and removal from site of unclassified material or unsuitable materials. Cost for more or less than that shown. **(Base bid to include 400 C.Y. RE: Section 01 2100-Allowances)**	Cubic Yard	$
B	General excavation and relocation on site of unclassified material General excavation and relocation on site of unclassified material on plans. (requires respreading of soil).	Cubic Yard	$
C	Trench and Footing excavation and removal from site of unclassified material or unsuitable materials. **(Base bid to include 150 C.Y. RE: Section 01 2100-Allowances)**	Cubic Yard	$
D	Trench and Footing excavation and relocation on site of unclassified material or unsuitable materials from footings and trenches.	Cubic Yard	$
E	Earth borrow; in place (non structural) - (from off-site material)	Cubic Yard	$
F	Compacted engineered fill or structural fill; in place - (from site material).	Cubic Yard	$
G	Compacted engineered fill or structural fill; in place - (from off-site material). **(Base bid to include 400 C.Y. RE: Section 01 2100-Allowances).**	Cubic Yard	$
H	Compacted drainage fill, in place (clean ¾" crushed stone).	Cubic Yard	$
I	Compacted granular fill, in place (base rock and gravel).	Cubic Yard	$
J1	Mass Rock.	Cubic Yard	$
J2	Footing & Trench Rock less than 10 feet below existing grade. **(Base bid to include 50 C.Y. RE: Section 01 2100-Allowances).**	Cubic Yard	$
K	Import and placement of shot-rock stabilization material (12" minus rock).	Cubic Yard	$
L	Import and placement of shot-rock stabilization material (6" minus rock)	Cubic Yard	$
M	Import and placement of crushed stone stabilization material (1" +/- rock).	Cubic Yard	$

N	Geogrid (Tensar Bx1100 or equivalent) in place.	Square Foot	$
O	Lean concrete (for backfill of footing over-excavation if required). **(Base bid to include 150 C.Y. RE: Section 01 2100-Allowances).**	Cubic Yard	$
P	Low Volume Change Layer. Cost for more or less than shown on plans.	Cubic Yard	$

PROPOSED SUB-CONTRACTORS & MARKUPS ON CHANGES TO WORK:

PROPOSED SUB-CONTRACTORS: The Undersigned proposes that the following entities will be utilized for the following scope of the Work. The Undersigned acknowledges that the prior experience and financial stability of the following entities may be consideration in the Owner's award of the Contract.

SCOPE-OF-WORK DESCRIPTION:	PROPOSED ENTITY NAME:
General Construction and Construction Management:	(By Prime General Contractor Proposer)
Building Concrete:	
Steel Work:	
Casework:	
Roofing Work:	
Sheet Metal Work:	
Hollow Metal Work:	
Wood Doors & Frames:	
Glazing Work:	
Finish Hardware:	
Fire Alarm System:	
Plumbing System:	
HVAC System:	
Electrical System:	
Excavation & Sitework:	
Asphalt Pavement:	
Concrete Hardscapes:	
Landscape Irrigation:	
Landscaping:	

ADDENDA:

The Bidder hereby acknowledges receipt and inclusion in the Bid Proposal the following addenda (number and date):

Addendum No. 1 through_____

BIDDER'S ENTITY FORMATION:

Please check and complete the following:

Contractor's license no. (when applicable): _____

_____ Company is sole proprietorship

_____ Company is a partnership

_____ Company is a corporation or limited liability company organized under the laws of

the State of: _____

If a partnership, corporation or limited liability company, list owners, partners, officers and members:

_____
_____
_____
_____

BIDDER'S EXECUTION:

THE PERSON SIGNING BELOW CERTIFIES that he or she is fully authorized and empowered to execute this instrument, and to bind the Bidder hereto, and does in fact so execute this instrument.

DATED THIS _____ DAY OF _____ , 20___

EXECUTED FOR THE BIDDER BY:

Legal Entity Name: _____

dba (if applicable): _____

Address: _____

City and State: _____

By: _____
Signature of Authorized Officer

_____
Title

ATTEST BY NOTARY PUBLIC:

STATE OF _____
COUNTY OF _____

On this _____ day of _____, before me the undersigned, a Notary Public, in and for the County and State aforesaid, personally appeared _____, to me known to be the person who executed the foregoing instrument in my presence and acknowledged to me that he/she executed the same as his free act and deed.
IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal the day and year last above written.

_____
NOTARY PUBLIC
My Commission Expires:_____

STATEMENT OF BIDDER'S QUALIFICATIONS

Each bidder for the work included in the specifications and drawings and the Contract Documents shall submit with their bid the data requested in the following schedule of information. This data must be included in and made part of each bid document and contained in the sealed envelope.

The Owner reserves the right to reject any bid if the evidence submitted by, or investigation thereof, fails to satisfy the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted. Failure to comply with this instruction may be regarded as justification for rejecting the Contractor's Proposal. Submit one (1) copy of this statement.

Project Name: _____

Company Name: _____

Business Address: _____

_____ Zip Code: _____

Phone: ( ) _____ Fax: ( ) _____

Email: _____

Federal ID number: _____ DUNS Number: _____

Organization Type (corporation, partnership, individual, joint venture, other):

_____

Licensed to do business In **[Missouri]** (check one): _____(Yes) _____(No)

Certificate Number: _____

Incorporated under the laws of the State of: _____

1. On a separate page or in the space below, list contracts on-hand and important projects completed in the last five (5) years of similar type to this project. Provide Project Name, Owner's Representative, Project Architect, Contract Amount and Date or Percentage of Completion:

2. Have you ever failed to complete any work awarded to your company? _____(Yes) _____(No)

   If so, where and why?

3. Have you ever defaulted on a contract? _____(Yes) _____(No)

   If so, explain:

4. Have any administrative or legal proceedings been started against you alleging violation of any wage or hour regulations or laws? _____(Yes) _____(No)

   If so, explain:

5. Are you currently involved in arbitration (or legal proceedings)? _____(Yes) _____(No)

   If so, explain:

6. List banking references:

The undersigned hereby authorizes the release of any information requested by **[insert Owner name]**, its agents or representatives, to verify the above stated financial information, including confidential financial information held by any financial institution, and hereby releases **[insert Owner name]**, its officers and agents, from any liability arising from attempted verification of information in this Statement of Bidders Qualifications.

Dated: _____ day of _____ 20___.

Name of Organization: _____

By: _____

Title: _____

Signature: _____

Phone: ( )_____

APPENDIX B: REFERENCE

Advancement of Construction Technology

SUBSTITUTION REQUEST

(During the Bidding Phase)

Project _____

_____

To: _____

_____

Re: _____

Substitution Request Number: N/A

From: _____

Date: _____

A/E Project Number: _____

Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____ ***Signature required***

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

Advancement of Construction Technology

SUBSTITUTION REQUEST
(After the Bidding Phase)

Project: _____

_____

_____

To: Paragon Architecture

_____

_____

Re:

Substitution Request Number: N/A

From: _____

Date: _____

A/E Project Number: _____

Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached - REQUIRED BY Fill in if required

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☑ Drawings ☑ Product Data ☐ Samples ☑ Tests ☑ Reports ☐ _____

SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

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Geotechnical Engineering Report

Cabool School District – Middle School FEMA Safe Room
Cabool, Missouri
January 12, 2021
Terracon Project No. B5205067

Prepared for:
Paragon Architecture, LLC
Springfield, Missouri

Prepared by:
Terracon Consultants, Inc.
St. Louis, Missouri

January 12, 2021

Paragon Architecture, LLC
637 West College Street
Springfield, Missouri 65806

Attn: Mr. Jared Younglove
P: (417) 885 0002
E: younglove@paragonarchitecture.com

Re: Geotechnical Engineering Report
Cabool School District – Middle School FEMA Safe Room
1025 Rogers Avenue
Cabool, Missouri
Terracon Project No. B5205067

