PROJECT MANUAL

PARK ELEMENTARY SCHOOL
EXPANSION PHASE 1

Casper, Wyoming

Project: 2047
Date: October 4, 2019
The following list represents those individuals who shall be their company's representative during the bidding and construction phase of this Project.

**OWNER:**
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Geotechnical Engineering Evaluation (Dated 08/22/2019)
The 1974 Geotechnical Evaluation is available at the office of the Architect.

To be issued with Phase 2 Documents

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PART 1 GENERAL
1.01 PROJECT
A. Project Name: Park Elementary School Addition and Renovation
B. Owner: Natrona County School District #1
C. Design-Build Team
   1. General Contractor: Caspar Building Systems, Inc.
   2. Architect: GSG Architecture
   3. MEP Engineers: West Plains Engineering
   4. Civil Engineer: ECS
D. Project Description:
   Park Elementary School consists of two buildings that were constructed at different times and has been utilized as an educational facility and has remained, with small alterations, largely in its original configuration since that time.
   The original gymnasium and library were constructed in 1956. The gym is a unique design utilizing a glulam arch system with tongue and groove wood decking to support the shingled, barrel roof. The library and original entry/lobby area to the gym are shorter and incorporate low-slope roofs. The gym includes a raised stage/platform area, along with other minor support spaces (approximately 5,847 total SF).
   The construction of the classroom portion of the facility was completed in 1974 and is a two-story, load-bearing, reinforced masonry structure with steel joists and concrete deck at the second level, and slab-on-grade concrete floors on the ground level (approximately 20,669 total SF). The roof is constructed with steel joists and metal deck and supports a low-slope roofing system. The basic structural layout consists of load-bearing exterior and interior walls that define the classrooms and major circulation areas of the building.
   The total footprint of the entire school, including the original gymnasium and library, is approximately 26,516 SF.
E. Existing Building Envelope
   The building envelope of the classroom portion is constructed with two wythes of masonry, consisting of exterior brick and load-bearing CMU. The exterior masonry work is of high original quality. There are signs of weathering (erosion of some mortar joints, and stress relief cracking), consistent with the construction and age of the structure. There are several locations where the mortar joints have been compromised by water and need to be re-pointed prior to repairing the water-related issues. This work will occur during Phase 2 of the work.
   The windows consist of insulated, double pane, aluminum-framed units with sliding operable panels. These windows will be replaced during Phase 2 of the work.
   All low-slope roofs consist of a JP Stevens single-ply, Hypalon membrane system that was installed in 1999. This system has functioned well, although it is now beginning to leak in several areas and will be replaced/coated during Phase 2 of the work.
   The gymnasium's vaulted roof consists of an architectural shingle system installed in 1993 and is currently leaking and will need to be replaced during Phase 2 of the work.
F. Environmental Analysis
   The District has completed an Environmental analysis and will address the abatement under a separate contract, prior to work commencing in the existing facility.
G. Scope of Work
   The site will be modified to improve drainage and provide new surfaces in the playground area. Parking will be modified to increase the number of spaces available through re-purposing the current parking lot and adjacent streets. This work will occur in Phase 2 of the project.
H. Project Phasing
   a. Phase 1 – North Classroom Addition – Fall 2019 thru Spring 2020
      1. Project consists of concrete foundation, steel frame and stud infill with GWB on the inside and insulation and brick veneer on the exterior with horizontal metal panel accents aligning with the original building. Slab on grade at the 1st floor, steel joists and deck with concrete slab for the 2nd floor, and steel joists and deck with rigid insulation and low slope membrane roof.
   b. Phase 2a – Summer 2020
      1. Link Addition (similar construction to CR addition – metal panels in lieu of brick veneer).
      2. Administration and Secured Entry Remodel (steel studs and GWB).
      3. “Above Ceiling” Renovation including but not limited to the following items:
         a. Individual CR HVAC allowing individual control of heating and AC
         b. Fire Sprinkler
         c. Lighting
         d. Fire Alarm
         e. Audio / Video updates
         f. Security Improvements – cameras, door monitoring
         g. Improve ventilation in RR’s
      4. Ceiling Replacement
      5. Begin Site Work
      6. Existing Roof Coating
   c. Phase 2b – Summer 2021 – “Below ceiling” Renovation including but not limited to the following items:
      1. Replace windows
      2. Casework / cabinet upgrades
      3. Replace Movable partitions
      4. Paint walls
      5. New tack surfaces
      6. New flooring
      7. Replace existing doors
      8. Refinish Gym and Stage Wood Floors
      9. Exterior Upgrades
      10. Replace existing plumbing fixtures

1.02 OWNER OCCUPANCY
   A. Owner intends to occupy the current Building and Site during the construction period following the District’s normal school schedule.

1.03 CONTRACTOR USE OF SITE AND PREMISES
   A. Construction Operations: Limited to areas noted on Drawings.
   B. Arrange use of site and premises to allow:
      1. Work by Others (Utility Companies).
   C. Provide access to and from site as required by law and by Owner:
      1. Emergency 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.
   D. Time Restrictions:
      1. Coordination will be required between the Owner and Contractor as to requirements for workdays and hours of the day.
   E. Utility Outages and Shutdown:
      1. Limit shutdown of utility services to 4 hours at a time, arranged at least 48 hours in advance with Owner and local utility providers.
      2. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 APPLICATIONS FOR PROGRESS PAYMENTS
   A. Payment Period: Submit at intervals stipulated in the Agreement, but not more than once per month.
   B. Form to be used: AIA G702 and G703.
   C. Execute certification by signature of authorized officer.
   D. 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.
   E. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
   F. Submit three copies of each Application for Payment.

1.02 MODIFICATION PROCEDURES
   A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
   B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
   C. 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.
   D. Execution of Change Orders: Owner will issue Change Orders for signatures of parties as provided in the Conditions of the Contract on Architect's Change Order Document.
   E. After execution of Change Order, promptly the CMAR will revise the Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

1.03 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.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1  GENERAL
1.01  SECTION INCLUDES
   1. Electronic document submittal service.
   2. Progress meetings.
   3. Construction progress schedule.
   4. Submittals for review.
   5. Submittals for information.
   7. Number of copies of submittals.
   8. Submittal procedure.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION
3.01  ELECTRONIC DOCUMENT SUBMITTAL SERVICE
   A. All documents transmitted for purposes of administration of the contract (excluding those which contain items to be selected based on aesthetic qualities such as color texture and / or pattern) are to be in electronic (PDF) format 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 PDF format.
      4. Subcontractors, suppliers, and Architect's consultants are to 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 PDF documents will not be reviewed.
      7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
   B. Cost: The cost of the service is to be paid by Owner.
   C. Submittal Service: The selected service is: Submittal Exchange
   D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
   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.
   F. Submittals which contain items to be selected based on aesthetic qualities such as color texture and / or pattern shall be provided as physical samples to the architect.

3.02  PROGRESS MEETINGS
   A. Contractor shall schedule and administer meetings throughout progress of the Work at maximum weekly intervals or as requested by the Owner or Architect.
   B. Contractor shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's Superintendent.
   5. Major Subcontractors.
D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE
A. Within 7 days after date of the final GMP Proposal, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.

3.04 SUBMITTALS FOR REVIEW
A. For B1 and B2 below, Architect review by electronic means per item 3.01 above. Architect shall receive the specified physical samples for all items and systems requiring judgement of color, texture or other physical qualities not accurately portrayed in electronic media.
B. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
C. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
D. Samples will be reviewed only for aesthetic, color, or finish selection.
E. 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.

3.05 SUBMITTALS FOR INFORMATION
A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. LEED submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types indicated.
B. Submit for Architect's knowledge as contract administrator or for Owner.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT
A. Submit Correction Punch List for Substantial Completion.
B. Submit Final Correction Punch List for Final Completion.
C. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
5. Other types as indicated.
D. Submit for Owner's benefit during and after project completion.

3.07 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.

3.08 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
B. Submittals for review shall be numbered using the Specification Section number from this project manual with a suffix identifying the number of the submittal within the section. (Example: Section 03 3000 may have several components to be submitted such as concrete mix design and rebar shops, Submittals would then be numbered 30 3000 - 01 03 3000 - 02 etc). Revised or resubmitted submittals should be original number and suffix with an additional identifier indication revision and revision number (Example: 03 3000 01 R1).
C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
D. 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.
E. Submittals which require physical samples shall be delivered to the the address provided by the Architect. Contractor shall allow adequate delivery and return delivery time for such physical submittals in the project schedule.
F. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
H. Provide space for Contractor and Architect review stamps.
I. When revised for resubmission, identify all changes made since previous submission.
J. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
K. Submittals not requested will not be recognized or processed.

END OF SECTION
SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

A. 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 conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

B. 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.

C. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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.

3.02 MOCK-UPS

A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. 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.

3.03 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

END OF SECTION
SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 TEMPORARY UTILITIES
   A. Existing utility infrastructure facilities may be used to activate temporary services.
   B. New permanent facilities may be used once installed with the express written permission of the Owner.

1.02 TELECOMMUNICATIONS SERVICES
   A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.03 TEMPORARY SANITARY FACILITIES
   A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.04 BARRIERS
   A. Provide barriers to prevent unauthorized entry to construction areas and to protect adjacent properties from damage from construction operations.
   B. Provide protection for plants designated to remain (if any). Replace damaged plants.

1.05 FENCING
   A. Temporary security fencing construction: Commercial grade chain link fence or welded wire fencing minimum 6’ high with vehicular gates and locks.

1.06 EXTERIOR ENCLOSURES
   A. During the construction process as necessary to facilitate work and protect installed products and/or systems, 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.

1.07 SECURITY
   A. Provide security and facilities to protect Work, and operations from unauthorized entry, vandalism, or theft by way of perimeter construction fence and eventually locked facility.

1.08 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.

1.09 WASTE REMOVAL
   A. Refer to See Section 01 7419 - Waste Management, for additional requirements.

1.10 PROJECT IDENTIFICATION
   A. Provide project identification sign of design and construction indicated on Drawings.
   B. Erect on site at location indicated, and if not indicated as directed by the Architect.

1.11 FIELD OFFICES
   A. Office: Provide a weathertight field office with lighting, electrical, telephone and data 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 a minimum of 6 persons.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 SUBMITTALS
   A. Erosion and Sedimentation Control Plan:
      1. Submit within 2 weeks after Notice to Proceed.
      2. Obtain the approval of the Plan by authorities having jurisdiction.
      3. Obtain the approval of the Plan by Owner.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
      1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
      2. Permittivity: 0.05 sec, minimum, when tested in accordance with ASTM D4491.
      3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 after 500 hours exposure.
      4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632.
      5. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D4533.
   B. Silt Fence Posts: One of the following, minimum 5 feet long:
      1. Steel 'U' or 'T' section, with minimum mass of 1.33 lb per linear foot.
      2. Softwood, 4 by 4 inches in cross section.
      3. Hardwood, 2 by 2 inches in cross section.

PART 3 EXECUTION

3.01 SCOPE OF PREVENTIVE MEASURES
   A. In all cases, if permanent erosion resistant measures have been installed, temporary preventive measures are not required.
   B. Construction Entrances: Traffic-bearing aggregate surface.
      1. Width: As required; 20 feet, minimum.
      2. Length: 50 feet, minimum.
      3. Provide at each construction entrance from public right-of-way.
      4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
   C. Linear Sediment Barriers: Made of silt fences.
      1. Provide linear sediment barriers:
         a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
         b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
         c. Along the toe of cut slopes and fill slopes.
         d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
         e. Across the entrances to culverts that receive runoff from disturbed areas.
2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a. Slope of Less Than 2 Percent: 100 feet.
   b. Slope Between 2 and 5 Percent: 75 feet.
   c. Slope Between 5 and 10 Percent: 50 feet.
   d. Slope Between 10 and 20 Percent: 25 feet.
   e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of
      fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient
      cores of blocks so runoff passes into inlet.
   2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout
   outlets and storm water outlets.

3.02 MAINTENANCE

3.03 CLEAN UP
   A. Remove temporary measures after permanent measures have been installed, unless permitted to remain
      by Architect.
   B. Clean out temporary sediment control structures that are to remain as permanent measures.
   C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade
      and finish to match adjacent ground surfaces.

END OF SECTION
SECTION 01 5721
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL
1.01 PROJECT GOALS
   A. Ventilation: Refer to mechanical specifications and commissioning reports to confirm all ventilation requirements.

1.02 SUBMITTALS
   A. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   B. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
   C. Duct and Terminal Unit Inspection Report.

PART 2 PRODUCTS
2.01 MATERIALS
   A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
   B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION
3.01 CONSTRUCTION PROCEDURES
   A. Begin construction ventilation when building is substantially enclosed.
   B. New HVAC equipment and ductwork shall NOT be used for ventilation during construction. If it is deemed that such use is required to maintain project schedule, budget or safety protocols provide the following:

3.02 BUILDING FLUSH-OUT
   A. Contractor's Option AND EXPENSE: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
   B. Perform building flush-out after TCO and Owner furniture and before Substantial Completion.
   C. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
   D. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING
   A. Contractor's Option AND EXPENSE: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

END OF SECTION
SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 – GENERAL

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

1.02 SUMMARY
   A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
   B. Related Requirements:
      1. Division 01 Section "References" for applicable industry standards for products specified.

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

1.04 ACTION SUBMITTALS
   A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
      1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
      2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
         a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
         b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
   B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE
   A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

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

   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.


6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor’s request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

5. Samples, if requested.

END OF SECTION
PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
      2. Field engineering and surveying.
      3. Installation of the Work.
      4. Cutting and patching.
      5. Coordination of Owner-installed products.
      6. Progress cleaning.
      7. Starting and adjusting.
      8. Protection of installed construction.
   B. Related Requirements:
      1. Division 01 Section "Summary" for limits on use of Project site.
      2. Division 01 Section "Submittal Procedures" for submitting surveys.
      3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

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

1.04 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For land surveyor.
   B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
   C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.05 QUALITY ASSURANCE
   A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
   B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
      1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Mechanical systems piping and ducts.
   f. Control systems.
   g. Communication systems.
   h. Fire-detection and -alarm systems.
   i. Conveying systems.
   j. Electrical wiring systems.
   k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable design requirements Section.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the
existence and location of underground utilities, mechanical and electrical systems, and other
construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary
sewer, storm sewer, and water-service piping; underground electrical services, and other
utilities.

2. Furnish location data for work related to Project that must be performed by public utilities
serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work,
examine substrates, areas, and conditions, with Installer or Applicator present where indicated,
for compliance with requirements for installation tolerances and other conditions affecting
performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of
connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be
installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing
finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is
required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with
the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or
relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in
or affected by construction. Coordinate with authorities having jurisdiction.

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for
clarification of the Contract Documents caused by differing field conditions outside the control of
Contractor, submit a request for information to Architect according to requirements in Division 01
Section “Project Management and Coordination.”

3.03 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction
and elsewhere as needed to locate each element of Project.

2. Establish limits on use of Project site.

3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain
required dimensions.

4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

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

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

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.

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

J. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

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

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 OWNER-INSTALLED PRODUCTS
A. Site Access: Provide access to Project site for Owner's construction personnel.
B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 PROGRESS CLEANING
A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.
B. Site: Maintain Project site free of waste materials and debris.
C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."
H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.09 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

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

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

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

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.010 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

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

END OF SECTION
SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL
1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
B. Related Requirements:
   1. Section 013100 “Project Management and Coordination.”
   2. Section 015000 “Temporary Facilities and Controls.”
   4. Section 042010 "Unit Masonry" for disposal requirements for masonry waste.
   5. Section 044301 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
   6. Section 312000 “Earth Moving.”

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

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

1.04 PERFORMANCE REQUIREMENTS
A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent minimum, with a goal of 75 percent, by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of all applicable materials, including but not limited to the following:
   1. Demolition Waste:
      a. Asphalt paving.
      b. Concrete.
      c. Concrete reinforcing steel.
      d. Brick.
      e. Concrete masonry units.
      f. Wood studs.
      g. Wood joists.
      h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
e. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
k. Lamps.
ll. Ballasts.
mm. Electrical devices.
n. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:
a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.

j. Piping.

k. Electrical conduit.

l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.

2) Cardboard.

3) Boxes.

4) Plastic sheet and film.

5) Polystyrene packaging.


7) Plastic pails.

B. Waste that cannot be recycled or diverted from landfill or incinerator (i.e. general waste/dust, food items) shall be documented in the same manner as all other waste removed from the Project site. NO MATERIAL SHALL LEAVE PROJECT SITE WITHOUT DOCUMENTATION.

1.05 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan no later than 10 days of date established for commencement of the Work. Plan shall indicate how Contractor proposes to collect, segregate, and dispose of all construction wastes and debris produced by the work of the Contract, including all costs associated with this plan. The plan must include all materials listed as well as those deemed cost-effective to recycle. Contractor to provide documentation to justify decision not to recycle any items specified herein. Show compliance with regulations specified under “Quality Assurance” article below. Include a list of recycling facilities to which indicated recyclable materials will be distributed for disposal, Identify materials that are not recyclable or otherwise conservable that must be disposed of in a landfill or other means acceptable under governing State and local regulations. List permitted landfills and/or disposal means to be employed. Indicate any instances where compliance with requirements of this specification does not appear to be possible and request resolution form the Architect.

1.06 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit the following information:

1. Material category.

2. Generation of point of waste.

3. Total quantity of waste in tons.

4. Quantity of waste salvaged, both estimated and actual in tons.

5. Quantity of waste recycled, both estimated and actual in tons.

6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Hauler Tickets shall contain the following information on each load ticket:

1. General description of each type of waste.

2. Location and type of receiving agent (recycles, landfill, incinerator, clean fill, salvage operation).

3. Quantity of waste in tons.

   a. For mixed loads which are sorted at an off-site location, provide weight and individual disposal information for each separated material.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Records of Reutilization: Provide complete information on where material was reutilized including address.

G. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

H. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

I. Waste reused on the Project: Materials such as rubblized concrete and asphalt which are reutilized on the project site as engineered fill, aggregate, or other material shall be documented.
   1. General Description of each type of waste.
   2. Location where reused on the project.
   3. Quantity of material.

J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.07 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Prior to beginning work at the site, schedule and conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination.” Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Discuss coordination and interface between the Contractor and other construction activities.
   4. Identify and resolve problems with compliance with requirements.
   5. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   6. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   7. Review waste management requirements for each trade.
   8. Record minutes of the meeting, identifying all conclusions reached and matters requiring further resolution.
   9. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including the waste management coordinator; the Construction Quality Manager; the Architect; and such additional Owner personnel as the Architect deems appropriate.
  10. Plan Revisions: Make any revisions to the Construction Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plant of the Architect for approval.

E. Implementation: Designate an on-site party responsible for instructing workers and implementing the Construction Waste Management Plan. Distribute copies of the Construction Waste Management Plan to the job site foreman and each subcontractor. Include waste management and recycling in worker orientation. Provide on-site instruction on appropriate separation, handling, recycling, and salvaging methods to be used by all parties at the appropriate stages of the work at the site. The Contractor must separate recyclable waste from non-recyclable waste prior to removal off-site. Include waste management and recycling discussion in pre-fabrication meetings with subcontractors and fabricators. Also include discussion of waste management and recycling in regular job meetings and job safety meetings conducted
during the course of work at the site.

1.08 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.


C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Contractor’s standard forms. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
   3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
   4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
   6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area off-site and designated by Owner.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.03 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum size accepted by asphalt-recycling facility.
   1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
   1. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Crush masonry and screen to comply with requirements in Section 312000 “Earth Moving” for use as general fill or satisfactory soil for fill or subbase.
   2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.04 RECYCLING CONSTRUCTION WASTE

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

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

C. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.05 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Glass: Remove waste glass products (sheet, bottles, etc.) daily from the work area and deposit in designated containers. Where glass containers are marked for separation by color or type, segregate glass accordingly. Glass containing imbedded wire (typical in some fire rated doors having glazed lights) is usually not reprocessed; verify with the Construction Quality Manager that wireglass is not recyclable.
   1. Verify with Owner how glass should be recycled or discarded. There is currently no local facility recycling glass in the city of Laramie.

C. Burning: Do not burn waste materials.

D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION
SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 – GENERAL

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

1.02 SUMMARY
A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.
B. Related Requirements:
   1. Division 01 Section "Execution" for progress cleaning of Project site.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 ACTION SUBMITTALS
A. Product Data: For cleaning agents.
B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS
A. Certificates of Release: From authorities having jurisdiction.
B. Certificate of Insurance: For continuing coverage.
C. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS
A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

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

4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections,
including tools, spare parts, extra materials, and similar items, and deliver to location designated by
Architect. Label with manufacturer's name and model number where applicable.
   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material
      submittal items, including name and quantity of each item and name and number of related

5. Submit test/adjust/balance records.

6. Submit sustainable design submittals required in Section 013515 – LEED Requirements and in
   individual Division 02 through 33 Sections.

7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to
   requesting inspection for determining date of Substantial Completion. List items below that are incomplete
   at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of
      changeover in security provisions.
   3. Complete startup, commissioning functional testing, and resolve all issues in the Commissioning
      Issues Log.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and
      systems. Submit demonstration and training video recordings specified in Division 01 Section
      "Demonstration and Training."
   6. Advise Owner of changeover in heat and other utilities.
   7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools,
      and similar elements.
   9. Complete final cleaning requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10
days prior to date the work will be completed and ready for final inspection and tests. On receipt of request,
Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will
prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on
Contractor's list or additional items identified by Architect, that must be completed or corrected before
certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is
      completed or corrected.
   2. Results of completed inspection will form the basis of requirements for final completion.

1.07 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion,
   complete the following:
   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion
      inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect.
      Certified copy of the list shall state that each item has been completed or otherwise resolved for
      acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with
      insurance requirements.
B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.
4. Submit list of incomplete items in the following format:

1.09 SUBMITTAL OF PROJECT WARRANTIES
A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

1. Obtain warranties and bonds, executed by responsible Subcontractors, suppliers, vendors and manufacturers prior to final completion of work. The date of commencement of warranty coverage shall be the date of Substantial Completion as determined by the Owner.
B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS
2.01 MATERIALS
A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
   p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
   q. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section “Construction Waste Management and Disposal.”

3.02 REPAIR OF THE WORK

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

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION
SECTION 01 7823
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

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

1.02 SUMMARY
A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.
B. Related Requirements:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
   3. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS
A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS
A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
B. Format: Submit operations and maintenance manuals in the following format:
   1. Three paper copies and/or electronic copy in .PDF format. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
   1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 7 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY
A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.


5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS
A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.
B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   5. Power failure.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.
C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.04 OPERATION MANUALS
A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers’ maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual’s table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers’ Maintenance Documentation: Manufacturers’ maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers’ maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 – EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION
SECTION 01 7839
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL
1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. Section includes administrative and procedural requirements for project record documents, including the following:
      1. Record Drawings.
      2. Record Specifications.
      3. Record Product Data.
      4. Miscellaneous record submittals.
   B. Related Requirements:
      1. Division 01 Section "Execution" for final property survey.
      2. Division 01 Section "Closeout Procedures" for general closeout procedures.
      3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
      4. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.03 CLOSEOUT SUBMITTALS
   A. Record Drawings: Comply with the following:
      1. Number of Copies: Submit copies of record Drawings as follows:
         a. Initial Submittal:
            1) Submit PDF electronic files of scanned record prints and one of file prints.
            2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
         b. Final Submittal:
            1) Submit PDF electronic files of scanned record prints and three sets of prints.
            2) Print each drawing, whether or not changes and additional information were recorded.
   B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
   C. Record Product Data: Submit one paper copy of each submittal.
      1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
   D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

PART 2 - PRODUCTS
2.01 RECORD DRAWINGS
   A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
      1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
         a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. **Content:** Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. **Record Digital Data Files:** Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Annotated PDF electronic file with comment function enabled.
   2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   3. Refer instances of uncertainty to Architect for resolution.
      a. See Division 01 Section "Submittal Procedures" for requirements related to use of Architect's digital data files.
      b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Format: Annotated PDF electronic file with comment function enabled.
   3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

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

2.03 RECORD PRODUCT DATA
A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders and record Drawings where applicable.
B. Format: Submit record Product Data as paper copy.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS
A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
B. Format: Submit miscellaneous record submittals as paper copy.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION
3.01 RECORDING AND MAINTENANCE
A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION
DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.

B. Related Requirements:
   1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors’ names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator, instructor, videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.04 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Date of video recording.
   2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.” Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.

E. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.06 COORDINATION
A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS
2.01 INSTRUCTION PROGRAM
A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.

   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project record documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.

   3. Emergencies: Include the following, as applicable: Instructions on meaning of warnings, trouble indications, and error messages.
      a. Instructions on stopping.
      b. Shutdown instructions for each type of emergency.
      c. Operating instructions for conditions outside of normal operating limits.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION
3.01 PREPARATION
   A. Assemble educational materials necessary for instruction, including documentation and training module.
   Assemble training modules into a training manual organized in coordination with requirements in Division
   01 Section "Operations and Maintenance Data."
   B. Set up instructional equipment at instruction location.
3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least 15 days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
   1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
   2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
   3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
   4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
      a. Name of Contractor/Installer.
      b. Business address.
      c. Business phone number.
      d. Point of contact.
      e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
   1. Film training session(s) in segments not to exceed 15 minutes.
      a. Produce segments to present a single significant piece of equipment per segment.
      b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
      c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
   1. Furnish additional portable lighting as required.
E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded or by dubbing audio narration off-site after recording is made. Include description of items being viewed.
F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION
SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

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

1.02 SUMMARY
A. 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
   4. Slabs-on-deck.

1.03 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, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 ACTION 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.

1.05 INFORMATIONAL SUBMITTALS
A. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
B. 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.
C. Placement Notification: Submit notification to Architect at least 24 hours in advance of placement.
D. Proposed location of saw cut joints not indicated on Drawings.

1.06 QUALITY ASSURANCE
A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
C. 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.
D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
E. 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."

