



Gunston Park Enclosed Athletic Facility Improvements

**1401 28th Street South
Arlington, Virginia 22206**

Project Manual

Bid Submission

**Project No.: 21-DPR-ITB-356
May 03, 2021**

TABLE OF CONTENTS

| | |
|--------------------|--|
| DIVISION 1 | GENERAL REQUIREMENTS |
| 010002 | TABLE OF CONTENTS |
| 011000 | GENERAL CONDITIONS |
| 012000 | MOBILIZATION |
| 013100 | PROJECT MANAGEMENT AND COORDINATION |
| 013200 | CONSTRUCTION PROGRESS DOCUMENTATION |
| 013233 | PHOTOGRAPHIC DOCUMENTATION |
| 013300 | SUBMITTAL PROCEDURES |
| 014000 | QUALITY REQUIREMENTS |
| 014200 | REFERENCES |
| 015000 | TEMPORARY FACILITIES AND CONTROLS |
| 016000 | PRODUCT REQUIREMENTS |
| 017300 | EXECUTION |
| 017329 | CUTTING AND PATCHING |
| 017419 | CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL |
| 017700 | CLOSEOUT PROCEDURES |
| 017823 | OPERATION AND MAINTENANCE DATA |
| 017839 | PROJECT RECORD DOCUMENTS |
| 017900 | DEMONSTRATION AND TRAINING |
| DIVISION 2 | SITE CONSTRUCTION |
| 024119 | SELECTIVE DEMOLITION |
| DIVISION 3 | CONCRETE |
| 033000 | CAST-IN-PLACE CONCRETE |
| DIVISION 7 | THERMAL AND MOISTURE PROTECTION |
| 079200 | JOINT SEALANTS |
| DIVISION 8 | DOORS AND WINDOWS |
| 084113 | ALUMINUM FRAMED ENTRANCES AND STOREFRONTS |
| 087100 | DOOR HARDWARE |
| 089119 | FIXED LOUVERS |
| DIVISION 9 | FINISHES |
| 099113 | EXTERIOR PAINTING |
| 099123 | INTERIOR PAINTING |
| DIVISION 10 | SPECIALTIES |

102800 TOILET, BATH, AND LAUNDRY ACCESSORIES

DIVISION 22 PLUMBING

220500 COMMON WORK RESULTS FOR PLUMBING
220517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
220523 GENERAL DUTY VALVES FOR PLUMBING PIPING
220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220719 PLUMBING PIPING INSULATION
221005 PLUMBING PIPING
221113 FACILITY WATER DISTRIBUTION
224000 PLUMBING FIXTURES

DIVISION 23 HEATING VENTILATING AND AIR CONDITIONING (HVAC)

230500 COMMON WORK RESULTS FOR HVAC
230548 VIBRATION AND SEISMIC CONTROLS FOR HVAC
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
231123 FACILITY NATURAL GAS PIPING
233100 HVAC DUCTS AND CASINGS
233300 AIR DUCT ACCESSORIES
233413 AXIAL HVAC FANS
233423 HVAC POWER VENTILATORS
233700 AIR OUTLETS AND INLETS
235533 FUEL-FIRED UNIT HEATERS
238200 CONVECTION HEATING AND COOLING UNITS
238300 RADIANT HEATING AND COOLING UNITS

DIVISION 26 ELECTRICAL

260500 COMMON WORK RESULTS FOR ELECTRICAL
260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
(600V OR LESS)
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533.13 CONDUIT FOR ELECTRICAL SYSTEMS
260533.16 BOXES FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923 LIGHTING CONTROL DEVICES
262100 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE
262200 LOW-VOLTAGE TRANSFORMERS
262416 PANELBOARDS
262726 WIRING DEVICES
265100 INTERIOR LIGHTING
265600 EXTERIOR LIGHTING

DIVISION 31 EARTHWORK

310000 EARTHWORK
311000 SITE CLEARING, DEMOLITION, AND REMOVALS

311300
312500

TREE PROTECTION AND ROOT PRUNING
TEMPORARY EROSION AND SEDIMENT CONTROL

DIVISION 32

EXTERIOR IMPROVEMENTS

321313
323113
329100
329200

CONCRETE PAVEMENT
CHAIN LINK FENCES AND GATES
PLANTING PREPARATION
SEEDING, SODDING, AND TOPSOIL

DIVISION 33

UTILITIES

334000

STORM DRAINAGE

APPENDIX

1.
2.
3.
4.

CLEAR SPAN MAIN FRAME ASSEMBLY
CLEAR SPAN MAIN FRABRIC ASSEMBLY
FABRIC SPECIFICATION
SHOP DRAWINGS OF EXISTING FIELD SEPARATION WALL

END OF TABLE OF CONTENTS

SECTION 011000 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Use of premises.
 - 3. General requirements.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Gunston Park Enclosed Athletic Facility Improvements
- B. Project Location: 1401 28th Street S, Arlington, VA 22206
- C. Owner: Arlington County, Virginia
Department of Parks and Recreation
2100 Clarendon Boulevard, Suite 414
Arlington, VA 22201
- D. The Work consists of, but is not limited to, the following:
 - 1. Demolition and site work, including the removal of the existing air supported structure and associated mechanical and electrical equipment.
 - 2. The construction of a new pre-engineered membrane structure and hardscape elements. Arlington County will purchase the structure separate from this contract. The Contractor is to coordinate with Arlington County and the pre-engineered membrane structure manufacturer the fabrication and shipment of the structure and material to meet the project schedule. The Contractor is to provide complete installation of the pre-engineered structure. The pre engineered structure manufacture is Clear Span Fabric Structures, 1395 John Fitch Blvd, South Windsor, CT, 06074. Contact is Brad Williams 800-603-4455 x 1241. The Contractor has the option to utilize Clear Span for the building installation or another contractor qualified to install the structure.
 - 3. Site preparation including construction fences, tree protection fencing, temporary erosion and sediment control measures, test pits and construction stake-out.
 - 4. Protection and maintaining all other existing park property, Arlington County right-of-way, and other existing improvements as required.
 - 5. Site restoration of all facilities damaged by construction operations, or as directed by Department of Parks and Recreation (DPR), to the original condition and/or the satisfaction of DPR. Site restoration includes, but is not limited to, pavement restoration, site grading, top soil, seeding and sodding.
- E. Project will be constructed under a single prime contract.

1.3 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated in the Specifications and on the Drawings by the Contract limits.
- B. Existing water fountain(s) shall not be used as supply for construction water.
- C. Use of Site: Do not disturb portions of Project site beyond areas in which the Limit of Disturbance (LOD) is shown. Specific limitations on use of the site include the following:
 - 1. Construction activity shall not take place inside designated tree protection areas, except when necessary. Contractor shall provide Project Officer with 72 hours notice when work within a tree protection area is necessary, so that the County's urban forester can be notified.
 - 2. Maintain public access to areas outside the limits of work whenever possible. Contractor shall request approval from Project Officer 72 hours in advance when closures outside the limits of work are necessary.

1.4 GENERAL REQUIREMENTS

- A. Coordination: The Contractor shall be responsible for coordinating all construction operations included in the various Sections of the Specifications to ensure efficient and orderly installation of each part of the work.
- B. Contact Person: The Contractor shall establish a single contact person that will be responsible for all communication between the Contractor (including all subcontractors) and the Project Officer, Landscape Architect, Architect, and/or Engineer.
- C. Submittals: Upon Contract award, the Contractor shall immediately prepare a list of required submittals, based on the specifications, and begin to gather the required submittals for submission to the Project Officer as soon as possible.
- D. Site Access: Contractor shall ONLY access site per plans. Contractor shall be responsible for any damage to park property from access point to construction entrance at the project's limits of disturbance.
- E. Tree Protection: See plans.
- F. Permits:
 - 1. The County shall provide the Virginia Stormwater Management Permit (VSMP) and the building permit to the Contractor. The Contractor is responsible for obtaining all other required permits (including but not limited to ROW, electrical and/or any other work necessary for the completion of the project) from the Arlington County Department of Environmental Services (DES) and/or Inspection Services Division (ISD).
 - 2. The Contractor is required to submit designs, shop drawings, structural calculations, engineer certifications, or other items required for permit approval. In that case, the Contractor shall build in the required time for obtaining, submitting, and gaining approval of these items into the construction schedule.

3. Permits: Contractor shall be required to obtain any necessary permits except the following that will be provided by the County:
 - a. Building Permit for pre-engineered structure*
 - b. Land Disturbance Activity (LDA) Permit.

G. Subcontractors:

1. A competent person from the Prime Contractor shall be present on the site during the work of all subcontractors. If such a person is not present while a subcontractor is working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.
2. All subcontractors must be furnished with a full set of the contract drawings and specifications at the Contractor's expense, and subcontractors shall be required to have these documents on site while the work is being performed. If the subcontractor does not have access to a full set of plans and specifications while working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.

H. Construction Schedule:

1. The construction schedule shall indicate the dates and date ranges where major components of the Work will be performed.
2. The schedule shall indicate the dates that required submittals will be provided, and shall also indicate time allotted for the review and approval of submittals.
3. The Contractor shall maintain and update the schedule on a monthly basis, and shall resubmit the updated schedule to the Project Officer.
4. The Contract completion date cannot be changed by submission of a construction schedule indicating a different completion date. The Contract completion date can only be changed if specifically authorized by Change Order.

I. Preconstruction Meeting:

1. The Contractor shall attend a preconstruction meeting on-site with the Project Officer, Landscape Architect, their Consultants, the Contractor, major subcontractors, major suppliers, and other concerned parties.
2. At the meeting, the Contractor shall provide the following:
 - a. Construction schedule
 - b. List of required submittals
 - c. List of proposed subcontractors
3. Items of significance that could affect the progress of the work shall be discussed at the meeting.
4. Requirements for tree protection and erosion control shall be reviewed.
5. The Contractor shall record and distribute meeting minutes.

J. Notice to Proceed:

1. After the preconstruction meeting, the Project Officer will issue a written Notice to Proceed (NTP) to the Contractor.

2. The work commencement date shall be (7) calendar days from the date of issuance of Notice to Proceed.
3. The commencement date shall be the first day of the contract.

K. Progress Meetings:

1. The Contractor shall attend construction progress meetings on a bi-weekly basis, and at the request of the Project Officer.
2. An updated construction schedule shall be submitted at each progress meeting.
3. At the meeting, the following issues shall be discussed:
 - a. Work completed to date.
 - b. Work remaining to be completed and anticipated timeframes.
 - c. Issues affecting the progress of the work.
 - d. Items that require correction.
4. The Contractor shall record and distribute meeting minutes.

L. Requests for Information (RFI):

1. The Contractor shall submit a written RFI in any of the following instances (not all-inclusive):
 - a. If the intent of any item in the drawings and specifications is unclear.
 - b. If existing conditions differ from those indicated on the drawings.
 - c. To document any verbal agreements or instructions.
2. In instances (a) and (b), the Contractor shall stop work in the affected area, notify the Project Officer, and await instructions.
3. The Contractor shall be responsible for any expenses incurred due to unexpected conditions if he fails to notify the Project Officer and wait for direction prior to continuing work in the affected area.
4. The Contractor's failure to properly document any verbal agreements or instructions will result in the rejection of any claim for changes to the Contract amount or additional time for completion.
5. The Contractor is responsible for making the necessary inquiries to determine the design intent of the drawings and specifications if anything is unclear, prior to submitting a bid. Claims for changes to the contract amount submitted after Contract award due to an RFI response may be approved or rejected at the sole discretion of the Project Officer.