Dear Mr. Younglove:

We have completed the Geotechnical Engineering services for the above-referenced project. This study was performed in general accordance with Terracon Proposal No. PB5205067, authorized December 10, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

STATE OF MISSOURI
ALLEN G. MINKS
NUMBER E-22438
REGISTERED PROFESSIONAL ENGINEER

Kaylee N. Cannon
Geotechnical Engineer

Allen G. Minks, P.E. 01-12-21
Senior Consultant
Missouri PE-22438
Renews: 12/31/2021

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	Four (4) borings were advanced to depths of 18 to 20 feet in order to obtain geotechnical engineering data for the proposed FEMA safe room. Estimated maximum load: 120 kips, vertical Little excavation other than foundation construction
Geotechnical Characterization	Existing fill materials were encountered in all of the borings to depths of about 1 to 2 feet. Fat clay soils with variable amounts of gravel and sand were encountered beneath the existing fill. Dolomite bedrock was encountered in one of the borings at a depth of 17.5 feet. Groundwater was not encountered in the borings.
Earthwork	**Existing Fill Soils**: Foundations should not bear on or above the existing fill soils. The existing fill could be removed and recompacted, or with some risk acceptance, portions of the existing fill could be left in place for support of floor slabs. **Expansive Soils**: The fat clay soils encountered in the borings are high in plasticity and prone to volume change with variations in moisture content. For this reason, we recommend that at least the upper 24 inches of soil below the bottom of the floor slab level consist of low plasticity (LP) material as defined in the **Earthwork** section. Clays are sensitive to moisture variation
Shallow Foundations	Allowable bearing pressure = 2,500 psf Expected settlements: less than 1 inch total, less than ¾ inch differential. Detect and remove zones of fill as noted in **Earthwork**
Seismic Considerations	International Building Code Site Class (IBC): D
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report.

Geotechnical Engineering Report

Cabool School District – Middle School FEMA Safe Room

1025 Rogers Avenue

Cabool, Missouri

Terracon Project No. B5205067

January 12, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed FEMA safe room to be located at 1025 Rogers Avenue in Cabool, Missouri. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface conditions
- Site preparation and earthwork
- Seismic site classification per IBC
- Foundation design and construction
- Floor slab design and construction

The geotechnical engineering scope of services for this project included the advancement of four (4) test borings to depths ranging from approximately 18 to 20 feet below existing site grades.

Maps showing the site and boring locations are included in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section of this report.

The **General Comments** section provides an understanding of the report limitations.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 1025 Rogers Avenue in Cabool, Missouri. Latitude: 37.1277°N Longitude: 92.1115°W See **Site Location**
Existing Improvements	Existing middle school and gravel parking
Current Ground Cover	Grass and crushed limestone

Item	Description
Existing Topography	The site slopes slightly downward from the northwest to the southeast with an elevation change of about a foot between the boring locations.
Geology	Based on the Geological Map provided by the United States Geologic Survey (USGS), the subject site is located over the Smithville Dolomite Formation. The Smithville Dolomite Formation consists of cherty dolomite.
Solution Features	Solution features, including springs, caves, and sinkholes, are commonly present in the bedrock formations in this area. Based on the review of information available from MDNR, the subject site does not contain any previously identified sinkhole formations; however, there are sinkholes within 2.5 miles of the site. It is difficult to predict future sinkhole activity. Site grading and drainage may alter site conditions and could possibly cause sinkholes in areas that have no history of this activity.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Project Description	This project includes a single-story FEMA safe room addition to the existing middle school with a footprint of about 3,250 square feet and a lobby with a footprint of about 625 square feet.
Finished Floor Elevation	100 feet (assumed Terracon datum)
Maximum Loads (assumed)	■ Columns: 120 kips ■ Walls: 12 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading	Up to 1 foot of fill is anticipated.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, and geologic setting. This characterization, termed GeoModel, forms the basis of our geotechnical analyses and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs and GeoModel can be found in the **Exploration Results** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile.

Model Layer	Layer Name	General Description
1	**Existing Fill**	Lean and/or fat clays with varying amounts of gravel and sand
2	**High Plasticity Soil**	Fat clay with varying amounts of gravel and sand
3	**Bedrock**	Dolomite

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**.

Groundwater was not encountered during or immediately after drilling operations. This does not necessarily mean the borings terminated above groundwater. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole. Long-term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be different from the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

Expansive Soils

The fat clay (CH) soils encountered in the borings are high in plasticity (PI≥30) and prone to volume change with variations in moisture content. For this reason, we recommend that at least the upper 24 inches below the bottom of the floor slab level in the building footprint consist of low plasticity (LP) material as defined in the **Earthwork** section.

This LP layer should also be confirmed or placed below other flatwork abutting the structure. The procedures recommended in this report may not eliminate all future subgrade volume change and resultant movements. However, the procedures outlined should reduce the potential for subgrade volume change. Additional reductions in subgrade movements could be achieved by using a thicker LP zone. LP material could be imported, if needed.

This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and at least minor cracking in the structure could still occur. The severity of cracking and other cosmetic damage, such as uneven floor slabs on grade, will likely increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic

distress may not be feasible, but it may be possible to further reduce the risk of movement if more extensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Existing Fill

Existing fill was encountered to depths of about 1 to 2 feet in the borings. The fill could extend deeper in areas not explored. No documentation or records regarding the placement of this fill were provided for our review. If records are available, Terracon should be supplied with these documents to better assess the suitability of the existing fill. Further exploration and testing (e.g., borings, test pits, geophysical testing) of the existing fills could be performed, if requested.

Foundations for the new building should not bear on or above the undocumented fill materials. The existing fill should be removed and replaced so that the foundations for the new building bear on suitable native soils or on properly placed and compacted engineered fill extending to suitable native soils. If the fill is completely removed and replaced, it should be removed within the proposed building footprint and extend at least 5 feet outside the building perimeter.

Provided the owner is willing to accept the risks associated with supporting floor slabs over the existing fill materials in exchange for reduced construction costs, portions of the existing undocumented fill could be left in place for support of floor slabs. If this alternative is chosen, at least 24 inches of new engineered fill should be placed directly below the floor slab. If the owner is not willing to accept the risks of supporting floor slabs over existing undocumented fill materials, the existing fill should be completely removed and replaced.

To reduce the risk of adverse performance from higher settlement and provide more consistent support for floor slabs, the exposed existing fill materials should be observed and tested during construction. Where unsuitable conditions are observed, the materials should be improved by scarification and compaction or be removed and replaced with engineered fill. Unsuitable fill materials observed during construction may warrant further exploration at that time.

Support of floor slabs on or above existing fill materials is discussed in this report within the **Floor Slabs** sections. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risks associated with building over the undocumented fills following the recommended reworking of the material.

EARTHWORK

Earthwork will include clearing, excavations, and fill placement.

Existing Fill

As noted in **Geotechnical Characterization**, the borings encountered existing fill to depths ranging from about 1 to 2 feet. Support of footings and floor slabs, on or above existing fill soils, is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building area.

We recommend that the exposed subgrade be thoroughly evaluated by a Geotechnical Engineer prior to placement of new fill. The soils on the site are sensitive to disturbance from construction equipment traffic, particularly during wet periods. Excessively wet or dry material should either be removed or moisture conditioned and recompacted. The exposed subgrade, including areas of existing undocumented fill, should be proofrolled where possible to aid in locating loose or soft areas. If unsuitable areas are observed during construction, subgrade improvement will then be necessary to establish a suitable subgrade support condition. Potential subgrade stabilization techniques are discussed below.