1.07 DELIVERY, STORAGE, AND HANDLING
A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement if present.

PART 2 - PRODUCTS

2.01 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. Medium-density overlay, Class 1 or better; mill-release agent treated and edged sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

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 (19 by 19 mm), 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.

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 form and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodeable metal closer than 1 1/2" 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.

2.02 STEEL REINFORCEMENT

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

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 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 II. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded.
   1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali incement.

C. Water: ASTM C 94 and potable.
2.05 ADMIXTURES
B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 494/C 494M, Type II.
   7. Mid-Range Water Reducing Admixture: ASTM C 494/C 494M, Type A.

2.06 CURING MATERIALS
A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   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. BASF Construction Chemicals - Building Systems; Confilm.
      b. ChemMasters; SprayFilm.
      c. Conspec by Dayton Superior; Aquafilm.
      d. Dayton Superior Corporation; Sure Film (J-74).
      e. Edoco by Dayton Superior; BurkeFilm.
      f. Euclid Chemical Company (The), an RPM company; Eucobar.
      g. L&M Construction Chemicals, Inc.; E-CON.
      h. Meadows, W. R., Inc.; EVAPRE.
      i. Sika Corporation; SikaFilm.
B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
C. Moisture-Retaining Cover: ASTM C 171, white burlap-polyethylene sheet; required at all exposed slabs.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Film must chemically break down in a four to six week period. Provide data from independent laboratory indicating maximum moisture less than 0.30 kg/m2 at 72 hours when tested in accordance with ASTM C 156.

2.07 RELATED MATERIALS
A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber
B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.08 REPAIR MATERIALS
A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) 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 (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.09 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 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, 0.30 for other reinforced concrete, and 1.00 for reinforced concrete that will be dry and protected from moisture in service, percent by weight of cement.

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

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, foundation walls, exterior slabs-on-grade, and other building elements not otherwise specified: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
   4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery.

B. Interior Slabs-on-Grade and Slabs-on-Deck: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information.
3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
   2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

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.

3.02 EMBEDDED ITEMS

A. Specify embedded items and anchorage devices for other work attached to or supported by cast-in-place concrete. Insert specific requirements for installing embedded items, if any, that are part of the Work.

B. 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 303 "Code of Standard Practice for Steel Buildings and Bridges."

3.03 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.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Size, length, number and placement of supports shall be sufficient as to maintain reinforcing position within specified tolerances during construction traffic and concrete placement.

E. On vertical formwork, use approved bar chairs or spacers as required to maintain concrete cover and bar position.

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

G. 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.

3.05 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate vertical joints beside pilasters integral with walls, near corners, and in concealed locations where possible.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3. Locate control joints where shown on Drawings. If not shown, provide control joints at column centerlines and at intervals not more than 12 feet each way.

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. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clips sections together.

3.06 CONCRETE PLACEMENT

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

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.07 FINISHING 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 or to be covered with a coating or covering material applied directly to concrete.

C. Related Uniform Surfaces: At tops of walls, horizontal offsets, and similar uniform 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.

3.08 FINISHING FLOORS AND SLABS
A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces not exposed in the final condition. Comply with ACI 302.R, Class 5 floor recommendations for hard-steel troweling and finishing operations for concrete surfaces exposed in final condition.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat
float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 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. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Moisture-retaining-cover shall be inspected each day by Contractor. Any areas which do not show condensation on underside of cover or any slab areas which are not wet shall be immediately rewetted and cover replaced to prevent moisture loss.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. 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.

3.11 CONCRETE SURFACE REPAIRS

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning and that are unacceptable to Architect. Allow Architect and Structural Engineer to observe concrete surfaces upon removal of forms and prior to repair of surface defects. Defects in structural concrete shall be brought to the attention of the Architect and Structural Engineer.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). 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. Submit proposed repair to Architect for review prior to commencement of work.

1. Repair finished surfaces containing defects that are unacceptable to Architect. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in
diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner shall engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. 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. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M.

a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

b. Cast and field cure two sets of two standard cylinder specimens for each composite sample to verify adequacy of curing and protection of concrete, as directed by Architect.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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

END OF SECTION
SECTION 03 3513
CONCRETE FLOOR SEALER

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Penetrating liquid floor treatment for horizontal concrete surfaces.
   2. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS
A. Product Data: Provide data on sealer, including information on compatibility of different products and limitations.
B. Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.04 QUALITY ASSURANCE
A. Qualification Data: For Installer.
B. Perform Work in accordance with ACI 301.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.06 FIELD CONDITIONS
A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting penetrating liquid floor treatment for concrete performance.
   1. Do not install penetrating liquid floor treatment for horizontal concrete surfaces when air temperature or concrete surface temperature is less than 40 degrees F.
   2. Maintain concrete floor surface temperature above freezing during and after installation of concrete liquid floor treatment until liquid floor treatment is cured.
B. Maintain light level equivalent to minimum 200 W light source, placed 8 feet above the floor surface, for each 425 sq ft of floor being finished.
C. Close areas to traffic during penetrating liquid floor treatment application and, after application, for time period recommended in writing by liquid floor treatment manufacturer.

PART 2 - PRODUCTS

2.01 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. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Bone Dry Products.
      b. Curecrete Distribution Inc.
      c. Euclid Chemical Company (The); an RPM company.
      d. L&M Construction Chemicals, Inc.
      e. PROSOCO, Inc; Consolideck LS.
      f. Vexcon Chemicals Inc.
      g. W. R. Meadows, Inc.
PART 3 - EXECUTION

3.01 FLOOR SURFACE PREPARATION
A. Make all applications of sealer per Manufacturer's recommendations and requirements, at a minimum and if not contraindicated by the Manufacturer prepare the floor for sealer application as follows:
   1. Verify that concrete was steel troweled and its free of fins, ridges or voids.
   2. Assure that curing agents used are compatible with coating system or completely removed.
   3. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.
   4. Remove surface contamination be cleaning or if necessary, by sandblasting.
   5. Patch holes or voids.
   6. Rout out cracks exceeding 1/16 inch wide and caulk.
   7. Calk non-moving joints up to 1 inch wide with suitable backer and sealant.
   8. Do not caulk or overcoat joints where movement exceeds 25% or joints are 1 inch wide. These joints must receive other joint treatment to assure watertightness.
   9. Install test patch according to Manufacturer's recommendation in an inconspicuous location. Wait for Architect's review and approval before proceeding with remainder of work.
   10. If test patch indicates lack of adhesion, install primer.

3.02 INSTALLATION
A. Penetrating Liquid Floor Treatment for Uncured and Cured Horizontal Concrete Surfaces:
   1. Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions included but not the limited to the following:
      a. DO NOT apply to surfaces scheduled to subsequently receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.
      b. Do not apply to uncured concrete horizontal surfaces that is less than 14 days' old.
      c. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
   2. Complete second application of concrete sealer just before Substantial Completion, and before Owner occupancy and before equipment is installed on floor.

3.03 PROTECTION OF LIQUID FLOOR TREATMENTS
A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

B. Allow no traffic on sealed surface for 72 hours after application.

3.04 PATCHING AND CLEANING
A. Patch areas which fail to match adjacent work.

B. Clean surface "broom clean" after completion of work.

C. Remove debris resulting from these operations.

END OF SECTION
PART 1 - GENERAL

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

1.02 SECTION INCLUDES
A. Masonry accessories including the following:
   1. Open mesh to collect and suspend mortar droppings in commercial masonry cavity walls, with insect barrier.
   2. Flexible flashing drainage plane system.
   3. Thru-wall flashing.
B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage, handling requirements and recommendations.
B. Verification Samples: For each specified, two samples representing actual product, color, and configuration.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: Minimum 2 years’ experience with similar masonry installations.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Protect products from exposure to direct sunlight.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Mortar Net Solutions or comparable product.

2.02 MATERIALS
A. Open mesh to collect and suspend mortar droppings in commercial masonry cavity walls:
   1. Description: 90 percent open weave mesh in trapezoidal configuration connected by continuous bottom strip 3 inches high. The insect barrier fabric is attached to one face of the trapezoidal material.
      a. Provide trapezoidal mesh material in thickness not more than 1/4 inch less than the cavity detailed.
B. Flexible Flashing Drainage Plane System:
   1. Engineered system, with high resistant to damage, composite with a stainless steel with non-asphalt adhesive polymer fabric laminated to one stainless steel and non-woven drainage fabric laminated to opposing face with non-asphalt adhesive:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide York Manufacturing, Inc.; York Flash-Vent SS or comparable product by one of the following:
         1) STS Coatings, Inc.; Wall Guardian Venting Stainless Steel TWF.
         2) Building Materials West Company, Inc.; Evacu-Flash SS.
      b. Accessories:
         1) Sealant: Type as recommended by flashing manufacturer.
         2) Outside Corner and Inside Corner: Stainless steel: 26-gauge stainless steel.
         3) End Dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using: Stainless steel: 26-gauge stainless steel.
         4) Splice Material: Self-adhered metal material; material matching system material and sealant as a splice.
3.01 \textbf{EXAMINATION}

A. \textit{Do not begin installation until substrates have been properly prepared.}

B. \textit{If substrate preparation is the responsibility of another installer, notify owner’s agent and architect of unsatisfactory preparation before proceeding.}

3.02 \textbf{INSTALLATION}

A. \textit{Open mesh to collect and suspend mortar droppings in commercial masonry cavity walls: multilayer with insect barrier. Install in strict accordance with manufacturer's instructions and as follows:}

1. \textit{Verify installation of flashing and completion of first two courses of masonry.}
2. \textit{Extend flashing from the bottom of the open mesh to at least 6 inches above the top of the open mesh to prevent mortar bridging between the outer wythe and inner wall.}
3. \textit{Remove mortar droppings and debris from flashing and weep vents.}
4. \textit{Install one continuous row of open mesh at base of wall in cavity and over all wall openings directly on flashing, with dovetail profile facing upward. For wall cavities that exceed 11 feet in height, place an additional continuous trapezoidal strip on wall reinforcing anchors/ties at every 9 feet to 11 feet of wall height.}
5. \textit{Butt ends together. Compress slightly if necessary.}
6. \textit{Face Insect Barrier toward the outside of the building.}

B. \textit{Flexible Flashing Drainage Plane System}

1. \textit{Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.}
   a. \textit{Prohibited practice: Tucking the flashing into the backer wall.}
   b. \textit{Prohibited practice: Bonding or splicing to non-woven drainage fabric.}
2. \textit{Extend flashing 6 inches minimum, beyond opening, each side without stretching flashing material. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use preformed end dams from manufacturer.}
3. \textit{Flashing Width: Width required starting 1.5 inch to the exterior of the outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2 inches. After inspection by the agreed upon parties the flashing should be cut flush with the leading edge of the brick.}
4. \textit{Splice end joints by butting ends together over 4-inch-wide piece of self-adhering stainless steel flashing. The self-adhering stainless-steel flashing should be sealed metal face down on to the substrate with the mastic. Remove the release liner and butt the two piece of flashing together and embed them into the splice sealant. Then seal the butt seam with sealant.}
5. \textit{Masonry back up:}

C. \textit{Thru Wall Flashing: Type 304 stainless steel core with one uncoated (bare) stainless steel face (outward facing) with a butyl block co-polymer adhesive (inward facing).}

1. \textit{Basis-of-Design Product: Subject to compliance with requirements, provide York Manufacturing, Inc.; York 304 SS or comparable product by one of the following:}
   a. \textit{Illinois Products, Inc.; IPCO Self-Adhesive Stainless Steel}
   b. \textit{STS Coatings, Inc.; Wall Guardian Self Adhering Stainless Steel Flashing}
   c. \textit{TK Products, Inc.; TK Self-Adhering Stainless Steel TWF}
   d. \textit{Vapro Shield, Inc.; VaproThru-Wall Flashing SA.}

2. \textit{Accessories:}
   a. \textit{Sealant: Type as recommended by flashing manufacturer.}
   b. \textit{Corner and End Dams: Stainless steel flashing in the field or use 26-gauge stainless steel pre-manufactured corners.}
   c. \textit{Mortar Deflection: Polyester strands that will not degrade and will keep weep vents from clogging with mortar.}
   d. \textit{Termination Bar: Rigid PVC or stainless-steel termination bar with sealant catch lip.}
a. Surface mount flashing after damp proofing installation in accordance with manufacturer’s installation instructions.
b. Apply flashing with drainage surface to outside.
c. Fasten to masonry back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.

6. Stud back up with sheathing:
   a. Surface mount flashing after certified compatible damp proofing installation specified in Damp Proofing Section in accord with manufacturer’s installation instructions
   b. Apply flashing with drainage surface to the outside.
   c. Fasten to stud back-up surface at top by embedding in layer of sealant and use a termination bar to fasten to the backer wall and seal the top of the termination bar with sealant.

7. Confirm compatibility with manufacturer’s mutual letters for all lapping components, Air barrier installation lapping over flashing top in the Air Barrier Section.
8. Lay flashing in continuous bead of sealant on masonry supporting steel.
9. Fold ends of flashing at end of opening to form dam; seal with sealant or utilize preformed end dams from manufacturer.
10. Inside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
11. Outside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
12. Do not coat the entire drainage fabric with air barrier. Leave the drainage fabric exposed at least an inch over the top of the mortar droppings.
13. Weep vent protection use the geotextile drainage and install it on the third-row height of standard bricks to have the fabric reach the base of the flashing and covering the weep vents.
14. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

C. Thru-Wall Flashing:
   1. Install where indicated, specified, or required in according with flashing manufacturer's written instructions and as follows.
      a. Extend flashing 6 inches minimum beyond opening. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use pre-manufactured units made of 26 gauge stainless steel.
      b. Flashing Width: ‘Width required starting flush with outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2”.
      c. Splice end joints by overlapping them a minimum of 2” and seal with a compatible sealant or metal splice tape.
      d. Masonry back up:
         1) Surface apply after dampproofing installation in accordance with manufacturer's installation instructions.
         2) Fasten to masonry back-up surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with compatible sealant or use a termination clamp, which is embedded in the block back up wall.
      e. Stud back up with sheathing:
         1) Fasten to stud back-up at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.
      f. Leave ready for certified compatible building felt or air barrier installation lapping flashing top installed in another Section.
      g. Fold ends of flashing at end of opening to form dam; seal with polyether sealant or use purchased manufacturers preformed end dams.
      h. Inside and outside corners: Make in industry accepted manner using corner and splice material or purchase manufactured corners from manufacturer.
      i. Use stainless steel or copper drip edge any location that the underside of the flashing will be exposed and/or deemed necessary by the design professional or AHJ on the project.
j. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

3.03 PROTECTION
   A. Protect installed products from damage until completion of project.
   B. Repair or replace damaged products before covering with construction.

END OF SECTION
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar and grout, and accessories.
C. Shop Drawings: Indicate bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.
D. Design Data: Indicate required mortar strength, unit assembly strength in each plane, and supporting test data.
E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE
A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.
   1. Maintain one copy of each document on project site.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.07 ENVIRONMENTAL REQUIREMENTS
A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.08 EXTRA MATERIALS
A. See Section 01 6000 - Product Requirements, for additional provisions.
B. Provide 50 of each size, color, and type of units for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS
A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners.
   3. Load-Bearing Units: ASTM C 90, lightweight.
      a. Hollow block, as indicated.
      b. Exposed faces: Manufacturer's standard color and texture where indicated.
   4. Pre-Faced Units: ASTM C 90, hollow block, with smooth resinous facing complying with ASTM C 744.
   5. Colors and styles: As selected from Manufacturer's standard colors.

2.02 MORTAR AND GROUT MATERIALS
A. Provide "Epoxy Grout" as topping grout (rake out 1/2") in all wet areas, see the drawings.
B. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.
   1. Hydrated Lime: ASTM C 207, Type S.
C. Pigments for Colored Mortar: Iron or chromium oxides with demonstrated stability and colorfastness.
   1. Colors: As required to match Architect's color samples.
D. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE
A. Manufacturers of Joint Reinforcement and Anchors:
   4. Substitutions: See Section 01 6000 - Product Requirements.
2.04 FLASHINGS
A. Plastic Flashings: Sheet polyvinyl chloride; 10 mil thick.
B. Lap Sealant: Butyl type as specified in Section 079005.

2.05 ACCESSORIES
A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      d. Substitutions: See Section 01600 - Product Requirements.
B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 1/2 inch wide x by maximum lengths available.
   1. Manufacturers:
      d. Substitutions: See Section 01600 - Product Requirements.
C. Weep/Cavity vents: Cotton rope.
D. Cavity Mortar Diverter: Semi-rigid polyethylene or polyester mesh blocks, sized to fill bottom of wall cavity and suspend mortar droppings above weep/cavity vents to allow cavity drainage.
E. Building Paper: ASTM D 226, Type I (*No. 15*) asphalt felt.
F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR MIXES
A. Ready Mixed Mortar: ASTM C 1142, Type RM.
B. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
   1. Engineered masonry: Type S.
   2. Masonry below grade and in contact with earth: Type S.
   3. Exterior, loadbearing masonry: Type S.
   4. Interior, loadbearing masonry: Type S.
C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

2.07 MORTAR MIXING
A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C 270 and in quantities needed for immediate use.
B. Maintain sand uniformly damp immediately before the mixing process.
C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
D. Do not use anti-freeze compounds to lower the freezing point of mortar.
E. If water is lost by evaporation, re-temper only within two hours of mixing.
F. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

2.08 GROUT MIXES
A. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

B. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.09 GROUT MIXING
A. Mix grout in accordance with ASTM C 94/C94M.
B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C 476 for fine and coarse grout.
C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.10 PRECONSTRUCTION TESTING
A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000.
B. Concrete Masonry: Test each type, class, and grade of concrete masonry unit in accordance with ASTM C 140 for conformance to requirements of this specification.
C. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C 780 recommendations for preconstruction testing.
D. Grout Mixes: Test grout batches in accordance with ASTM C 1019 procedures.
E. Compressive Strength: Where indicated, test masonry prisms in accordance with ASTM C 1314.
   1. Prepare two sets of prisms; test one set at 7 days and the other at 28 days.
   2. Concrete masonry prisms: Height-to-thickness ratio of not less than 1.33 and not more than 5.0; apply correction factor per ACI 530.1/ASCE 6/TMS 602 for ratio other than 2.0. Required Compressive Strength of Masonry F’m = 2,000. Psi.
F. Flexural Bond Strength: Where indicated, test masonry prisms in accordance with ASTM E 518, with tooled joints downward.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION
A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
B. Clean reinforcement of loose rust.
C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
D. Only low lift grouting will be employed, maximum lift height of 48".

3.03 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

3.04 PLACING AND BONDING
A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
C. Remove excess mortar as work progresses.
D. Interlock intersections and external corners.
E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

3.05 REINFORCEMENT AND ANCHORAGE

A. Reinforcement Bars: Secure at locations indicated and to avoid displacement during grouting. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.
   1. Welding of splices is not permitted.

B. Joint Reinforcement: Install horizontal joint reinforcement 8 inches oncenter.
   1. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
   2. Place continuous joint reinforcement in first and second joint below top of walls.
   3. Lap joint reinforcement ends minimum 6 inches.

C. Anchors: Reinforce joint corners and intersections with strap anchors 16 inches on center.

D. Anchors: Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

E. Wall Ties: Install wall ties at locations indicated, spaced at not more than 24 inches on center horizontally and 16 inches on center vertically, unless otherwise indicated on drawings.

F. Reinforced Hollow Unit Masonry: Keep vertical cores to be grouted clear of mortar, including bed area of first course.
   1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

3.06 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend plastic flashings to within 1/4 inch of exterior face of masonry.

C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

3.07 GROUTING

A. Use only low-lift grouting techniques, maximum lift height of 48".
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Clean out masonry cells and other cavities to be grouted by vacuum methods or compressed air. Remove debris, allow to dry, and inspect before grouting.
   3. Hollow Masonry: Limit lifts and pours to maximum height of 4 feet.
   4. Place grout for spanning elements in single, continuous pour.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joint in accordance with Section 079000 for sealant performance.

3.09 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

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

3.10 TOLERANCES
A. Maximum Variation from Alignment of Columns: 1/4 inch.
B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.11 CUTTING AND FITTING
A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 FIELD QUALITY CONTROL
A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.
B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C 140 for conformance to requirements of this specification.
C. Mortar Tests: Test each type of mortar in accordance with recommended procedures in ASTM C 780, testing with same frequency as masonry samples.
D. Test and evaluate grout in accordance with ASTM C 1019 procedures.
   1. Test with same frequency as specified for masonry units.
E. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C 1314 and for flexural bond strength in accordance with ASTM C 1072 or ASTM E 518; perform tests and evaluate results.

3.13 CLEANING
A. Remove excess mortar and mortar smears as work progresses.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

3.14 PROTECTION OF FINISHED WORK
A. Without damaging completed work, provide protective boards at exposed external corners which are subject to damage by construction activities.

END OF SECTION
SECTION 04 2001
MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Clay Facing Brick.
B. Mortar.
C. Reinforcement and Anchorage.
D. Flashings.
E. Installation of Lintels.
F. Accessories.

1.02 RELATED REQUIREMENTS
A. Section 04 2000 Reinforced Unit Masonry Assemblies: Concrete masonry unit backup for masonry veneer.
B. Section 05 5000 - Metal Fabrications: Loose steel lintels.
C. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.
D. Section 07 9005 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS
A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
I. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene two weeks before starting work of this section.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units and mortar.
C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.07 FIELD CONDITIONS
A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
PART 2 PRODUCTS

2.01 BRICK UNITS
A. Manufacturers:
   1. General Shale.
   2. Interstate Brick Co.
   3. Hebron Brick Co.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and Texture: To match existing red brick.

2.02 MORTAR MATERIALS
A. Mortar: As specified in Section 04 2000.

2.03 REINFORCEMENT AND ANCHORAGE
A. Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.
   4. Manufacturers:

2.04 FLASHINGS
A. Flashing: As specified in Section 04 0900, Masonry Accessories.
B. Weeps: Cotton rope.
C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR MIXES
   1. Exterior, non-loadbearing masonry; Type N.
B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

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

3.02 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Brick Units:
   1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.

3.03 PLACING AND BONDING
A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
D. Remove excess mortar as work progresses.
E. Interlock intersections and external corners, except for units laid in stack bond.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS
A. Install weeps in veneer walls at 32 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.05 CAVITY MORTAR CONTROL
A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER
A. Install horizontal joint reinforcement 16 inches on center.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
C. Place continuous joint reinforcement in first and second joint below top of walls.
D. Masonry Back-Up: Embed anchors in masonry back-up to bond veneer at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches oncenter.

3.07 MASONRY FLASHINGS
A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 8 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.
B. Extend metal flashings to within 1/4 inch of exterior face of masonry.
C. Extend flexible flashings to within 1/4 inch of exterior face of masonry.
D. Lap end joints of flashings at least 4 inches and seal watertight with flashing sealant/adhesive.

3.08 LINTELS
A. Install loose steel lintels over openings.

3.09 CONTROL AND EXPANSION JOINTS
A. Do not continue horizontal joint reinforcement through control or expansion joints.
B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
C. Size control joints as indicated on drawings; if not shown, 3/4 inch wide and deep.
3.10 TOLERANCES
   A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
   B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
   C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
   D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
   E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.11 CUTTING AND FITTING
   A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
   B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING
   A. Remove excess mortar and mortar smears as work progresses.
   B. Replace defective mortar. Match adjacent work.
   C. Clean soiled surfaces with cleaning solution.
   D. Use non-metallic tools in cleaning operations.

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

END OF SECTION
PART 1 - GENERAL

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

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

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

1.04 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop and Erection Drawings: Show location, fabrication, and assembly of structural-steel components.
      1. Location of each piece or detail within the structure.
      2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
      3. Include embedment piece and setting drawings.
      4. 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.
      5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

1.05 INFORMATIONAL SUBMITTALS
   A. Welding certificates.

1.06 QUALITY ASSURANCE
   A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
   B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   C. Comply with applicable provisions of the following specifications and documents:
      1. AISC 303 as amended below:
         a. Section 3.2: Replace entire section with the following: “Requirements for structural steel including quantities, sizes, locations, arrangement, and details shall be shown or noted in the overall Contract Drawing package. Fabricator is responsible for incorporating all such information from structural, architectural, mechanical, and electrical drawings, as well as those of other disciplines.”
         b. Section 3.5: Remove all text after first sentence.
         c. Section 4.4: Revise second sentence to read the following: “The shop and erection drawings shall be returned in accordance with the schedule defined in Division 1 of the project Specification. In the absence of such schedule, the Owner’s Designated Representative for Design shall return submittals within 14 calendar days of receipt from the Owner’s Designated Representative for Construction.”
      2. AISC 360
      3. RCSC’s "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
1.07 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.

1.08 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

2.01 STRUCTURAL-STEEL MATERIALS
   A. W-Shapes: ASTM A 992 unless indicated otherwise on Drawings.
   B. Channels, Angles Shapes: ASTM A 36 unless indicated otherwise on Drawings.
   C. Plate and Bar: ASTM A 36 unless indicated otherwise on Drawings.
   D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
   E. Welding Electrodes: Comply with AWS requirements, 70 Series

2.02 BOLTS, CONNECTORS, AND ANCHORS
   A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.
   C. Steel Headed Stud Anchors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
   D. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.
   4. Washers: ASTM F 436 (ASTM F 436M)
   5. Finish: Plain
   E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
   3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
   4. Finish: Plain
   F. Threaded Rods: ASTM A 36/A 36M.
   3. Finish: Plain
   G. Expansion Anchors, Screw Anchors, and Adhesive Anchors: Size and Manufacturer as indicated on Drawings. Complete assemblies with required rods, nuts, washers, and adhesive system as applicable.
Installed in accordance with Manufacturer’s installation instructions. Current ICC approval and published ICC Research Report required.

1. Finish for use in conditioned environments free from potential moisture (interior): Plain or in accordance with Manufacturer's standard.
2. Finish for use in exposed or potentially wet environments and for attachment of exterior cladding materials: Galvanized in conformance with ASTM A 153 or stainless steel, Series 300.

2.03 PRIMER
A. Primer: Where steel is to be field painted, provide fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 GROUT
A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Minimum compressive strength = 8000 psi. Required where grout is exposed to view or weathering.