M. Documentation of Events: The Contractor shall document and immediately report any of the following events to the Project Officer:

1. Accidents.
2. Stoppages, delays, shortages, and losses.
3. Orders and requests of authorities having jurisdiction.
4. Services connected and disconnected.
5. Existing conditions that significantly differ from those indicated on the drawings.

- N. If the project site will not be worked on a particular work day or days, the Contractor shall notify the Project Officer that the site will not be worked on, and shall state the reason for such.
- O. Claims for Delay:
1. The Contractor shall submit a written Claim for Delay within ten (10) working days of any event where the Contractor believes that an extension to the Contract time for completion is necessary or justified.
 2. The written Claim for Delay must include the following information:
 - a. Amount of days claimed
 - b. Justification for the delay
 - c. Supporting documentation
 3. Justifications for Claims for Delay include the following:
 - a. Inclement weather that prevents work on the site
 - b. Events beyond the control of the Contractor that result in a delay to the project, with the following exceptions:
 - 1) Delays in the delivery of materials.
 - 2) Failure of suppliers to provide required submittals in a timely manner.
 - 3) Any delays that result from the actions of a subcontractor.
 - 4) Disputes between the Contractor and subcontractors or suppliers
 - 5) Rejection of submittals.
 - 6) Re-work resulting from unsatisfactory work.
 - 7) Re-work resulting from failure to provide required submittals.
 - 8) Re-work resulting from failure to submit a Request for Information (RFI) if the design intent is unclear.
 - 9) Failure to obtain required permits in a timely fashion, as stated in Section 1.4. D. Permits.
 - 10) Failure to request required inspections from the Inspection Services Division (ISD) in a timely fashion, or rejection of work by an inspector.
 - 11) Stop work orders issued by authorities having jurisdiction that are due to items that are the Contractor's responsibility.
 4. A Claim for Delay may be denied if the Contractor fails to continue work on other aspects of the project that are not affected by the particular delayed item, or if, in the Project Officer's determination, the Contractor has failed to continuously work on the project or effectively manage the project.
 5. If planting installation is not feasible because it is not the proper season for planting, the Contractor shall notify the Project Officer. The Project Officer, at his sole discretion, may decide to treat planting as a Punch List item, thereby exempting it as a requirement for a Determination of Substantial Completion.
- P. Liquidated Damages (Damages for Delay): The Project Officer does NOT have the authority to waive Liquidated Damages unless the supporting documentation described above has been provided by the Contractor (within the aforementioned time limit) and approved by the Project Officer.

- Q. Existing Conditions: Dimensions and/or locations of existing facilities and/or underground utilities shown on the plans are approximate. Contractor shall verify exact locations before commencing work.
- R. Code Compliance: Comply with all applicable codes and regulations of authorities having jurisdiction.
- S. Safety: Take all precautions necessary to protect the public during the construction period.
- T. Protection of Existing Conditions: Take all precautions necessary to protect existing facilities to remain during the construction period. Repair any and all damage to existing facilities to remain caused by construction operations. Maintain existing utilities and protect them against damage during construction. Contact Miss Utility at (800) 552-7001 for utility locations prior to any excavation.
- U. County Rights-of-Way: Work taking place within the right-of-way of County streets shall conform to the Arlington County DES Construction Standards and Specifications. The Contractor shall obtain a right-of-way permit from the County for work to take place within street rights-of-way.
- V. Differing or Conflicting Requirements: If a Specification section requires compliance with two or more standards, or if requirements conflict, the more stringent standard or requirement shall apply.
- W. Quality Control Testing and Laboratory Services: The Contractor shall provide necessary labor and supervision required to support field testing and inspection by the Project Officer. Defects disclosed by tests shall be rectified at no additional cost to the County.
- X. Operation and Maintenance Manuals: Contractor shall provide operations and maintenance manuals for all applicable products and systems used in the Work prior to substantial completion inspection.

END OF SECTION 011000

SECTION 012000 – MOBILIZATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Mobilization shall include the following items:
1. Furnish and set up Contractor's necessary general plant and equipment required for operations on to the site.
 2. Providing on-site sanitary facilities
 3. Providing on-site all OSHA required notices and establishment of safety programs.
 4. Obtaining all required permits for completion of the project.
 5. Having the Contractor's superintendent at the jobsite full time.
 6. The cost of required insurance and bonds and/or any other similar significant initial expense required for the initiation of the contract work shall be included in this item.
 7. Submitting initial submittals and log.

The determination of the adequacy of the Contractor's facilities, except as noted above, shall be made by the Contractor.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 Such work as is done in providing the facilities and services under this item shall be done in safe and workmanlike manner and shall conform with any pertinent County, State or Federal law, regulation, or code. Good housekeeping consistent with safety shall be maintained.

PART 4 – MEASUREMENT AND PAYMENT

The Contractor's attention is directed to the condition that no payment for Mobilization, or any part thereof, will be approved for payment under the Contract Documents until all Mobilization items listed above have been completed as specified to the satisfaction of the Project Officer.

For MOBILIZATION in accordance with the specifications the Contractor shall receive the Schedule-of-Values amount, which is not to exceed three percent (3%) of the total contract bid price excluding the bid for mobilization.

The LUMP SUM price bid for mobilization shall include furnishing, maintaining and demobilization of all services, and facilities noted in this specification, to the extent and at the time the Contractor deems them necessary for his operations, consistent with the requirements of this work and this contract.

END OF SECTION 012000

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project

site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-installation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop

Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 2 inches in diameter and larger.

- b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 - 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 - 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 3300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 - 2. File Preparation Format: DWG Version 2010, operating in Microsoft Windows operating system.
 - 3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.
 - 4. Architect will furnish Contractor one set of digital data files of Drawings for the floor plans and reflected ceiling plan only for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCad 2010 format.
 - c. Contractor shall execute a data licensing agreement Agreement form acceptable to Owner and Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five work days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day. RFI received on Fridays after 1pm will be considered as received on the following Monday.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Use software log that is part of Project Web site. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 5 days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises and existing building.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.

- z. Progress cleaning.
 - 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1.
 - 2. Attendees: Authorized representatives of Owner, Owner's testing and inspection agent, Architect, Architect's consultants as appropriate, Contractor and its superintendent, major subcontractors, installers, fabricators and other concerned parties involved in or affected by the installation, coordination or integration with other materials and installations that have preceded or will follow, shall attend the conference.
 - 3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Compatibility requirements.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written instructions.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Installation procedures.
 - u. Coordination with other work.
 - v. Required performance results.
 - w. Protection of adjacent work.
 - x. Protection of construction and personnel.
 - 4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 5. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
 4. Minutes: Contractor shall record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority (when appropriate) and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.

- 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Minutes: Contractor is responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. PDF electronic file.
 2. One paper and one .pdf copy of all final approved submittals shall be provided to the Owner at the completion of the project.
- B. Startup construction schedule.
1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at monthly intervals.
- G. Material Location Reports: Submit monthly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion and Final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 business days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. Primary Mechanical Equipment
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 business days for startup and testing.
 5. Punch List and Final Completion: Include no fewer than 15 business days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Use of premises restrictions.
 - e. Provisions for future construction.
 - f. Seasonal variations.
 - g. Environmental control.
 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.

- b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Hazardous Materials Abatement, Critical Phasing Objectives, Substantial Completion, and Final Completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 01 2900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 15 business days or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
1. Use Microsoft Project, Primavera, Meridian Prolog, or scheduling component of Project Web site software specified in Section 01 3100 "Project Management and Coordination," for Windows XP or Windows 7 operating systems. The scheduling component of the Project Web site software, if used, must comply with all CPM scheduling, reporting, and performance features and requirements outlined and required in the Contract Documents.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 20 calendar days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.

3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- C. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- D. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.

3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- F. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts 5 business days before each regularly scheduled progress meeting.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.

13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 5 business days before the regularly scheduled progress meeting immediately before the monthly submission date.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Periodic construction video recordings.
 - 6. Web-based construction photographic documentation.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 01 7700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 3. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 4. Section 02 4119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:

- a. Name of Project.
- b. Name and contact information for photographer.
- c. Name of Architect.
- d. Name of Contractor.
- e. Date photograph was taken.
- f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.5 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Take a minimum 80 photographs to show existing conditions before starting the Work.
 2. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs monthly adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take a minimum of 80 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

END OF SECTION 01 3233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Landscape Architect or Project Officer's responsive action.
- B. Informational Submittals: Written information that does not require Landscape Architect or Project Officer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 GENERAL REQUIREMENTS

- A. Upon Contract Award, the Contractor shall prepare a list of required submittals, and shall immediately begin working to compile all required submittals.
- B. The Contractor shall not begin work which requires the submission of other data, until said submittals are returned with the Project Officer's stamp indicating approval or "approved as noted."
- C. Deviations from Contract Documents: Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents. Approval of a submittal does not indicate acceptance of any deviations from the Contract Documents included in the submittal. Such deviations must be approved specifically in writing by the Project Officer.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- B. Project Officer: All submittals shall be submitted to the Project Officer, who will then distribute submittals to the Landscape Architect, as applicable. Landscape Architect shall return submittals with action taken to the Project Officer who will then notify the Contractor.
- C. Submittals Schedule: Include a list of submittals for review in the construction schedule.

- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Project Officer's receipt of submittal. No extension of the Contract Time will be authorized because of the Contractor's failure to incorporate this time into the construction schedule, or transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow ten (10) business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Project Officer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow ten (10) business days for review of each resubmittal.
- E. Identification: Each submittal shall indicate the following:
1. Name of firm or entity that prepared each submittal.
 2. Project name.
 3. Date.
 4. Name and address of Contractor.
 5. Name and address of subcontractor.
 6. Name and address of supplier.
 7. Name and address of manufacturer.
 8. Applicable specification section.
 9. A unique identifier, such as a submittal number.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Project Officer will discard submittals received from sources other than Contractor.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "approved" or "approved as noted."
- I. Use for Construction: Use only final submittals with mark indicating "approved" or "approved as noted" by Project Officer.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Manufacturer's installation instructions.
 - e. Manufacturer's catalog cuts.
 - f. Compliance with specified referenced standards.
 - g. Testing by recognized testing agency labels and seals.
 - h. Notation of coordination requirements.
 - i. Availability and delivery time.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Number of Copies: Submit three (3) copies and one (1) electronic copy of Product Data, unless otherwise indicated. Project Officer will return one copy.
- C. Shop Drawings: Where required in the Specifications, prepare project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Schedules.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if required.
 - i. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 3. Number of Copies: Submit three (3) copies and one (1) electronic copy of each submittal. Project Officer will return one copy.

- D. Samples: When required by other specification sections, submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of samples that includes the following:
 - a. Generic description of sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate specification section.
 - e. Specification paragraph number and generic name of each item.
 3. Samples for Initial Selection: If colors, textures, and/or patterns are not clearly indicated in the drawings and/or specifications, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Project Officer will return submittal with options selected.
 4. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit one set of samples. Project Officer will retain the sample set and indicate acceptance or rejection in writing to the Contractor.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Project Officer will not return copies.
 2. Certificates and Certifications: Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- C. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."
- D. Contractor's Construction Schedule: Comply with requirements specified in Section 01 3200 "Construction Progress Documentation."
- E. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."
- F. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."
- G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- I. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- J. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- K. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- L. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- M. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- N. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.