- **Scarification and Recompaction** – It may be feasible to scarify, dry, and recompact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades would likely not be achievable if the thickness of the unstable soil is greater than about 1 foot, if the unstable soil is at or near groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.

- **Crushed Stone** – The use of crushed stone or gravel is the most common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 6 to 30 inches below finished subgrade elevation with this procedure. The use of high modulus geosynthetics (i.e., geotextile or geogrid) could also be considered after underground work such as utility construction is completed. Prior to placing the geosynthetic, we recommend that all below-grade construction, such as utility line installation, be completed to avoid damaging the geosynthetic. Equipment should not be operated above the geosynthetic until one full lift of crushed stone fill is placed above it.

The maximum particle size of granular material placed over the geosynthetic should meet the manufacturer's specifications, and generally should not exceed 1½ inches.

Fill Material Types

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
High Plasticity Material	CH (LL≥70 or PI≥40)	Below upper 3 feet of floors and other lightly-loaded structures; 2 feet of foundations; and 1 foot of pavement base rock
Moderate to High Plasticity Material [2]	CH or CL, with 70>LL≥45 or 40>PI≥25	Below upper 2 feet of floor slabs and any other lightly-loaded structures, below upper 1 foot of pavement base rock
Granular Material [3]	GM, GC, SM, or SC	All locations and elevations
Low Plasticity (LP) Material [4]	CL (LL<45 & PI<25) or Granular Material [3]	

1. Compacted structural fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to Terracon for evaluation. On-site soils generally appear suitable for use as fill outside of the LP zone.
2. Delineation of moderate to high plasticity clays should be performed in the field by a qualified geotechnical engineer or their representative, and could require additional laboratory testing. If fat clay material contains greater than 35 percent granular material retained on a ¾-inch sieve, it may be used in the low volume change zone.
3. Crushed limestone aggregate, limestone screenings or granular material such as sand, gravel or crushed stone containing at least 15 percent low plasticity fines.
4. Low plasticity cohesive soil or granular soil having low plasticity fines. Material should be approved by the geotechnical engineer.

Fill Compaction Requirements

Item	Description
Fill Lift Thickness	9 inches or less in loose thickness for heavy compaction equipment 4 to 6 inches or less in loose thickness for light, hand-operated compaction equipment
Compaction Requirements [1]	At least 95 percent of the material's maximum standard Proctor dry density
Moisture Content – Cohesive Soil	Low plasticity cohesive: -2 percent to +2 percent of the optimum moisture content value as determined by the standard Proctor test High plasticity cohesive: 0 to +4 percent of the optimum moisture content value as determined by the standard Proctor test

Item	Description
Moisture Content – Granular Material	Workable moisture levels [2]

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. As stated within ASTM D 698, this procedure is intended for soils with 30 percent or less material larger than ¾ inch. Accordingly, we recommend full time proofroll observation be performed instead of moisture density testing for materials containing more than 30 percent aggregate retained on the ¾-inch sieve.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches in cohesive soils are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches are a common source of water infiltration and migration. All utility trenches in cohesive soils that penetrate beneath buildings should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure. We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the structure exterior. The plug material should consist of lean clay compacted at a water content at or above the soil’s optimum water content. The lean clay fill should be placed to completely surround the utility line and be compacted in accordance with the recommendations in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. These greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be checked to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure’s maintenance program. Where paving or flatwork abuts the structure a maintenance

program should be established to effectively seal and maintain joints to resist surface water infiltration.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Any water that collects over, or adjacent to, construction areas should be promptly removed. If the subgrade freezes, or becomes excessively wet or dry, or is disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and recompacted, prior to further construction. All of these processes should be observed by Terracon.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations. Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming any responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum net allowable bearing pressure [1, 2]	2,500 psf
Required bearing stratum [3]	stiff native soils
Minimum foundation dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate passive resistance [4] (equivalent fluid pressures)	250 pcf (LP clay)
Ultimate coefficient of sliding friction [5]	0.30 (LP clay)
Minimum embedment below finished grade [6]	30 inches
Estimated total settlement from structural loads [2]	Less than about 1 inch

Item	Description
Estimated differential settlement [2, 7]	About ¾ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. A factor of safety of 3 has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20 percent within 10 feet of the structure.
2. Values provided are for the maximum loads noted in **Project Description**.
3. Unsuitable or soft soils, including any existing fill, should be overexcavated and replaced according to the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. Should be neglected if passive pressure is used to resist lateral loads.
6. Embedment necessary to resist the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are as measured over a span of up to 50 feet.

Construction Adjacent to Existing Building

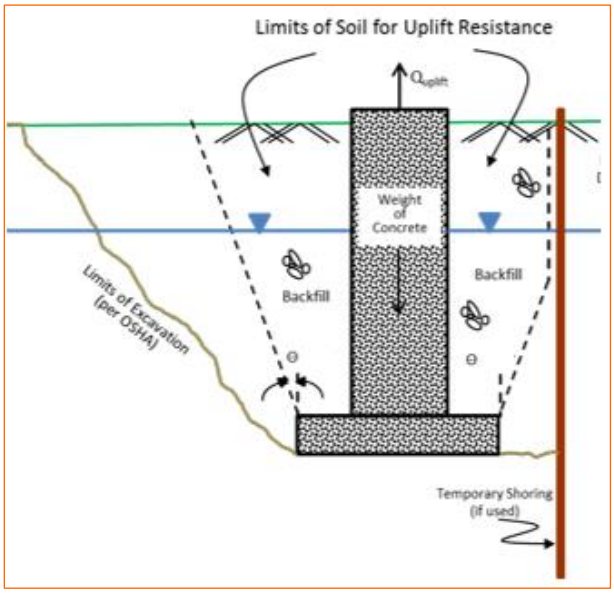
Care should be taken to not disturb the bearing soils beneath the existing building foundations and floor slabs. It is recommended, where possible, that excavations below these elements not extend below an imaginary plane extending out and down from the outside edge of existing footings, grade beams, and/or floor slabs at a slope of approximately 2H:1V. Even with these criteria, excavations that extend below the level of existing structures should be backfilled the same day they are excavated. Where this is impractical, shoring or underpinning of existing foundations may be required to resist undermining or movement of the existing structures.

Existing fill in excavations near the existing building should also be anticipated. It should be noted that the backfill for the existing foundations may not have been placed in accordance with the recommendations provided in this report, and should not be used for foundation support.

Some overlap in stress distribution from new and existing footings may occur, which may cause some movement of the existing footings and the supported structures. Maintaining a clear distance at least equal to the width of the new spread footings between the edges of the new and existing footings could reduce this risk. Connections between the new and existing structures should be designed to allow for the anticipated differential movement. Differential settlement between new and existing structures may approach the estimated total settlement, unless the foundations are structurally tied together.

Design Parameters - Uplift Loads

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 120 pcf should be used for the backfill. This unit weight should be reduced to 60 pcf for portions of the backfill or natural soils below the groundwater elevation.



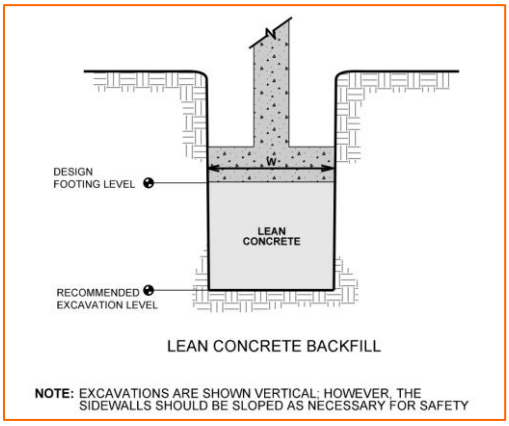
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated by the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed. Placement of a lean concrete mud-mat over the bearing soils should be considered if the excavations must remain open for an extended period of time.