2.05 FABRICATION
A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   2. Mark and match-mark materials for field assembly.
   3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations, if applicable.
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, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces. Do not enlarge bolt holes by burning.
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 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning."
F. Steel Headed Stud Anchors and Deformed Anchor Studs / Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of anchors. Use automatic end welding of anchors according to AWS D1.1 and manufacturer's written instructions.
G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, thermal cut, or punch holes perpendicular to steel surfaces.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
H. Splices: Splicing of members to obtain required lengths is not permitted without prior approval of Structural Engineer-of-Record unless indicated on the Drawings.
I. Substitutions: Where exact sizes and weights indicated on Drawings are not readily available, secure approval of alternate sizes from Structural Engineer-of-Record in time to prevent project delay.

2.06 SHOP CONNECTIONS
A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: As indicated on Drawings.
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.

2.07 SHOP PRIMING
A. Shop prime steel surfaces except the following:
   1. Retain, revise, or delete five subparagraphs below to suit Project.
2. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
3. Surfaces to be field welded, including top flange of beams to receive steel headed stud anchors.
5. Surfaces not otherwise indicated to be painted that are not exposed to view or weather in the final condition.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to either of the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. 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.

2.08 GALVANIZING
A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes in closed sections (HSS or Pipe) 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 steel supporting the stone veneer located in exterior walls.

PART 3 - EXECUTION
3.01 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.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION
A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate where indicated on Drawings.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Clean and moisten surfaces to receive grout. Immediately remove any remaining free water. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
C. Maintain erection tolerances of structural steel within AISC'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.
E. Do not use thermal cutting during erection unless approved by Structural Engineer-of-Record. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

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

G. Steel Headed Stud Anchors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: As indicated on Drawings.

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. 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.

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections.
   1. Verify structural steel materials and inspect steel frame joint details.
   2. Verify weld materials and visually inspect field welds according to AWS D1.1/D1.1M.
   3. Verify connection materials and inspect high-strength bolted connections.

3.06 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.

END OF SECTION
PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      2. Joist accessories.

1.03 DEFINITIONS
   A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
   B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.04 ACTION SUBMITTALS
   A. Product Data: For each type of joist, accessory, and product.
   B. Shop Drawings:
      1. Include layout, designation, number, type, location, and spacing of joists.
      2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
      3. Indicate locations and details of bearing plates to be embedded in other construction.

1.05 INFORMATIONAL SUBMITTALS
   A. Welding certificates.

1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
      1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
   B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
   B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
   A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
      1. Use ASD; data are given at service-load level.
      2. Design special joists to withstand design loads with live-load deflections no greater than the following:
         a. Floor Joists: Vertical deflection of 1/360 of the span.

2.02 K-SERIES STEEL JOISTS
   B. Provide holes in chord members for connecting and securing other construction to joists.
C. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

D. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

E. Camber joists according to SJI's "Specifications."

2.03 PRIMERS
A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.04 JOIST ACCESSORIES
A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

D. Welding Electrodes: Comply with AWS standards.

E. Furnish miscellaneous accessories required by joist manufacturer to complete joist assembly.

2.05 CLEANING AND SHOP PAINTING
A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION
3.01 EXAMINATION
A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.02 INSTALLATION
A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
   1. Space, adjust, and align joists accurately in location before permanently fastening.
   2. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.03 FIELD QUALITY CONTROL
A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and to perform field tests and inspections and prepare test and inspection reports.

B. Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, as applicable:
      a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709.

C. Visually inspect bolted connections.
D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.04 PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 05 3100
STEEL DECKING

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Roof deck.
   2. Composite floor deck.

1.03 ACTION SUBMITTALS
A. Product Data: For each type of deck, accessory, and product indicated.
B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 QUALITY ASSURANCE
A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.02 ROOF DECK
A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), grade, thickness and profile as indicated, shop primed with manufacturer's standard baked-on, rust-inhibitive primer. Use at interior locations.
   2. Color: Manufacturer's standard.
   3. Deck Profile: Type WR, wide rib.
   4. Profile Depth: 1-1/2 inches (38 mm).
   5. Design Uncoated-Steel Thickness: 0.0358 inch (0.91 mm).

2.03 COMPOSITE FLOOR DECK
A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), grade, thickness and profile as indicated, G60 zinc coating.
   2. Profile Depth: 1-1/2 inches (38 mm).
   3. Design Uncoated-Steel Thickness: 0.0474 (1.2 mm).
2.04 NONCOMPOSITE FORM DECK
   A. Noncomposite 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. 31, with the minimum section properties indicated, and with the following:
      1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), grade, thickness and profile as indicated, G90 zinc coating typical.
      2. Profile Depth: 9/16 inch (14 mm).
      3. Design Uncoated-Steel Thickness: 0.0239 (0.61 mm).
      4. Side Laps: Overlapped

2.05 ACCESSORIES
   A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
   B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
   C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
   D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
   E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated but not less than recommended by SDI Publication No. 31 for overhang and slab depth.
   F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
   G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

PART 3 - EXECUTION
3.01 EXAMINATION
   A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL
   A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
   B. 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. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
   G. Mechanical fasteners may be used in lieu of welding to fasten deck with prior written approval of Structural Engineer-of-Record. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION
   A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
      1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. **Weld Spacing:** Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart at end laps, end supports and at the perimeter edge of the roof.

B. **Side-Lap and Perimeter Edge Fastening:** Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. **End Bearing:** Install deck ends over supporting frame with a minimum end bearing length of 1-1/2 inches (38 mm) minimum or as indicated on Drawings with end joints as follows:

1. **End Joints:** Lapped.

D. **Miscellaneous Roof-Deck Accessories:** Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer’s written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

### 3.04 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. **Weld Diameter:** As indicated
2. **Weld Spacing:** Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. **Weld Washers:** Install weld washers at each weld location when the minimum uncoated steel thickness is less than 0.028 inches (0.7 mm).

B. **Side-Lap and Perimeter Edge Fastening:** Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows unless otherwise indicated:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

C. **End Bearing:** Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm) or as indicated.

1. **End Joints:** Lapped.

D. **Pour Stops and Girder Fillers:** Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. **Floor-Deck Closures:** Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### 3.05 FIELD QUALITY CONTROL

A. **Testing and Inspection:** Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

### 3.06 PROTECTION

A. **Galvanizing Repairs:** Where deck is exposed to weather or moisture, prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer’s written instructions.

B. **Repair Painting:** Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

1. Do not use deck units for storage or as a working platform until permanently secured in position.
2. Contractor shall assure that completed deck is not damaged by use as a runaway, storage of materials or subsequent work.
3. Contractor shall assure that construction loads are not allowed which exceed the safe carrying capacity of the deck.

END OF SECTION
PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.
   3. Roof joist framing.
B. Related Requirements:
   1. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing.

1.03 ACTION SUBMITTALS
A. Product Data: For each type of cold-formed steel framing product and accessory.
B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.04 INFORMATIONAL SUBMITTALS
A. Welding certificates.

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

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.02 LOAD-BEARING WALL FRAMING
A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   2. Coating: G60 (Z180), A60 (ZF180), or equivalent.
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: 0.0428 inch.
C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.
D. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch or 0.0677 inch as indicated on drawings.
   2. Flange Width: 1-5/8 inches (41 mm).

2.03 EXTERIOR NON-LOAD-BEARING WALL FRAMING
A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   2. Coating: G60 (Z180), A60 (ZF180), or equivalent
B. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with
   1. Minimum Base-Metal Thickness: 0.0428 inch.
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 indicated otherwise on drawings.
   2. Flange Width: 1-1/4 inches and as indicated on drawings.
D. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
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 loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09mm) and as indicated on drawings.
   2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures, or as indicated on drawings.
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 loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch (1.09mm) and as indicated on drawings.
      b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures, or as indicated on drawings.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch (1.09mm) and as indicated on
      b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures, or as indicated on drawings.
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 through positive mechanical attachment to stud web and structure.

2.04 ROOF JOIST FRAMING
A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   2. Coating: G60 (Z180), A60 (ZF180), or equivalent.
B. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch.
   2. Flange Width: 2 inches.
2.05 FRAMING ACCESSORIES
A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
B. Provide accessories of manufacturer's standard thickness and configuration, 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.

2.06 ANCHORS, CLIPS, AND FASTENERS
A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
B. Anchor Bolts: ASTM F 1554, Grade 36.
C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
E. 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.
F. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS
A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
B. 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/C 1107M, with fluid consistency and 30-minute working time.
C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.08 FABRICATION
A. Fabricate cold-formed steel 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 steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

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

3.03 INSTALLATION, GENERAL
   A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
   B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
   C. 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, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
   D. Install cold-formed steel 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 steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
         a. Comply with AWS D1.3/D1.3M 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.
   E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
   F. 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. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
   G. Install insulation, specified in Section 072100 “Thermal Insulation,” in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
   H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 LOAD-BEARING WALL INSTALLATION
   A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
      1. Anchor Spacing: 12 inches.
   B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated.
   C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
   D. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
   E. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   F. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
      1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
   G. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.
      1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
      2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
      3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
   H. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION
   A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
   B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as indicated.
   C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
   D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
      1. Install single or double deep-leg deflection tracks and anchor to building structure.
   E. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
      1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
      2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
   F. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, casework, stone veneer and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturers written recommendations and industry standards in each case, considering weight or load resulting from item supported.

G. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) 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 bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

      a. Install solid blocking as indicated on Drawing.

   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.

H. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.06 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes but not limited to:
   1. Steel fabricated items including:
      a. Loose lintels.
      b. Ledge angles, shelf angles, channels, and plates.
      c. Miscellaneous steel items specifically detailed or required to complete assembly on drawings.

1.03 SUBMITTALS
A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
B. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
C. Qualification Data:
   1. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
   2. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE
A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).

1.05 FIELD CONDITIONS
A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. Delegated Design: Engage a qualified professional engineer to design ladders.
B. 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.

2.02 MATERIALS - STEEL
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 Sections: ASTM A36/A36M.
C. Steel Tubing: ASTM A500, Grade B cold-formed structural tubing.
D. Plates: ASTM A283.
E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish unless specifically noted otherwise.
2.03 FASTENERS
A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563; and, where indicated, flat washers.
C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
D. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
E. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.04 MISCELLANEOUS MATERIALS
A. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
D. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION
A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.06 FABRICATED ITEMS
A. Lintels:
   1. 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.
   2. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing:
   1. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.
      a. For support of metal decking.
b. Prime paint finish.

C. Miscellaneous steel as detailed or required: Pipes, Tubes, ‘C’ Sections, ‘L’ Sections

2.07 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items specifically noted to receive that finish.

B. Prepare surfaces to be primed in accordance with SSPC-SP3.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 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:

D. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

E. Obtain fusion without undercut or overlap.

F. Remove welding flux immediately.

G. 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.

H. 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.

I. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

J. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

K. Obtain Architect approval prior to site cutting or making adjustments not scheduled.

3.04 INSTALLATION OF 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. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

C. Manufacturer’s written instructions. Slope grout up approximately 1/8 inch toward bollard.
3.05 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 06 1053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking and nailers.
   3. Plywood backing panels.

B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Evaluation Reports: For the following, from ICC-ES:
   1. Preservative-treated wood.
   2. Fire-retardant-treated wood.
   4. Post-installed anchors.
   5. Metal framing anchors.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
   3. Plywood backing panels.

2.04 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:
   1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
   2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
   3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
   4. Eastern softwoods, No. 3 Common grade; NELMA.
   5. Northern species, No. 3 Common grade; NLGA.
D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.05 PLYWOOD BACKING PANELS
A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.06 FASTENERS
A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

PART 3 - EXECUTION
3.01 INSTALLATION, GENERAL
A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities where indicated.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
3.02 WOOD BLOCKING AND NAILER INSTALLATION
   A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
   B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.03 PROTECTION
   A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION
SECTION 06 1600
SHEATHING

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Wall sheathing.
   2. Parapet sheathing.
B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.04 SUBMITTALS
A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
B. Qualification Data: For Installer.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 WALL AND PARAPET SHEATHING
A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
   1. 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:
      a. CertainTeed Corporation.
      b. Georgia-Pacific Gypsum LLC.
      c. National Gypsum Company.
      d. USG Corporation.
   2. Type and Thickness: As indicated on the drawings.

2.03 FASTENERS
A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
   1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.04 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 9200 “Joint Sealants.”

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with MISCELLANEOUS MATERIALS

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   2. ICC-ES evaluation report for fastener.

D. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION


B. Fastening Methods: Fasten panels as indicated below:
   1. Wall and Roof Sheathing:
      a. Screw to cold-formed metal framing.
      b. Space panels 1/8 inch apart at edges and ends.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with nails or screws.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Specially fabricated cabinet units.
B. Plastic Laminates.
C. Solid Surface Window Sills.
D. Cabinet hardware.

1.02 RELATED REQUIREMENTS
A. Section 06 1000 - Rough Carpentry: Support framing for solid surface countertops, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS
A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
F. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
H. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
C. Product Data: Provide data for hardware accessories.
D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE
A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Premium quality.
B. Perform cabinet construction in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Premium quality, unless other quality is indicated for specific items.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
D. Manufacturer Qualifications: Member in good standing of the Architectural Woodwork Institute (AWI) or the Architectural Woodwork Manufacturers Association of Canada (AWMAC) or familiar with the standards outlined by AWI/AWMAC and willing to adhere to their quality standards and practices.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect units from moisture damage.

1.07 FIELD CONDITIONS
A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
PART 2 PRODUCTS

2.01 MANUFACTURERS
A. JBD, Inc.
B. Eggli Brothers Millwork.
C. Woodwise Cabinets, Inc.
D. Johnson Brothers Planing Mill.
E. Sidney Millwork.
F. LSI.
G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINETS
A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Premium Grade.

2.03 WOOD-BASED COMPONENTS
A. Wood fabricated from old growth timber is not permitted.

2.04 PANEL MATERIALS
A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.
B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
C. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for drawer bottoms, dust panels, and other components indicated on drawings.

2.05 LAMINATE MATERIALS
A. Manufacturers:
   4. Chemetal: www.chemetalco.com
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
C. Provide specific types as indicated on the drawings.
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, color to be selected.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, color to be selected.
   3. Cabinet Liner: CLS, 0.020 inch nominal thickness, color to be selected.
   4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 SOLID POLYMER MATERIALS (SOLID SURFACE)
A. Manufacturers:
   1. Avonite: www.avonitesurfaces.com
   2. Trespa North America Ltd.: www.trespanorthamerica.com
   3. DuPont: www.corian.com
   4. Formica Corp.: www.formica.com
   6. LG Hausys Hi-Macs: www.lghimacsusa.com
7. Substitutions: See Section 016000 - Product Requirements.

B. General: Non-porous, homogeneous blend of polyester or acrylic polymers and fillers to create a material that cuts like wood. The color and pattern shall extend throughout the material and be equal to Avonite Surfaces.

C. Recycled Content: Materials chosen must be certified to contain a minimum 40% pre-consumer recycled content.

D. Provide specific types as indicated on drawings at countertops and window sills.

2.07 WINDOW SILLS

A. Solid Polymer Window Sills:
   1. 1/2" thick solid surface with 3" roundover edge. Color to be selected from manufacturer's standards.
   2. General: Shall be non-porous, homogeneous blend of polyester or acrylic alloys and fillers to create a material that cuts like wood. The color and pattern shall extend throughout the material.
   3. Joint Adhesive: Type recommended by manufacturer, in color to match surfaces.
   4. Silicone Sealant: Type recommended by manufacturer.
   5. Installation: In locations indicated, conforming to manufacturer's recommended installation procedures.

2.08 ACCESSORIES

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

B. Plastic Edge Banding: 3mm extruded PVC, flat shaped; smooth finish; of width to match component thickness, color as selected from manufacturer's standards.
   1. Use at all exposed shelf edges, doors and drawers.

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

2.09 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

B. Cabinet Drawer and Door Pulls:
   1. Product: DP3B- 4" Tab Drawer Pull manufactured by Doug Mockett & Co.

C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
   1. Provide one lock per individual active cabinet door, and drawer as indicated on drawings. Spring catches on inactive cabinet door will not be accepted.
   2. Product: CL920R manufactured by Schlage or approved equal.

D. Catches: Magnetic.

E. Drawer Slides:
   1. Type: Full extension. Galvanized steel construction, ball bearing separating tracks.
   2. Static Load Capacity: Commercial grade.
   4. Stops: Integral type.

F. Hinges: European style concealed self-closing type, steel with satin finish.
   1. Products:
   2. Detention Center Cabinets:
a. Substitutions: See Section 01 6000 - Product Requirements.

2.10 FABRICATION

A. Cabinet Style: Flush overlay.
B. Cabinet Doors and Drawer Fronts: Flush style. 3/4” inch thick.
C. Drawer Construction Technique: Dovetail joints.
D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
E. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
F. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
G. 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.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed laminate finish edges with material of same finish and pattern.
H. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
B. Use concealed joint fasteners to align and secure adjoining cabinet units.
C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
D. Secure cabinets to floor using appropriate angles and anchorages.
E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.
B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

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

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Board insulation at perimeter foundation wall, and over roof deck.
B. Batt insulation and vapor retarder in exterior wall construction.
C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete.
B. Section 06 1053 – Miscellaneous Rough Carpentry.
C. Section 07 2119 - Sprayed Insulation: Sprayed-on, adhered insulation.
D. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.
E. Section 09 2216 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

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

PART 2 PRODUCTS

2.01 APPLICATIONS
A. Insulation at Perimeter of Foundation: Extruded polystyrene board.
B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
C. Insulation Over Roof Deck: Polyisocyanurate board faced with oriented strandboard.

2.02 FOAM BOARD INSULATION MATERIALS
A. Extruded Polystyrene Board Insulation: Perimeter foundation walls, at masonry cavity walls and metal panel walls. ASTM C 578, Type IV; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or 450 or less, when tested in accordance with ASTM E84.
   4. Board Thickness: 2 inches.
   6. Thermal Conductivity (k factor) at 25 degrees F: 0.20.
8. Board Density: 1.6 lb/cu ft.
9. 5 year aged R-Value: 5.0 per inch.
10. Water Absorption, maximum: 0.1 percent, volume.
11. Manufacturers:
   d. Foam-Control Plus+250 25 psi (approved for below grade use only)
12. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS
A. Glass or Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C 665; friction fit.
   1. Flame Spread Index: 25 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.
   7. Manufacturers:
      c. Knauf Insulation GmbH: www.knaufinsulation.us.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES
A. Sheet Vapor Retarder: Clear polyethylene film for above grade application, 10 mil thick.
B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
E. Adhesive: Type recommended by insulation manufacturer for application.
   1. Provide Dow Mastic No. 7 or No. 11 or for extruded polystyrene insulation.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER
A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints.
   2. Extend sheet full height of joint.
B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
2. Install boards horizontally on foundation perimeter.
3. Place boards to maximize adhesive contact.
4. Install in running bond pattern.
5. Butt edges and ends tightly to adjacent boards and protrusions.
C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
E. Apply to interior face of exterior foundation walls from finish floor line (bottom of slab) to top of footing.

3.03 BATT INSTALLATION
A. Install insulation and vapor retarder in accordance with manufacturer's instruction.
B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
F. Retain insulation batts in place with spindle fasteners at 12 inches on center.
G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
I. Tape seal tears or cuts in vapor retarder.
J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.
K. Coordinate work of this section with construction of weather barrier seal specified in Section 07 2500.

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

END OF SECTION
SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Closed-cell spray polyurethane foam.
   2. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS
A. Product Data: For each type of product.
B. Qualification Data: For Installer.
C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
D. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.01 CLOSED-CELL SPRAY POLYURETHANE FOAM
A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
   1. 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:
      a. BASF Corporation.
      b. Gaco Western LLC.
      c. Icynene-Lapolla.
      d. Johns Manville; a Berkshire Hathaway company.
   2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.

2.02 MISCELLANEOUS MATERIALS
A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.01 PREPARATION
A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.02 INSTALLATION
A. Comply with insulation manufacturer's written instructions applicable to products and applications.
B. Spray insulation to envelop entire area to be insulated and fill voids.
C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.03 PROTECTION
A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION
**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Weather barrier membrane.
B. Seam Tape.
C. Flashing.
D. Fasteners.

**1.02 RELATED REQUIREMENTS**

A. Section 04 2001 - Masonry Veneer.
B. Section 06 10 53 – Miscellaneous Rough Carpentry.
C. Section 07 6200 - Sheet Metal Flashing and Trim.
D. Section 08 1113 - Hollow Metal Doors and Frames.
E. Section 08 4313 - Aluminum Framed Storefronts.

**1.03 REFERENCES**

A. ASTM International:
   5. ASTM E 84; Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM E 1677; Specification for Air Retarder Material or System for Framed Building Walls.
B. AATCC – American Association of Textile Chemists & Colorists:

**1.04 SUBMITTALS**

A. Product Data: Submit manufacturer current technical literature for each component.
B. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.
C. Quality Assurance Submittals:
   1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
   2. Manufacturer Instructions: Provide manufacturer’s written installation instructions.
D. Closeout Submittals:
   1. Refer to Section 01 7800 Closeout Submittals.

**1.05 QUALITY ASSURANCE**

A. Qualifications:
   1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
   2. Installation shall be in accordance with weather barrier manufacturer’s installation guidelines and recommendations.
B. Mock-up:
   1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer’s current printed instructions and recommendations.
      a. Mock-up size: 10 feet by 10 feet
b. Mock-up Substrate: Match wall assembly construction, including window opening.
c. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE AND HANDLING
A. Refer to Section 01 6000 Product Requirements.
B. Deliver weather barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.
C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.07 SCHEDULING
A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

PART 2 PRODUCTS
2.01 MANUFACTURER
C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS
A. Commercial Grade materials only.
   1. Performance Characteristics:
      a. Air Penetration: Type 1 when tested in accordance with ASTM E 1677.
      b. Water Vapor Transmission: 30 perms, when tested in accordance with ASTM E 96, Method B.
      c. Water Penetration Resistance: 235 cm when tested in accordance with AATCC Test Method 127.
      d. Basis Weight: 2.4 oz/yd2, when tested in accordance with TAPPI Test Method T-410.
      e. Air Infiltration Resistance: Air infiltration at >750 seconds, when tested in accordance with TAPPI Test Method T-460.
      f. Tensile Strength: 33/41 lbs/in., when tested in accordance with ASTM D 822, Method A.
      g. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 15, Smoke Developed: 25.

2.03 ACCESSORIES
A. Seam Tape: Tape as manufactured by weather barrier manufacturer and compatible with all other products in this installation.
B. Fasteners:
   1. #4 nails with large 1-inch plastic cap fasteners or 1-inch minimum plastic cap staple with a 7/8” minimum staple length.
C. Sealants
   1. Refer to Section 07 9005 Joint Sealants.
   2. Provide Sealants recommended by the weather barrier manufacturer.
D. Adhesives:
   1. Provide adhesive recommended by weather barrier manufacturer.
E. Primers:
   1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
   2. Products:
      a. Primers recommended by the flashing manufacturer
F. Flashing:
1. Flexible membrane flashing materials for window openings and penetrations.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.02 INSTALLATION - WEATHER BARRIER
   A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
   B. Install weather barrier prior to installation of windows and doors.
   C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
   D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.
   E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.
   F. Window and Door Openings: Extend weather barrier completely over openings.
   G. Overlap weather barrier:
      1. Exterior corners: minimum 12 inches.
      2. Seams: minimum 6 inches.
   H. Weather Barrier Attachment:
      1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommend fasteners, space 6 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

3.03 SEAMING
   A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
   B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.04 OPENING PREPARATION (AT ALUMINUM STOREFRONT OPENINGS AND OTHER NON FLANGED INSTALLATIONS)
   A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.
   B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.05 FLASHING (AT ALUMINUM STOREFRONT OPENINGS AND OTHER NON FLANGED INSTALLATIONS)
   A. Cut flexible flashing a minimum of 12 inches longer than width of sill rough opening.
   B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
   C. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
   D. Apply 9-inch wide strips of flexible flashing at jambs. Align flashing with interior edge of jamb framing. Start flexible flashing at head of opening and lap sill flashing down to the sill.
   E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.
   F. Install flexible flashing at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.
   G. Coordinate flashing with window installation.
   H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer’s instructions and ASTM C 1193.
   I. Position weather barrier head flap across head flashing. Adhere using 4-inch wide flexible flashing over the 45-degree seams.
J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer’s instructions and ASTM C 1193.

3.06 OPENING PREPARATION (FOR USE WITH FLANGED WINDOWS)

A. Cut weather barrier in a modified “i-cut” pattern.
   1. Cut weather barrier horizontally along the bottom of the header.
   2. Cut weather barrier vertically 2/3 of the way down from top center of window opening.
   3. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.
   4. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.07 FLASHING (FOR USE WITH FLANGED WINDOWS)

A. Cut flexible flashing a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer’s instructions.

F. Apply 4-inch wide strips of flexible flashing at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply 4-inch wide strip of flexible flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide flexible flashing over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer’s instructions and ASTM C 1193.

3.08 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION
SECTION 07 4213
METAL WALL PANEL SYSTEM

PART 1 - GENERAL

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

1.02 SUMMARY
B. This Section includes
   1. Factory-formed: exposed-fastener, metal wall panels.
   2. Finish must conform to the “Metal Construction Association Certified Premium Painted designation.

1.03 RELATED SECTIONS
A. Division 5 Section “Cold Formed Metal Framing”
B. Division 6 Section “Rough Carpentry”
C. Division 7 Section “Sheet Metal Flashing and Trim”
D. Division 7 Section “Gutters and Downspouts”
E. Division 7 Section “Manufactured Copings”

1.04 PERFORMANCE REQUIREMENTS
A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
B. System shall meet performance criteria as installed. Either test data or signed and sealed engineering calculations shall document the performance of the panel system to meet design loads required.
C. Wind Loading: Design and size components to withstand dead and live loads caused by wind pressures as follows:
   1. Positive pressure: 27 psf normal to panel.
   2. Negative pressure: 45 psf normal to panel.
D. Maximum Deflection under Design Loads:
   1. 1/240 of span.
E. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
F. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft.