5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- P. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- Q. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- R. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- S. Design Data, where applicable: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and service and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Prior to submittal to Project Officer, review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions.

- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 7700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 LANDSCAPE ARCHITECT'S ACTION

- A. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Landscape Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. No Exceptions Taken or Approved: A marking of "approved or "No Exceptions Taken" indicates approval of a submittal for general conformance with the design concept of the Project and with the drawings and specifications.
 - a. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - b. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
 - 2. Make Corrections, Approved as Noted or Approved as Noted: A marking of "Make Corrections, Approved as Noted" or "Approved as Noted" indicates conditional approval of a submittal.
 - a. The Contractor is expected to comply with the revisions or notes indicated by the Landscape Architect in the document. These notes become an integral part of the approved submittal and their acceptance by the Contractor indicates an agreement to comply with the noted requirements.
 - b. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - c. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
 - 3. Revise and Resubmit: Based on the notations provided by the Landscape Architect, make revisions required to comply with the requirements in the Contract Documents, and resubmit for approval.
 - 4. Rejected: The product indicated does not comply with the requirements in the Contract Documents and shall not be used in the Project. Provide submittals for the correct product as indicated in the drawings and specifications.
- B. Informational Submittals: Landscape Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.

- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

1.4 CONFLICTING REQUIREMENTS

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

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 1. Indicate manufacturer and model number of individual components.
 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 15 days of Notice to Proceed. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager shall not have other Project responsibilities.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and

inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.
- K. Integrated Exterior Mockup: Construct integrated exterior mockup and coordinate and review installation of exterior envelope materials, products, and quality for one full-height and full width section of exterior cavity wall construction, including, but not limited to doors, windows, and the designated exterior wall veneer, back-up, flashing, moisture barrier, etc. The integrated mock-up shall be the section of exterior wall located between Column Line 3 and Column Line 4 in Detail 1/A302. The Integrated Mock-up shall extend horizontally from existing column to existing column and vertically from grade to the underside of the existing structure above. Also refer to Detail 6/A401, 7/A401, and 7/A815 for additional information

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 Insert number hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspecting equipment at Project site.

- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections applicable to this project and the approved Building Permit, and as follows:
- B. Special Tests and Inspections: Conducted by a qualified [testing agency] [special inspector] as required by authorities having jurisdiction, as indicated in individual Specification Sections[and in Statement of Special Inspections attached to this Section], and as follows:
 - 1. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, with copy to Contractor and to authorities having jurisdiction.
 - 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 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.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 10. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 11. AGA - American Gas Association; www.aga.org.
 - 12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 14. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 15. AIA - American Institute of Architects (The); www.aia.org.
 - 16. AISC - American Institute of Steel Construction; www.aisc.org.
 - 17. AISI - American Iron and Steel Institute; www.steel.org.
 - 18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 20. ANSI - American National Standards Institute; www.ansi.org.
 - 21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 22. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 23. APA - Architectural Precast Association; www.archprecast.org.
 - 24. API - American Petroleum Institute; www.api.org.
 - 25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 26. ARI - American Refrigeration Institute; (See AHRI).
 - 27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 - 28. ASCE - American Society of Civil Engineers; www.asce.org.

29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).

71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA ? Electronic Components Industry Association; www.eciaonline.org
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.
103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.

114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).
144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.

160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrassod.org.
190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tilerroofing.org.
191. UBC - Uniform Building Code; (See ICC).
192. UL - Underwriters Laboratories Inc.; www.ul.com.
193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
194. USAV - USA Volleyball; www.usavolleyball.org.
195. USGBC - U.S. Green Building Council; www.usgbc.org.
196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).

203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

204. WPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).

5. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's personnel, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Refer to Paragraph 3.2.B below for additional information.
- C. Electric Power Service: Electricity from the Owner's existing electrical power systems will be available for use by the Contractor without usage charges. Installation and permitting of temporary power and any associated distribution for use by the Contractor shall be by the Contractor.
- D. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, as needed.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing for Site Enclosure Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- B. Storage and Fabrication Facilities: Provide storage, staging and fabrication facilities equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.
 - 2. All storage of material shall be within the limits of the project or must be located offsite. Arlington County may allow the short-term use of on-site parking for storage containers, but this is not included in the provision of this scope of work. It is the Contractor's

responsibility to locate and confirm availability of storage and staging facilities outside of the limits of the project.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: As needed, provide vented, self-contained, liquid-propane-gas with individual space thermostatic control, as allowed and permitted by the local jurisdiction. Portable, self-contained air conditioning units vented directly to the outside shall be provided to maintain interior space temperature requirements, as required.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run as required to maintain proper negative pressure and air filtration levels during construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Under no circumstance are unauthorized effluents or runoff of any kind allowed to be disposed of through site or street accessible sanitary or storm sewers. This project is located within the Chesapeake Bay Watershed and there are significant legal and monetary consequences that may be incurred by the Contractor for failing to properly manage and dispose of project related runoff and effluents.
 - 2. Discharge of effluents in to the public storm sewer may be allowed if the appropriate storage and pre-discharge dechlorination, filtration and diffusion measures are taken. The contractor is solely responsible for evaluating and complying with the specific requirements and securing approval from the appropriate Arlington County permitting authorities. Contractor shall provide written authorization from Arlington County permitting authorities to the Owner before any discharge activities are initiated.

- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use. Refer to Paragraph 3.2.B above for additional information.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. The Owner will not allow the use of existing sanitary facilities by the Contractor.
- F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. The use of existing or permanent HVAC systems for heating and cooling during construction is not allowed.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead unless otherwise indicated.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Install lighting for Project identification sign.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Permanent Roads and Paved Areas: Temporary use of project site permanent paved areas and hardscapes will be allowed. The contractor is to recondition or restore all permanent existing roadways, sidewalks, and hardscapes used on for temporary construction access to pre-use conditions upon attainment of Substantial Completion.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: No onsite parking shall be provided for the Contractor and construction personnel.
- E. Project Signs: Provide Project signs only as indicated. Unauthorized signs are not permitted.
 1. Temporary Signs: Provide other signs as needed and required to inform public and individuals seeking entrance to Project and for the identification of the project address.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 2. Maintain and touchup signs so they are legible at all times.
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction to secure on-street locations for portable dumpsters, if allowed. Comply with progress cleaning requirements in Section 01 7300 "Execution."
- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, walkways, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains. Refer the contract documents for detailed information.
- D. Tree and Plant Protection: Comply with requirements specified outlined in the contract documents.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence as required to prevent people and animals from easily entering site except by entrance gates. The existing chain link fence around the existing building may be used for portions of the Site Enclosure Fence.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: N/A
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 - 1. Construct covered walkways using scaffold or shoring framing.
 - 2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 - 3. Paint and maintain appearance of walkway for duration of the Work.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. The construction site is a no smoking zone.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
- M. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- N. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION 015000

INTENTIONALLY OMITTED

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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; product substitutions; and comparable products.
- B. See Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
- C. See Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 SUBMITTALS

- A. Proposed Equivalent Item Requests during bidding process:

Refer to Section I. – Instructions to Bidders, Paragraph 16. – Use of Brand Names/Substitutes of the solicitation document for request procedures.

- B. Substitution Requests after Contract award:

- 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Reasons why the specified product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the product specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and owners, if requested.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Statement of impact on the construction schedule. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - i. Cost information, including a proposal of change, if any, in the Contract Sum.

- j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Project Officer's Action: If necessary, Project Officer will request additional information or documentation for evaluation within five (5) business days of receipt of a request for substitution. Project Officer will notify Contractor of acceptance or rejection of proposed substitution within ten (10) business days of receipt of request, or five (5) business days of receipt of additional information or documentation, whichever is later.
- a. Use product specified if Project Officer cannot make a decision on use of a proposed substitution within time allocated.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.5 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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Project Officer.
 - 2. Special Warranty (if required by other specification sections): Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Project Officer.
- B. Special Warranties (if required by other specification sections): Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and that are new at time of installation.
1. Standard Products: 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.
- B. Product Selection Procedures:
1. Sole-Source: Where Specifications name a single product and manufacturer without the words "or approved equal," provide the named product that complies with requirements. No substitutions will be accepted.
 2. Product or Approved Equal: Where Specifications name a single product and manufacturer accompanied by the words "or approved equal," the specification establishes a minimum standard for design and quality. This should not be construed as eliminating from competition other products of equal or better quality that also satisfy the design intent of the project (as determined by the Project Officer). In this case, either provide the named product that complies with requirements, or submit proposed equivalent items for consideration by the Project Officer in accordance with process described in the solicitation documents.
 3. Product List: Where Specifications include a list of manufacturers and products, provide the specified quantity of one of the named products that complies with requirements or an equivalent. Product selected shall be compatible with products previously selected, even if previously selected products were also options. Alternatives not listed will be considered by the Project Officer based on the compliance with specification requirements. To request consideration of an alternative not listed, submit proposed equivalent items for consideration by the Project Officer in accordance with process described in the solicitation documents.

END OF SECTION 016000

SECTION 01 7300 - EXECUTION

1.1 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.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
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. Section 01 1000 "General Conditions" for limits on use of Project site.
2. Section 01 3300 "Submittal Procedures" for submitting surveys.
3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 02 4119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor, professional engineer.
- B. Certificates: Submit certificate signed by land surveyor, professional engineer certifying that location and elevation of improvements comply with requirements.
 1. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be

relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit three copies signed by land surveyor or professional engineer as required by prevailing jurisdictional requirements.
- E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 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

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- 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

3.1 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.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. 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 Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. 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.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

- D. Final Property Survey: Engage a land surveyor or professional engineer, depending on the prevailing jurisdictional requirements, to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, depending on the prevailing jurisdictional requirements, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 84 inches in occupied spaces and 84 inches in unoccupied spaces.
- 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.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 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. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize or prevent, if possible, interruption to occupied areas.
- G. 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 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after all construction operations of all trades requiring cutting are complete.
- H. 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. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface or wall containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface or wall containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 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.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 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 Section 01 5000 "Temporary Facilities and Controls." Section 01 7419 "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.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "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 Section 01 4000 "Quality Requirements."

3.10 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

INTENTIONALLY OMITTED

SECTION 01 7329 - CUTTING AND PATCHING

PART 1 -GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 QUALITY ASSURANCE

- A. General: Contractor shall take reasonable care prior to all cutting and drilling in order to minimize unintended damage to concealed conduits, cables, pipes, reinforcing steel, etc. In circumstances where the absence of such concealed elements is not established conclusively, utilize detection and mapping technology, e.g., X-ray or Sub-surface Interface Radar (SIR), to locate any such elements that may be present before proceeding with the cutting or drilling work.
- B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- C. 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:
 - 1 Air or smoke barriers.
 - 2 Fire-protection systems.
 - 3 Control systems.
 - 4 Communication systems.
 - 5 Conveying systems.
 - 6 Electrical wiring systems.
 - 7 Operating systems of special construction in Division 13 Sections.
- D. Miscellaneous Elements: Do not cut and patch elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous Elements include the following:
 - 1 Water, moisture, or vapor barriers.
 - 2 Membranes and flashings.
 - 3 Exterior curtain-wall construction.
 - 4 Equipment supports.
 - 5 Piping, ductwork, vessels, and equipment.