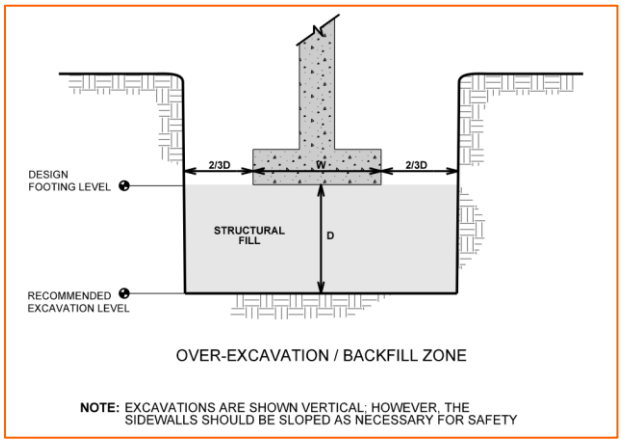
Although groundwater was not encountered in the borings at depths expected to affect foundation excavations, it could still be encountered during foundation excavations or in other excavation activities. In addition, some surface and/or perched groundwater may enter foundation excavations during construction. It is anticipated that any water entering foundation excavations

from these sources can be removed using sump pumps or gravity drainage. Additional dewatering efforts may be required if greater inflow occurs.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils. The footings could then bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



As an alternative, the footings could also bear on properly compacted structural backfill extending down to suitable soils. Overexcavation for compacted structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. Overexcavation for structural fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7-10. Based on the soil/bedrock properties encountered at the site and as described on the boring logs, the **Seismic Site Class is D**. Borings at this site were extended to a maximum depth of 20 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

FLOOR SLABS

The subgrade soils include moderate to high plasticity clays, and these soils exhibit the potential to swell with increased water content. Construction of the floor slab, combined with revising site drainage creates the potential for gradual increased water contents within the clays. Increases in water content could cause the clays to swell and damage the floor slab. To reduce the swell potential, we recommend that at least the upper 24 inches of materials below the floor slab be an approved Low Plasticity (LP) material.

As previously discussed, If the owner is not willing to accept the risks of supporting floor slabs over existing undocumented fill materials, then the existing fill should be removed and replaced to support floor slabs. If the owner is willing to accept the risks of supporting the floor slab on existing fill, then at least 24 inches of newly placed structural fill should be placed beneath the bottom of the floor slab.

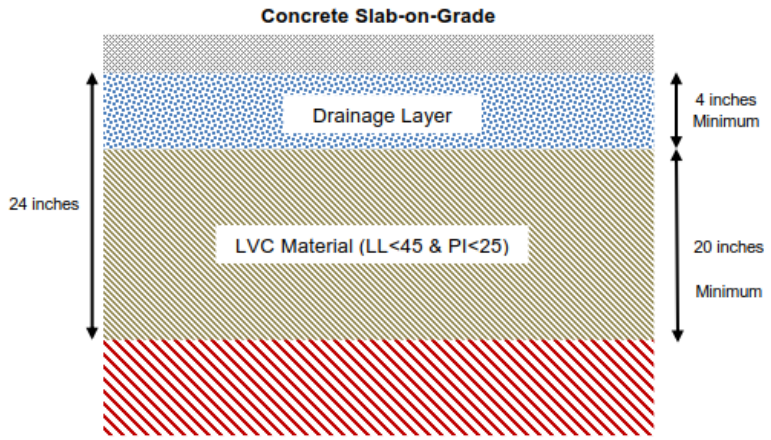


Image not to scale

Design parameters for floor slabs assume that the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure. This also includes positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor slab support [1]	Minimum 4 inches of free-draining (less than 5 percent passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95 percent of ASTM D 698 [2, 3] over at least 20 inches of low plasticity cohesive or granular soils with at least 15 percent passing the U.S. No. 200 sieve.
Estimated modulus of subgrade reaction [2]	150 pounds per square inch per inch (psi/in) for point loads.

1. Floor slabs should be structurally independent of any building footings or walls to reduce the potential of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table including the 24-inch thick LP layer. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Other design considerations, such as cold temperatures and condensation, development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a waterproof, nonextruding compressible compound specifically recommended for heavy-duty concrete and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are

constructed. If the subgrade should become excessively wet or dry, or damaged prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

GENERAL COMMENTS

Our services are conducted with the understanding of the project as described in the proposal, and incorporate collaboration with the design team as we complete our services. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

Support of floor slabs over existing fill is discussed in this report. However, even with the recommended construction testing, there is a risk that unsuitable materials within or buried by the fill will not be discovered. This risk cannot be eliminated without removing the fill but can be reduced by thorough exploration and testing.

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations may occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during construction. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is

solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation costs. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation costs. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
3	20	Building
1	18 [1]	

1. The boring was terminated above the planned depth of 20 feet upon encountering bedrock.

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±20 feet). Approximate elevations (rounded to the nearest ½-foot) were obtained with a surveyor's level and grade rod. The finished floor elevation of the existing building was used as a temporary benchmark with an assigned elevation of 100.0 feet. If more precise elevations and boring locations are desired, we recommend the borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with an ATV-mounted rotary drill rig using continuous flight, solid-stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using split-barrel sampling procedures.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance (SPT N-value). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Based on the material's texture and plasticity, we describe and classify soil samples in accordance with the Unified Soil Classification System. The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the soil and rock strata. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- Water content
- Atterberg limits

Rock classification was conducted using **Descriptions of Rock Properties** and local practices for engineering purposes. Petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan
Geologic Map

Note: All attachments are one page unless noted above.

SITE LOCATION

Cabool School District – Middle School FEMA Safe Room ■ Cabool, Missouri
January 12, 2021 ■ Terracon Project No. B5205067