1.05 SUBMITTALS
A. Product Data: Manufacturer's current product specifications and installation instructions.
B. Shop Drawings: Include small-scale elevations, as required. Show details of trim and flashing conditions, fastening and anchorage methods, weatherproofing techniques, terminations, and penetrations.
C. Samples:
   1. Selection Samples: Submit actual metal chips with full range of colors available for Architect's selection.
   2. Verification Samples: Submit two samples of each type of metal panel required, not less than 12 inches (305 mm), and illustrating finished panel profile.
D. Product Test Reports: Submit copies of test reports or load tables verifying performance capability of panel system:
   2. Fastener test and pull-out calculations.
   3. Load tables.

1.06 QUALITY ASSURANCE
A. Installer: Company specializing in the type of work required for this project, with not less than 5 years of documented experience.
B. Pre-Installation meeting: Convene meeting not less than one week prior to beginning installation between general contractor, installing contractor, owner's representative and manufacturer.

1.07 DELIVERY, STORAGE & HANDLING
A. Do not deliver materials of this section to project site until suitable facilities for storage and protection are available.
B. Protect materials from damage during transit and at project site. Store under cover, but sloped to provide
positive drainage. Do not expose materials with strippable protective film to direct sunlight or extreme
heat.
C. Do not allow storage of other materials or allow staging of other work on installed metal panel system.
D. Upon receipt of delivery of metal panel system, and prior to signing the delivery ticket, the installer is to
examine each shipment for damage and for completion of the consignment.

1.08 WARRANTY
A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair
finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within
specified warranty period.
   1. Fluoropolymer Finish Warranty Period: 30 years from date of Substantial Completion.
B. Special Installer's Warranty: Specified form in which Wall Installer agrees to repair or replace
components of custom-fabricated sheet metal wall that fail in materials or workmanship within 5 years
from date of Substantial Completion.

PART 2 – PRODUCTS
2.01 MANUFACTURERS
A. Basis-of Design Product: ATAS International, Inc.; Belvedere™ BWK360
B. Other Acceptable Manufacturers (providing proof of matching the Basis of Design can be achieved):
   c. Sheffield Metals International: www.sheffieldmetals.com
   d. Substitutions: See Section 01 6000 – Product Requirements.
C. Manufacturer's Qualifications: All panels are to be factory formed and packaged per job requirements.
   1. Manufacturer shall have a minimum of ten (10) years' experience in the factory fabrication of metal
      wall panels.
   2. Manufacturer must be certified to ISO 9001:2008 with design.
D. Coordinate with insulation requirements as noted by Architect.
E. Secondary framing members as required for load criteria and wind requirements.

2.02 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS
A. Exposed-fastener, Lap seam Metal Wall Panels: Provide Factory-formed, designed to be field assembled
   by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed
   fasteners in side laps. Include accessories required for weather tight installation.
B. Ribbed-Profile, Exposed-Fastener Metal Wall Panels
      a. Texture: Smooth.
      b. Finish: KYNAR 5000® PDVF or HYLAR 5000® Finish.
      c. Color: Standard or Premium color to be chosen later.
   2. Panel Coverage: 36".
   3. Panel Height: 1-1/2".
   4. Panel Application Orientation: Horizontal and Diagonal matching the roof slope of 1:12.
   5. Major Rib Spacing: 6".

2.03 FABRICATION
A. Panels:
   1. Panels to be Factory fabricated in a controlled environment.
   2. Panels to be tension leveled during roll forming process.
   3. Panels to be produced in longest lengths possible, except when modular units are utilized.
B. Form all components true to shape, accurate in size, square and free from distortion or defects. Cut
   panels to precise lengths indicated on approved shop drawings or as required by field conditions.
C. Accessories: Factory fabricates trim and flashing components in standard 12-foot lengths.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate wall panels as required to maintain fabrication tolerances and to withstand design loads.
D. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with
   joints between panels designed to form weathertight seals.
E. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable,
   temporary protective covering before shipping.
F. Panels, fabrication, and installation shall meet the requirements of the Metal Construction Association
   Preformed Metal Wall Guidelines.
PART 3 - EXECUTION

3.01 PREPARATION

A. Field Measurements
   1. Field measurements should be taken by the installer for verification of dimensional correctness in relationship to original plans, prior to providing manufacturer with a bill of material.

B. Delivery, Storage, and Handling
   1. Do not deliver materials of this section to project site until suitable facilities for storage and protection are available.
   2. Protect materials from damage during transit and at project site. Store under cover, but sloped to provide positive drainage. Do not expose materials with strippable protective film to direct sunlight or extreme heat.
   3. Do not allow storage of other materials or allow staging of other work on installed metal panel system.
   4. Upon receipt of delivery of metal panel system, and prior to signing the delivery ticket, the installer is to examine each shipment or damage and for completion of the consignment.

C. Sequencing and Scheduling
   1. Installer shall coordinate with general contractor as to scheduled delivery time after receipt of field verified bill of material by manufacturer as it relates to actual project scheduling.

3.02 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal wall panels by torch is not permitted.
   2. Rigidly fasten metal wall panels and allow for thermal expansion and contraction as required by the panel manufacturer. Pre-drill panels as required.
   3. Install screw fasteners.
   4. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing and material compatibility.
   6. Provide weatherproof seals for pipe and conduit penetrating exterior walls.

B. Fasteners: Use fasteners of size and length as required for compatibility with substrate.
   1. Steel Wall Panels: Use stainles-stell fasteners or metallic coated fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
   2. Exposed fasteners shall have a high performance factory applied coating to match paint color.
   3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.

D. Provide water and air infiltration retarder / barriers as noted within project documents.

3.03 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   3. Panels, fabrication and installation shall meet the requirements of the Metal Construction Association Preformed Metal Wall Guidelines.

3.04 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed. Maintain in a clean condition during construction.

B. Protection:
   1. Provide as required, completed work of this section will be without damage or deterioration at date of substantial completion.

C. Touch up minor abraisons with matching paint provided by panel manufacturer. Remove and replace panels that cannot be satisfactorily touched up. See Metal Construction Association Technical Bulletin...
D. Sweep and remove chips, shavings and dust from roof on a daily basis during installation period. Leave installed work clean, free from grease, finger marks and stains. Remove all protective masking from material immediately after installation of product.
E. Upon completion of installation, remove scraps and debris from project site.
F. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt and sealant.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wall panel assembly consisting of:
      a. Metal Composite Material (MCM)
      b. Installation System
      c. Accessories
   2. The extent of the wall panel assembly as indicated in these specifications and in the drawings.

B. Related Sections:
   1. Section 05 1200 Structural Steel Framing
   2. Section 06 1053 Miscellaneous Rough Carpentry
   3. Section 07 2100 Thermal Insulation
   4. Section 07 6200 Sheet Metal Flashing And Trim
   5. Section 07 9005 Joint Sealers
   6. Section 08 4113 Aluminum Frames, Entrances, and Storefronts

1.02 REFERENCES

A. American Society For Testing And Materials (ASTM)
   1. ASTM B117 Standard Practice For Operating Salt Spray (Fog) Apparatus
   2. ASTM B137 Standard Test Method For Measurement Of Coating Mass Per Unit Area On Anodically Coated Aluminum
   3. ASTM B211 Standard Specification For Aluminum And Aluminum-Alloy Rolled Or Cold Finished Bar, Rod, And Wire
   4. ASTM B680 Standard Test Method For Seal Quality Of Anodic Coatings On Aluminum By Acid Dissolution
   5. ASTM C267 Standard Test Methods For Chemical Resistance Of Mortars, Grouts, And Monolithic Surfacings And Polymer Concretes
   6. ASTM C297 Standard Test Method For Flatwise Tensile Strength Of Sandwich Construction
   8. ASTM D523 Standard Test Method For Specular Gloss
   9. ASTM D635 Standard Test Method For Rate Of Burning And/Or Extent And Time Of Burning Of Plastics In A Horizontal Position
   10. ASTM D714 Standard Test Method For Evaluating Degree Of Blistering Of Paints
   13. ASTM D1781 Standard Test Method For Climbing Drum Peel For Adhesives
   14. ASTM D1929 Standard Test Method For Determining Ignition Temperature Of Plastics
   15. ASTM D2244 Standard Practice For Calculation Of Color Tolerances And Color Differences From Instrumentally Measured Color Coordinates
   16. ASTM D2247 Standard Practice For Testing Water Resistance Of Coatings In 100% Relative Humidity
   17. ASTM D2248 Standard Practice For Detergent Resistance Of Organic Finishes
19. ASTM D3359 Standard Test Methods For Measuring Adhesion By Tape Test
20. ASTM D3363 Standard Test Method For Film Hardness By Pencil Test
21. ASTM D4145 Standard Test Method For Coating Flexibility Of Prepainted Sheet
22. ASTM D4214 Standard Test Methods For Evaluating The Degree Of Chalking Of Exterior Paint Films
23. ASTM D5420 Standard Test Method For Impact Resistance Of Flat, Rigid Plastic Specimen By Means Of A Striker Impacted By A Falling Weight (Gardner Impact)
25. ASTM E283 Standard Test Method For Determining Rate Of Air Leakage Through Exterior Windows, Curtain Walls, And Doors Under Specified Pressure Differences Across The Specimen
27. ASTM E331 Standard Test Method For Water Penetration Of Exterior Windows, Skylights, Doors, And Curtain Walls By Uniform Static Air Pressure Difference

B. American Architectural Manufacturers Association (AAMA)
   1. AAMA 2605 Voluntary Specification, Performance Requirements And Test Procedures For Superior Performing Organic Coatings On Aluminum Extrusions And Panels

1.03 DEFINITIONS
A. Metal Composite Material (MCM): A factory manufactured panel consisting of metal skins bonded to a plastic core, as defined by the International Building Code (IBC) Section 1402.
B. ISO 9001:2008: A set of guidelines set forth by the International Organization For Standardization (ISO) to provide guidance and tools for companies and organizations who want to ensure that their products and services consistently meet customer’s requirements, and that quality is consistently improved.

1.04 SYSTEM DESCRIPTION
A. Design Requirements:
   1. Barrier System: Wall panel assembly shall be designed in accordance with manufacturer’s guidelines to be sealed at all panel joints, intersections, dissimilar material abutments, and cutouts, thus providing a weathertight barrier system.
   2. Expansion and Contraction: Wall panel assembly shall be designed with provisions for thermal expansion and contraction of the component parts to prevent buckling, failure of joint seals, undue stress on fasteners or other detrimental effects due to accumulation of dead loads and various live loads.
   3. Windload: Wall panel assembly shall be designed to withstand a positive and negative windload pressure acting inward and outward normal to the plane of the wall to meet the requirements of the latest adopted Local Building Code.

B. General Performance: Wall panel assembly shall comply with performance requirements, as determined by the following testing performed by a qualified agency.

1.05 SUBMITTALS
A. Product Data:
   1. Submit manufacturer's datasheet for specified product.
   2. Submit manufacturer's installation guidelines for specified product.
B. Shop Drawings: Submit shop drawings indicating project layout and elevations, fastening and anchoring methods, dimensions of individual components and profiles, detail and location of joints, sealants and gaskets, flashing and accessories.
C. Samples:
   1. Submit two (2) samples 3” x 5” of each product specified.
   2. Submit two (2) samples 3” x 5” of each finish specified.
D. Test Reports: Submit test reports indicating compliance of products with specified performance requirements from an independent testing agency.
E. Warranty: Submit manufacturer’s warranty meeting the requirements of this section.

1.06 QUALITY ASSURANCE
A. Qualifications:
1. Manufacturer: Manufacturer shall have a minimum of ten (10) years’ experience in the manufacture of this product, shall be an ISO 9001:2008 Registered Company, and shall be located within the United States of America.
2. Installer: Installer shall be experienced in performing work of this section and in work of similar scope required by this project.

B. Pre-Installation Meeting:
1. Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Acceptance at Site:
1. Materials to be packaged to protect against transportation damage. Examine materials upon receipt to ensure that no damage has occurred during shipment.

B. Storage And Protection:
1. Storage: Materials should be stored horizontally on pallets or platforms, covered with a suitable ventilated and weathertight covering. Do not store materials where accumulation of moisture may occur or in contact with materials that might cause staining, denting, or other damage.
2. Material Handling: Use care in unloading, storing, and erecting the materials to prevent bending, warping, and twisting. Protect finish and edges from damage. The protective film on the panel surface is to remain in place until installation and shall be removed immediately upon completion.

1.08 PROJECT CONDITIONS
A. Field Measurements: Verify location and dimension of all elements related to the installation of the wall panel assembly. Indicate those measurements on the shop drawings.

B. Limitations: Proceed with installation of the wall panel assembly only when existing site conditions comply with manufacturer’s recommendations.

1.09 WARRANTY
A. Metal Composite Material (MCM):
1. Panel: The integrity of the panel bond will remain intact for a minimum of five (5) years from the Date of Substantial Completion.
2. Finish:
   a. Polyvinylidene Fluoride (PVDF):
      1) The finish will not have a Fade Differential of greater than 5E units. Testing shall be in accordance with ASTM D2244.
      2) The finish will not have a Chalk Rating of less than 8. Testing shall be in accordance with ASTM D4214.
      3) The finish will not check, peel, lose adhesion or fracture (other than minute fractures which may develop due to fabrication and which are acceptable by industry standards on the Date Of Substantial Completion).
      4) Warranty period shall be thirty (30) years from the Date Of Substantial Completion.
   b. Anodized:
      1) The finish will not check, peel, lose adhesion or fracture.
      2) Warranty period shall be twenty (20) years from the Date Of Substantial Completion.
B. Installation System:
1. Fabricator and/or installer standard form in which they agree to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.
2. Weathertight warranties or other such guarantees regarding installation shall be the responsibility of the installing contractor.
C. Accessories: Warranties or other such guarantees regarding accessories used during installation shall be the responsibility of the installing contractor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Citadel Architectural Products, Inc.; 3131-A North Franklin Road; Indianapolis, IN 46226 ph: (800) 446-8828; fax: (800) 247-2635; www.citadelap.com; info@citadelap.com

B. Substitutions:
1. Not permitted without approval of the architect 10 days prior to bid.
2. Items being submitted for consideration must be of the same function and meet the performance requirements set forth in this section.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
1. Product Data: Submit product data including testing performed by a qualified agency indicating compliance with performance requirements specified in this section.
2. Samples: Submit two (2) samples 3" x 5" of each proposed product substitution.

2.02 WALL PANEL ASSEMBLY

A. Metal Composite Material (MCM):
   a. Composition: Face: .024" (min) prefinished smooth aluminum Core: .105" thermoset phenolic resin Back: .010" primed smooth aluminum
   b. Thickness: 4mm (nominal)
   c. Weight: 1.25 lbs/ft²
   d. Tolerance: Thickness: ±1/32" Length / Width: +0, -1/8" Squareness: 1/64" per lineal ft.
   e. Performance:
      1) Surface Burning Characteristics: Panel shall have a Class A rating with a Flame Spread Index less than 25, and a Smoke Developed Index less than 450. Testing shall be in accordance with ASTM E84.
      2) Bond Integrity: Panel shall have a minimum peel strength of 34.5 lb-in/lb. Testing shall be in accordance with ASTM D1781.
      3) Ignition Temperature: Panel shall have a minimum self-ignition temperature of 900° F. Testing shall be in accordance with ASTM D1929.
      4) Impact Resistance: Panel shall not have a deformation measuring larger than 0.186" in diameter or 0.007" in depth after being struck by a falling ball at 24 in-lb. Testing shall be in accordance with ASTM D5420.
      5) Rate Of Burning: Panel shall have a CC1 Classification indicating a burning extent of 1" (25.4mm) or less when tested at a nominal thickness of .060" (1.5mm) or thickness of intended use. Testing shall be in accordance with ASTM D635.
      6) Tensile Strength: Panel shall have a mean value of 1650 lbs. Testing shall be in accordance with ASTM C297.

2. Finish:
   a. Polyvinylidene Fluoride (PVDF):
      1) Type: Kynar 500® coating using 70% resin. Finish shall be in conformance with AAMA 2605.
      2) Color:
         a) As selected by Architect from manufacturer's color guide.
      3) Composition:
         a) Three-Coat Colors: 0.2-mil primer coat, 0.8-mil color coat, 0.7-mil clear coat.
      4) Performance:
         a) Gloss: Finish shall have a gloss value of 20-35 at 60°. Testing shall be in accordance with ASTM D523.
b) Solar Reflectance: Finish shall have a value of >25% initial, >15% after 3 years for Steep Slope and a value of >65% initial, >50% after 3 years for Low Slope. Testing shall be in accordance with ASTM E903.

c) Emissivity: Finish shall have a value of 0.80 (80%) min. Testing shall be in accordance with ASTM C1371.

d) Pencil Hardness: Finish shall have a value of F-2H. Testing shall be in accordance with ASTM D3363.

e) Flexibility: Finish shall have a value of 0-2 T-bend, no pick off. Testing shall be in accordance with ASTM D4145.

f) Adhesion: Finish shall have a value of No Adhesion Loss. Testing shall be in accordance with ASTM D3359.

g) Reverse Impact: Finish shall have a value of No Cracking Or Adhesion Loss. Testing shall be in accordance with ASTM D2794.

h) Abrasion: Finish shall have a value of 65-85 l/mil. Testing shall be in accordance with ASTM D968.

i) Mortar Resistance: Finish shall have a value of No Effect. Testing shall be in accordance with ASTM C267.

j) Detergent Resistance: Finish shall have a value of No Effect using 3% detergent @ 100 F° (72 hrs). Testing shall be in accordance with ASTM D2248.

k) Acid Resistance: Finish shall have a value of No Effect using 10% muriatic acid (24 hrs) and No Effect using 20% sulfuric acid (18 hrs). Testing shall be in accordance with ASTM D1308.

l) Acid Rain: Finish shall have a value of No Objectionable Color Change after 15 cycle min. Testing shall be in accordance with Kesternich SO2, DIN 50018.

m) Alkali Resistance: Finish shall have a value of No Effect using 10%, 25% NaOH (1 hr). Testing shall be in accordance with ASTM D1308.

n) Salt Spray Resistance: Finish shall have a value of No Face Blistering; Max average 1/16" scribe creep, passes 4000 hrs using 5% salt fog @ 95° F. Testing shall be in accordance with ASTM B117.

o) Humidity Resistance: Finish shall have a value of Passes 4000 hrs, No #8 blisters using 100% relative humidity @ 95° F. Testing shall be in accordance with ASTM D714, ASTM D2247.

p) Exterior Exposure: Finish shall have a value of Max 5 fade and Max 8 chalk at 10 yrs @ 45°, south Florida. Testing shall be in accordance with ASTM D2244, ASTM D4214.

b. Anodized:

1) Type: AA-C22-A21 (clear) AA-C22-A23 (colored)

2) Color: As selected by Architect from manufacturer's color guide.

3) Composition:
   a) Anodized (clear): barrier, aluminum oxide, nickel/hydrate seal
   b) Anodized (colored): barrier, aluminum oxide, colorant, nickel/hydrate seal

4) Performance:
   a) Salt Spray Resistance: Testing shall be in accordance with ASTM B117.
   b) Acid Dissolution: Testing shall be in accordance with ASTM B680.
   c) Gloss: Testing shall be in accordance with ASTM D523.
   d) Coating Mass: Testing shall be in accordance with ASTM B137.

B. Installation System:

1. Reveal (RV) System:
   a. Description: Field-assembled installation system consisting of metal composite material (MCM), trim moldings, silicone sealant, and accessories to provide a barrier system.
   b. Performance:
1) Air Infiltration: Installation system shall not allow air infiltration in excess of 0.06 cfm/ft² at 1.57 psf. Testing shall be in accordance with ASTM E283.

2) Structural Performance: Installation system shall have a design load of 35.0 psf applied in the positive and negative direction. There shall be no deflection in excess of L/175 of the span of any support member nor shall there be any failure of the system. At a structural test load equal to 1.5 times the specified design load, no support member shall have permanent deformation in excess of 1/1000 of its span nor shall there be any failure of the system. Testing shall be in accordance with ASTM E330.

3) Water Penetration: Installation system shall not have uncontrolled water penetration to the room side at a static air pressure differential of 15.0 psf. Testing shall be in accordance with ASTM E331.

c. Trim Moldings:
   1) CRAX-1 Horizontal / Vertical (Reveal)
   2) CRAX-2 Perimeter J (Reveal)
   3) CRAX-3 Perimeter J
   4) CRAX-4 Inside Corner
   5) CRAX-5 Outside Corner
   6) CRAX-6 Horizontal / Vertical (3" Reveal)
   7) CRAX-7 Horizontal / Vertical
   8) CRAX-8 Outside Corner (Adjustable)
   9) CRAX-9 Inside Corner (Adjustable)

C. Accessories:
   1. Extrusions:
      a. Shall conform with ASTM B211 and the manufacturer's recommendations.
      b. Shall be applied in accordance with the panel manufacturer's installation guidelines.
   2. Sealants:
      a. Selected from the panel manufacturer's approved list of sealants.
      b. Shall be applied in accordance with both the panel manufacturer's installation guidelines and the sealant manufacturer's recommendations.
   3. Fasteners:
      a. Selected by contractor to suit project requirements.
      b. Shall be applied using the recommended fastener schedule in accordance with panel manufacturer's installation guidelines.
      c. Shall be coated to prevent corrosion and/or reaction with other materials.
      d. Shall be concealed except where unavoidable. Exposed fasteners shall be finished to match adjoining metal.
   4. Flashing:
      a. Selected by contractor to suit project requirements.
      b. Shall be installed in such a manner to maintain the integrity of the wall system against moisture intrusion.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate to receive the work of this section to verify that the conditions are acceptable for installation.
   1. Substrate to receive panels shall be even, smooth, sound, clean, dry, and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work.
   2. Substrate to receive panels shall be in vertical and horizontal alignment with no more deviation than 1/4" in 20'.
B. Proceed with installation only after all unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.02 PREPARATION
A. Verify dimensions as required.
B. Protect adjacent work areas and finished surfaces to prevent damage that otherwise might occur during the work of this section.

3.03 INSTALLATION
A. Wall panel assembly shall be installed in accordance with the manufacturer's written installation guidelines and the approved set of shop drawings.
B. Erect wall panel assembly level and true to the intended plane.
C. Maximum deviation from vertical and horizontal alignment of erected wall panel assembly shall be no more than 1/4" in 20'-0".
D. Maximum deviation in panel flatness shall be 0.6% of the assembled units.
E. Seal all joints as required using methods and materials as recommended by the panel manufacturer.

3.04 CLEANING
A. Remove panel masking immediately after installation. Delay will result in difficulty with removal and possibly residue on the panel surface.
B. Remove temporary coverings and protection to adjacent work areas.
C. Remove and legally dispose of construction debris from project site.

END OF SECTION
PART 1 - GENERAL

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

1.02 PREINSTALLATION MEETINGS
A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.03 SUMMARY
A. Section Includes:
   1. Fully adhered membrane roofing over substrate system including cover boards.
   2. Vapor barrier.
   3. Roof insulation and taper system.

1.04 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Membrane Layout and Fastening Pattern (Corners, Perimeters and Field).
   3. Cover Board fastening patterns.
C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
1. Installer shall provide business address showing a location no more than four hours distant from project site.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article and roof system, as indicated in the construction documents, meets requirements for roof system warranty specified in "Warranty" Article.

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

F. Warranties: Special warranties specified in this Section.

G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.05 CLOSEOUT SUBMITTALS
A. Maintenance Data: For roofing system to include in maintenance manuals.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: A qualified firm with 5-years (minimum) documented experience installing thermoplastic membrane systems that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty. Submit the following qualification data:

1. Project Foreman or Superintendent shall have supervised a minimum of five (5) project of similar size and scope as this Project. Contractor shall provide Name and address of these five (5) project of similar size and scope as this Project. Include contact name and phone number for reference.

B. Manufacturer Qualifications: A qualified manufacturer with twenty (20) year's experience manufacturing the same membrane without formulation changes. The roofing membrane and system shall be identical to that used for this Project and which can show evidence of these materials being satisfactorily used on at least Ten (10) projects of similar size, scope and type within such a period. At least three (3) projects in Wyoming shall have been in successful use for 10 years or longer. Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

1. Manufacturer's with less than the stipulated years of experience under a single name may be included with documentation of production of membrane material under of the same formula under another corporate identity.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 FIELD CONDITIONS
A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.09 WARRANTY
A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, walkway products and other components of membrane roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

3. Warranty shall include 1 1/2" hail warranty and shall not include exclusions for ponding water.
4. Warranty Shall Include 115 MPH wind damage clause to repair damage by winds up to 115 MPH as substantiated by the nearest certified weather station.

5. Installed membrane shall carry FM field of roof rating of 1-75 against uplift.

B. Installer Warranty: Installer shall provide additional 2 year warranty against defects in workmanship and installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1. Typical Roof area (outward): 40 PSF
2. Typical Roof Special Zone 1 (Eaves, Rakes and Ridges - Outward): 67 PSF.
3. Roof Special Zone 2 (Corners - Outward): 100 PSF.
4. Typical Parapet (Inward or Outward): 86 PSF.
5. Parapet Corners (Inward or Outward): 118 PSF.

D. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.02 KETONE ETHYLENE ESTER (KEE) ROOFING

A. KEE Sheet: ASTM D6754/D6754M, Keytone Ethylene Ester (KEE) Sheet Roofing and system dependant accessories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products specified by Seaman Corporation; FiberTite 50 XT or comparable product.
2. Physical Material Properties:
   a. Thickness: Per ASTM D-751; .050 Minimum.
   b. Tensile Strength: Per ASTM D-882 and ASTM D-751; 9500 psi.
   c. Breaking Strength: Per Grab Method; 400 lbs.
   d. Tear Strength (8" x 10" sample): Per ASTM D-751; 125 lbs.
   e. Puncture Resistance: Per Fed. Std. 101B, Method 2031; 23 joules
   f. Dimensional Stability ASTM D-12040.5%.
   g. Low Temperature: ASTM D-2136; -40F.
   h. Accelerated Weathering: Per Carbon Arc with water Spray; 5,000 hours - no cracking, blistering, or crazing.
   i. Oil Resistance: Per Mil-20696C; No swelling, cracking or leaking.
   j. Hydrocarbon Resistance: Per Mil-C-20696C; No swelling, cracking or leaking.
   k. Seam Strength: Per ASTM D-751; 100% of Fabric.
   l. Coating Adhesion: Per ASTM D-751; Cannot initiate coating peel.
   m. Color: White.
   n. Maximum Sheet width 78".