6 Noise-and vibration-control elements and systems.

- E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.4 WARRANTY

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

PART 2 -PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing and In-Place Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, shall match the visual and functional performance of existing materials.

PART 3 -EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations to adjoining areas.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned,

bypass such services before cutting to prevent interruption of services to occupied areas.

1. If existing services to occupied areas must be interrupted, coordinate and receive approval of the interruption of services prior to starting work.

3.2 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

- 1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- 2 Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
- 3 Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
- 4 Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
- 5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- 6 Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that shall eliminate 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. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of

- uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
- a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 7329

SECTION 01 7419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- F. The following sources may be useful in developing the Waste Management Plan:
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1 Burning on the project site
 - 2 Burying on the project site
 - 3 Dumping or burying on other property, public or private
 - 4 Other illegal dumping or burying
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste. Take back reusable items or unused products to

vendors for credit.

- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production runoff water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-project rates for salvage/recycling of at least Seventy-Five percent (75%) by weight of total waste generated by the Work.

1. Demolition Waste:

- a. Asphaltic concrete 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.
 - ee. Sprinklers.
 - ff. Mechanical equipment.
 - gg. Refrigerants.
 - hh. Electrical conduit.
 - ii. Copper wiring.
 - jj. Lighting fixtures.
 - kk. Lamps.
 - ll. Ballasts.
 - mm. Electrical devices.
 - nn. Switchgear and panel boards.
 - oo. Transformers.

2. Construction Waste:

- a. Site-clearing waste.
- b. Masonry and CMU.
- c. Lumber.
- d. Wood sheet materials.
- e. Wood trim.
- f. Metals.
- g. Roofing.
- h. Insulation.
- i. Carpet and pad.
- j. Gypsum board.
- k. Piping.
- l. Electrical conduit.
- m. Packaging: Regardless of salvage/recycle goal indicated 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.
 - 6) Wood crates.
 - 7) Plastic pails.

1.04 SUBMITTALS

- A. See Section 01 3300 Submittal Procedures, for submittal procedures.

1. Provide alternatives to landfill use for at least the following materials:

- a. Aluminum and plastic beverage containers.

- b. Corrugated cardboard.
- c. Wood pallets.
- d. Clean dimensional wood.
- e. Concrete.
- g. Bricks.
- h. Concrete masonry units.
- i. Asphalt paving.
- j. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

B. Waste Management Plan: Include the following information:

- 1 Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
- 2 Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of.
- 3 Recycling: The name, address, and telephone number of the Recycler(s) where trash/waste will be delivered for reuse.
- 4 Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
- 5 Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
- 6 Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 016000 Product Requirements for substitution submission procedures.
- B. Substitution Requests submitted during the bidding period: follow the instructions included in Section I. INSTRUCTIONS TO BIDDERS of the Invitation to Bid document.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 013100 and 01320 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 017329 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and

overseeing and documenting results of the Waste Management Plan

- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1 Pre-bid meeting
 - 2 Pre-construction
 - 3 Regular jobsite
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1 Provide containers as required
 - 2 Provide adequate space for pickup & delivery & convenience to subcontractors
 - 3 Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse offsite

END OF SECTION 01 7419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Project Officer of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Project Officer unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit as-built drawing markups, operation and maintenance manuals, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Project Officer. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Project Officer. Advise Project Officer's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 10. Advise Project Officer of changeover in utilities.
 - 11. Submit changeover information related to Project Officer's occupancy, use, operation, and maintenance.
 - 12. Complete final cleaning requirements, including touchup painting.
 - 13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Final Completion. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled

requirements. Project Officer will prepare the Certificate of Final Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by the Project Officer, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection 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 Acceptance.

1.3 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 1. Submit a final Application for Payment.
 2. Submit copy of Project Officer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Project Officer. The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Instruct Project Officer's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Officer will process final payment after inspection or will notify Contractor of construction that must be completed or corrected before payment will be issued.
 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.5 WARRANTIES

- A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- B. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Clean each surface or unit to condition expected in an average cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove snow and ice to provide safe access to site.
 - e. Remove labels that are not permanent.
 - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- g. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - h. Replace parts subject to unusual operating conditions.
 - i. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - j. Leave Project clean and ready for use.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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.

1.2 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. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 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.

1.4 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 all required operations and maintenance manuals in the following format:

1. One PDF (Portable Document Format) electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 2. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return one copy.
- 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.
- E. Final Payment: Final Payment to the Contractor will not be released until Operation And Maintenance Manuals have been reviewed and approved in accordance with the requirements of this section.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 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."

2.2 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.
3. Manual 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, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names

used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. 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. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
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. Provide reduced scale facsimile versions in the binder and provide a reference pointing to the large scale drawings located at the rear of the manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

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

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor 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.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 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.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

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

2.6 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, if applicable.
- 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

3.1 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. Separately, comply with requirements of newly prepared record Drawings in Section 01 7839 "Project Record Documents."
- G. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

1.1 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.

1.2 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. Section 01 7300 "Execution" for final property survey.
 - 2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 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 one paper-copy set of marked-up record prints.
 - 2) Submit one PDF electronic file of scanned record prints.
 - 3) 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 set(s) of prints.
- B. Record Specifications: Submit three paper copies and one scanned PDF copy of the paper mark-up for each submittal, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and one scanned copy of the paper mark-up for 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 and one scanned PDF copy of each submittal.

- E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, 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.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3300 "Submittal Procedures" for requirements related to use of digital data files.
- 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.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 3. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as three paper copies and one scanned PDF copy of the paper copy.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
- B. Format: Submit record Product Data as one paper copy and one scanned PDF copy of the marked-up paper copy.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

3.1 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 01 7839

INTENTIONALLY OMITTED

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 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, and 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.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module. Provide two electronic copies within seven days of each training module in electronic video format (MPEG).
 - 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. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc or DVD.

1.5 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 Section 01 4000 "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. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "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.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 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

2.1 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:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 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

3.1 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 Section 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 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 through Architect with at least fifteen 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. Cleanup: Collect used and leftover educational materials and give to the Owner, if requested or remove from Project Site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 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 .mp4 format file type or a format file type acceptable to Owner with prior approval, 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. 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 01 7900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "General Conditions" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for use.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

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

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.

B.

- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control]and, for noise control. Indicate proposed locations and construction of barriers.

- D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

- 4. Use of elevator and stairs.
- 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- F. 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.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Inventory: Submit a list of items that have been removed and salvaged.
- 1.8 QUALITY ASSURANCE
 - A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- 1.9 FIELD CONDITIONS
 - A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
 - D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
 - E. Storage or sale of removed items or materials on-site is not permitted.
 - F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- PART 2 - PRODUCTS
 - 2.1 PERFORMANCE REQUIREMENTS
 - A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - B. Standards: Comply with ASSE A10.6 and NFPA 241.
- PART 3 - EXECUTION
 - 3.1 EXAMINATION
 - A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
 - B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
 - C. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."

2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- 3.2 PREPARATION
- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- 3.4 PROTECTION
- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
 - B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and

finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner

5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.9 SELECTIVE DEMOLITION SCHEDULE (Refer to drawings for additional information)

- A. Remove:
 - 1. The existing air support structure and its associated mechanical system are to be removed completely. Refer to the drawings for other items to be removed.
- B. Remove and Salvage:
 - 1. Existing fans.
- C. Remove and Reinstall:
 - 1. The existing soccer field separation wall panels, including goals are to be removed, labeled, stored in a weather tight environment and reinstalled in their current location once the new structure is erected. The contractor is to provide any missing or damaged fasteners for a complete installation. Any damaged panels are to be replaced with new panels to match existing at no cost to the Owner. The existing benches are to be removed, stored and reinstalled.
- D. Existing to Remain:
 - 1. The existing field turf is to remain. The contractor is to protect the existing sport turf from damage during construction. Areas of turf are to be pulled back to allow for construction of the new structural supports. The turf is to be reinstalled as per the manufacturer's recommendations. Any damaged turf is to be replaced with new turf to match existing at no cost to the Owner.
 - 2. Existing concrete walkways not scheduled to be demolished on the drawings are to remain and be protected. Any damaged walkway is to be replaced with new concrete walkway to match existing.
 - 3. The existing chain link fence is to remain unless noted otherwise on the drawings. Portions of the fence can be removed and reinstalled if required for construction operations and is to be reinstalled.

E.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer, manufacturer, and testing agency.

- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Vapor retarders.
 - 7. Semirigid joint filler.
 - 8. Joint-filler strips.
- D. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
- F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

- D. Comply with ACI 301.
- E. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 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 edge 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.
 - 3. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls/grade beams indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- C. Deformed-Steel Wire: ASTM A 1064/A 1064M.

- D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- F. Galvanized-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.4 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.

2.5 CONCRETE MATERIALS

- A. 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.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II.
 - 2. Fly Ash: ASTM C 618, Class F Fly ash shall be from a single source
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag or Type IP, portland-pozzolan cement.
 - 5. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S, Class 3M or Class 1N coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

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

F. Water: ASTM C 94 and potable.

2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.7 RELATED MATERIALS

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

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Slag Cement: 50 percent.
 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: as indicated on drawings.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Piers, exterior slab on grade, walls and grade beams: Normal-weight concrete.
 - 1. Minimum Compressive Strength: as indicated on drawings.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- C. Interior Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: as indicated on drawings.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

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

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F 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 are not 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 Project Officer.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for grade beams, in the middle third of spans. Offset joints in girders a minimum distance of twice the grade beam width from a beam-pier intersection.
 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals/piers, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6

inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

3.7 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.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. 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 restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.

- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighthen 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 interior slabs
 - 2. Finish surfaces to be flush and level with the existing pavement
 - 3. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
- 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 ITEM INSTALLATION

- 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.

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 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 remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. 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 does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

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

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Project Officer. Remove and replace concrete that cannot be repaired and patched to Project Officer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches 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. Repair materials and installation not specified above may be used, subject to Project Officer's approval.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. 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.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; [ASTM C 173/C 173M one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. 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.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. 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.
10. 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.
11. Test results shall be reported in writing to Project Officer, 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.
12. 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 Project Officer. 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.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silyl-terminated polyether joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

B. Related Requirements:

1. Section 07 9100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
2. Section 07 9219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product. For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.
- E. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- F. Laboratory Test Reports for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

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

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 1. Architectural sealants shall have a VOC content of 250 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
 1. Sealant materials exposed to view shall match colors of adjacent surfaces.
 2. Manufacturer's standard colors may be used, providing color match can be attained. If manufacturer's standard color do not achieve suitable color match, provide custom blended colors.
 3. Architect/ Interior Designer shall make final color selection or determination.