Terracon GeoReport

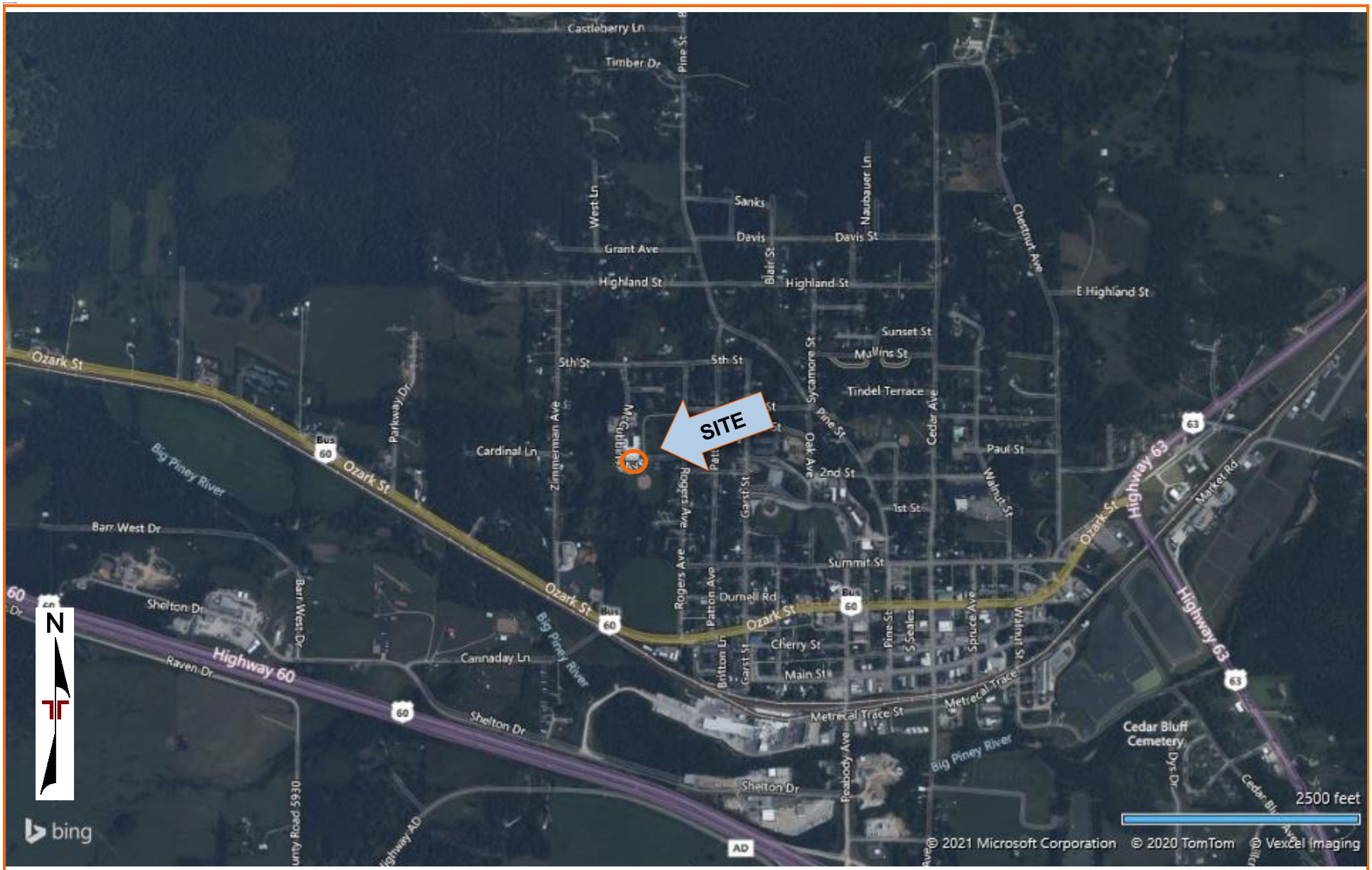


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Cabool School District – Middle School FEMA Safe Room ■ Cabool, Missouri
January 12, 2021 ■ Terracon Project No. B5205067

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

GEOLOGIC MAP

Cabool School District – Middle School FEMA Safe Room ■ Cabool, Missouri
January 12, 2021 ■ Terracon Project No. B5205067

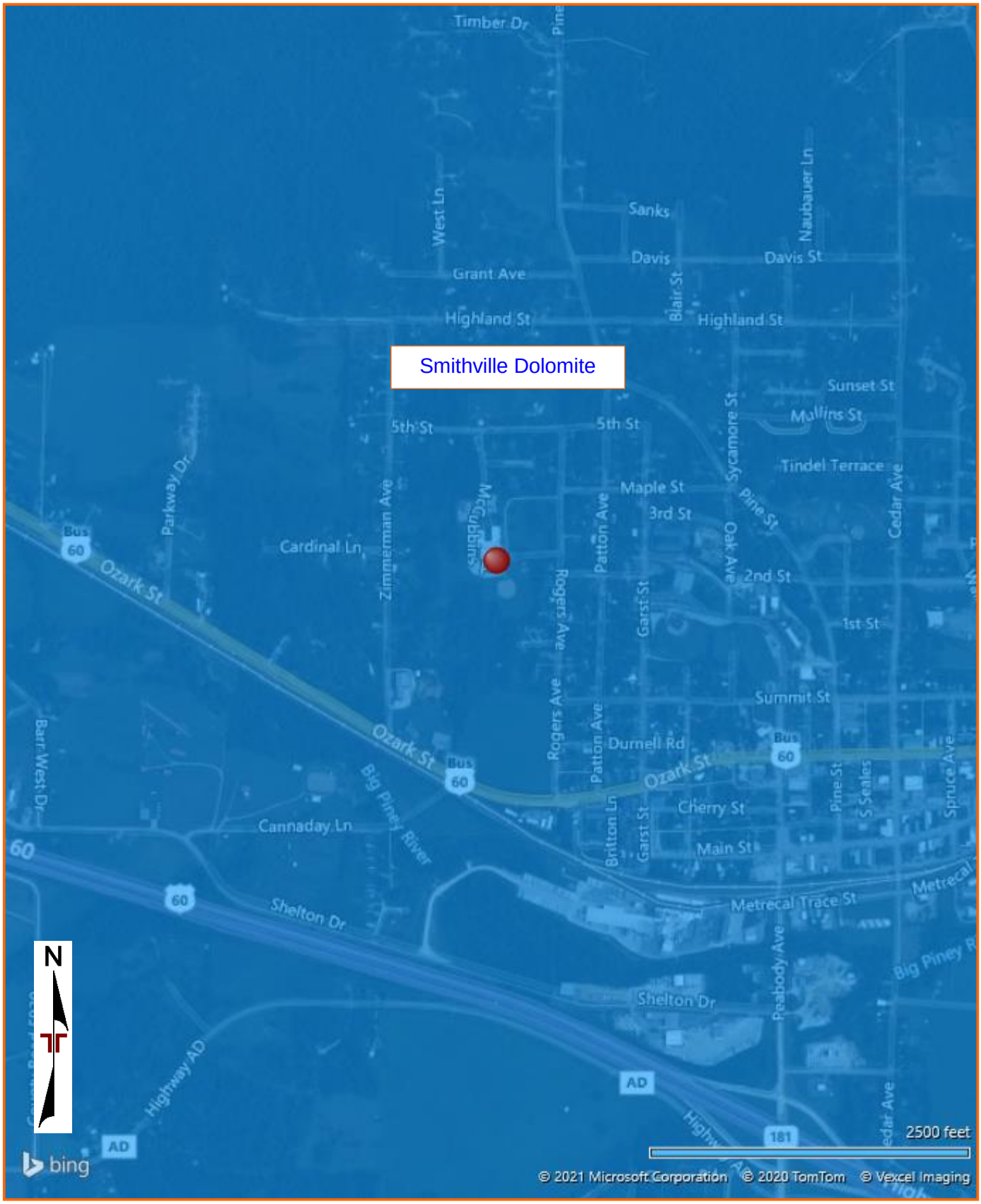


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

GEOLOGIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
AERIAL IMAGE COURTESY OF GOOGLE EARTH

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Cabool School District - Middle School
FEMA Safe Room

CLIENT: Paragon Architecture, LLC
Springfield, Missouri

SITE: 1025 Rogers Ave.
Cabool, Missouri

LOCATION See Exploration Plan

Latitude: 37.1277° Longitude: -92.1116°

Surface Elev.: 100 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1		0									
		1.0	99								
2			**FILL - GRAVELLY LEAN CLAY**, brownish red								
			LEAN TO FAT CLAY WITH GRAVEL (CL/CH), red and tan, stiff to very stiff			X	8	5-6-10 N=16	1	23.6	49-19-30
						X	9	10-8-10 N=18	2	35.5	
				5		X	11	3-4-5 N=9	3	32.2	
		8.5	91.5								
			FAT CLAY WITH GRAVEL (CH), trace sand, tan, stiff			X	8	5-6-7 N=13	4	28.6	
				10							
		13.5	86.5								
			GRAVELLY FAT CLAY (CH), with sand, red and tan, stiff to very stiff			X	10	6-7-6 N=13	5	32.8	
				15							
						X	8	6-7-8 N=15	6	21.3	
		20.0	80	20							
			Boring Terminated at 20 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Stem Augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using a surveyor's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not observed while drilling