2.03 AUXILIARY ROOFING MATERIALS

A. Auxiliary Materials: In general, Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
1. **Sheet Flashing:** Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
2. **Bonding Adhesive:** Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
3. **Metal Termination Bars:** Manufacturer's standard predrilled aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
4. **Metal Battens:** Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.
5. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
6. **Miscellaneous Accessories:** Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
7. **Wood Nailers:** As required by roofing manufacturer.

### 2.04 COVER BOARD

A. **Cover Board:** ASTM C1177/C1177M, glass-mat, water-resistant gypsum board, or ASTM C1278/C1278M fiber-reinforced gypsum board.
   1. **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:
      a. Dens Deck prime.
      b. Securock Gypsum Fiber.
      c. Or approved equal.
   2. **Thickness:** 1/2 inch.
   3. **Surface Finish:** Factory primed.

### 2.05 DECK SHEATHING

A. **Cover Board:** ASTM C1177/C1177M, glass-mat, water-resistant gypsum board, or ASTM C1278/C1278M fiber-reinforced gypsum board.
   1. **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:
      a. Dens Deck prime.
      b. Securock Gypsum Fiber.
      c. Or approved equal.
   2. **Thickness:** 5/8 inch.
   3. **Surface Finish:** Factory primed.

### 2.06 VAPOR RETARDER

A. **Vapor barrier:** Polyethylene Film: ASTM D4397, clear polyethylene; 15 mils thickness.
   1. **Tape:** Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

### 2.07 INSULATION

A. **General:** Prefinished roof insulation boards manufactured or approved by KEE roof membrane manufacturer.
B. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   3. Or approved equal.
C. **Base Insulation System:**
   1. **Polyisocyanurate Board Insulation:** Rigid cellular foam, complying with ASTM C 1289, Type II, Class 1 with the following characteristics:
      a. Premanufactured tapering system.
      b. Compressive Strength: 16 psi.
      c. **Board Size:** 48 x 96 inch, base size, trimmed and tapered as necessary to achieve drainage patterns indicated on drawings.
d. Board Thickness: Base 6.6" thickness layer boards as necessary to achieve final base thickness, stagger joints by a minimum of 6".
   1) Add additional thickness as necessary to achieve slope

e. Board Edges: Square


g. In general, provide preformed roof insulation boards that comply with requirements and referenced standards.

D. Tapered insulation system: Same core material and properties as board insulation.
   1. Premanufactured tapering system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from spilling or migrating onto surfaces of other construction.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Where indicated, install preformed sound absorbing glass fiber insulation strips supplied with deck material in acoustic deck flutes. Install in accordance with manufacturer's instructions.

3.03 INSTALLATION OF DECK FIRE BARRIER BOARD

A. Loose lay with long side at right angle to flutes; stagger end joints; provide support at ends.

B. Cut barrier board cleanly and accurately at roof breaks and protrusions to provide smooth surface.

C. Tape joints.

D. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual recommendations and manufacturer's instructions.
   1. Fasten cover board and insulation using eight (8) threaded fasteners and plates per (4' by 8') board minimum.
   2. Over entire roof area, fasten sheathing using 6 fasteners with washers per sheathing board.

3.04 INSTALLATION OF VAPOR BARRIER

A. Install vapor barrier perpendicular over fire barrier board.

B. Lap edges and ends a minimum of 4 inches and tape all joints with 2 inch wide tape. Lap joints in the downhill direction such that the completed vapor barrier will shed water.

3.05 INSTALLATION OF BASE AND TAPER SYSTEM

A. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

B. Attachment of Insulation:
   1. Loose lay first layer of insulation.
   2. Mechanically fasten subsequent insulation layers to deck in accordance with insulation manufacturer's instructions and Factory Mutual requirements and the uplift resisting requirements of the structural engineer as noted in this document.

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, maintain minimum 1/4" per foot slope for all taper systems.

E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
F. Tape joints of insulation in accordance with insulation manufacturer's instructions.
G. At roof drain sumps, use boards cut to slope to slope down to bottom of sump pan. Provide R-18 in sump pan at roof drains, with a minimum sump pan in each location of 18 inches clear of drain basket on all sides.
H. Do not apply more insulation than can be covered with membrane in same day.
I. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
J. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

3.06 INSTALLATION OF COVER BOARD
A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 12 inches in each direction. Loosely butt cover boards together and fully adhere to underlying material with adhesive recommended by and compatible with the roof insulation manufacturer's products at the rate prescribed by the manufacturer to comply with the established wind resistance rating.

3.07 INSTALLATION OF FULLY ADHERED ROOFING MEMBRANE
A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
D. Shingle joints on sloped substrate in direction of drainage.
E. Apply adhesive to substrate at rate prescribed by the manufacturer and as necessary to meet wind and uplift warranty terms. 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.
F. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
G. At intersections with vertical surfaces:
   1. Extend membrane as detailed up parapets and other vertical surfaces using manufacturer's recommended intermediate membrane clips as necessary.
   2. Fully adhere flexible flashing over membrane and up to reglets.
   3. Secure flashing to nailing strips at 4 inches on center.
   4. Insert flashing into reglets and secure.
H. Fully Adhere roofing membrane securely at terminations, penetrations, and perimeter of roofing.

3.08 BASE FLASHING INSTALLATION
A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

3.09 FIELD QUALITY CONTROL
A. Pre-Installation Conference: Contractor shall include in their bid, the cost for roofing system manufacturer's technical personnel to attend the Pre-Installation Conference.
B. Carry out all roof inspections required by manufacturer for warranty issue arrange for such inspections with the manufacturer in accordance with their requirements at a minimum provide for the following inspection schedules even if not required by the manufacturer.
   1. Contractor shall include in their bid, the cost for roofing system manufacturer's technical personnel to inspect roofing installation prior to the contractor's completion of 50% of the project. Upon completion of this inspection, the roofing system manufacturer's technical personnel shall submit an in-progress report to the Owners representative.
Final Roof Inspection: Contractor shall include in their bid, the cost for the roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit final inspection report to the Owners representative.

3. Notify Owner's representative 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

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

E. The Owner retains the right to hire a roofing specialist to inspect the work. This consultant may or may not attend the Manufacturer's inspection tour at the Owner's discretion.

1. The Contractor shall provide access to the Owner's Independent Roofing Consultant with a minimum of 24 hours' notice.

2. The Owner's Independent Roofing Consultant is not empowered to direct or otherwise authorize changes to the work.

3.10 PROTECTING AND CLEANING

A. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Repair or replace defaced or damaged finishes caused by work of this section.

END OF SECTION
PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Formed wall sheet metal fabrications.
      2. Formed equipment support flashing.
      3. Formed overhead-piping safety pans.

1.03 COORDINATION
   A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
   B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
      3. Review requirements for insurance and certificates if applicable.
      4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.05 SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
   B. Shop Drawings: For sheet metal flashing and trim.
      1. Include plans, elevations, sections, and attachment details.
      2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
      3. Include identification of material, thickness, weight, and finish for each item and location in Project.
      4. Include details for forming, including profiles, shapes, seams, and dimensions.
      5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
      6. Include details of termination points and assemblies.
      7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
      8. Include details of roof-penetration flashing.
      9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
     10. Include details of special conditions.
     11. Include details of connections to adjoining work.
     12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
   C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
   D. Samples for Verification: For each type of exposed finish.
1. **Sheet Metal Flashing**: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. **Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications**: 12 inches long and in required profile. Include fasteners and other exposed accessories.

3. **Unit-Type Accessories and Miscellaneous Materials**: Full-size Sample.

**E. Qualification Data**: For fabricator.

**F. Product Test Reports**: For each product, for tests performed by a qualified testing agency.

**G. Sample Warranty**: For special warranty.

### 1.06 CLOSEOUT SUBMITTALS

**A. Maintenance Data**: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

### 1.07 QUALITY ASSURANCE

**A. Fabricator Qualifications**: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

### 1.08 DELIVERY, STORAGE, AND HANDLING

**A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

**B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

### 1.09 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. **Exposed Panel Finish**: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. **Finish Warranty Period**: 20 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

**A. General**: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

**B. Sheet Metal Standard for Flashing and Trim**: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

**C. Thermal Movements**: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. **Temperature Change**: 120 deg F, ambient; 180 deg F, material surfaces.

#### 2.02 SHEET METALS

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

**B. Aluminum Sheet**: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. **As-Milled Finish**: One-side bright mill.

2. **Exposed Coil-Coated Finish**: 
a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.

4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).

2.03 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

C. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

D. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

E. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

F. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.


2.04 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

G. Do not use graphite pencils to mark metal surfaces.

2.05 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick.
   2. Stainless Steel: 0.016 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:
   1. Aluminum: 0.040 inch thick.
   2. Stainless Steel: 0.019 inch thick.

2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:
   1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.02 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder aluminum sheet.

2. Do not use torches for soldering.

3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after lining and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.
3.05 WALL FLASHING INSTALLATION
   A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
   B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04.
   C. Reglets: Installation of reglets is specified in Section 03 3000 "Cast-in-Place Concrete." and Division 04.
   D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.06 MISCELLANEOUS FLASHING INSTALLATION
   A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
   B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.07 ERECTION TOLERANCES
   A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION
   A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
   B. Clean and neutralize flux materials. Clean off excess solder.
   C. Clean off excess sealants.
   D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
   E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
PART 1 - GENERAL
1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Materials and installation methods for flexible rubberized asphalt, self-sealing flashing and flashing accessories.

1.03 SUBMITTALS
A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, for each manufactured product and accessory.
B. Shop Drawings: For self-adhered flashing.
   1. Include plans, elevations, sections, and attachment details.
C. Samples of flashing.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Comply with manufacturer's recommendations for storage and handling of each product.

1.05 WARRANTY
A. Standard Product Warranty:
   1. Submit manufacturer's warranty that flashing and accessories are free of defects at time of delivery, and are manufactured to meet manufacturer's published physical properties and material specifications.
   2. Installer to warrant that flashing and accessories have been installed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS
2.01 MATERIALS
A. Flashing Description: 35 mil of self-adhesive rubberized asphalt integrally bonded to 5 mil of aluminum film to provide a min. 40 mil thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products specified by Perm-A-Barrier Aluminum Flashing manufactured by Grace Construction Products or comparable product.
   2. Performance Requirements:
      a. UV Exposure Limit: Not more than 365 calendar days
      b. Water Absorption, ASTM D 570: max 0.1% by weight
      d. Lap Adhesion at 25°F, ASTM D 1876 Modified: 5.0 lbs./in. of width
      e. Low Temperature Flexibility, ASTM D 1970 Modified: Unaffected to -15°F.
      f. Tensile Strength, ASTM D 412, Die C Modified: min. 600 Psi.
      g. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412, Die C Modified: min. 200%.

PART 3 - EXECUTION
3.01 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install self-adhered flashing according to manufacturer's written instructions.
B. Refer to manufacturer's literature for recommendations on installation
C. Prime substrate to receive wall flashing as required per manufacturer's written instructions.
   1. Precut pieces of flashing to easily handled lengths for each location.
   2. Remove silicone-coated release paper and position flashing carefully before placing it against the surface.
   3. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
   4. Overlap adjacent pieces 2 inch and roll all seams with a hand roller.
   5. Trim bottom edge 1/2 inch back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
   6. At heads, sills and all flashing terminations, turn up ends a minimum of 2 inch and make careful folds to form an end dam, with the seams sealed.
   7. Seal top edge of flashing with termination mastic.
   8. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.

END OF SECTION
SECTION 07 7200
ROOF ACCESSORIES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Copings.
   B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS
   A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
   B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
   C. Samples: Submit two appropriately sized samples of coping.
   D. Qualification Data: For manufacturer.
   E. Product Test Reports: For copings, for tests performed by a qualified testing agency.
   F. Sample Warranty: For manufacturer's special warranty

1.04 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE
   A. Perform work in accordance with SMACNA (ASMM) details.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
   B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.07 FIELD CONDITIONS
   A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.08 WARRANTY
   A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
      1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
         a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
         b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
         c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
      2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
   A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
   B. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:
      1. Design Pressure: As indicated on Drawings.
   C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants,
failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COPINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Architectural Products Company.
2. ATAS International, Inc.
4. Castle Metal Products.
5. Cheney Flashing Company.
7. OMG EdgeSystems (formerly, W.P. Hickman).
8. Merchant & Evans Inc.
9. Metal-Era, Inc.
10. Perimeter Systems; a division of SAF.
11. SAF (Southern Aluminum Finishing Company, Inc.).

B. Copings: Fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES RE-3 to positive and negative design wind pressure as defined by applicable code but not less than the engineered values as follows:
   a. Typical Parapet (Inward of Outward): 86 PSF
   b. Parapet Corners (Inward or Outward): 118 PSF
3. Material: Formed aluminum sheet, 0.063 inch thick, minimum.
4. Surface: Smooth, flat finish.
5. Finish: Two-coat fluoropolymer.
6. Color: To be selected by Architect from manufacturer's full range.

C. Control and Expansion Joint Covers: Composite construction of 12 inch wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

2.03 MATERIALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.04 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.05 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.06 FINISHES
   A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.
   B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
   C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
   D. Aluminum Finishes:
      1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.
         a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

PART 3 - EXECUTION
3.01 EXAMINATION
   A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
   B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
   C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
   D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION
   A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.03 INSTALLATION, GENERAL
   A. General: Install roof specialties according to manufacturer’s written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
      1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
      2. Provide uniform, neat seams with minimum exposure of solder and sealant.
      3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
      4. Torch cutting of roof specialties is not permitted.
      5. Do not use graphite pencils to mark metal surfaces.
   B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
      1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
      2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
      1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
      2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
   D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
   E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.04 COPING INSTALLATION
   A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
   B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
   C. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.05 CLEANING AND PROTECTION
   A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
   B. Clean and neutralize flux materials. Clean off excess solder and sealants.
   C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
   D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Sealants and joint backing.
B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS
A. Section 07 6200 - Sheet Metal Flashing and Trim
B. Section 08 4313 - Aluminum Framed Storefronts
C. Section 08 8000 - Glazing: Glazing sealants and accessories.
D. Section 09 2900 - Gypsum Board
E. Section 09 9000 - Painting and coating

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data indicating sealant chemical characteristics.
C. Samples: Submit two sample cards, 4 x 8 inch in size illustrating sealant colors for selection.
D. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE
A. Manufacturer and Applicator Qualifications: Companies specializing in manufacturing and installing the Products specified in this section with minimum five years documented experience.

1.07 MOCK-UP
A. Provide mock-up of sealant joints in conjunction with wall under provisions of Section 01 4000.
B. Construct mock-up with specific sealant types within walls and other components as requested by the Architect.
C. Locate where directed.
D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS
A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 WARRANTY
A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:
  14. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

A. General Purpose Exterior Sealant: Acrylic, solvent release curing; ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A; single or multi-component.
   1. Color: color as selected.
   2. Applications: Use for:
      a. Joints between concrete and other materials.
      b. Joints between metal frames and other materials.
      c. Other exterior joints for which no other sealant is indicated.

B. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.
      b. Concealed sealant bead in siding overlaps.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

D. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

E. Acoustical Sealant for Concealed Locations:
   1. Composition: Acrylic latex emulsion sealant.
   2. Applications: Use for concealed locations only:
      a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
F. Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Single or multi-part, 100 percent solids by weight.
   2. Hardness: 85 after 7 days, when tested in accordance with ASTM D2240 Shore A.
   3. Color: Concrete gray.
   6. Applications: Use for:
      a. Control joints in concrete slabs and floors not filled with filler placed in form.
      b. Joints in concrete slabs and floors.

G. Rigid Polyurethane Crack and Joint Filler: Two part, low viscosity, fast setting, rigid sealant intended for cracks and control joints not subject to significant movement; used on cracks and joints prior to application of moisture control systems, underlayments, and toppings.
   1. Applications: Use for:
      a. Interior and exterior control joints in concrete slabs and floors.
      b. Saw cut joints.
      c. Cracks, spalls, and other repairs.

   1. Approved by manufacturer for wide joints up to 1-1/2 inches.
   2. Color: Match adjacent finished surfaces.
   3. Applications: Use for:
      a. Expansion joints in floors.

   2. Applications: Use for:
      a. Joints in sidewalks and vehicular paving.

J. Nonsag Polyurethane Sealant: ASTM C920, Grade NS, Class 25, Uses NT, I, M, A; single component, chemical curing, non-staining, non-bleeding, non-sagging type.
   1. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: -40 to 180 degrees F.
   5. Applications: Use for:
      a. Vertical control between dissimilar exterior materials.

2.03 ACCESSORIES
A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.
B. Verify that joint backing and release tapes are compatible with sealant.
3.02 PREPARATION
A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean and prime joints in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Protect elements surrounding the work of this section from damage or disfigurement.
E. Exposed Concrete Floor Joints: Test joint filler in inconspicuous area of floor slab. Verify specified product does not stain or discolor slab.

3.03 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 where joint backing is not used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
H. Tool joints concave.
I. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

3.04 CLEANING
A. Clean adjacent soiled surfaces.

3.05 PROTECTION
A. Protect sealants until cured.

END OF SECTION
SECTION 07 9500
EXPANSION JOINT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Furnish Expansion Joint Systems in accordance with the drawings and general provisions of the Contract.
   2. Provide Expansion joint in areas where movement between existing and new construction is anticipated whether indicated on drawings or not, and other openings indicated.
   3. Furnish complete prefabricated joint systems of the following type from a single manufacturer
      a. Exterior wall expansion joint systems.
      b. Interior floor expansion joint assemblies
      c. Interior wall to wall expansion joint assemblies
      d. Interior ceiling expansion joint systems.

B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Manufacturer’s specifications, technical data, installation instructions, and detail drawings for each system.

D. Certificates or other documentation confirming UL approved compliance with fire resistance rating of fire barrier assemblies.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.

F. Sample of specified systems where required.

1.04 QUALITY ASSURANCE

A. Manufacturer: Furnish assemblies from one (1) manufacturer with a minimum of five (5) years of experience in the design, engineering and fabrication of expansion joint systems.

B. Installer: Firm with not less than five (5) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

1.05 DELIVERY AND STORAGE

A. Provide temporary protective covers on anodized aluminum finished surfaces.

B. Deliver joint systems to jobsite in new, clean, unopened cartons or crates of sufficient size and strength to protect materials during transit.

C. Store components in original containers in a clean, dry location.
1.06 WARRANTY
A. Manufacturer's Standard warranty against material and manufacturing defects for a period of not less than three (3) years when installed in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS
2.01 MANUFACTURER
A. Basis-of-Design Product: Subject to compliance with requirements, provide products as specified or comparable product.
   1. Architectural Art Mfg., Inc.
   2. Construction Specialties, Inc.
   3. MM Systems Corp.

2.02 MATERIALS
A. Manufacturer's Standard for the system detailed.
B. Fasteners, accessories and other materials required for complete installation in accordance with the manufacturer's instructions.

2.03 EXTERIOR JOINT SYSTEMS
A. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
   1. Basis of design: CS Construction Specialties; HS Series or similar design by approved acceptable manufacturer.
      b. Joint Seal Color: As selected by Architect from Manufacturer's full range.

B. Vertical Applications in Masonry:
   1. Basis of design Balco; a CSW Industrials Company; FCVS-2 or similar design by approved acceptable manufacturer.
   2. General Characteristics:
      a. Accordion type unit capable of multi directional movement and weather tight function.
      b. Continuous extruded aluminum frame secured to both sides of joint with mechanical attachment to masonry.
      c. Exterior Cover Plate: Continuous extruded flexible silicone face seal full length of joint capable of 100% expansion
         1) Color: As selected by Architect from Manufacturer's full range.
      d. Interior Baffle: Continuous santoprene material inserted into fill length of aluminum frame, capable of 100% expansion.
      e. Base closure unit: Self flashed assembly; component of complete expansion joint system for exterior enclosures.

C. Roof to Wall Bellows:
   1. Basis of design Balco; a CSW Industrials Company; BRBS-1-2CSE or similar design by approved acceptable manufacturer.
   2. General Characteristics:
      a. EPDM Bellows with Closed Cell foam backing.
      b. Width: 4 inch wide.
      c. Movement Capability: +50 percent.
      d. Stainless steel flat flanges.

2.04 INTERIOR SYSTEMS
A. Floor System: Embedded frame with aluminum cover plate Construction Specialties Model GFPS-200 and/or 200M width appropriate to joint detail or similar design by approved acceptable manufacturer.
   1. General Characteristics:
      a. Continuous extruded two part tongue and groove style aluminum cover plate with flexible gasketing
      b. Continuous extruded aluminum frame 1 1/2” in block out height with mechanical attachment to concrete deck. Inset frames shall be provided with primer when set in concrete.
c. Heavy Duty minimum 2000 pound point load.

B. Wall to Wall and Wall to Ceiling and Ceiling to Ceiling Systems: Single side attachment for flat to flat and corner conditions Construction Specialties model FWF-200 and FWFC (GWB), and FCF-200 and FCFC-200 (Lay-in tile) width appropriate to joint detail or similar design by approved acceptable manufacturer.

1. General Characteristics:
   a. Continuous extruded cover plate secured to wall or ceiling component, and with no-mar gasketing in preformed channel material on underside of plate to eliminate marking of adjacent surface.

C. Concealed wall to wall system: Closed cell ethylene vinyl acetate foam, Construction Specialties Model HS, width appropriate to joint detail or similar design by approved acceptable manufacturer.

1. Density: ASTM D3575, 10lb/ft³
2. Tensile Strength: ASTM D3575, 120 psi
3. Tensile Elongation: ASTM D3575, 250%
4. Tear Resistance: ASTM D624, 21.5 lbs/in

2.05 ACCESSORIES
A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.

B. Manufacturer's stainless-steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.06 FABRICATION
A. Field assemble components provided in standard lengths with pre-packaged fasteners and accessories.

B. Fabricate special transitions and corner fittings as required. Miter and weld elastomeric seal as applicable.

2.07 FINISHES
A. For metallic elements of all expansion joints: mill finish aluminum.

B. All others: As selected by the Architect at the time of submittal.

PART 3 - EXECUTION
3.01 EXAMINATION
A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

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

3.02 PREPARATION
A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.03 INSTALLATION
A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
   3. Shimming is not permitted.
   4. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   5. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
6. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer’s written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.04 PROTECTION AND CLEANING
A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer’s written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION
SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section includes:
      1. Interior standard steel doors and frames.
      2. Exterior standard steel doors and frames.
   B. Refer to Division 01 sustainable & energy efficiency project requirements affecting work of this section.

1.03 COORDINATION
   A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
   B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.04 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
   B. Shop Drawings: Include the following:
      1. Elevations of each door type.
      2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
      3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
      4. Locations of reinforcement and preparations for hardware.
      5. Details of each different wall opening condition.
      6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
      7. Details of anchorages, joints, field splices, and connections.
      8. Details of accessories.
      9. Details of moldings, removable stops, and glazing.
   C. 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 Drawings. Coordinate with final door hardware schedule.

1.06 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.07 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 non-vented plastic.
      1. Provide additional protection to prevent damage to factory-finished units.
   B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
   C. 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

2.01 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. DE LA FONTAINE.
4. Mesker Door Inc.
5. Michbi Doors Inc.
6. MPI Group, LLC (The).
7. Pioneer Industries.
8. Premier Products, Inc.
10. Security Metal Products; a brand of ASSA ABLOY.
11. Steelcraft; an Allegion brand.

2.02 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.

2.03 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Model 1, Full Flush.
   e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
   f. Core: Manufacturer's standard.

2. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Full profile welded.


2.04 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   d. Edge Construction: Model 2, Seamless.
   e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
   f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
   g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
   h. Core: Manufacturer's standard insulated core.
   i. Profile: As indicated on the drawings.
2. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   b. Construction: Full profile welded.

2.05 BORROWED LITES
   A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.042 inch.
   B. Construction: Face welded.
   C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
   D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.06 FRAME ANCHORS
   A. 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.
   B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
   C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
   D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
      1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.07 MATERIALS
   A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
   B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
   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 ASTM E 136 for combustion characteristics.
   F. Glazing: Comply with requirements in Section 08 8000 "Glazing".

2.08 FABRICATION
   A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
   B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
      1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
      2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
      3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.09 STEEL FINISHES
A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION
3.01 PREPARATION
A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.02 INSTALLATION
A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
B. Hollow-Metal Frames: Comply with SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Floor Anchors: Secure with post-installed expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
   5. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.

D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.03 CLEANING AND TOUCHUP

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
SECTION 08 1416
FLUSH WOOD DOORS

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Five-ply flush wood veneer-faced doors for transparent finish.

1.03 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.04 SUBMITTALS
A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
B. 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.
C. Samples: Submit two samples of door construction, 12” x 12” in size cut from top corner of door.
D. Samples: Submit two samples of door veneer, 6 x 6 inch in size illustrating wood grain, stain color, and sheen.
E. Sample Warranty: For special warranty.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons, and wrap bundles of doors in plastic sheeting.
C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.06 FIELD CONDITIONS
A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.07 WARRANTY
A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of veneer.
      b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.01 FLUSH WOOD DOORS, GENERAL
A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WW's "Architectural Woodwork Standards."
   1. Provide labels from AWI indicating that doors comply with requirements of grades specified.

2.02 FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH
A. All Doors: See drawings for locations and additional requirements.
   2. Flush construction
   3. Wood Veneer Faced 5 ply, factory finished.
      a. Species: Sliced White Maple.
   4. 1 3/4" THICK.
   5. Solid core all locations.
B. Door and Panel Cores:
   1. Non-Rated Solid Core Doors: Type Agrifiber cores, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Door Facings:
      b. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.03 LIGHT FRAMES
   A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard flush wood beads unless otherwise indicated.
      1. Wood Species: Same as door faces.
      2. Profile: Flush rectangular beads.