2.2 SILICONE SEALANT

- A. Silicone Sealant: One-part, moisture curing, non-sag, low-modulus, silicone.
 1. Specification Compliance:
 - a. ASTM C920, Type S, Grade NS, Class 25
 - b. FS TT-S-001543A
 - c. FS TT-S-00230C
 2. Joint Movement Capability: ASTM C719
 - a. 100% max. total joint movement ($\pm 50\%$ joint movement)

3. Joint Dimensions:
 - a. Width: 1” maximum
 - b. Depth: 1/4” minimum; 3/8” maximum
4. Typical Applications: Exterior vertical and non-traffic horizontal surfaces
5. Provide one of the following products, or an approved equivalent:
 - a. Dow-Corning - 790 Silicone Building Sealant
 - b. Dow-Corning - 795 Silicone Building Sealant
 - c. GE - SilPruf NB SCS9000
 - d. Pecora - 864
 - e. Tremco - Spectrem 1
 - f. Tremco - Spectrem 3

2.3. POLYURETHANE SEALANT.

A. Polyurethane Sealant: Two-part, cold applied, self-leveling

1. Specification Compliance:
 - a. ASTM C920, Type M, Class A, Grade P, Class 25, Use T
 - b. FS TT-S-00227E, Type I and Type II
2. Joint Movement Capability: ASTM C719
 - a. 50% max. total joint movement ($\pm 25\%$ joint movement)
3. Joint Dimensions:
 - a. Width: No limitation
 - b. Depth: 1/4” minimum; 1/2” maximum
5. Typical Applications: Exterior and interior horizontal and sloped traffic surfaces
6. Provide one of the following products or an approved equivalent:
 - a. Pecora - Urexpan NR-200
 - b. Sonneborn - SL2
 - c. Tremco - THC-900/901
 - d. Vulkem - 245

2.4. ACRYLIC SEALANT

A. Acrylic Sealant: One-part, acrylic latex; non-staining, non-bleeding, and paintable

1. Specification Compliance: ASTM C834
2. Joint Dimensions:
 - a. Width: 3/4” maximum
 - b. Depth: 1/4” minimum; 3/8” maximum
3. Typical Applications: Interior vertical and non-traffic horizontal surfaces
4. Provide one of the following products or an approved equivalent:
 - a. Pecora - AC-20

- b. Sonneborn - Sonolac
- c. Tremco - Tremflex 834

2.5. SANITARY SEALANTS

- A. Sanitary Sealants: One-part, fungicidal, silicone rubber sealant
 - 1. Specification Compliance:
 - a. ASTM C920, Type S, Grade NS, Class 25
 - b. FS TT-S-00230C
 - c. FS TT-S-001543C
 - 2. Typical Applications: At plumbing fixtures, lavatory counters, and countertops
 - 3. Provide one of the following products, or an approved equivalent:
 - a. Dow-Corning - 786
 - b. GE- 1700
 - c. Pecora - 898
 - d. Tremco - Tremsil 200

2.2 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or

by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:

- a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precaster architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.
 - h. Joints between different materials listed above.
 - i. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - j. Control and expansion joints in ceilings and other overhead surfaces.
 - k. Other joints as indicated on Drawings.
 2. Joint Sealant: Polyurethane Sealant: Two-part, cold applied, self-leveling. Refer to Paragraph 2.3 above..
 3. Joint-Sealant Color: As selected by Landscape Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and partitions.
 - d. Other joints as indicated on Drawings.
 1. Joint Sealant: Polyurethane Sealant: Two-part, cold applied, self-leveling. Refer to Paragraph 2.3 above.
 2. Joint-Sealant Color: As selected by Landscape Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic Sealant: One-part, acrylic latex; non-staining, non-bleeding, and paintable. Refer to Paragraph 2.4 above.
 3. Joint-Sealant Color: As selected by Landscape Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: One-part, fungicidal, silicone rubber sealant. Refer to paragraph 2.5 above.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- 3.8 Separate and recycle waste materials to maximum extent economically feasible in compliance with Waste Management Plan for LEED Credit MR 2.1 and MR 2.2; refer to Section 01 7419, Construction Waste Management and Disposal.

END OF SECTION 079200

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

- A. This Section includes Aluminum Entrances, glass and glazing, and door hardware and components.

Types of Kawneer Aluminum Entrances include: a.

90 Swing Door; Wide stile, 5" (127 mm) vertical face dimension, 1-3/4" (44.5 mm) depth, high traffic applications.

- B. Related Sections:

1. 079200 "Joint Sealants"
2. 087100 Door Hardware

1.3 Definitions

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

- A. General Performance: Aluminum-framed entrance system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Aluminum Framed Entrance Performance Requirements:
 1. Wind loads: As indicated on drawings and based on 2015 International Building Code..
 2. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 PA) for single and pairs of doors. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft². A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm/ft².
 3. Structural Performance: Corner strength shall be tested per the Kawneer dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity
- C. Environmental Product Declarations (EPD): Shall have a Type III Product-Specific EPD.
- D. Material Ingredient Reporting: Shall have a complete list of chemical ingredients to at least 100ppm (0.01%) that covers 100% of the product, acceptable documentation includes:

1.5 Submittals

-
- A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed entrance door indicated.
 - 1. Recycled Content:
 - a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content with a sample document illustrating project specific information that will be provided after product shipment.
 - b. Once product has shipped, provide project specific recycled content information, including:
 - 1) Indicate recycled content; indicate percentage of pre- and post-consumer recycled content per unit of product.
 - 2) Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - 3) Indicate location recovery of recycled content.
 - 4) Indicate location of manufacturing facility.
 - 2. Environmental Product Declaration (EPD).
 - a.

Include a Type III Product-Specific EPD.
 - 3. Material Ingredient Reporting:
 - a.

Include documentation for material reporting that has a complete list of chemical ingredients to at least 100ppm (0.01%) that covers 100% of the product.
 - B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
 - C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
 - D. Samples for Verification: For aluminum-framed entrance door and components required.
 - E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed entrance doors.
 - F. Fabrication Sample: Corner sample consisting of a door stile and rail, of full-size components and showing details of the following:
 - 1. Joinery, including welds.
 - 2. Glazing.
 - G. Other Action Submittals:
 - 1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum-framed entrance doors and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

- C. Source Limitations: Obtain aluminum-framed entrance door through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed entrance doors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements". Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for type(s) of swing entrance door(s) indicated, in location(s) shown on Drawings.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 Project Conditions

- A. Field Measurements: Verify actual dimensions of aluminum-framed entrance door openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 -

PRODUCTS 2.1

**A. Basis-of-Design Product:
Manufacturers**

- 1. Kawneer Company Inc.
 - 1. The door stile and rail face dimensions of the entrance door will be as follows

| Door | Vertical Stile | Top Rail | Bottom Rail |
|-------------|-----------------------|-----------------|--------------------|
| 500 | 5" (127 mm) | 5" (127 mm) | 10" (254 mm) |
 - 2. Major portions of the door members to be 0.125" (3.2) nominal in thickness and glazing molding to be 0.05" (1.3) thick.
 - 3. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
 - 4. Provide adjustable glass jacks to help center the glass in the door opening.

B. Acceptable Manufacturers

- 1. YKK
- 2. EFCO

2.2 Materials

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum-framed entrance door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" (2.3 mm) wall thickness at any location for the main frame and door leaf members.

-
1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
 - B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components.
 - C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
 - E. Red List Free: All parts and materials comply with the Living Building Challenge/DECLARE Red List and the Cradle-to-Cradle (C2C) Banned List.
 1. PVC free.
 2. Neoprene free.OR

2.3 Storefront Framing System

- A. Storefront Entrance Framing:
 1. Thermally Broken Entrance Framing - Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
 - a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- B. Non-Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing

-
- A. Glazing: 1" Insulated Glazing, Fully Tempered, Maximum U Factor= .77, Minimum SHGC= .40
 - B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rub-ber.
 - C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 Hardware

- A. General: Refer to section 087100 Door Hardware

2.6 Fabrication

- A. Fabricate aluminum-framed entrance doors in sizes indicated. Include a complete system for as-sembling components and anchoring doors.
- B. Fabricate aluminum-framed glass doors that are reglazable without dismantling perimeter fram-ing.
 - 1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" (29 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
 - 2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
 - 3. Prepare components with internal reinforcement for door hardware.
 - 4. Arrange fasteners and attachments to conceal from view.
- C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.

2.7 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Associa-tion for designating aluminum finishes.
- B. Factory Finishing:
 - 2. (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color to be selected by Architect from Manufacturer's full range of colors.)

PART 3 -

EXECUTION 3.1

- A. **Examination** Examine openings, substrates, structural support, anchorage, and conditions, with Installer pre-sent, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
 - 1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76.2 mm) of opening.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

-
- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories, and other components.
 - B. Install aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
 - C. Set sill threshold in bed of sealant, as indicated, for weather tight construction.
 - D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

- A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 Adjusting, Cleaning, and Protection

- A. Clean aluminum surfaces immediately after installing aluminum-framed entrance doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084113

1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" (29 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
 2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
 3. Prepare components with internal reinforcement for door hardware.
 4. Arrange fasteners and attachments to conceal from view.
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2.7 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
 2. (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color to be selected by Architect from Manufacturer's full range of colors.)

PART 3 - EXECUTION

3.1 Examination

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
 1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76.2 mm) of opening.
 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories, and other components.

-
-
- B. Install aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
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- A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 Adjusting, Cleaning, and Protection

- A. Clean aluminum surfaces immediately after installing aluminum-framed entrance doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084113

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow steel doors.
- B. Electrified door hardware.
- C. Thresholds, weatherstripping, seals and door gaskets.

1.02 RELATED SECTIONS

- A. Section 061000 – Rough Hardware
- B. Section 061100 – Provisions for installation of work in this section
- C. Section 081113 – Hollow Metal Doors and Frames

1.03 REFERENCES

- A. ANSI/ICC A117.1 – Standard for Accessibility and Usable Buildings and Facilities; 2003
- B. BHMA A156.4 – Standard for Door Controls-Closers; 2008
- C. BHMA A156.6 – Standard for Architectural Door Trim; 2005
- D. BHMA A156.7 – Standard for Template Hinge Dimensions; 2009
- E. BHMA A156.8 – Standard for Door Controls-Overhead Stops and Holders; 2005
- F. BHMA A156.13 – Standard for Mortise Locks and Latches; 2005
- G. BHMA A156.16 – Standard for Auxiliary Hardware; 2008
- H. BHMA A156.18 – Standard for Material and Finishes; 2006
- I. BHMA A156.21 – Standard for Thresholds; 2009
- J. BHMA A156.22 – Standard for Door Gasketing Systems; 2005
- K. BHMA A156.23 – Standard for Electromagnetic Locks; 2004
- L. BHMA A156.26 – Standard for Continuous Hinges; 2006
- M. BHMA A156.28 – Standard for Keying Systems; 2007
- N. BHMA A156.30 – Standard for High Security Cylinders; 2003

- O. DHI A115 Series – Specification for Steel Door and Frame Preparation for Hardware; Door and Hardware Institute; current edition
- P. DHI (LOCS) – Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 1990
- Q. NFPA 80 – Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007
- R. NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Agency; 2006
- S. UL (BMD) – Building Materials Directory; Underwriters Laboratory, Inc.; current edition

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit six (6) copies of the hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking. The hardware schedule shall clearly indicate the architect's hardware set and manufacturer of each proposed item. The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant, who shall affix his or her seal attesting to the completeness and correctness of the hardware schedule.
2. Provide two (2) copies of illustrations from the manufacturers catalogs and data in brochure form.
3. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable items and proposed substitutions in the hardware schedule.
4. Furnish hardware samples for design and finish as requested by the architect. These samples may remain part of the project as long as product is protected from damage and remain in new condition.
5. Provide a keying schedule using keyset symbols referenced in the Door and Hardware Institute manual "Keying Systems and Nomenclature". The keying schedule shall be indexed by door number, keyset and hardware heading number and shall include cross keying instructions and special stamping instructions.
6. Provide a complete and detailed system of operating and elevation diagrams specifically developed for each opening requiring electrified hardware, except openings where only magnetic hold-opens and door position switches are specified. Provide these diagrams with the hardware schedule submittal, for approval. The following shall be included:
 - a. System schematic
 - b. Point to point wiring diagram
 - c. Riser diagram
 - d. Elevation of each door
 - e. Detail interface between electrified hardware and associated trades

B. Manufacturers Installation Instructions:

1. Provide manufacturers written installation and adjustment instructions for each item of hardware. Send installation instructions to the site with hardware.