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 12-29-2020 | Boring Completed: 12-29-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205067

BORING LOG NO. B-2

PROJECT: Cabool School District - Middle School FEMA Safe Room

CLIENT: Paragon Architecture, LLC Springfield, Missouri

SITE: 1025 Rogers Ave. Cabool, Missouri

LOCATION See Exploration Plan

Latitude: 37.1277° Longitude: -92.1114°

Surface Elev.: 99.5 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1			**FILL - FAT CLAY WITH GRAVEL**, red								
		2.0	97.5			X	8	5-5-5 N=10	1	18.0	
2			**FAT CLAY WITH GRAVEL (CH)**, red and tan, very stiff								
				5		X	10	7-8-9 N=17	2	30.9	
		6.0	93.5								
			FAT CLAY WITH GRAVEL (CH), trace sand, red, very stiff			X	16	8-10-12 N=22	3	28.0	
						X	15	13-11-11 N=22	4	40.0	
				10							
		13.5	86								
			FAT CLAY WITH GRAVEL (CH), with sand, red and tan, stiff to very stiff			X	17	4-4-5 N=9	5	35.4	
				15							
						X	12	14-14-11 N=25	6	34.3	
		20.0	79.5	20							
			Boring Terminated at 20 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Stem Augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using a surveyor's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not observed while drilling

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 12-29-2020 | Boring Completed: 12-29-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205067

BORING LOG NO. B-3

PROJECT: Cabool School District - Middle School
FEMA Safe Room

CLIENT: Paragon Architecture, LLC
Springfield, Missouri

SITE: 1025 Rogers Ave.
Cabool, Missouri

LOCATION See Exploration Plan

Latitude: 37.1276° Longitude: -92.1116°

Surface Elev.: 99.5 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		0.3	99	**AGGREGATE BASE COURSE**								
1		1.5	98	**FILL - GRAVELLY LEAN CLAY**, brownish red								
				FAT CLAY WITH GRAVEL (CH), trace sand, red and tan, very stiff				8	9-10-9 N=19	1	27.5	
								12	12-13-14 N=27	2	26.2	
					5			14	8-9-6 N=15	3	26.6	
		8.5	91									
		9.5	90	**FAT CLAY WITH GRAVEL (CH)**, trace sand, tan, very stiff				13	9-9-10 N=19	4	32.9	
2				**GRAVELLY FAT CLAY (CH)**, red and tan, very stiff	10							
		13.5	86									
				FAT CLAY WITH GRAVEL (CH), tan and red, medium stiff				8	2-2-4 N=6	5	27.4	
		17.5	82		15							
3		18.0	81.5	**DOLOMITE**, gray				0	50/0"	6		
				Auger Refusal at 18 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Stem Augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using a surveyor's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not observed while drilling

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 12-29-2020 | Boring Completed: 12-29-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205067

BORING LOG NO. B-4

PROJECT: Cabool School District - Middle School
FEMA Safe Room

CLIENT: Paragon Architecture, LLC
Springfield, Missouri

SITE: 1025 Rogers Ave.
Cabool, Missouri

LOCATION See Exploration Plan

Latitude: 37.1276° Longitude: -92.1114°

Surface Elev.: 99 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1		0.3	98.5								
		AGGREGATE BASE COURSE									
		FILL - GRAVELLY LEAN CLAY, brown				X	8	4-7-11 N=18	1	14.3	
		2.0	97								
2		**FAT CLAY WITH GRAVEL (CH)**, red and tan, very stiff									
		3.5	95.5			X	7	13-27-18 N=45	2	11.9	
		GRAVELLY FAT CLAY (CH), red and tan, hard		5							
		6.0	93			X	11	6-7-18 N=25	3	15.5	
		GRAVELLY FAT CLAY (CH), trace sand, red and tan, very stiff				X	12	6-7-11 N=18	4	36.7	
				10							
		13.5	85.5								
		FAT CLAY (CH), trace gravel, red, medium stiff to very stiff				X	13	10-11-13 N=24	5	39.9	
				15							
		20.0	79			X	15	3-4-3 N=7	6	35.9	
		Boring Terminated at 20 Feet		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Solid-Stem Augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using a surveyor's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not observed while drilling

Terracon
4765 W Junction St
Springfield, MO

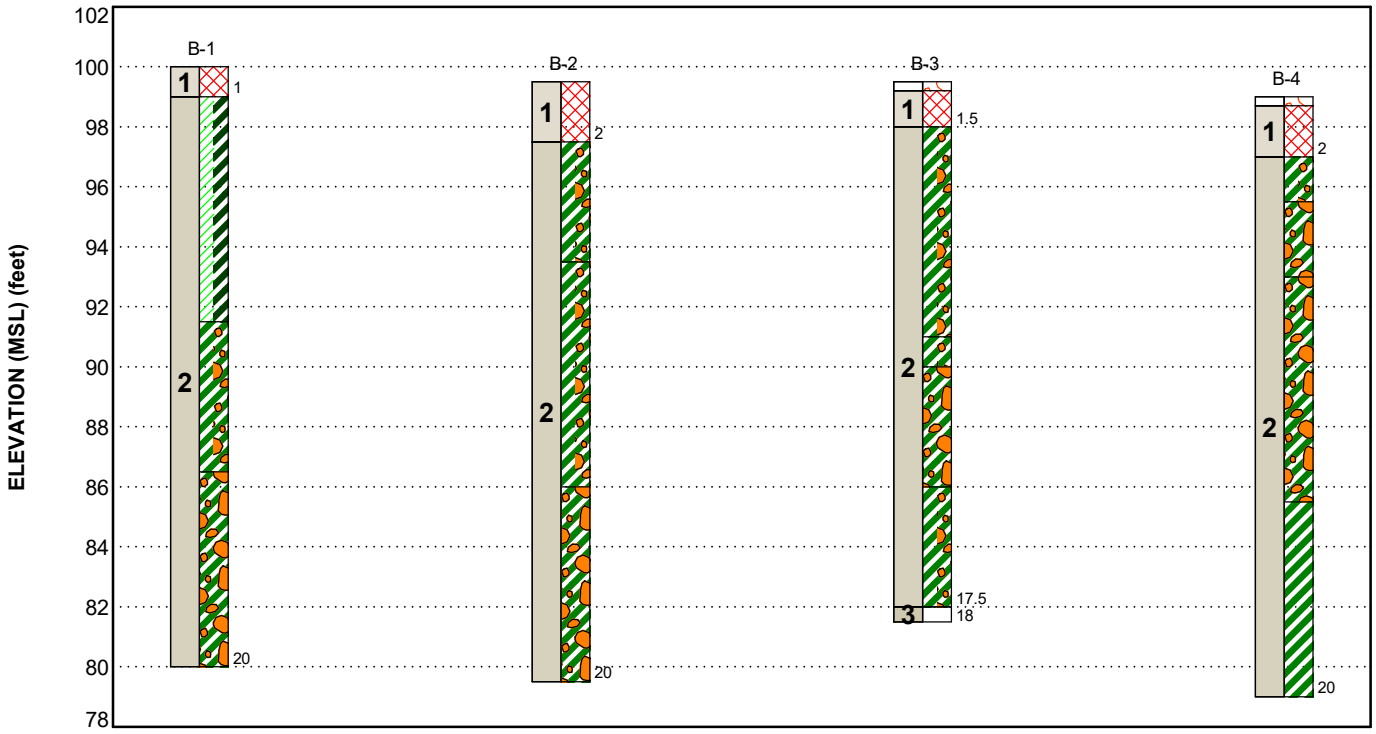
Boring Started: 12-29-2020 | Boring Completed: 12-29-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205067