2.04 ACCESSORIES
   A. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws, field painted color as selected by Architect. Refer to Section 09 9000 Painting and coating. Sizes and configurations as indicated on drawings.
   B. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, field painted color as selected by Architect. Refer to Section 09 9000 Painting and coating.

2.05 DOOR CONSTRUCTION
   A. Fabricate doors in accordance with door quality standard specified.
   B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
   C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

2.06 FACTORY FINISHING - WOOD VENEER DOORS
   A. Finish work in accordance with, Section 5 - Finishing for grade specified and as follows:
      1. Transparent:
         a. System - 1, Lacquer, Nitrocellulose.
         b. Stain: As selected by Architect.
         c. Sheen: Satin.
   B. Seal door top edge with color sealer to match door facing.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine doors and installed door frames, with Installer present, before hanging doors.
      1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
      2. Reject doors with defects.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
   A. Hardware: For installation, see Section 08 7100 "Door Hardware."
   B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   C. Install frames level, plumb, true, and straight.
      1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
      2. Anchor frames to anchors or blocking built in or directly attached to substrates.
         a. Secure with countersunk, concealed fasteners and blind nailing.
         b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
            1) For factory-finished items, use filler matching finish of items being installed.
D. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
      a. Do not trim stiles and rails in excess of limits set by manufacturer.
   3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   4. Clearances:
      a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
      b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
      c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
   5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING
   A. Operation: Rehang or replace doors that do not swing or operate freely.
   B. Adjust all closers to comply with ADA requirements.
   C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION
SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 - GENERAL
1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. Section includes:
      1. Access doors and frames for walls and ceilings.
      2. Floor access doors.

1.03 SUBMITTALS
   A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
   B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
   C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.
   D. Qualification Data: For testing and inspecting agency.

1.04 CLOSEOUT SUBMITTALS
   A. Record Documents: List of applicable room name and number in which access door is located.

PART 2 - PRODUCTS
2.01 ACCESS DOORS AND FRAMES
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Acudor Products, Inc.
      2. Babcock-Davis.
      5. Larsen's Manufacturing Company.
      6. Milcor Inc.
      7. Nystrom, Inc.

2.02 ACCESS DOOR AND PANEL APPLICATIONS
   A. Walls, Unless Otherwise Indicated:
      1. Material: Steel.
      2. Size: 12 by 12 inch, unless otherwise indicated.
      4. Tool-operated spring or cam lock; no handle.
      5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.
      6. Color: Paint to match adjacent wall color in exposed locations.
   B. Walls in Wet Areas:
      1. Performance Requirements:
         a. Air Infiltration: Less than 0.01 cfm/sq foot in accordance with ASTM E 283.
         b. Water Penetration: No leakage at 15.05 psf in accordance with ASTM E 331.
      3. Size: 12 by 12 inch, unless otherwise indicated to suit conditions of installation.
      4. Door: Continuous exposed stainless steel hinged door.
      6. In All Wall Types: Flush access doors and frames, with extruded door gasket. Gasket to be continuous bulb trim seal.
      7. Color: Paint to match adjacent wall color in exposed locations.
   C. Ceilings, Unless Otherwise Indicated: Same type as for walls.
      1. Material: Steel.
2. Size in Other Ceilings: 12 by 12 inch, unless otherwise indicated to suit conditions of installation.
4. Tool-operated spring or cam lock; no handle.
5. Color: Paint to match adjacent wall color in exposed locations

2.03 WALL AND CEILING UNITS
A. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Double-Skinned Hollow Steel Door Panels: 16 gage, 0.059 inch, minimum, on both sides and each edge.
   4. Primed and Factory Finish: Polyester powder coat; color as selected by Architect.
   5. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

2.04 FLOOR ACCESS DOORS
A. Basis-of-Design Product: Bilco, TER Floor Access.
B. Performance characteristics:
   1. Cover: Reinforced to support a minimum live load of 150 psf with a maximum deflection of 1/150th of the span.
   2. Operation: Smooth and easy with controlled operation throughout the entire arc of opening and closing.
   3. Operation of the cover not to be affected by temperature.
C. Cover: 1 inch fillable pan to receive concrete or a combination of concrete and flooring material as selected by Architect. All fill material to be furnished and installed by others in the field.
D. Frame: Extruded aluminum with full anchor flange around the perimeter.
E. Lifting Mechanisms: Include required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube prevents accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube interlocks with a flanged support shoe fastened to a formed 1/4 inch gusset support plate.
F. Handle: Removable exterior turn/lift handle with a spring loaded ball detent, provided to open the and the latch release protected by a flush, gasketed, removable screw plug.
G. Hardware:
   1. Hinges: Continuous heavy duty Type 316 stainless steel hinge.
   2. Cover:
      a. Equipped with an aluminum hold open arm that automatically locks the cover in the open position.
      b. Fitted with the required number and size of compression spring operators.
   3. Type 316 stainless steel snap lock with fixed handle mounted on the underside of the cover.
   4. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware, zinc plated and chromate sealed.
H. Finishes: Factory mill aluminum finish with bituminous coating applied to the exterior of the frame.

2.05 FABRICATION
A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

C. Provide where shown, specified, or required, for non-mechanical equipment access. See DIVISIONS 22, 23 and 26 for access doors provided in those divisions for access to mechanical and electrical equipment.

3.02 INSTALLATION

A. Install units in accordance with manufacturer’s instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION
SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS AND WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront.
B. Aluminum-framed windows.
C. Infill panels of glass.
D. Aluminum doors and frames.
E. Weatherstripping.
F. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

1.04 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   1. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
B. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.
D. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 12.0 lbf/sq ft.
E. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
1.05 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Submit Storefront and Curtainwall in a single submittal.
   C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
   D. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
   E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
   F. Manufacturer’s Certificate: Certify that the products supplied meet or exceed the specified requirements.
   G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE
   A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Handle products of this section in accordance with AAMA CW-10.
   B. Protect finished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 PROJECT CONDITIONS
   A. Coordinate the work with installation of other components or materials.

1.09 FIELD CONDITIONS
   A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY
   A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.
   B. Correct defective Work within a five year period after Date of Substantial Completion.
   C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Basis of Design: See below under description of products.
   C. Interior Storefront System to be 450 for ¼” infill.
   D. Doors to be 500 Wide stile.
   E. Aluminum-Framed Storefront and Doors:
      5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS
   A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior (exterior wall applications only), drainage holes and internal weep drainage system.
      1. Framing members for interior applications need not be thermally broken.
      3. Cross-Section: 2 x 4 1/2 inch nominal dimension at exterior units; 1 3/4 x 4 1/2 inch at interior units.
4. Include sill receptor at all frames.

B. Swing Doors: Glazed aluminum.
   2. Top Rail: 5 inches wide.
   5. Glazing Stops: Square.

2.03 MATERIALS
   C. Fasteners: Stainless steel.
   D. Perimeter Sealant: As specified in Section 07 9005.
   E. Glass: As specified in Section 08 8000.
   F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
   G. Glazing Accessories: As specified in Section 08 8000.

2.04 FINISHES
   A. Anodized Exterior Finish:

2.05 HARDWARE
   A. For each door, include weatherstripping, sill sweep strip, and threshold.
   B. Other Door Hardware: As specified in Section 08 7100.
   C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
   D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
   E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

2.06 FABRICATION
   A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
   B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
   C. Prepare components to receive anchor devices. Fabricate anchors.
   D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   E. Arrange fasteners and attachments to conceal from view.
   F. Reinforce components internally for door hardware and door operators.
   G. Reinforce framing members for imposed loads.
   H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
      1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify dimensions, tolerances, and method of attachment with other work.
   B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
3.02 INSTALLATION
A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Set thresholds in bed of sealant and secure.
F. Install hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.
G. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
H. Install perimeter sealant in accordance with Section 07 9005.
I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.
J. Provide batt insulation stuffed full, within all accessible voids of aluminum framing prior or as part of installation.

3.03 TOLERANCES
A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING
A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING
A. Remove protective material from pre-finished aluminum surfaces.
B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
C. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION
A. Protect installed products from damage during subsequent construction.
B. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.
C. Protect finished work from damage.

END OF SECTION
PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes commercial door hardware for the following:
      1. Swinging doors.
      2. Other doors to the extent indicated.
   B. Door hardware includes, but is not necessarily limited to, the following:
      1. Mechanical door hardware.
      2. Electromechanical door hardware.
   C. Related Sections:
      1. Division 08 Section "Hollow Metal Doors and Frames".
      2. Division 08 Section "Flush Wood Doors".
      3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
      4. Division 08 Section “Access Control Hardware”.
   D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
      6. NFPA 105 - Installation of Smoke Door Assemblies.
      7. State Building Codes, Local Amendments.
   E. Standards: All hardware specified herein shall comply with the following industry standards:
      1. ANSI/BHMA Certified Product Standards - A156 Series
      2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.03 SUBMITTALS
   A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
   B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
      2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
      3. Content: Include the following information:
         a. Type, style, function, size, label, hand, and finish of each door hardware item.
         b. Manufacturer of each item.
         c. Fastenings and other pertinent information.
         d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
         e. Explanation of abbreviations, symbols, and codes contained in schedule.
         f. Mounting locations for door hardware.
         g. Door and frame sizes and materials.
         h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.04 QUALITY ASSURANCE
A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3. Review sequence of operation narratives for each unique access controlled opening.

4. Review and finalize construction schedule and verify availability of materials.

5. Review the required inspecting, testing, commissioning, and demonstration procedures.

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.07 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Seven years for heavy duty cylindrical (bored) locks and latches.
2. Twenty five years for manual surface door closer bodies.
3. Two years for electromechanical door hardware.

1.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer’s Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers’ names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
   a. Hager Companies (HA) - CB Series.
   b. Ives (IV).
   c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:
   a. Ives (IV).
   b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.03 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
   b. Securitron (SU) - EL-CEPT Series.
   c. Von Duprin (VD) - EPT-10 Series.
2.04 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location
      approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.
   3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for
      windstorm components where applicable.
   4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for
      appropriate installation and operation.

B. Manufacturers:
   a. Ives (IV).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.05 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key
   systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as
   locksets and exit devices, unless otherwise indicated.
   1. Manufacturers:
      a. Schlage (SC).
      b. No Substitution.

C. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
   4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be
      free spinning with matching finishes.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core
      manufacturer's cylinder and door hardware. Provide removable core (small or large format) as
      specified in Hardware Sets.

E. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used
   together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.
   1. Manufacturers:
      a. Schlage Lock (SC) - Primus Everest.
      b. No Substitution.

F. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented
   and restricted keyway requiring the use of a patented key. Cylinders are to be protected from
   unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be
   factory keyed with owner having the ability for on-site original key cutting.
   1. Manufacturers:
      a. Schlage Lock (SC) - Everest D Series.
      b. No Substitution.

G. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Conduct specified "Keying Conference" to define and document keying system instructions and
      requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number
      as directed by Owner.
   3. Existing System: Key locks to Owner's existing system.
H. **Key Quantity:** Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Three (3).
   2. Master Keys (per Master Key Level/Group): Five (5).
   4. Construction Control Keys (where required): Two (2).
   5. Permanent Control Keys (where required): Two (2).
I. **Construction Keying:** Provide temporary keyed construction cores.
J. **Key Registration List (Bitting List):**
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

**2.06 MECHANICAL LOCKS AND LATCHING DEVICES**

A. **Cylindrical Locksets, Grade 1 (Heavy Duty):** ANSI/BHMA A156.2, Series 4000, Grade 1 certified.
   1. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2” (3/4” at rated paired openings) throw brass or stainless steel latchbolt.
   2. Locks are to be non-handed and fully field reversible.
   3. Manufacturers:
      a. Schlage (SC) – ND Series.

**2.07 INTELLIGENT WIFI ACCESS CONTROL**

A. **IP Enabled Wireless Integrated Card Reader Mortise Lock:** IP enabled WiFi™ ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated proximity card reader, request-to-exit, latchbolt and deadbolt monitoring, and door position signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, 3/4” deadlocking anti-friction latch, and 1” case-hardened steel deadbolt (optional). Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
   1. Completely intelligent and integrated locking unit with network communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding wireless access points) via an existing or newly installed 802.11b/g wireless network.
   2. Open architecture design supports wireless integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit), auxiliary latch, deadbolt, and door position (open/closed status) monitoring.
   3. Advanced data security techniques including AES 128-bit encryption changing with every exchange. Supportive of open standard WiFi™ network security including: WEP, WPA, and LEAP.
   4. 2,000 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand-alone operation in absence of network communication allowing for system operational redundancy.
   5. Supports HID 125 kHz proximity formats up to 39 bits, including Corporate 1000. Dual credentialing available with keypad option.
   6. 9VDC power provided by (6) AA batteries for completely wireless applications.
   7. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
   8. Real-time lockdown capabilities with separate external 9VDC power supply, hard wiring option. Inside lever retracts latch bolt and deadbolt simultaneously.
   9. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.
   10. Ethernet system framework and 802.11 b/g wireless access points (by others) required for complete system functionality.
      a. Comply with IEEE 802.11b/g WiFi standard for Wireless LAN communications.
      b. Frequency Range: Worldwide product covering 2.4 to 2.5 GHz, programmable for different country regulations.
      c. Maximum Output Power: 100 mW.
      d. Power Management: Continuous aware power saving polling mode.
11. Manufacturers:
   a. Corbin Russwin Hardware (RU) - Access 800 - ML20800 WI1 Series.
   b. Sargent Manufacturing (SA) - Profile - S2 8200 Series.

B. IP Enabled Wireless Integrated Card Reader Mortise Locks: IP enabled WiFi™ technology ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated card reader, deadbolt monitoring, and request-to-exit and door position switch signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, 3/4” deadlocking stainless steel latch, and 1” hardened steel deadbolt (optional). Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Wireless access control mortise locks interface using field replaceable IEEE 802.11b/g/n 2.4 GHz wireless radio connection to an Ethernet Local Area Network (LAN), facilitating central control via a Software Development Kit (SDK). Locks will continue to operate independently of an Ethernet (LAN) connection slowdown or failure.

2. Fully-encrypted AES 128 wireless communication between IP enabled lock and access control system via the Software Development Kit (SDK).

3. Integrated card reader supports HID® 125kHz proximity credentials; or ISO 14443 A/B and ISO 15693 13.56 MHz contactless credentials: HID® iCLASS (full authentication, all formats), MIFARE Classic, DESFire EV1 (full authentication, all formats); or Near Field Communications (NFC), or Bluetooth Smart-enabled mobile phones.

4. Configuration: Locks require a minimum of 2,400 user codes and the ability to audit the last 10,000 transactions. Programmable for time zone periods, holidays, and automatic unlock (with or without first entry).

5. Power Source: 6 AA alkaline batteries with LED indication of locked, programming mode and low capacity warning status conditions.

6. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

7. Complete installation to include Software Development Kit (SDK), and network and lock configuration CD tool kit for initial lock set-up. Electronic on-line access control system platform, including communication cabling and software, by others.

8. Manufacturers:
   a. Corbin Russwin (RU) – ML20100 IN120 Series.
   b. Sargent Manufacturing (SA) – IN120-7900 Series.
   c. Sargent Manufacturing (SA) – IN120-8200 Series.

C. IP Enabled Wireless Integrated Card Reader Cylindrical Lock: IP enabled, WiFi™ ANSI/BHMA A156.2 Grade 1 bored lockset with integrated proximity card reader and request-to-exit signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim with 1/2” deadlocking stainless steel latch. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings.

1. Completely intelligent and integrated locking unit with network communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding wireless access points) via an existing or newly installed 802.11b/g wireless network.

2. Open architecture design supports wireless integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected in-door DPS).

3. Advanced data security techniques including 128-bit encryption changing with every exchange. Support of open standard WiFi™ network security including; WEP, WPA, and LEAP.

4. 2,000 users and 10,000 event transaction history (audit trail). Distributed intelligence allows standalone operation in absence of network communication allowing for system operational redundancy.

5. Supports HID 125 KHz proximity formats up to 39 bits, including Corporate 1000. Dual credentialing available with keypad option.

6. 9VDC power provided by (6) AA batteries for completely wireless applications.

7. Real-time lockdown capabilities with separate external 9VDC power supply, hard wiring option.

8. High security lockdown key provides emergency override retraction of latchbolt without need for electronic activation.
9. Ethernet system framework and 802.11 b/g wireless access points (by others) required for complete system functionality.
   a. Comply with IEEE 802.11b/g WiFi standard for Wireless LAN communications.
   b. Frequency Range: Worldwide product covering 2.4 to 2.5 GHz, programmable for different country regulations.
   c. Maximum Output Power: 100 mW.
   d. Power Management: Continuous aware power saving polling mode.

10. Manufacturers:
   a. Corbin Russwin Hardware (RU) - Access 800 - CL33800 W1 Series.
   b. Sargent Manufacturing (SA) - Profile - S2 10-Line Series.

D. IP Enabled Wireless Integrated Card Reader Cylindrical Locks: IP enabled WiFi™ technology ANSI/BHMA A156.2 Grade 1 cylindrical lockset with integrated card reader and request-to-exit signaling in one complete unit. Separate DPS connects directly to lock electronics for door position (open/closed status) monitoring. Motor driven locking/unlocking control of the lever handle trim with 1/2” deadlocking stainless steel latch. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings.

1. Wireless access control mortise locks interface using field replaceable IEEE 802.11b/g/n 2.4 GHz wireless radio connection to an Ethernet Local Area Network (LAN), facilitating central control via a Software Development Kit (SDK). Locks will continue to operate independently of an Ethernet (LAN) connection slowdown or failure.

2. Fully-encrypted AES 128 wireless communication between IP enabled lock and access control system via the Software Development Kit (SDK).

3. Integrated card reader supports HID® 125kHz proximity credentials; or ISO 14443 A/B and ISO 15693 13.56 MHz contactless credentials: HID® iCLASS (full authentication, all formats), MIFARE Classic, DESFire EV1 (full authentication, all formats); or Near Field Communications (NFC), Bluetooth Smart-enabled mobile phones.

4. Configuration: Locks require a minimum of 2,400 user codes and the ability to audit the last 10,000 transactions. Programmable for time zone periods, holidays, and automatic unlock (with or without first entry).

5. Power Source: 6 AA alkaline batteries with LED indication of locked, programming mode and low capacity warning status conditions.

6. Complete installation to include Software Development Kit (SDK), and Lock Management Tool (LMT) kit for initial lock set-up. Electronic on-line access control system platform, including communication cabling and software, by others.

7. Manufacturers:
   a. Corbin Russwin (RU) – CL33100 IN120 Series.
   b. Sargent Manufacturing (SA) – IN120-10 Line Series.

E. IP Enabled Wireless Integrated Card Reader Exit Hardware: IP enabled, WiFi™ ANSI/BHMA A156.3 Grade 1 rim and mortise exit device hardware with integrated proximity card reader, touchbar monitoring, and request-to-exit signaling in one complete unit. Motor driven locking/unlocking control of the lever handle exit trim with 3/4” throw latch bolt. U.L listed and labeled for either panic or “fire exit hardware” for use on up to 3 hour fire rated openings.

1. Completely intelligent and integrated locking unit with network communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding wireless access points) via an existing or newly installed 802.11b/g wireless network.

2. Open architecture design supports wireless integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected in-door DPS).

3. Advanced data security techniques including 128-bit encryption changing with every exchange. Supportive of open standard WiFi™ network security including: WEP, WPA, and LEAP.

4. 2,000 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand-alone operation in absence of network communication allowing for system operational redundancy.

5. Supports HID 125 kHz proximity formats up to 39 bits, including Corporate 1000. Dual credentialing available with keypad option.

6. 9VDC power provided by (6) AA batteries for completely wireless applications.

7. Real-time lockdown capabilities with separate external 9VDC power supply, hard wiring option.
8. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.

9. Ethernet system framework and 802.11 b/g wireless access points (by others) required for complete system functionality.
   a. Comply with IEEE 802.11b/g WiFi standard for Wireless LAN communications.
   b. Frequency Range: Worldwide product covering 2.4 to 2.5 GHz, programmable for different country regulations.
   c. Maximum Output Power: 100 mW.
   d. Power Management: Continuous aware power saving polling mode.

10. Manufacturers:
    a. Corbin Russwin Hardware (RU) - Access 800 - ED5000 W1 Series.
    b. Sargent Manufacturing (SA) - Profile - S2 80 Series.

F. IP Enabled Wireless Exit Hardware: IP-enabled, WiFi™ ANSI/BHMA A156.3 Grade 1 rim and mortise exit device hardware with integrated card reader, touchbar monitoring, and request-to-exit signaling in one complete unit. Motor driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings.

1. Wireless access control mortise locks interface using field replaceable IEEE 802.11b/g/n 2.4 GHz wireless radio connection to an Ethernet Local Area Network (LAN), facilitating central control via a Software Development Kit (SDK). Locks will continue to operate independently of an Ethernet (LAN) connection slowdown or failure.

2. Fully-encrypted AES 128 wireless communication between IP enabled lock and access control system via the Software Development Kit (SDK).

3. Integrated card reader supports HID® 125kHz proximity credentials; or ISO 14443 A/B and ISO 15693 13.56 MHz contactless credentials: HID® iCLASS (full authentication, all formats), MIFARE Classic, DESFire EV1 (full authentication, all formats); or Near Field Communications (NFC).

4. Configuration: Locks require a minimum of 2,400 user codes and the ability to audit the last 10,000 transactions. Programmable for time zone periods, holidays, and automatic unlock (with or without first entry).

5. Power Source: 6 AA alkaline batteries with LED indication of locked, programming mode and low capacity warning status conditions.

6. Complete installation to include Software Development Kit (SDK), and network and lock configuration CD tool kit for initial lock set-up. Electronic on-line access control system platform, including communication cabling and software, by others.

7. Manufacturers:
    a. Corbin Russwin (RU) – ED5000 IN120 Series.
    b. Sargent Manufacturing (SA) – IN120-80 Series.

2.08 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.
2.09 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.


9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
   a. Von Duprin (VD) - 35A/98 XP Series.
   b. Yale (YA) - 7000 Series.

2.09 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL EXIT DEVICES

A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).

2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.

3. 12VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). 24VDC required for solenoid operated exit trim (12VDC if applicable). Fail safe or fail secure options.

4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

5. Manufacturers:
   a. Corbin Russwin Hardware (RU) - Access 600 - ED5000 RNE1 Series.
   b. Sargent Manufacturing (SA) - Harmony - H1/H2 80 Series.
   c. Schlage (SC) - AD300 Series.
d. Yale Locks and Hardware (YA) - Symphony – 7000 SYM Series.

e. No Substitution.

2.11 INTEGRATED WIEGAND OUTPUT EXIT DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).

2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.

3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.

4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

6. Manufacturers:
   a. Corbin Russwin (RU) – ED5000 SE-LP10 Series.
   b. Sargent Manufacturing (SA) – M1 80 Series.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and operating force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:
   a. LCN Closers (LC) - 4040 Series.

2.13 PNEUMATIC DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:
   1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
   2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. LCN Closers (LC) - 4840 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2” less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1” less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
   3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
   4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
      a. Stainless Steel: 300 grade, 050-inch thick.
   5. Options and fasteners: Provide manufacturer’s designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
   6. Manufacturers:
      a. Ives (IV).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Ives (IV).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).
C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
   1. Manufacturers:
      a. Rixson Door Controls (RF).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS
A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
F. Manufacturers:
   1. National Guard Products (NG).
   2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.17 ELECTRONIC ACCESSORIES
A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   1. Manufacturers:
      a. Alarm Controls (AK) - APS Series.
      b. Security Door Controls (SD) - 630 Series.
      c. Von Duprin (VD) - PS.

2.18 FABRICATION
A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES
A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION
A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

3.03 INSTALLATION
A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL
A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 ADJUSTING
A. Initial 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.