C. Maintenance Data:

1. Submit three (3) sets of operating and maintenance manuals containing the following information:
 - a. Complete information in the care, maintenance, lubrication, adjustment and preservation of finishes.
 - b. Data on repair and replacement parts.
 - c. Catalog pages for each product.
 - d. Name, address and phone number of the local representative for each manufacturer.

CI. Keys:

1. Deliver with identifying tags to the Owner by security shipment direct from the hardware supplier.

CII. Warranty:

1. Submit manufacturers written warranty and assure that forms have been completed in the Owners name and registered with the manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:

1. NFPA 101
2. NFPA 80

B. Manufacturers Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of ten (10) years of documented experience. Obtain each item of hardware (i.e. hinges, latch and locksets, exit devices, closers) from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with a minimum of ten (10) years of documented experience. The hardware supplier shall have warehousing facilities within 100 miles of the project and employ a certified Architectural Hardware Consultant. This consultant shall be available to the architect and general contractor during normal operating hours.

D. Substitutions: Manufacturers and model numbers listed are to establish a standard of quality and design. Any substitution of products not listed in the specifications will be reviewed in accordance with the provisions of Section 012500.

E. Six (6) months after final completion of the project a factory representative of the provided material shall perform a jobsite walk through. This will be done to determine if products are performing as recommended by the manufacturer and meet all fire and life safety requirements. Deficiencies due to installation shall be corrected by the general contractor and defective material shall be replaced by the hardware distributor.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements pertaining to fire rated doors and frames.
- B. All Hardware on Fire Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

1.07 PRE-INSTALLATION MEETING

- A. Convene one (1) month prior to commencing work of this section with the owner to establish final keying and masterkey groups.
- B. Prior to installation of the hardware, manufacturers representatives for locksets, exit devices and closers shall arrange and hold a jobsite meeting to instruct the installing contractors personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the architect and owner.
- C. The general contractor shall arrange a meeting with the architect and owner to establish security requirements for this project. This meeting shall be conducted prior to erection of interior and exterior partitions to establish wire runs and location of junction boxes and power supplies.

1.08 DELIVERY, STORAGE AND PROTECTION

- A. Package hardware items individually; label and identify each package with door number and hardware item code to match the hardware schedule.
- B. Deliver, store and handle packaged hardware to prevent damage to finishes and deterioration in the product due to the elements.
- C. Inventory door hardware upon receipt and provide a secure lock-up.

1.09 COORDINATION

- A. Coordinate the work with other trades directly affected involving the manufacture or fabrication of internal reinforcement for door hardware.
- B. Furnish two (2) complete sets of templates for door and frame preparation with copies of the final approved hardware schedule. Submit necessary templates and schedules as soon as possible to the hollow metal, wood door and aluminum door (if applicable) fabricators so as not to delay production.
- C. Coordinate Owners keying requirements during the course of the work.
- D. The general contractor shall be responsible for coordination of all Electrical System rough-in and connections to electrified door hardware.

1.10 WARRANTY

- A. The warranty period shall be one (1) year from the date of final completion for all items of hardware unless noted otherwise.

- B. The warranty period for manual door closers shall be ten (10) years from the date of final completion.
- C. All manufacturers screws and attachments supplied with each hardware item must be installed to maintain the warranty.

1.11 MAINTENANCE PRODUCTS

- A. Provide special wrenches and tools as applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by the hardware component manufacturer.
- C. Furnish three (3) dozen extra screws and other fasteners of each size, type and finish used with the hardware items provided. These screws and fasteners are to be delivered to the hardware installer for use during installation. All extra screws and fasteners and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the project.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS: Provide products by one of the following manufacturers, or an approved equal:

- A. Continuous Hinges:
 - 1. McKinney Products Company (MK)
 - 2. Markar Architectural Products, Inc. (MA)
 - 3. Pemko Manufacturing Company (PE)
- B. Latchsets and Locksets:
 - 1. Corbin Russwin ML2000 Series (RU)
 - 2. Schlage Lock Company L9000 Series (SC)
 - 3. Sargent Manufacturing Company 8200 Series (SA)
- C. Manual Door Closers:
 - 1. Corbin Russwin DC6000 Series (RU)
 - 2. Norton Door Controls 7500 Series (NO)
 - 3. Sargent Manufacturing Company 1131/1431/351 Series (SA)
- D. Overhead Stops and Holders:
 - 1. Rixson (RF)
 - 2. Rockwood Manufacturing Company (RO)
 - 3. Sargent Manufacturing Company (SA)
- E. Exit Devices:
 - 1. Sargent Manufacturing Company (S) 8000 Series
 - 2. Yale Locks and Hardware (YA)- 6000 Series
 - 3. Corbin Russwin (RU) ED4000 Series
- F. Protection Plates:

1. Rockwood Manufacturing Company (RO)
2. Hiawatha, Inc. (HI)
3. Trimco (TR)

G. Thresholds:

1. Pemko Manufacturing Company (PE)
2. Reese Enterprises, Inc (RE)
3. Zero International (ZE)

H. Gasketing and Door Bottoms:

1. Pemko Manufacturing Company (PE)
2. Reese Enterprises, Inc (RE)
3. Zero International (ZE)

2.02 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:

1. Applicable provisions of Federal, State and local codes.
2. ANSI/ICC A117.1 American National Standards for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101 Life Safety Codes.
4. Applicable provisions of NFPA 80 Fire Rated Doors.
5. All hardware on fire rated doors and frames as listed and classified by UL as suitable for the purpose specified and indicated.

B. Finishes: Identified in the hardware sets at the end of this section.

2.03 MORTISE LOCKSETS

A. Provide lock functions and trim as specified in the hardware sets, with the following provisions:

1. Backsets: 2-3/4 inches.
2. Locks shall have field adjustable, beveled armored front, with a 1/8 inch thick-ness minimum.
3. Cylinders shall be manufacturers high security, seven pin, meeting the require-ments of UL437.
4. Latchbolt shall be solid one-piece 3/4 inch throw anti-friction stainless steel.
5. Deadbolt shall be a full one inch throw made of stainless steel and have two (2) hardened steel roller inserts.
6. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf.

2.04 HIGH SECURITY CYINDERS

A. All cylinders shall meet the requirements of UL 437 including those for drill and pick resistance.

B. Pick Resistance: Cylinders shall incorporate two or more independent locking mecha-nisms, including:

1. A pin tumbler device with six top pin chambers, capable of masterkeying to accommodate various keying levels including masterkey level, grandmasterkey level and higher. Mushroom shaped driver pins shall be provided in all top pin chambers. Additionally, the pin chambers in the cylinder shall be countermilled to engage the lip of the mushroom top during a picking attempt.
 2. Coded sidebar locking mechanisms operated independently from the six top pin tumbler devices. The sidebar shall be milled from nickel-silver, be physically capable of at least 2,500 different combinations and be operated by five coded stainless steel sidepins. The sidebars shall be reversible thus forming two distinct keyways per sidebar. False grooves around each sidepin for the sidebar shall offer additional pick resistance.
- C. Drill Resistance: Cylinders shall incorporate hardened or case-hardened components to foil drilling attacks, as follows:
1. Cylinder housing shall contain fixed in-place case-hardened inserts to protect the pin tumbler shear line.
 2. Cylinder plug shall contain case-hardened inserts to protect the pin tumbler shear line and the sidebar.
 3. Mushroom shaped stainless steel driver pins.
 4. Sidepins shall be of stainless steel.

2.05 KEYING

- A. All locks and cylinders to be Grandmaster or Masterkeyed to a new high security key system as required by the owner.
- B. Keying requirements to be coordinated and completed at factory to protect the integrity of the system. Field keying will not be permitted and will be considered as just cause for rejection of supplier.
- C. Cylinders shall be an integral part of the locks as manufactured by specified lock supplier. Substitution of foreign made cylinders or components will not be allowed and also will be cause for rejection of supplier.
- D. All cylinders to be furnished with the manufacturers seven pin tumbler.
- E. Provide quantities of keys as follows:
 1. Six (6) each grandmasterkeys
 2. Six (6) each masterkeys each group
 3. Three (3) each change keys per lock or cylinder
- F. Provide nickel-silver keys.
- G. All keys to be stamped with the keyset symbol and "DO NOT DUPLICATE".
- H. Provide a factory issued bitting list indicating the key cut numbers corresponding with the keyset symbol.

2.06 CLOSERS

- A. Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA.
- B. Heavy duty arms shall be provided with cast iron heavy duty soffit brackets. Stamped bracket material will not be acceptable.
- C. Provide drop plates, brackets or adaptors for door and frame as required to suit conditions.
- D. Mount closers on room side of corridor doors, interior of exterior doors and stair side of stairway doors, unless noted otherwise.
- E. Provide back-check for all closers.
- F. Back-check and delayed-action feature (where specified) shall be provided with a standard pressure relief valve to protect the door from excessive force.
- G. Closing speed, latching speed and back-check shall be controlled by separate key operated valves. All valves to be captivated.
- H. Closer covers shall be of high impact plastic material of flame retardant grade, secured by machine screws. Projection of the closer body from the door shall not exceed 2-3/16 inches.

2.07 DOOR TRIM AND PROTECTIVE PLATES

- A. Kickplates shall be .050 gauge and two (2) inches less the door width at single openings, and one (1) inch less the door width at pairs of doors, unless otherwise specified. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware sets.
- B. Provide all protection plates with countersunk screw holes and pan head machine or self tapping screws.

2.08 OVERHEAD STOPS AND HOLDERS

- A. Provide overhead stops and holders as specified in the hardware sets, with the following provisions:
 - 1. All overhead stops and holders shall be provided with extruded bronze channels and arms.
 - 2. All overhead stops and holders shall be provided with metal end caps finished to match the channel.
 - 3. All overhead stops and holders shall be provided and installed with thru-bolts. The contractor is to review final door and frame locations on the project and determine the proper type of door stop to be provided and installed based on the actual conditions, and at no additional cost to the owner.

2.09 THRESHOLDS, WEATHERSTRIPPING AND DOOR SEALS

DOOR HARDWARE

08 7100 - 8

GUNSTON PARK

- A. Provide thresholds as specified in the hardware sets, with the following provisions:
1. Refer to drawings for special details. Provide accessories, shims and fasteners.
 2. Provide machine screws and expansion bolts for all thresholds at concrete floors.
 3. Provide self-tapping fasteners for weatherstripping and door seals being applied to hollow metal frames.
 4. Where thresholds are specified at openings exposed to pools or high corrosive areas stainless steel or zinc plated fasteners shall be provided.