GEOMODEL

Cabool School District - Middle School FEMA Safe Room ■ Cabool, Missouri
Terracon Project No. B5205067



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Existing Fill**	Lean and fat clays with varying amounts of gravel and sands
2	**High Plasticity Soil**	Lean to fat and fat clay with varying amounts of gravel and sand
3	**Bedrock**	Dolomite

LEGEND

- Fill
- Gravelly Fat Clay
- Fat Clay
- Lean Clay/Fat Clay
- Aggregate Base Course
- Fat Clay with Gravel
- Dolomite

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Cabool School District - Middle School FEMA Safe Room ■ Cabool, Missouri

Terracon Project No. B5205067

SAMPLING	WATER LEVEL	FIELD TESTS
Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** **Cave In Encountered** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:**	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines:	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:**	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines:	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

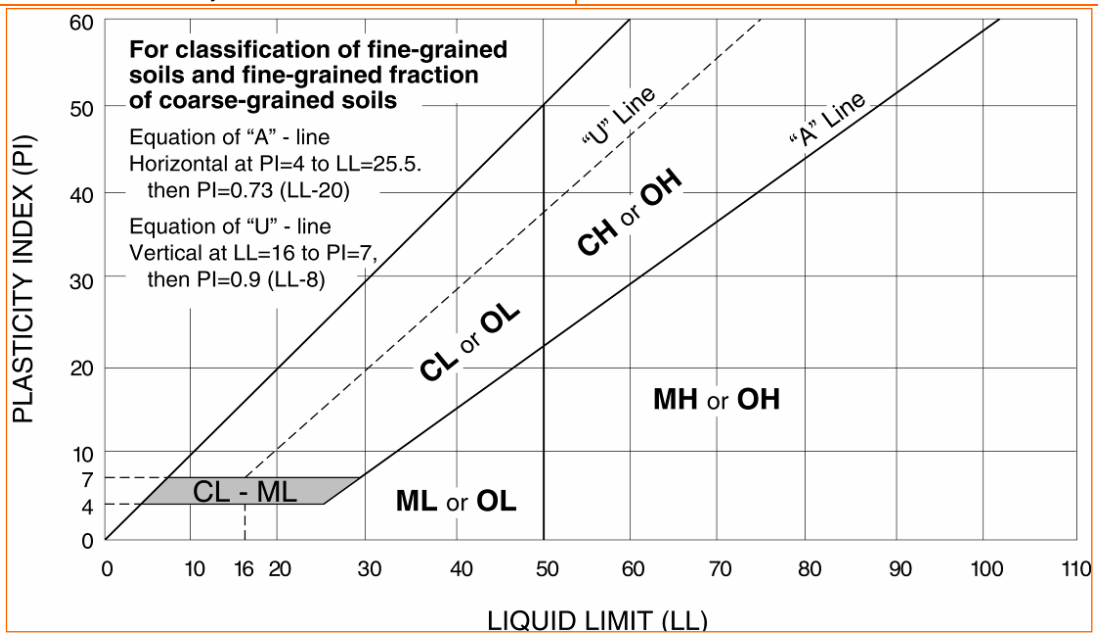
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009
Technical Manual for Design and Construction of Road Tunnels – Civil Elements

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MICHAEL L. PARSON, Governor

Annual Wage Order No. 28

Section 111
TEXAS COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Taylor Burks, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2021**

Last Date Objections May Be Filed: **April 8, 2021**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	*$19.77
Boilermaker	*$19.77
Bricklayer	*$19.77
Carpenter	*$19.77
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	*$19.77
Plasterer	
Communications Technician	*$19.77
Electrician (Inside Wireman)	$42.12
Electrician Outside Lineman	*$19.77
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	*$19.77
Glazier	*$19.77
Ironworker	*$19.77
Laborer	*$19.77
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	*$19.77
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	*$19.77
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$43.82
Plumber	*$19.77
Pipe Fitter	
Roofer	$38.39
Sheet Metal Worker	*$19.77
Sprinkler Fitter	*$19.77
Truck Driver	*$19.77
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title.
Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

Heavy Construction Rates for
TEXAS County

Section 111

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	*$19.77
Millwright	
Pile Driver	
Electrician (Outside Lineman)	*$19.77
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$44.71
General Laborer	
Skilled Laborer	
Operating Engineer	$57.41
Group I	
Group II	
Group III	
Group IV	
Truck Driver	*$19.77
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

"General Decision Number: MO20210025 07/30/2021

Superseded General Decision Number: MO20200025

State: Missouri

Construction Type: Building

County: Texas County in Missouri.

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

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021
1	01/22/2021
2	02/19/2021
3	04/09/2021
4	04/23/2021
5	06/25/2021
6	07/30/2021

ASBE0063-002 11/01/2020

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 27.47	13.00

BRMO0015-004 04/01/2020

	Rates	Fringes
BRICKLAYER	$ 29.69	17.89

BRMO0015-018 06/01/2020

	Rates	Fringes

TILE SETTER	$ 23.69	13.96

* CARP0012-004 05/01/2021

	Rates	Fringes
CARPENTER (Including Form Work)	$ 40.58	18.40

* CARP1310-005 05/01/2021

	Rates	Fringes
CARPENTER (Floor Layer) (Vinyl Installation Only)	$ 36.08	18.40

ELEC0453-003 09/01/2020

	Rates	Fringes
ELECTRICIAN	$ 32.76	16.27

ELEV0003-001 01/01/2021

	Rates	Fringes
ELEVATOR MECHANIC	$ 53.46	35.825+a+b

a. VACATION: Employer contributes 8% of basic hourly rate as vacation pay credit for more than 5 years of service; and 6% for 6 months to 5 years of service.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day,the Friday after Thanksgiving Day and Christmas Day.

ENGI0513-010 05/01/2021

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Backhoe/Excavator/ Trackhoe	$ 32.41	28.24
Bulldozer	$ 32.41	28.24
Loader	$ 32.41	28.24
Paver	$ 32.41	28.24
Roller	$ 32.41	28.24

IRON0396-012 08/05/2020

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL	$ 31.39	29.20

LABO0840-004 03/01/2021

	Rates	Fringes
LABORER		
Brick Mason Tender	$ 28.01	14.19
Landscape	$ 27.11	14.19

PLAS0527-006 04/01/2019

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 33.56	18.92

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* PLUM0562-011 07/01/2021

	Rates	Fringes
PIPEFITTER, Includes HVAC Pipe Installation Mechanical Contracts including all piping and temperature control work $7.0 million & under	$ 43.16	21.49
Mechanical Contracts including all piping and temperature control work over $7.0 million	$ 45.10	27.85
PLUMBER, Excludes HVAC Pipe Installation Mechanical Contracts including all piping and temperature control work $7.0 million & under	$ 43.16	21.49
Mechanical Contracts including all piping and temperature control work over $7.0 million	$ 45.10	27.85

ROOF0020-003 02/01/2021

	Rates	Fringes
ROOFER	$ 26.00	12.64

SFMO0669-003 04/01/2021

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 39.22	23.40

SHEE0036-025 07/01/2020

	Rates	Fringes
SHEET METAL WORKER, Includes HVAC Duct and Unit Installation	$ 30.46	15.19

SUMO2010-024 03/08/2010

	Rates	Fringes
LABORER: Common or General	$ 24.90	0.00
OPERATOR: Grader/Blade	$ 22.80	10.78
PAINTER: Brush Only	$ 16.44	6.01
PAINTER: Roller	$ 16.44	6.01
PAINTER: Spray	$ 18.79	8.12

TRUCK DRIVER: Dump Truck.....$ 25.57 0.00

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

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

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

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

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division

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

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

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

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

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

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

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

DIVISION OF LABOR STANDARDS

MISSOURI DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

CONTRACTOR PAYROLL RECORDS

(See Sections 290.210 to 290.340, RSMo and 8 CSR 30-3.010 to 8 CSR 30-3.060)

Name of ☐ Contractor ☐ Subcontractor	Address of Contractor or Subcontractor: City: State: ZIP: Phone Number: ( ) -
Name of Public Body	Address of Public Body: City: State: ZIP: Phone Number: ( ) -

Payroll No.	For Week Ending / /	AWO	Project and Location	Project or Contract No.