3.06 CLEANING AND PROTECTION
A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
B. Clean adjacent surfaces soiled by door hardware installation.
C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION
A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.
### 3.08 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:
   1. MK - McKinney
   2. PE - Pemko
   3. RO - Rockwood
   4. VD - Von Duprin
   5. SC - Schlage
   6. RF - Rixson
   7. LC - LCN Closers
   8. OT - OTHER
   9. SU - Securitron

#### Hardware Sets

**Set: 1.0**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Hinge w/cutout</td>
<td>CFM__HD1 PT</td>
<td>PE</td>
</tr>
<tr>
<td>1 Removable Keyed Mullion</td>
<td>KR4954</td>
<td>SP28</td>
</tr>
<tr>
<td>1 Mullion Stabilizer</td>
<td>154</td>
<td>SP28</td>
</tr>
<tr>
<td>1 Mullion Wall Mounting Kit</td>
<td>MT54</td>
<td>SP28</td>
</tr>
<tr>
<td>1 Rim Exit Dev (DT, LX, RX)</td>
<td>LX-RX-LC 98DT 990DT SNB</td>
<td>US32D</td>
</tr>
<tr>
<td>1 Rim Exit Dev (ELR, LX, RX)</td>
<td>LX-RX-LC QEL 98NL 990NL SNB</td>
<td>US32D</td>
</tr>
<tr>
<td>1 Rim Cylinder</td>
<td>20-057 ICX</td>
<td>626</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>20-061 ICX</td>
<td>626</td>
</tr>
<tr>
<td>2 Primus Permanent Core</td>
<td>20-740 - verify &amp; match existing</td>
<td>626</td>
</tr>
<tr>
<td>1 Door Closer (STOP)</td>
<td>4040XP SCUSH</td>
<td>AL</td>
</tr>
<tr>
<td>1 Door Closer Shoe</td>
<td>4040XP-30 as required</td>
<td>AL</td>
</tr>
<tr>
<td>1 Door Spacer</td>
<td>4040XP-61 as required</td>
<td>AL</td>
</tr>
<tr>
<td>1 Closer Drop Plate</td>
<td>4040XP-18PA</td>
<td>AL</td>
</tr>
<tr>
<td>1 Door Operator</td>
<td>4841 SCUSH</td>
<td>AL</td>
</tr>
<tr>
<td>1 Shoe</td>
<td>4840-30</td>
<td>AL</td>
</tr>
<tr>
<td>1 Spacer</td>
<td>4840-61</td>
<td>AL</td>
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<tr>
<td>1 Threshold</td>
<td>252x3AFG</td>
<td>PE</td>
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<tr>
<td>2 Sweep</td>
<td>345CNB</td>
<td>PE</td>
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<tr>
<td>1 Mullion Seal</td>
<td>5110BL</td>
<td>PE</td>
</tr>
<tr>
<td>1 Weatherseal</td>
<td>Door manufacturer</td>
<td>OT</td>
</tr>
<tr>
<td>2 Electric Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>PS900 as required</td>
<td>VD</td>
</tr>
<tr>
<td>2 Door Position Switch</td>
<td>By security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>By security contractor</td>
<td>OT</td>
</tr>
<tr>
<td>1 Wiring Diagram</td>
<td>As required</td>
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</tr>
<tr>
<td>1 Tubing</td>
<td>925 (100 ft)</td>
<td>LC</td>
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<tr>
<td>Set: 2.0</td>
<td>Doors: V102</td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Control Box</td>
<td>7982SES</td>
</tr>
<tr>
<td>2</td>
<td>Weather Ring</td>
<td>8310-801</td>
</tr>
<tr>
<td>2</td>
<td>Actuator</td>
<td>8310-853T</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Box</td>
<td>8310-867F</td>
</tr>
<tr>
<td>Notes: Outside low energy operator actuator enabled when lock is unlocked, disabled when locked. Inside actuator always enabled. Valid credential at reader retracts (unlocks) active leaf exit device latch for entry. Free egress at all times.</td>
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<td>1</td>
<td>Control Box</td>
</tr>
<tr>
<td>2</td>
<td>Weather Ring</td>
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<tr>
<td>2</td>
<td>Actuator</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Box</td>
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<p>| 1 | Control Box | 7982SES |
| 2 | Weather Ring | 8310-801 |
| 2 | Actuator | 8310-853T |
| 2 | Mounting Box | 8310-867F |
| Notes: Outside low energy operator actuator enabled when lock is unlocked, disabled when locked. Inside actuator always enabled. Valid credential at reader retracts (unlocks) active leaf exit device latch for entry. Free egress at all times. |</p>
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<tr>
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<tbody>
<tr>
<td>Doors: 120A, 120B, 120C</td>
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</tr>
<tr>
<td>6 Hinge (heavy weight)</td>
<td>T4A3786 (NRP as required)</td>
<td>US26D MK</td>
</tr>
<tr>
<td>2 Manual Flush Bolt</td>
<td>555</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>570</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Storeroom Lock 3/4” latch</td>
<td>ND80 T RHO 14-042</td>
<td>626 SC</td>
</tr>
<tr>
<td>1 Standard Permanent Core</td>
<td>23-030 - verify &amp; match existing</td>
<td>626 SC</td>
</tr>
<tr>
<td>2 Door Closer (HO)</td>
<td>4040XP SHCUSH</td>
<td>AL LC</td>
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<tr>
<td>4 Armor Plate</td>
<td>K1050 34” CSK BEV</td>
<td>US32D RO</td>
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<td>2 Silencer</td>
<td>608-RKW</td>
<td>RO</td>
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<tr>
<td>6 Hinge (heavy weight)</td>
<td>T4A3786 (NRP as required)</td>
<td>US26D MK</td>
</tr>
<tr>
<td>2 Manual Flush Bolt</td>
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<td>2 Kick Plate</td>
<td>K1050 10” CSK BEV</td>
<td>US32D RO</td>
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<td>2 Wall Stop</td>
<td>403</td>
<td>US26D RO</td>
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<td>1 Gasketing</td>
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<td>1 Meeting Stile Seal (edge)</td>
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<tr>
<td>3 Hinge (heavy weight)</td>
<td>T4A3786 (NRP as required)</td>
<td>US26D MK</td>
</tr>
<tr>
<td>1 Storeroom Lock</td>
<td>ND80 T RHO</td>
<td>626 SC</td>
</tr>
<tr>
<td>1 Standard Permanent Core</td>
<td>23-030 - verify &amp; match existing</td>
<td>626 SC</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K1050 10” CSK BEV</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>403</td>
<td>US26D RO</td>
</tr>
<tr>
<td>3 Silencer</td>
<td>608-RKW</td>
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<td>Doors: 110, 112, 208, 210</td>
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<tr>
<td>3 Hinge (heavy weight)</td>
<td>T4A3786 (NRP as required)</td>
<td>US26D MK</td>
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<td>1 Storeroom Lock</td>
<td>ND80 T RHO</td>
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<td>23-030 - verify &amp; match existing</td>
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<td>1 Door Closer (HO)</td>
<td>4040XP HEDA</td>
<td>AL LC</td>
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<tr>
<td>1 Kick Plate</td>
<td>K1050 10” CSK BEV</td>
<td>US32D RO</td>
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<tr>
<td>1 Wall Stop</td>
<td>403</td>
<td>US26D RO</td>
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<td>1 Gasketing</td>
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<td>PE</td>
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Set: 8.0
Doors: V103A
6  Hinge (heavy weight)   T4A3786 (NRP as required)   US26D   MK
2  Manual Flush Bolt       555   US26D   RO
1  Dust Proof Strike       570   US26D   RO
1  Classroom Lock 3/4" latch ND70 T RHO 14-042   626   SC
1  Standard Permanent Core 23-030 - verify & match existing 626   SC
2  Door Closer (HO)        4040XP H/HEDA   AL   LC
2  Kick Plate              K1050 10" CSK BEV   US32D   RO
2  Wall Stop               403   US26D   RO
2  Silencer                608-RKW   RO

Set: 9.0
Doors: V103B
1  Continuous Hinge        CFM__HD1   PE
1  Dummy Push Bar          350   US32D   VD
1  Dummy Pull Trim         990DT   US26D   VD
1  Door Operator           4841 SCUSH   AL   LC
1  Shoe                    4840-30   AL   LC
1  Spacer                  4840-61   AL   LC
1  Wall Stop               415   US26D   RO
1  Weatherseal             Door manufacturer   OT
1  Tubing                  925 (100 ft)   LC
1  Control Box             7982SES   LC
2  Actuator                8310-853T   LC
2  Mounting Box            8310-867F   LC

Set: 10.0
Doors: 110A, 112A, 208A
3  Hinge (heavy weight)    T4A3786   US26D   MK
1  Passage Latch           ND10S RHO   626   SC
1  Kick Plate              K1050 10" CSK BEV   US32D   RO
1  Wall Stop               403   US26D   RO
3  Silencer                608-RKW   RO

Set: 11.0
Doors: 100
3  Hinge (heavy weight)    T4A3786 (NRP as required)   US26D   MK
1  Entrance/Office Lock    ND50/53 T RHO   626   SC
1  Standard Permanent Core 23-030 - verify & match existing 626   SC
1  Kick Plate              K1050 10" CSK BEV   US32D   RO
1  Wall Stop               403   US26D   RO
3  Silencer                608-RKW   RO
### Set: 12.0

**Doors:** 114A

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<td>SP28 VD</td>
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<tr>
<td>1 Mullion Wall Mounting Kit</td>
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<td>1 Removable Keyed Mullion</td>
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<td>98EO-F SNB</td>
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<tr>
<td>1 Standard Permanent Core</td>
<td>23-030 - verify &amp; match existing</td>
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<td>2 Door Closer</td>
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<tr>
<td>2 Wall Stop</td>
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<td>1 Mullion Seal</td>
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<td>1 Gasketing</td>
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<td>1 Meeting Stile Seal (edge)</td>
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### Set: 13.0

**Doors:** 114B

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<td>1 Mullion Wall Mounting Kit</td>
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<tr>
<td>2 Rim Exit Device (EO)</td>
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<td>2 Meeting Stile Seal (edge)</td>
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END OF SECTION
SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Glass.
B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS
A. Section 07 9005 - Joint Sealers: Sealant and back-up material.
B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors.
C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
D. Section 08 4313 - Aluminum-Framed Storefronts.

1.03 REFERENCE STANDARDS
J. GANA (GM) - GANA Glazing Manual; 2009.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
C. Certificates: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE
B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.06 FIELD CONDITIONS
A. Do not install glazing when ambient temperature is less than 50 degrees F.
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY
A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.
B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

A. Sealed, Tempered, Insulating Glass Units: Vision glass, double glazed.
   1. Application(s): Aluminum Framed Storefronts and Hollow Metal Doors as indicated on Window and / or Door schedules.

A. 2. Outboard Lite:
    Fully tempered float glass, 1/4 inch thick, minimum, ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or as indicated, Quality-Q3.
       a. Tint: Clear.

B. 3. Inboard Lite:
    Fully tempered float glass, 1/4 inch thick, minimum, ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or as indicated, Quality-Q3.
       a. Tint: Clear.
       b. Coating: Low-E type, on #3 surface.

4. Total Thickness: 1 inch.
5. Glazing Method: Gasket glazing.

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   7. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.04 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   4. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Edge Spacers: Aluminum, bent and soldered corners.
3. **Edge Seal**: Glass to elastomer with supplementary silicone sealant.
4. **Edge Seal Color**: black.
5. Purge interpane space with dry hermetic air.

### 2.05 GLAZING COMPOUNDS

**A. Manufacturers:**
5. **Substitutions**: Refer to Section 01 6000 - Product Requirements.

**B. Glazing Putty**: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

**C. Butyl Sealant**: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

**D. Acrylic Sealant**: Single component, solvent curing, non-bleeding; ASTM C 920, Type S, Grade NS, Class 12-1/2, Uses M and A; cured Shore A hardness of 15 to 25; color as selected.

**E. Polysulfide Sealant**: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

**F. Polyurethane Sealant**: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.

**G. 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.

### 2.06 GLAZING ACCESSORIES

**A. Setting Blocks**: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

**B. Spacer Shims**: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

**C. Glazing Tape, Back Bedding Mastic Type**: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
1. **Manufacturers**:
   c. **Substitutions**: Refer to Section 01 6000 - Product Requirements.

**D. Glazing Gaskets**: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; black color.

**E. Glazing Clips**: Manufacturer's standard type.

### PART 3 EXECUTION

### 3.01 EXAMINATION

**A. Verify** that openings for glazing are correctly sized and within tolerance.

**B. Verify** that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

### 3.02 PREPARATION

**A. Clean** contact surfaces with solvent and wipe dry.

**B. Seal** porous glazing channels or recesses with substrate compatible primer or sealer.

**C. Prime** surfaces scheduled to receive sealant.
D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)
A. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)
A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
E. Trim protruding tape edge.

3.05 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)
A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
D. Place glazing tape on free perimeter of glazing in same manner described above.
E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
F. Knife trim protruding tape.

3.06 FIELD QUALITY CONTROL
A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING
A. Remove glazing materials from finish surfaces.
B. Remove labels after Work is complete.
C. Clean glass and adjacent surfaces.

3.08 PROTECTION
A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wall and ceiling outlet boxes.
   B. Pull and junction boxes.

1.02 RELATED REQUIREMENTS
   A. Section 26 0032 - Product Requirements.
   B. Section 26 0050 - Firestopping.
   C. Section 26 0526 - Grounding and Bonding.
   D. Section 26 2726 - Wiring Devices: Wall plates in finished areas and floor box service fittings.
   E. Section 31 2316 - Excavation.

1.03 REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
   C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
   D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
   A. See Division 01 and Section 26 0030 for submittal procedures.
   B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents. Also record actual locations of floor boxes on project record documents.

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 PULL AND JUNCTION BOXES
   A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
   B. Hinged Enclosures: As specified in Section 26 2716.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that mounting surfaces are ready to receive boxes.
   B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
   B. Install in locations as shown on Drawings and approved by owner, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
   C. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.
   D. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
   E. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet (3 m) if required to accommodate intended purpose, without adjustment in contract amount.

F. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

G. Maintain headroom and present neat mechanical appearance.

H. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

I. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 12 inches (____ mm) from ceiling access panel or from removable recessed luminaire.

J. Install boxes to preserve fire resistance rating of partitions and other elements.

K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

L. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

M. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

N. Use flush mounting outlet boxes in finished areas.

O. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening at nearest mortar joint.

P. DO NOT INSTALL FLUSH MOUNTING BOX BACK-TO-BACK IN WALLS; PROVIDE MINIMUM 12 INCHES HORIZONTAL SEPARATION. PROVIDE MINIMUM 24 INCHES HORIZONTAL SEPARATION IN ACOUSTIC RATED WALLS.

Q. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

R. Properly support boxes with approved methods.

S. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

T. Use properly supported, adjustable steel channel fasteners for hung ceiling outlet box.

U. Do not fasten boxes to ceiling support wires.

V. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.

W. Use gang box where more than one device is mounted together. Do not use sectional boxes.

X. Use 4" square box with plaster ring for single device outlets.

Y. Use cast outlet box, FD type, in exterior locations and wet locations.

Z. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION
PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Electrical demolition.

PART 2 PRODUCTS
2.01 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections and drawings.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify field measurements and circuiting arrangements are as indicated on contract documents.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition drawings are based on casual field observation and existing record documents.
   D. Report discrepancies to Architect before disturbing existing installation.
   E. Beginning of demolition means installer accepts existing conditions.
   F. An attempt has been made to show all devices and branch circuits. The electrical contractor shall visit the site to verify devices not shown, extent of conduit, boxes etc, & routings. All devices need to be removed in the demolition area unless noted on the drawings.
   G. It is mandatory that the existing building remain in continuous and non-interrupted operation during remodeling/altering of the existing bldg. The specific area(s) being remodeled/altering at any scheduled time are obviously exclusive of the statement. Services to existing building shall be kept on continuous operation including power, lighting, telephone, fire alarm, etc. Any absolutely necessary interruption of these services to accomplish project construction shall be held to a minimum, arranged with the Owner through the general contractor two (2) weeks in advance. Temporary services shall be furnished and installed where necessary to accomplish this purpose. Temporary systems shall be removed only after new permanent services are installed, fully operational, tested and compliant.
   H. Electrical Contractor shall refer to architectural drawings to familiarize himself with extent of alteration/remodeling work and more specifically note where new partitioning is being installed, where existing partitioning is being removed, where ceilings are being removed and or replaced, etc.
   I. If existing devices to be reused, provide all necessary conduit, wire, and terminations between devices and head end panels.
   J. If existing conduit is allowed to be reused it shall be supported per NEC and these specifications. Field verify the existing conditions prior to bidding.

3.02 PREPARATION
   A. Services to areas not within the demolition/remodel areas shall be maintained.
   B. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   C. All required service and utility outages shall be scheduled in advance, and approved by School District in writing in advance.
   D. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
   E. Existing Electrical Services: Maintain existing systems in service.
   F. Existing Fire Alarm System: Maintain existing system in service as long as possible.
      1. Notify Owner before partially or completely disabling system.
G. Existing Telephone, Data, and Television Systems: Maintain existing systems in service.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Systems to be relocated, extended, or modified include, but are not limited to (not all may apply) telephone, data, fire alarm, PA, intercom, security, nurse call, etc. All systems shall be re-tested to ensure functionality. Testing shall be by vendors for proper certifications of operation.

C. Remove abandoned wiring to source of supply.

D. If existing systems supporting/mounting methods are removed support/remount as required to meet the specifications for new.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

K. Remove all surface mounted conduit/boxes and their associated wiring. Remove all concealed raceways, boxes and wiring from partitions being demolished. Remove all existing wiring/cabling from all existing concealed raceways in partitions that are to remain relating to demolished devices.

L. In remodeled/changed areas any feeders, conduits, branch circuits, signal and telephone circuits, etc. Passing through the remodeled areas to serve (or be served from) existing adjacent, remote, or surrounding areas that are to remain, shall be retained and kept operational and shall be rerouted in all cases where they interfere with any new work or usage to be accomplished in the remodeled area.

M. Where devices are omitted from present branch circuits, the remaining devices shall be re-wired, if needed and as required, to remain on their respective circuits and in operating condition. Re feed from nearest panel or replacement panel. Where possible, electrical contractor may use existing branch circuit conduit, but new circuit wiring will need to be pulled. If existing circuiting is not available in the area of the electrical load, provide a new circuit from the panelboard servicing the area. Where practical, contractor will be allowed to reuse existing wiring, provided that it matches required color code. If contractor elects to exercise this option, he shall warrant used wire as new.

N. All wiring (power, lighting) not reused for remodeling areas, shall be completely removed back to associated panels. Empty boxes and conduits shall be removed beyond remodeled area (above ceiling).

O. Extend existing installations using existing materials where practical, and providing new materials and methods compatible with existing electrical installations. Refer to specific notes on the drawings.

3.04 SALVAGE ITEMS

A. The Owner shall have salvage rights for existing equipment and wire removed and not reused. If owner does not wish to keep this equipment, it shall become Contractor's property and be removed from the site, unless otherwise specified or shown.
B. Disposal of all electrical items (fluorescent lamps, fluorescent ballasts, HID lamps, HID ballasts, transformers, etc.) shall be done in full compliance with all applicable local, county, state, and federal requirements. This Contractor shall bear all costs (fees, permits, etc.) associated with these disposal requirements.

C. Check with owner prior to removal of all items.

D. Items shall not be damaged during removal.

E. Deliver to the Owner all salvage items to be retained by owner. Deliver to owner determined site within the city limits.

F. The Owner shall have the first choice to accept existing devices being removed. Do not relocate existing devices - provide new unless otherwise noted.

G. Salvage items to be returned to Owner shall be as specifically noted on the drawings.

H. All demolition materials not scheduled to be salvaged shall become the Contractor's property, and shall be removed from the site and legally disposed of by or through the contractor.

3.05 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Electrical contractor shall be responsible for his own demolition, removal, capping, storing, abandoning, disconnecting, relocating and reconnection of existing electrical equipment and material. All cutting, patching, repairing, replacement and refinishing, shall match the existing construction as nearly as possible.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Firestopping materials.
   B. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED SECTIONS
   A. Section 26 0035 - Execution Requirements: Cutting and patching.
   B. Section 26 0519 - Low-Voltage Power Conductors and Cables.
   C. Section 26 0534 - Conduit.

1.03 REFERENCES

1.04 SUBMITTALS
   A. No submittals are required for this section.

1.05 QUALITY ASSURANCE
   A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with ASTM E 814 and ASTM E 119.

1.06 ENVIRONMENTAL REQUIREMENTS
   A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
   B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING ASSEMBLIES

2.02 MATERIALS
   A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
      1. Durability and Longevity: Permanent.
      2. Color: Per Manufacturer.
      3. Manufacturers:
         a. 3M Product CP25WB+.
   B. Foam Firestopping: Single component foam compound; conforming to the following:
      1. Durability and Longevity: Permanent.
      2. Color: Per Manufacturer.
   C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
      1. Durability and Longevity: Permanent.
      2. Color: Per Manufacturer.
   D. Fiber Packing Material: Mineral fiber packing insulation; conforming to the following:
1. Durability and Longevity: Permanent.

E. Firestop Devices: Mechanical device with incombustible filler and sheet stainless steel jacket; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      a. EZ Pathway Products; Product EZ Path.

F. Intumescent Putty: Compound which expands on exposure to surface heat gain; conforming to the following:
   1. Potential Expansion: Minimum 1000 percent.
   2. Durability and Longevity: Permanent.
   3. Color: Per Manufacturer.
   4. Manufacturers:
      a. 3M Product MPS+.
      b. 3M Product MPP+.

G. Firestop Pillows: Formed mineral fiber pillows; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      a. 3M Product FB249.
      b. 3M Product FB269.
      c. 3M Product FB369.

H. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

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

3.02 PREPARATION
   A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
   B. Remove incompatible materials which may affect bond.

3.03 INSTALLATION
   A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
   B. Do not cover installed firestopping until inspected by authority having jurisdiction.

3.04 CLEANING AND PROTECTION
   A. Clean adjacent surfaces of firestopping materials.
   B. Protect adjacent surfaces from damage by material installation.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS
   A. Section 07 9200 - Joint Sealants.
   B. Section 26 0050 - Firestopping.
   C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   D. Section 26 0529 - Hangers and Supports for Electrical Systems.
   E. Section 26 0553 - Identification for Electrical Systems.
   F. Section 26 0537 - Boxes.
   G. Section 31 2316 - Excavation.

1.03 REFERENCE STANDARDS
   A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
   B. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
   C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
   D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
   F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
   G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005.
   H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
   I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
   J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
   A. There are no shop drawing submittals required for this section.
   B. Samples of Materials Actually Delivered to Site:
   C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches (51 mm).

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Accept conduit on site. Inspect for damage.
   B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
   C. Protect PVC conduit from sunlight.
PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   2. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   3. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground: Not permitted.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet (1.8 m).

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch (19 mm) for circuit homeruns, and for runs with more than the equivalent of three single circuits served with single pole breakers and #12 AWG conductors. 1/2" conduit may be used for all other runs with the equivalent of 7 #12 AWG conductors or less.
2. Minimum conduit size for runs supplying a single communications outlet shall be 1” or larger as noted on the plans or in Division 27.

B. Underground Installations:
1. More than 5 Feet (1.5 Meters) from Foundation Wall: Use thickwall non-metallic conduit.
2. Through foundation walls and five feet either side: Use plastic coated rigid steel conduit.
3. Where conduits turn up from under slab or from underground: Use plastic coated rigid steel conduit until above slab or grade.
4. Under Slab on Grade: Use thickwall non-metallic conduit.
5. Minimum Size: 3/4 inch (19 mm).
6. Other locations shall be Schedule 40 PVC.

C. Outdoor Locations Exposed Above Grade: Use rigid steel conduit or intermediate metal conduit.

D. In Slab Above Grade (precast wall panels): Conduits shall not be routed in concrete floor topping.
1. Use rigid steel conduit or intermediate metal conduit with appropriate protective coating.

E. Wet and Damp Locations: Use rigid steel conduit or intermediate metal conduit.
1. Liquid tight conduit with liquid tight fittings shall be used for final connection to equipment in kitchens, wells, sump pits, transformer connections, underfloor in computer/server rooms and other areas of moisture content.

F. Dry Locations:
2. Exposed: Use electrical metallic tubing.
3. Flexible metal conduit shall be used for connections to motors, fixed appliances, equipment subject to vibration, and recessed luminaires where required.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
A. Manufacturers:

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

2.04 INTERMEDIATE METAL CONDUIT (IMC)
A. Manufacturers:

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

2.05 METAL CONDUIT
A. Manufacturers: Republic Steel Company, Youngstown, Triangle, Allied, Wheatland, or approved equivalent.
B. Rigid Steel Conduit: ANSI C80.1.
C. Intermediate Metal Conduit (IMC): Rigid steel.
D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
E. All connectors shall have insulated throats.

2.06 PVC COATED METAL CONDUIT
A. Manufacturers: Allied, Robroy Industries or approved equivalent.
B. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil (0.05 mm) thick.
C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.
D. All connectors shall have insulated throats.

2.07 FLEXIBLE METAL CONDUIT
A. Description: Interlocked steel construction.
B. Fittings: NEMA FB 1.
C. All connectors shall have insulated throats.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT
A. Manufacturers: Anaconda, Liquatite, or Electri-Flex or approved equivalent.
B. Description: Interlocked steel construction with PVC jacket.
C. Fittings: NEMA FB 1.
D. All connectors shall have insulated throats.

2.09 ELECTRICAL METALLIC TUBING (EMT)
A. Description: ANSI C80.3; galvanized tubing.
B. Fittings and Conduit Bodies: NEMA FB 1; steel set screw type, except that compression type steel fittings shall be used in wet or damp locations.
C. All connectors shall have insulated throats.

2.10 NONMETALLIC CONDUIT
A. Manufacturers: Carlon, Triangle, Johns-Manville or approved equivalent.
B. Description: NEMA TC 2; Schedule 40 PVC (unless noted or specified elsewhere).
C. Fittings and Conduit Bodies: NEMA TC 3.

2.11 ACCESSORIES
A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as shown on drawings.
B. Verify that mounting surfaces are ready to receive conduits.
C. Verify that conditions are satisfactory for installation prior to starting work.
D. Verify routing and termination locations of conduit prior to rough-in.
E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION
A. Install products in accordance with manufacturer’s instructions.
B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Conduit Routing:
   1. When conduit destination is indicated and routing is not shown, determine exact routing required.
   2. Conceal all conduits unless specifically indicated to be exposed.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   5. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   8. Route conduits above water and drain piping where possible.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  10. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
  11. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces.
      This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
  12. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

J. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide (2) two 1" spare conduits with pull strings over all hard surface ceilings for future use.

O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

P. Provide grounding and bonding in accordance with Section 26 0526.

3.03 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer’s instructions.
D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING
A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION
A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
B. At contractor’s option, existing conduit in remodeled areas may be reused for new branch circuits and feeders where practical, and as noted on the plans. Existing conduits shall meet all requirements for new conduit as specified herein, and shall be warranted as new by the contractor.
C. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
D. Install steel conduit as specified in NECA 101.
E. Install nonmetallic conduit in accordance with manufacturer's instructions.
   1. For all nonmetallic conduit runs 2 inch trade size and larger, all sweeps shall be of galvanized rigid construction. If sweeps are underground, sweeps shall be PVC coated.
F. Arrange supports to prevent misalignment during wiring installation.
G. Support conduit using method approved for installation. All conduit shall be supported from structural members of the building, and not from ceiling support wires, ducts, pipes, or the like.
H. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
I. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.
J. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
K. Arrange conduit to maintain headroom and present neat appearance.
L. Route exposed conduit parallel and perpendicular to walls.
M. Route conduit under slab, and underground from point-to-point.
N. No conduit shall be run within concrete slabs unless specifically noted otherwise.
O. Maintain adequate clearance between conduit and piping.
P. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.
R. Bring conduit to shoulder of fittings; fasten securely.
S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
T. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.
U. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size. Runs that require more than three 90 degree bends shall be brought to the attention of the Engineer.
V. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
W. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
X. Provide conduit seals where raceway enters the building from underground. Seal in accordance with NEC requirements.
Y. Provide suitable pull string in each empty conduit except sleeves and nipples.
Z. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
AA. All conduits to cable trays shall be bonded to the cable tray.
AB. Where conduits pass through exterior walls or roofs, Contractor shall seal penetrations with materials outlined in Section 07 9200.
AC. Where conduits pass through smoke or fire rated walls Contractor shall seal penetrations with appropriate smoke and/or fire rated materials as outlined in Section 26 0050.

3.06 INTERFACE WITH OTHER PRODUCTS
A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0050.
B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation.

END OF SECTION
SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Conduit and equipment supports.
   B. Anchors and fasteners.
   C. For communications cabling, see also specific sections.

1.02  RELATED REQUIREMENTS
   A. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.
   B. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
   C. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03  REFERENCE STANDARDS
   A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04  ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
      2. Coordinate the work with other trades to provide additional framing and materials required for installation.
      3. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

1.05  QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2  PRODUCTS

2.01  MATERIALS
   A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
   B. Supports: Fabricated of structural steel or formed steel members; galvanized or painted, as required.
   C. Anchors and Fasteners:
      1. Do not use powder-actuated anchors.
      2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
      3. Steel Structural Elements: Use beam clamps, steel ramset fasteners, or welded fasteners.
      4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
      5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
      7. Sheet Metal: Use sheet metal screws.
   D. Formed Steel Channel:
1. Product: Unistrut, or equivalent.

E. Steel Spring Clips:
   1. Product: Caddy, or equivalent.
   2. Use only in concealed locations (i.e. above ceilings, within walls, etc.)

F. Conduit Straps:
   1. Product: Steel City, or equivalent.
   2. Cadmium plated steel, one or two hole type, to hold conduit tight to surface.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as shown on the drawings.
   B. Verify that mounting surfaces are ready to receive support and attachment components.
   C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer’s instructions.
   B. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
   D. Install surface-mounted cabinets and panelboards with minimum of four anchors.
   E. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
   F. All supports shall be securely positioned to the structure, not equipment or ceiling tile supports. Coordinate structure load capabilities with General Contractor.
   G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION
August 22, 2019

GSG Architecture
Tim Schenk
606 South David Street
Casper, Wyoming 82601

Re: Geotechnical Engineering Evaluation for the Proposed Additions to Park Elementary School Located at 140 West 9th Street, Casper, Wyoming

Mr. Schenk:

At your request, we have conducted a geotechnical engineering study for the subject project located in Casper, Wyoming.

The subsurface conditions generally consist of 3 to 9 ft of lean clay overlying poorly graded sand with silt. Groundwater was not encountered at the time of drilling.

Structural loads for the additions should be supported with spread footings placed on either the natural, undisturbed sand stratum or on imported granular structural fill as described herein. The thickness of structural fill required will vary across the classroom addition footprint depending on the depth of lean clay, which will require verification by the geotechnical engineer at the time of excavation.

This report describes in detail our field work, summarizes our findings, and presents our recommendations. One electronic copy of the report is provided.

If you have any questions regarding this report, please contact us.

Sincerely,

ECS ENGINEERS, LLC

Brian L. Chandler, P.E.
Geotechnical Engineer

Rev:SG
Enclosure
Geotechnical Engineering Evaluation

Proposed Additions to Park Elementary School
140 West 9th Street
Casper, Wyoming

Prepared for:

GSG Architecture
Tim Schenk
606 South David Street
Casper, Wyoming 82601

Prepared by:

Environmental & Civil Solutions, LLC
111 West 2nd Street, Suite 600
Casper, Wyoming 82601

August 22, 2019
PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical engineering study for the proposed additions to Park Elementary School located at 140 West 9th Street in Casper, Wyoming. This study was conducted for the purpose of developing foundation, site grading, and pavement recommendations for the proposed additions and new parking areas. This study was conducted in accordance with the Work Order between GSG Architecture and ECS Engineers (ECS) and our proposal dated May 10, 2019.

The field exploration program consisted of drilling three exploratory borings within the breezeway addition and the classroom addition footprints to obtain information on the subsurface conditions. The exploratory borings were located generally as shown on the attached Location of Exploratory Borings, Figure 1. Samples of the soil obtained during the field exploration were tested to determine physical and engineering characteristics and analyzed to develop earthwork and construction design recommendations. The results of the field exploration and laboratory testing are presented herein.

This report has been prepared to summarize the data obtained during this study, and to present conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. A discussion of geotechnical engineering considerations related to construction is included in this report.

PROPOSED CONSTRUCTION

We understand that three additions are planned for the existing Park Elementary School. The main addition will be located north of the classroom wing and will add four new classrooms. This addition will be two stories and will have plan dimensions of approximately 42 ft by 71 ft. A second addition will be located on the north side of the existing breezeway which connects the gymnasium to the classroom wing. This addition will be one story and will have a footprint area of approximately 1,700 sf. A third small addition will be located at the southwest corner for new office space. This addition will be one story and will have plan dimensions of approximately 11 by 15 ft. The type of construction will likely be steel framing with masonry veneer. Structural loads are expected to range from 2,000 to 3,000 pounds per lineal foot for walls for the single level additions and 3,000 to 4,000 pounds per lineal foot for the two story addition. Finished floor
elevations for the additions will generally match the existing finished floor elevations. The breezeway addition will require stepping or sloping to match the different finished floor elevations between the gymnasium and the classroom wing.

Site improvements will include additional parking. A row of diagonal parking will be added along David Street and a row of diagonal parking will be added along 8th Street on the south side. Initial plans call for closing 8th Street to the general public and reserving its use for Park School and the NCSD bus hub. We expect only asphalt pavement will be considered.

SITE CONDITIONS

At the time of our field exploration the site of the proposed project was occupied by the existing Park Elementary School. The school grounds are bounded by 9th street to the south, David Street to the west, Center Street to the east, and 8th Street to the north. The existing building is generally “L” shaped and located on the southern portion of the site. The classroom wing is located along the western portion of the site and parallels David Street. The classroom addition is currently used as concrete sidewalk and gravel playground. The breezeway addition is paved with concrete and asphalt and a small storage shed is located within or near the proposed footprint. The office addition is currently a sidewalk. Parking is currently located along the west side of the classroom wing and extends from 8th Street to 9th Street. The topography of the site slopes slightly downward to the north with an elevation difference of approximately 5 ft across the entire site. Surrounding development includes residential, some commercial, and the school district bus hub to the north.

Based on a structural drawing of the existing classroom wing provided by GSG Architecture, the school was supported by spread footings extending to the sand stratum. A note on the drawing stated that foundation bearing elevation is 39.0’ and top of floor slab elevation is 47.32’. This implies that the stem walls are 7 ft in height and that the footings were placed on the sand stratum.

FIELD EXPLORATION

ECS Engineers conducted the field exploration on August 5, 2019. Three borings were drilled to depths of 16.5 ft. Boring B-1 was drilled within the breezeway addition and borings B-2 and B-3
were drilled within the classroom addition. The approximate boring locations are shown on Figure 1. ECS established the boring locations in the field referencing on site features.

ECS contracted Henderson Drilling to perform the drilling services. The drill crew advanced the borings through the on-site soils with a CME 75 truck mounted drill rig using 3.25 inch inside diameter hollow-stem auger. An ECS field engineer logged the borings. Auger refusal was not encountered within any of the borings.

Samples of the subsurface soils were obtained using 1 ⅜ inch inside diameter split barrel samplers. The samplers were driven into the various strata using a 140 lb hammer falling 30 inches. The total number of blows required to advance the standard split barrel samplers each of three successive 6 inch increments is recorded and the sum of the second and third 6 inch increments is recorded as the penetration resistance value (SPT or N value). This testing is performed in general accordance with ASTM D1586, Split Barrel Sampling. Penetration resistance values provide an indication of the relative density of granular soils or consistency of fine-grained soils. Depths at which the samples were obtained, and the penetration resistance values are shown on the attached exploratory boring logs.

The groundwater levels were measured within each boring at the time of drilling. The borings were backfilled with auger cuttings upon completion of drilling and groundwater measurements.

LABORATORY TESTING

Samples of soil obtained during the field exploration were observed and visually classified in accordance with ASTM D2487, which is based on the Unified Soil Classification System. Samples were selected for testing to determine the engineering and physical properties in general accordance with ASTM or other generally recognized procedures. The following table summarizes the tests performed for this project:

<table>
<thead>
<tr>
<th>Test</th>
<th>ASTM Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Moisture Content</td>
<td>D2216</td>
</tr>
<tr>
<td>Percent Passing No. 200 Sieve</td>
<td>D1140</td>
</tr>
<tr>
<td>Atterberg Limits</td>
<td>D4318</td>
</tr>
<tr>
<td>Sieve Analysis</td>
<td>D422</td>
</tr>
</tbody>
</table>
Results of all laboratory tests are summarized on the exploratory boring logs and presented on the table below. The laboratory data, along with the visual field logging information, were used to prepare the exploratory boring logs.

**SUBSURFACE CONDITIONS**

Based on the soil samples obtained from drilling, the subsurface conditions generally consist of 3 to 9 ft of lean clay overlying poorly graded sand with silt. The attached boring logs should be referenced for complete soil descriptions and classifications, stratum thicknesses, N values, and laboratory test results. A brief description of each soil type encountered follows:

**Lean Clay (CL)**

Lean clay was encountered below the asphalt in boring B-1 and below the playground gravel in borings B-2 and B-3. The lean clay extended to approximate depths of 3 ft in boring B-1, 6 ft in boring B-2, and 9 ft in boring B-3. The consistency of the lean clay is medium stiff to stiff as indicated by the N values ranging from 5 to 15. The clay is brown to dark brown in color and moist. Laboratory testing indicates that the lean clay has a moderate to significant compression potential upon loading and becoming wetted.

**Poorly Graded Sand with Silt (SP-SM)**

Poorly graded sand with silt was encountered below the lean clay in all three borings. The sand extended to the depths explored in all three borings, 16.5 ft. The relative density of the sand ranged from loose to dense as indicated by the N values ranging from 7 to 33. However, the stratum is mostly medium dense as the majority of N values ranged from 14 to 25. The sand is light brown in color and slightly moist. A summary of laboratory test results for a sample of the sand is presented in the table below.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Moisture Content</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Percent Passing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1 @ 7.5 ft</td>
<td>2.7%</td>
<td>NP</td>
<td>96</td>
<td>93</td>
</tr>
</tbody>
</table>
Groundwater

Groundwater was not encountered within the borings at the time of drilling. Numerous factors contribute to fluctuations of groundwater levels, and evaluation of such factors are beyond the scope of this study.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

The recommended design and construction criteria presented below should be observed for the geotechnical engineering aspects of the project. The following construction details should be considered when preparing project documents.

Site Grading

The topography of the site slopes slightly downward to the north. The construction of the additions will require minor site grading. Fills ranging from 2 to 3 ft may be required to achieve the floor elevation for the classroom addition. Cuts and fills of 1 ft or less will be required for the other two additions.

Site Preparation

Prepare each addition site by following the general recommendations provided below.

1. Remove all topsoil, vegetation, organic matter, concrete, asphalt, and playground gravel from all construction areas and cut and fill areas.

2. Remove the lean clay in its entirety from all three addition footprints. The exact vertical and lateral extents of the lean clay within each addition footprint can only be determined at the time of foundation excavations. An ECS geotechnical engineer must inspect over-excavations to determine required over-excavation limits.

3. All fill and backfill should be approved by the geotechnical engineer. The lean clay and the poorly graded sand will be the soil types encountered within site grading and foundation excavations. The lean clay is suitable for re-use as new fill only for exterior
foundation wall backfill. It is not suitable for re-use as fill below floors slabs or below pavement areas. The poorly graded sand is suitable for re-use below floor slabs, below pavement sections, and as foundation wall backfill.

4. Structural fill will be required below foundations for the classroom addition and below floor slabs for all three additions. Structural fill will need to be imported and must be approved by the geotechnical engineer prior to importing. In general, structural fill should consist of a consistently graded granular material with a maximum particle size of 1.5 inches, 35 to 75% passing the No. 4 sieve, and 10 to 20% passing the No. 200 sieve.

5. Place imported fill and on-site soil fill required to obtain design grades in thin (8 inch thick maximum), uniform lifts and compact to the following minimum percentages of the maximum dry density as determined by ASTM D698 (Standard Proctor).

<table>
<thead>
<tr>
<th>Application</th>
<th>Compaction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Foundations</td>
<td>97</td>
</tr>
<tr>
<td>Building Pad (below floors)</td>
<td>97</td>
</tr>
<tr>
<td>Exterior Foundation Wall Backfill</td>
<td>95</td>
</tr>
<tr>
<td>Below Concrete Flatwork</td>
<td>95</td>
</tr>
<tr>
<td>Utility Trenches</td>
<td>95</td>
</tr>
<tr>
<td>Below Pavement Sections</td>
<td>95</td>
</tr>
<tr>
<td>Overlot Fill</td>
<td>90</td>
</tr>
</tbody>
</table>

Moisture condition and place imported fill material and on-site soil placed as new fill to within ±2% of the optimum moisture content of each soil as determined by ASTM D698.

Excavations

Based on the subsurface conditions encountered within the exploratory borings, the lean clay and the poorly graded sand will be encountered within the site grading excavations and foundation excavations and over-excavations. Conventional heavy-duty earth excavation equipment will be sufficient for anticipated cuts and foundation excavations.

Care must be taken not to cause construction related induced distress to the existing structure. Appropriately sized equipment for excavating, placing, and compacting fill must be used when working immediately adjacent to the existing building.
Based on a structural drawing of the existing classroom wing provided by GSG Architecture, the school was supported by spread footings extending to the sand stratum. A note on the drawing stated that foundation bearing elevation is 39.0’ and top of floor slab elevation is 47.32’. This implies that the stem walls are 7 to 8 ft in height. If this is the case over-excavations should not undermine existing footings. If this is not the case, over-excavations required for the classroom addition will extend below existing footings for the existing building. Over-excavations that extend below existing footings must be made in short segments, preferably about 10 ft in length and made perpendicular to the existing footings and backfilled with structural fill as soon as possible to help reduce the potential for soil loss below the existing footings.

It is the contractor’s responsibility to provide safe working conditions and safe temporary side slopes for all excavations. Based on the soil type encountered within the exploratory borings and for planning purposes use only, we estimate that the excavation sides will require slopes of 1 horizontal to 1 vertical or flatter to meet OSHA 29 CFR 1926, Subpart P requirements.

**Surface Drainage**

Observe the following drainage precautions during construction and maintain them at all times after the additions have been completed.

1. Slope the ground surface adjacent to exterior foundations to drain away from the foundations in all directions. We recommend a minimum slope of 5% in the first 10 ft for landscaped areas and 2.5% in the first 10 ft for pavement, concrete flatwork, or driveway areas.

2. Discharge roof downspouts and drains well beyond the limits of all foundation wall backfill, preferably a minimum of 10 ft. Maintain downspouts and drains over the life of the facility.

3. Keep landscaping that requires irrigation at least 5 ft from exterior walls.

**Foundations**

*Breezeway and Office Additions*

Approximately 3 ft of compressible lean clay was encountered within the breezeway addition. A boring was not drilled within the footprint of the office addition. However, we believe the lean clay will be relatively shallow in depth. The depth and condition of the lean clay stratum within the office addition footprint must be verified by the ECS geotechnical engineer during construction.
Based on the subsurface profile, spread footing are a suitable foundation type for the breezeway addition and the office addition and must be placed on the natural, undisturbed sand stratum.

**Classroom Addition**

Based on the presence of 6 to 9 ft of compressible lean clay, we recommend that the clay be entirely removed from below all new foundations. Placing foundations on compressible lean clay entails a significant risk of excessive differential movement potentially causing damage to foundations. The lean clay is not suitable for support of structural loads. If the existing footing extended to the sand stratum, undermining of existing footings should not occur. If the existing footings did not extend to the sand stratum, over-excavations will be required that extend below existing foundations. Underpinning can likely be avoided if over-excavations are made in relatively short segments and backfilled with structural fill to the existing bearing elevation as soon as possible. Over-excavations should be constructed at slopes of 1 horizontal to 1 vertical or flatter and should have a minimum bottom width of 4 ft.

Backfilling a relatively deep over-excavation could be made more effective by using a clean ¾ inch gravel for the lower portions. The advantages to using a clean gravel include less compactive effort, less moisture conditioning, and the requirement for compaction testing on the clean gravel would be eliminated. The gravel should be placed in 1.5 ft thick lifts and compacted until all noticeable vertical deflection has ceased or at least six passes of a vibratory compactor. We recommend the use of clean gravel as structural fill only if the existing footings do not extend as deep as indicated on the structural design drawing. If Grading “J” base or other approved structural fill is used, it must be compacted to 97% of the maximum dry density and within 2% of the optimum moisture content as determined by ASTM D698, Standard Proctor.

**Spread Footings**

As outlined above, spread footings are a suitable foundation type provided they are placed on the natural, undisturbed sand stratum or properly placed and compacted structural fill. Design footings using a maximum allowable bearing pressure of 3,000 psf.

Observe the design and construction criteria presented below for a spread footing foundation system.

1. We determined a footing depth and bearing pressure for the design of footings that should provide against bearing failure and excessive settlement. Based upon our experience and
analyses using one-dimensional settlement theory, we recommend that footings be designed using a maximum allowable bearing pressure of 3,000 psf for the properly placed structural fill. For footings designed using this bearing pressure, we estimate the total settlement for the footings will be 1 inch or less. We estimate differential settlement will be less than half the total settlement.

2. Place exterior footings or footings below unheated areas at least 42 inches below final exterior grade for frost protection.

3. Settlements that take place for the additions will be differential with respect to the existing building. The additions should be separated from the existing building as much as possible with construction joints that will allow for differential movement between the structures.

4. Footing sizes must be designed by a licensed Professional Engineer. For planning purposes, we recommend minimum footing widths of 18 inches for continuous footings and 24 inches for isolated pads.

5. Design and construct reinforcing for continuous footings and foundation walls to span an unsupported length of at least 10 ft.

6. Use Type II Portland cement in concrete in contact with the on-site soils.

7. A representative of the geotechnical engineer must observe the foundation excavations prior to concrete placement.

Floor Systems

We understand that the addition floors will consist of concrete slab-on-grade construction. The on-site lean clay in its existing condition is not suitable for support of concrete slab-on-grade floor construction. The floors should be supported on a zone of structural fill. The lean clay should be entirely removed and replaced with imported granular structural fill for all three additions. Compact fill placed below floor slabs to at least 97% of the maximum dry density and at a moisture content within ±2% of optimum moisture as determined by ASTM D698, Standard Proctor.

Observe the following recommendations for concrete slab-on-grade construction.

1. To reduce the effects of some differential movement, separate floor slabs from all bearing walls and columns with expansion joints, which allow unrestrained vertical movement.

2. Use floor slab control joints to reduce damage due to shrinkage cracking. Provide joints approximately 15 ft apart.
3. The requirements for slab reinforcement and thickness should be established by the designer based on experience and the intended use of the slab.

4. Place a 4-inch thick layer of free-draining gravel beneath all concrete slab-on-grade floor slabs. This material should consist of minus 1½-inch size aggregate with less than 60% passing the No. 4 sieve, and less than 5% passing the No. 200 sieve.

Pavement Design

The primary purpose of a pavement section is the distribution of concentrated wheel loads to the subgrade in a manner such that the subgrade is not over-stressed. Performance of the pavement section is directly related to the strength of the subgrade soils and the characteristics of the traffic loading. For purposes of designing a pavement section, subgrade soils are represented by a soil support value for flexible pavements (asphalctic concrete). This representative value is empirically related to strength.

Pavement design procedures are based upon strength properties of the subgrade soils and pavement materials, along with the design traffic conditions (especially truck traffic). Subgrade strength decreases when the subgrade is wetted and is further reduced when saturated. Therefore, proper drainage, both surface and subsurface, is essential for adequate pavement performance.

Pavement requirements were analyzed for anticipated uses within the proposed new parking areas. We do not expect that traffic loads will vary from existing conditions. Traffic will consist of mostly light passenger vehicles. The pavement subgrade will consist of the lean clay. Therefore, a relatively low CBR value was assumed for these soils. The pavement section thickness design was made by using a subgrade modulus of 6,000 psi, which was correlated from an estimated CBR of 4. The analyses included using a 20-year design life and a reliability factor of 80%. In designing the pavement section, we used methods from the AASHTO Guide to Pavement Design (1993).

Subgrade Preparation

Minor cuts may be required to achieve rough subgrade elevation for the pavement areas. Prior to placement of the geotextile fabric, the subgrade should be scarified to a minimum depth of 9 inches, moisture conditioned to near optimum, and compacted. After compaction of the scarified
zone, the resulting subgrade should be proof-rolled with a loaded dump truck to inspect for loose or soft areas. If loose or soft areas are encountered, over-excavation of 1 to 2 ft will be required. An imported granular material (such as Grading J) should be used within the over-excavations, compacted to 95% of the maximum dry density as determined by ASTM D698. If fill is required to achieve the desired pavement subgrade elevations, it should be approved by the geotechnical engineer. Use fill beneath pavements consisting of the on-site soils or imported material approved by the geotechnical engineer. Compact fill below pavement sections to at least 95% of the maximum dry density and within ±2% of optimum moisture content as determined by ASTM D698.

**Recommended Pavement Section**

Based on our design calculations, anticipated traffic, and the field conditions, we recommend the pavement section shown below for new or re-constructed pavement areas and parking areas.

**FLEXIBLE SECTION - ASPHALTIC CONCRETE**

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphaltic Concrete</td>
<td>4</td>
</tr>
<tr>
<td>Crushed Aggregate Base</td>
<td>6</td>
</tr>
<tr>
<td>Subbase</td>
<td>12</td>
</tr>
<tr>
<td>Woven Geotextile Fabric</td>
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</tbody>
</table>

The geotextile fabric should consist of Mirafi 500X, or equivalent. The crushed aggregate base course should consist of Grading W and should be compacted to at least 98% of the maximum dry density and within ±2% of optimum moisture content as determined by ASTM D698. The subbase should consist of Grading J material and should be compacted to at least 95% of the maximum dry density and within ±2% of optimum moisture content as determined by ASTM D698. The asphalt should have a minimum stability of 2,000 lb and should be placed to at least 96% Marshall density.

**Building Maintenance**

It is extremely critical that proper maintenance be performed over the life span of the new additions and the overall building. It is very important that positive site drainage be maintained to ensure overall performance of the foundations and floor systems as presented herein. Maintaining positive site drainage will require periodic maintenance to ensure roof gutters and roof downspouts are properly maintained and properly discharged away from the foundation in all
directions. All landscaping or surface re-grading must take into consideration the positive drainage recommendations presented herein. Changing the surface drainage could have a negative impact on surface flow.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the design data submitted to ECS Engineers, data obtained from the exploratory borings drilled at the locations indicated on Figure 1, and the proposed construction discussed in this report. The nature and extent of subsurface variations across the site may not become evident until construction. During construction, if fill, soil, bedrock or water conditions appear to be different from those described herein, this office must be advised at once so that we may re-evaluate the recommendations made.

This report has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information which has not been described or documented in this report. As the project evolves, we should provide continued consultation during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Significant design changes may require additional analysis or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata by a representative of the geotechnical engineer. Have soil compaction tested during construction in the field by a qualified testing laboratory.

Attachments:
   Figure 1 – Boring Location Plan
   Exploratory Boring Logs
   Laboratory Test Results
CASPER, WY - PARK ELEMENTARY SCHOOL

FIGURE 1 - LOCATION OF EXPLORATORY BORINGS

PARK ELEMENTARY SCHOOL
**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>SPT Value</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Passing No. 200 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
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<td>6</td>
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</tbody>
</table>

- **3 inches of asphalt**
- 0.25 to 3 ft
- Lean Clay (CL), medium stiff, brown, moist
- **3 to 16.5 ft**
- Poorly Graded Sand (SP), medium dense, brown, moist
- Bottom of Boring 16.5 ft

**Sampler Type Symbols:**
- California Sampler
- Split Barrel Sampler

**Groundwater at time of drilling**
- Stabilized groundwater level
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>SPT Value</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Passing No. 200 (%)</th>
<th>Lithology Symbol</th>
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<td>2.5</td>
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<td>3 inches of pea gravel</td>
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<td>5</td>
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<td>0.25 to 6 ft Lean Clay (CL), medium stiff to stiff, brown, moist</td>
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<td>34</td>
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<td>6 to 16.5 ft Poorly Graded Sand (SP), medium dense to dense, light brown, slightly moist</td>
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<td>10</td>
<td></td>
<td>22</td>
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<td>Bottom of Boring 16.5 ft</td>
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</tbody>
</table>

**MATERIAL DESCRIPTION**

- **3 inches of pea gravel**  
  0.25 to 9 ft  
  Lean Clay (CL), medium stiff to stiff, brown, moist

- **9 to 16.5 ft**  
  Poorly Graded Sand (SP), medium dense to dense, light brown, slightly moist

- **Bottom of Boring 16.5 ft**  

**Sampler Type Symbols:**  
- California Sampler  
- Split Barrel Sampler

**Groundwater at time of drilling:**  
- Stabilized groundwater level

**Project Name:** Park Elementary School Additions, Casper, Wyoming  
**Boring Number:** B-3  
**Driller:** Henderson Drilling  
**Logger:** Brian Chandler  
**Boring Location:** West Side of Proposed Classroom Add., See Figure 1  
**Drill Date:** August 5, 2019  
**Drilling Equipment:** CME 75  
**Boring Diameter:** 7 inches  
**Hammer Type:** Automatic  
**Ground Elevation:** 5141.6  
**Groundwater:** Not encountered during drilling

**Log of Exploratory Boring B-3**
Park Elementary School Additions
One Dimensional Swell / Collapse
Boring B-1 at 5 ft

Stress (psf)

Lean Clay (CL)

Strain (%)

Water Added