1. Name and Address of Employee	2. Occupational Title ***	3. Day and Date								4. Total Hours	5. Hourly Rate + Cash Fringe	6. Gross Amt	7. Deductions					8. Net Wages Paid for Week
		Day										Project / Week	FICA and Medicare	Federal and State Withhold-ing Tax	Other A	Other B	Total Deduc-tions	
		Date																
		Hours Worked Each Day																
		DT																
		OT																
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***** If a worker performs work in more than one occupational title, you must separately list the hours worked per occupational title and wage rates. *****

FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

In addition to the basic rates paid to each laborer or mechanic on the payroll, payments have been or will be made to appropriate programs for the benefit of these employees as shown in the following chart below. If fringe benefit amounts paid are the same for all employees, you may list the amount of each such identical fringe payment only once in the appropriate column; if the fringe benefit amounts vary by employee, list each employee's name and set out the amounts paid on behalf of each employee for each fringe benefit.

Employee Name	Health and Welfare ($/hr)	Pension ($/hr)	Vacation ($/hr)	Holiday ($/hr)	Appren-tice Training ($/hr)	Other C ($/hr)	Other D ($/hr)	Total ($/hr)	If "Other/Deduction" or Fringes, please explain. (Indicate Other A, B, C or D)	Identify by name, the plan, fund, or programs to which fringe benefits are paid. (Indicate H&W, Pension, etc.)

Date: _____

I, _____ *(Name of Signatory Party)*, _____ *(Title)* do hereby state:

(1) That I pay or supervise the payment of the persons employed by _____ *(Contractor or Subcontractor)* on the _____ *(Building or Work)*; that during the payroll period commencing seven (7) days prior to the week ending date of _____ all persons employed on said project have been paid the full weekly wages stated above, that no rebates have been or will be made either directly or indirectly to or on behalf of _____ *(Contractor or Subcontractor),* from the full weekly wages earned by any person and that no deductions have been made

either directly or indirectly from the full wages earned by any person, other than legally permissible deductions, that full and accurate records clearly indicating the names, occupations, and crafts of every worker employed by them in connection with the public work together with an accurate record of the number of hours worked by each worker and the actual wages paid for each class or type of work performed and deduction made for each worker have been prepared, that these payroll records are kept and have been provided for inspection to the authorized representative of the contracting public body and will be available as often as may be necessary and such records shall not be destroyed or removed from the state for the period of one year following the completion of the public work in connection with which the records are made.

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage order incorporated into the contract; that the occupational title set forth herein for each laborer or mechanic conform with the work performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a state apprenticeship agency recognized by the Office of Apprenticeship (OA), U.S. Department of Labor (USDOL), or if no such recognized agency exists in a state, are registered with the OA, USDOL.

Name and Title	Signature
The falsification of any of the above statements may subject the contractor or subcontractor to criminal prosecution. See Sections 290.340, 570.090, 575.050, and 575.060, RSMo.	

Missouri Department of Labor and Industrial Relations is an equal opportunity employer/program.

DIVISION OF LABOR STANDARDS

MISSOURI DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

AFFIDAVIT
COMPLIANCE WITH THE PREVAILING WAGE LAW

I, _____, upon being duly sworn upon my oath state that: (1) I am the
(Name)

_____ of _____; (2) all requirements of
(Title) *(Name of Company)*

§§ 290.210 to 290.340, RSMo, pertaining to the payment of wages to workers employed on public works projects have been fully satisfied with regard to this company's work on _____;
(Name of Project)

(3) I have reviewed and am familiar with the prevailing wage rules in 8 CSR 30-3.010 to 8 CSR 30-3.060; (4) based upon my knowledge of these rules, including the occupational titles set out in 8 CSR 30-3.060, I have completed full and accurate records clearly indicating (a) the names, occupations, and crafts of every worker employed by this company in connection with this project together with an accurate record of the number of hours worked by each worker and the actual wages paid for each class or type of work performed, (b) the payroll deductions that have been made for each worker, and (c) the amounts paid to provide fringe benefits, if any, for each worker; (5) the amounts paid to provide fringe benefits, if any, were irrevocably made to a fund, plan, or program on behalf of the workers; (6) these payroll records are kept and have been provided for inspection to the authorized representative of the contracting public body and will be available, as often as may be necessary, to such body and the Missouri Department of Labor and Industrial Relations; (7) such records shall not be destroyed or removed from the state for one year following the completion of this company's work on this project; and (8) there has been no exception to the full and complete compliance with the provisions and requirements of Annual Wage Order No. _____ Section _____ issued by the Missouri Division of Labor Standards and applicable to this project located in _____ County, Missouri, and completed on the ____ day of _____, _____.

The matters stated herein are true to the best of my information, knowledge, and belief. I acknowledge that the falsification of any information set out above may subject me to criminal prosecution pursuant to §§290.340, 570.090, 575.040, 575.050, or 575.060, RSMo.

_____
Signature

Subscribed and sworn to me this ____ day of _____, _____.

My commission expires _____, _____.

_____
Notary Public

_____
Receipt by Authorized Public Representative

Missouri Department of Labor and Industrial Relations is an equal opportunity employer/program.

Reset Form Print Form

Form **5060**

Missouri Department of Revenue
Project Exemption Certificate

This form is to be completed and given to your contractor.

Exempt Entity and Project Information

Name of Exempt Entity Issuing the Certificate			Missouri Tax Exemption Number
Address	City	State	ZIP Code
E-mail Address			
Project Number	Project Begin Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___	Estimated Project End Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___	
Description of Project			
Project Location		Certificate Expiration Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___	

Provide a signed copy of this certificate, along with a copy of the exempt entity's Missouri Sales and Use Tax Exemption Letter to each contractor or subcontractor who will be purchasing tangible personal property for use in this project. It is the responsibility of the exempt entity to ensure the validity of the information on the certificate. The exempt entity must issue a new certificate if any of the information changes.

Signature of Authorized Exempt Entity	Printed Name of Authorized Exempt Entity	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Contractor

The Missouri exempt entity named above hereby authorizes the purchase, without sales tax, of tangible personal property to be incorporated or consumed in the construction project identified herein and no other, pursuant to **Section 144.062, RSMo.** Under penalties of perjury, I declare that the above information and any attached supplement is true, complete, and correct.

Name of Purchasing Contractor	Signature of Contractor	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Address	City	State	ZIP Code

Subcontractor

Contractors - Present this to your supplier in order to purchase the necessary materials tax exempt. Complete the Subcontractor portion if extending the certificate to your subcontractor. The contractor must sign the form in the space provided below.

Name of Purchasing Subcontractor			
Address	City	State	ZIP Code

Signature of Contractor	Contractor's Printed Name	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Taxation Division
P.O Box 358
Jefferson City, MO 65105-0358

Phone: (573) 751-2836
Fax: (573) 522-1271
E-mail: salestaxexemptions@dor.mo.gov

Visit **http://dor.mo.gov/business/sales/sales-use-exemptions.php** for additional information.