2.10 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. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. 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.
7. 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.

8. Rail Sizing: Provide exit device rails factory sized for proper door width application.

B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.
- B. The general contractor shall ensure that the building is secured and free from weather elements prior to installing interior hardware. Examine hardware before installation to ensure it is free from defects.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install hardware in accordance with the manufacturer's instructions and applicable codes. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in any other way, coordinate removal, storage and re-installation or application of surface protection with finishing work specified in Division 9 sections. Do not install surface mounted items until finishes have been completed on the substrates involved.
- B. Use templates provided by the hardware item manufacturer.
- C. Install hardware on fire rated doors and frames in accordance with code and NFPA 80.
- D. Set units level. Plumb and true to line and location. Adjust and reinforce attachment to substrate as necessary for proper installation and operation.
- E. Set thresholds for exterior and acoustical openings in full bed of butyl-rubber or polyisobutylene mastic sealant forming a tight seal between threshold and surface to which it is set.
- F. Boxed power supplies shall be located as indicated, or if not indicated, above accessible ceilings or in equipment rooms. Verify location with the architect.
- G. Mounting heights for hardware from finished floor to centerline of hardware item:
 - 1. For steel doors and frames and wood doors comply with DHI Recommended Locations for Architectural Hardware for Steel Doors and Frames.
 - 2. Hardware locations for steel and wood doors shall be the same.

A. 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 ventilation equipment, and to comply with referenced accessibility requirements.

B. Clean hardware surfaces soiled by installation or by work in adjacent areas.

3.04 PROTECTION OF FINISHED WORK

A. Do not permit adjacent work to damage door hardware or finish.

3.05 DOOR HARDWARE SETS

Set: 1 – Exterior Entry Door

Doors: 101

| | | | | |
|---|------------------|---------------------------|-------|----|
| 2 | Continuous Hinge | MCK-25HD | Clear | MK |
| 2 | Exit Device | AD8406 x ET | 32D | SA |
| 2 | Closer | PRO7500 | 689 | NO |
| 2 | Mounting Plate | 7788 | 689 | NO |
| 2 | Kickplate | K1050 8" x 2" LDW 4BE CSK | US32D | RO |
| 2 | Overhead Stop | 9-X36 x 90 deg | 652 | RF |
| 2 | Drip Strip | 346 C x DOW + 4" | | PE |
| 1 | Overhead Holder | 9-X26 x 90 deg | 630 | RF |
| 1 | Threshold | 1715 AK x DOW x MS & ES25 | | PE |
| 1 | Gasketing (Set) | S88 BL x DOW x DOH | | PE |
| 1 | Door Bottom Seal | 345 AV x DOW | | PE |

Confirm cylinder options with door manufacturer.

Set: 2 – Exterior Entry Door

Doors: 102 and 103

| | | | | |
|---|------------------|----------------------------|-------|----|
| 1 | Continuous Hinge | MCK-25HD x 83" | Clear | MK |
| 1 | Exit Device | AD8406 x ET | 32D | SA |
| 1 | Latch Protector | 321 | US32D | RO |
| 1 | Closer | DC6210 A13 | 689 | RU |
| 1 | Kickplate | K1050 10" x 2" LDW 4BE CSK | US32D | RO |
| 1 | Overhead Holder | 9-X26 x 90 deg | 630 | RF |
| 1 | Threshold | 1715 AK x DOW x MS & ES25 | | PE |
| 1 | Gasketing (Set) | S88 BL x DOW x DOH | | PE |
| 1 | Door Bottom Seal | 345 AV x DOW | | PE |
| 1 | Drip Strip | 346 C x DOW + 4" | | PE |

Confirm cylinder options with door manufacturer.

Set: 3 – Exterior Storage

Doors: 04

| | | | |
|-------------------|--------------------|-------|----|
| 6 Gate Hinges | by Gate Contractor | | |
| 1 Exit Device | 8804 ET | 32D | SA |
| 1 Latch Protector | 321 | US32D | RO |

Set: 4 – Toilet Room Doors

Doors: D1 and D2

| | | | |
|--------------------|----------------------------|-------|----|
| 1 Continuous Hinge | MCK-25HD x 83" | Clear | MK |
| 1 Privacy Lockset | ML2030 NSA x M19V | 630 | RU |
| 1 Latch Protector | 321 | US32D | RO |
| 1 Closer | DC6210 A13 | 689 | RU |
| 1 Kickplate | K1050 10" x 2" LDW 4BE CSK | US32D | RO |
| 1 Overhead Holder | 9-X26 x 90 deg | 630 | RF |
| 1 Threshold | 1715 AK x DOW x MS & ES25 | | PE |
| 1 Gasketing (Set) | S88 BL x DOW x DOH | | PE |
| 1 Door Bottom Seal | 345 AV x DOW | | PE |
| 1 Drip Strip | 346 C x DOW + 4" | | PE |

END OF SECTION 087100

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed, formed-metal louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

- D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: procedures and personnel according to the following:
 - 1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 FIELD CONDITIONS

- A. Qualify
- B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
 - 2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louvers

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Ruskin Company; Tomkins PLC.
 - d. or Approved Equal
- 2. Louver Depth: 4 inches.
- 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
- 4. Mullion Type: Exposed.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide subsills made of same material as louvers for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Fluoropon or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As selected by Landscape Architect from manufacturer's full range of standard and premium colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, 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.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.

- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Wood.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equivalent:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As indicated in a color schedule.

2.3 PRIMERS/SEALERS

- A. Primer, Bonding, Water Based: MPI #17.

2.4 METAL PRIMERS

- A. Primer, Galvanized, Water Based: MPI #134.

2.5 WATER-BASED PAINTS

- A. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.

2.6 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, alkyd, anti-corrosive for metal[, MPI #79].
- b. Prime Coat: Shop primer specified in Section where substrate is specified.
- c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- d. Topcoat: Light industrial coating, exterior, water based (Gloss Level 3)[, MPI #161].
- e. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5)[, MPI #163].
- f. Topcoat: Light industrial coating, exterior, water based, gloss (Gloss Level 6)[, MPI #164].

2. Alkyd System:

- a. Prime Coat: Primer, alkyd, anticorrosive for metal, MPI #79.
- b. Prime Coat: Shop primer specified in Section where substrate is specified.
- c. Intermediate Coat: Exterior alkyd enamel matching topcoat.
- d. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

B. Galvanized-Metal Substrates:

1. Latex System:

- a. Prime Coat: Primer, galvanized, water based, MPI #134.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 099113

INTENTIONALLY OMITTED

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
 - 1. Concrete floors
 - 2. Concrete masonry units (CMU).
 - 3. Metal
 - 4. Gypsum board

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equivalent:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24.)
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Colors: As indicated on drawings

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107.
- B. Primer, Alkyd, Anti-Corrosive, for Metal:[MPI #79.]

1. Primer, Galvanized, Water Based: MPI #134.

2.6 WATER-BASED PAINTS

- A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.
- B. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.

2.7 FLOOR COATINGS

- A. Sealer, Water Based, for Concrete Floors: MPI #99.
 1. Sealer, Solvent Based, for Concrete Floors: MPI #104.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces (toilet rooms):
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Landscape Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Landscape Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
- B. Steel Substrates:
 - 1. Latex over Alkyd Primer System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, Gloss Level 5, MPI #54.
- C. Galvanized-Metal Substrates:
 - 1. Latex over Waterborne Primer System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

D. Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.

END OF SECTION 099123

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. See Editing Instruction No.1 in the Evaluations for cautions about naming manufacturers. Retain one of first two paragraphs and list of manufacturers below. See Section 016000 "Product Requirements."
- B. Basis-of-Design Product: Borbrick Washroom Equipment, Inc. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following or approved equivalent:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

C. Grab Bar

- 1. Basis-of-Design Product: Bobrick, B5806
- 2. Mounting: Flanges with concealed fasteners.
- 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
- 4. Outside Diameter: 1-1/2 inches
- 5. Configuration and Length: As indicated on Drawings
- 6. American Dryer, Inc.
- 7. American Specialties, Inc.
- 8. Bobrick Washroom Equipment, Inc.
- 9. Bradley Corporation.
- 10. Excel Dryer Corporation.
- 11. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
- 12. Tubular Specialties Manufacturing, Inc.
- 13. World Dryer Corporation.

2.3 UNDERLAVATORY GUARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following or approved equivalent:
 - 1. Plumberex Specialty Products, Inc.

2. Truebro by IPS Corporation.

B. Underlavatory Guard

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf , when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Division 01, the General Conditions, Supplementary General Conditions, and Special Conditions apply to this and all Plumbing sections.
- B. This Section applies to all Plumbing specification Sections.

1.2 JOB CONDITIONS

- A. The drawings show the general scope and arrangement of the plumbing systems and shall be followed as closely as actual conditions allow.
- B. Give consideration to all other trades. Make arrangements to avoid conflicts and interference with other work. Fully coordinate all components of plumbing systems with minor adjustments as required, including provision of offsets, transitions, fittings, and accessories to meet actual conditions.

1.3 ELECTRICAL WORK

- A. Electrical equipment and electrical motor-driven equipment specified herein shall be provided complete with motors, integral motor starters where indicated, and controls.
- B. Electrical equipment and wiring shall conform to the requirements of Division 26 - Electrical. Manual or automatic control and protective or signal devices required for the operation specified herein, and any control wiring required for control devices but not shown on the electrical plans shall be provided under this Section.

1.4 CONFORMANCE TO REGULATIONS

- A. All work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes.

1.5 REGULATORY REQUIREMENTS

- A. All products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the contractor shall be responsible for having the equipment or materials tested by a UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.6 QUALITY ASSURANCE

- A. Work shall meet or exceed minimum recommendations of:
 - 1. ANSI - American National Standards Institute
 - 2. ASME American Society of Mechanical Engineers
 - 3. ASPE - American Society of Plumbing Engineers
 - 4. ASTM - American Society for Testing and Materials
 - 5. AWS - American Welding Society
 - 6. USDOE - United States Department of Energy
 - 7. EPA - Environmental Protection Agency
 - 8. IBC - International Building Code (current adopted edition)
 - 9. IECC - International Energy Conservation Code (current adopted edition)
 - 10. IPC - International Plumbing Code (current adopted edition)

11. NEMA - National Electrical Manufacturers Association
 12. NIOSH - National Institute for Occupational Safety and Health
 13. NSF - National Sanitation Foundation
 14. OSHA - Occupational Safety and Health Act
 15. TIMA - Thermal Insulation Manufacturers Association
 16. UL - Underwriters' Laboratories
 17. VUSBC - Virginia Uniform Statewide Building Code (current adopted edition)
- B. Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective at the date of taking bids.
- C. The specifications, codes, and standards referenced in these specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made. In case of conflict between the referenced specifications, the more stringent requirement shall govern unless otherwise permitted by the Architect/Engineer. Major conflicts shall be referred to the Engineer for resolution.
- 1.7 MATERIALS AND EQUIPMENT
- A. Unless specifically provided otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and be new, current design, unused, and undamaged.
- B. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate equipment shall be interchangeable.
- 1.8 UTILITIES AND CONNECTIONS
- A. Verify location of all existing utilities before laying out and making connections. Report any inconsistencies to Engineer before commencing work. Contractor shall be responsible for any error resulting from failure to exercise these precautions.
- 1.9 WIRING DIAGRAMS
- A. All plumbing equipment shall be provided with complete wiring diagrams showing all power and control connections. The diagrams shall be placed in a clear plastic pouch that is permanently affixed to the equipment.
- 1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Refer to Division 01 requirements.
- B. Protect products from damage, marring, and soiling.
- C. Any marring of factory finishes shall be touched up to match the original factory finish.
- 1.11 SUBMITTALS
- A. Refer to Division 01 requirements.
- B. General: The Contractor shall submit information, for Landscape Architect review, to demonstrate compliance of proposed Products and/or installations with the Contract Documents. This information shall include, but not be limited to: catalog data; performance data; noise levels; etc. Proposed Products that are not in compliance with the Contract Documents may be rejected. Information must be submitted on all required Products, including proposed Products that appear to be in compliance with the Contract Documents.
- C. Contractor preparation:

1. The Contractor shall review and approve each submittal and coordinate all other related or affected Work before submitting for review. All copies of each submittal shall bear the Contractor's stamp, with signature or initials, certifying review and approval; verification of field dimensions; and coordination with adjacent Work are in compliance with the requirements of the Contract Documents.
 2. The Contractor shall identify variations from the requirements of the Contract Documents on all copies of applicable submittals. No extra charges shall be paid for the providing of Products or furnishing of Work required as a result of failure to comply with this requirement.
- D. Submittal Format:
1. Each submittal shall be accompanied by a letter of transmittal listing Project Title, Contractor, Subcontractor or supplier, submitted Products, pertinent drawing and detail number, and specification section number, as appropriate.
 2. Product data shall be clearly marked to identify the applicable Products or models. Options or modifications required by the Contract Documents shall be clearly identified.
 3. Submittals shall be complete with all associated Products. Submittals on portions of a Product or system shall not be reviewed.
 4. Provide Manufacturer's start-up procedures, testing and checklists.
- E. Landscape Architect Procedures: Submittals will be reviewed with reasonable promptness. The Contractor shall allow 10 days for review of each submittal. The Landscape Architect's comments will be indicated on a Submittal Review Comments form, which will be attached to each copy of the submittal. Contractor shall be responsible for distributing copies of reviewed submittals as appropriate.
- F. Resubmission: Contractor shall change or correct submittals as required by the Landscape Architect and resubmit until approved. The Contractor shall identify any changes other than those required by the Landscape Architect on all copies of the resubmittal.
- G. Approval required: The ordering, fabrication and/or installation of Products before approval of all relevant submittals shall be at the Contractor's risk. Any damage to new or existing Work resulting from the installation of unapproved Products shall be repaired or replaced by the Contractor at no additional cost. Payment will not be recommended for any Work that does not have an approved submittal.
- 1.12 SUBSTITUTIONS
- A. Refer to Division 01 requirements.
 - B. For a Product specified by naming one or more manufacturer and model, and followed with the statement "or approved equal," the Contractor may submit a Product other than the Product specified by manufacturer and model, that Product shall be considered a Substitute Product and shall comply with the following conditions:
 1. The Contractor shall verify the Substitute Product is equal or superior in all respects to the Specified Product.
 2. The Contractor shall submit data on the Substitute Product in compliance with the "Submittals" paragraph herein.

3. After the Substitute Product has been approved by the Landscape Architect, the Contractor shall be responsible for coordinating the installation of the Substitute Product with all trades. The Contractor shall be responsible for any changes required to incorporate the Substitute Product into the Work.
4. The Contractor waives all claims for additional costs related to the Substitute Product that becomes apparent before, during or after installation.

1.13 OPERATING AND MAINTENANCE MANUAL

- A. Refer to Division 01 requirements.
- B. General: The Contractor shall submit one copy of the Operation and Maintenance Manual to the Landscape Architect for review a minimum of 60 days prior to Instruction and Training Sessions. This copy will be returned to the Contractor with Architect/Engineer's comments or approval. The Contractor shall revise and resubmit one copy of the O&M Manual as required. The Contractor shall provide four copies of the approved O&M Manual. Instruction and Training Sessions shall begin 30 days after receipt of the approved O&M Manuals. Refer to "Instruction and Training Sessions" paragraph herein.
- C. Binders: Commercial quality, 8-1/2x11 inch, three ring binders with durable plastic covers; three inch maximum ring size. Attach printed labels to the front and side of each binder stating '[PROJECT NAME] OPERATION AND MAINTENANCE MANUAL'; applicable volume number; and project title. Provide tabbed dividers for each Product and system, with typed description or applicable Specification Section. Provide a table of contents for the entire manual and insert at the front of each binder.
- D. Contents: The manual shall consist of three parts as follows:
 1. Part 1: Directory listing names, addresses, and telephone numbers of Landscape Architect, Architect, Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions including, but not limited to, the following:
 - a. General description and specifications of each component and of each system as a whole.
 - b. Manufacturer's catalog description of each component supplemented by approved equipment submittals.
 - c. Detailed electrical and logic descriptions.
 - d. Installation and start-up instructions, including complete calibration procedures for each component and for system as a whole.
 - e. Operating instructions including:
 - 1) Sequence of operation
 - 2) Shutdown procedure
 - 3) Emergency operating procedures
 - f. Trouble shooting guide with service instructions
 - g. Preventive maintenance schedules
 - h. Parts list with names, addresses, and telephone numbers of local parts suppliers.
 - i. Names, addresses, and phone numbers of nearest service organizations
 - j. Interface requirements and capabilities.

- k. Detailed schematics of equipment.
 - l. Complete equipment schedules.
 - 3. Part 3: Project documents including, but not limited to, the following:
 - a. Certificates
 - b. Copies of warranties.
 - E. Quality: The manual will be reviewed by the Landscape Architect to determine accuracy, completeness and quality of printing. Deficiencies will necessitate resubmittals by the Contractor. Refer to "Submittals" paragraph herein.
 - 1.14 INSTRUCTION AND TRAINING SESSIONS
 - A. Refer to Division 01 requirements.
 - B. After all equipment and services are in operation and receipt of the approved Operation and Maintenance Manuals, Instruction and Training Sessions shall be conducted for representatives of the Owner.
 - C. Instruction Session shall be conducted during the Owner's normal working periods and at times satisfactory to the Owner.
 - 1. Session shall be sufficient to address all aspects of instruction and training for the installed systems.
 - D. The Training Session shall address the operation and maintenance of each piece of equipment and of the system as a whole. Preventative maintenance techniques shall be included.
 - E. Instructions and training shall be given by competent, factory-trained service and operating personnel from the appropriate manufacturer(s). The Contractor shall record the names of all personnel present at each Instruction and Training Session and shall forward a copy of the attendance log to the Landscape Architect within seven days after each session.
 - 1.15 RECORD DRAWINGS
 - A. Refer to Division 01 requirements.
 - 1.16 PROJECT/SITE CONDITIONS
 - A. Install work in locations shown on Drawings, unless prevented by Project conditions.
 - B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.
 - 1.17 WARRANTIES
 - A. Refer to Division 01 requirements.
 - B. Warranty periods shall begin from Date of Final Completion.
 - 1.18 CONTRACTOR COORDINATION
 - A. Nomenclature for final room names and numbers may vary from the construction documents. Final names and numbers used in the shop drawings shall be coordinated with final room names and numbers assigned by the Owner and Architect.
 - B. Plumbing contractor(s) shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of each contractor to review the work of other trades (including, but not limited to civil, structural, architectural, HVAC, and electrical) as it affects their work, and as their work affects other trades, to insure
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that the construction documents are closely followed. Where discrepancies arise, they shall be referred to the Landscape Architect for resolution before proceeding with the Work.

PART 2 - EXECUTION

2.1 GENERAL

- A. Unless otherwise noted, install equipment in accordance with manufacturer's printed instructions for application indicated.
- B. Install, operate, and adjust systems in accordance with the plans and specifications.
- C. All work for this division shall conform to the regulations of the applicable federal, state, and local laws, ordinances, and codes.
- D. A Request For Information (RFI) shall be submitted to the Architect/Engineer for any portion of the Work that the Contractor determines a clarification is required. Prior to submitting a RFI the Contractor shall thoroughly research the Contract Documents to ensure information has not been overlooked. The RFI shall include references to the portion of the Contract Documents that requires a clarification. The Contractor shall allow a minimum of three business days for the Landscape Architect to respond to the RFI. The Contractor shall not proceed with that portion of the Work until a response has been returned.
- E. All Products delivered to the site(s) shall be stored in accordance with the manufacturer's printed instructions. If a manufacturer does not have printed instructions then the Product shall be adequately housed and otherwise protected against damage or corrosion. If any Product stored at the site(s) is not protected as specified herein, the Contractor shall not receive payment for that Product. Any Product damaged as a result of failure to comply with this requirement shall be replaced by the Contractor at no additional cost to the Owner.

2.2 ACCESSIBILITY

- A. Locate all equipment, which must be serviced, operated, or maintained in fully accessible positions in accordance with manufacturer's recommendations and subject to approval of Architect. Provide a minimum of two feet of clearance in front of equipment access doors and components requiring service.

2.3 PROTECTION OF OPENINGS

- A. Openings in partially installed systems, including equipment and piping, shall be plugged, capped, or otherwise closed with approved methods and materials or devices until connections are made.

2.4 PROTECTION FROM MOVING PARTS

- A. Belts, shafts, couplings, and other rotating or moving parts, located so that any person may come in proximity thereto, shall be fully enclosed or properly guarded.

END OF SECTION

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.2 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.3 QUALITY ASSURANCE

- A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.
- B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- E. Pipe Passing Through Mechanical Floors:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Clearances:
 - 1. Provide allowance for insulated piping.

2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations:
 1. Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, partitions, and [_____]. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 1. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
- G. Manufactured Sleeve-Seal Systems:
 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.

2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- 3.3 CLEANING
- A. Upon completion of work, clean all parts of the installation.
 - B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Applications.
- B. General requirements.
- C. Ball valves.

1.2 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 0719 - Plumbing Piping Insulation.
- C. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- C. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.
- D. ASME B31.9 - Building Services Piping 2017.
- E. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- F. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- G. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- H. NSF 61 - Drinking Water System Components - Health Effects 2019.
- I. NSF 372 - Drinking Water System Components - Lead Content 2016.

1.4 SUBMITTALS

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.5 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - 2. Store valves in shipping containers and maintain in place until installation.

- a. Store valves indoors in dry environment.
- b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball.
- C. Domestic Cold Water Valves:
 - 1. 2 NPS (50 DN) and Smaller:
 - a. Ball: One piece, full port, bronze with brass trim.

2.2 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
 - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- D. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Solder Joint Connections: ASME B16.18.
- E. General ASME Compliance:
 - 1. Building Services Piping Valves: ASME B31.9.
- F. Valve Materials for Potable Water: NSF 61 and NSF 372.
- G. Bronze Valves:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.3 BRONZE BALL VALVES

- A. One Piece, Reduced Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 400 psig (2760 kPa).
 - 3. CWP Rating: 600 psig (4140 kPa).
 - 4. Body: Bronze.
 - 5. Ends: Threaded.
 - 6. Seats: PTFE.
 - 7. Ball: Chrome plated brass.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.

- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
 - D. Should valve is determined to be defective, replace with new valve.
- 3.2 INSTALLATION
- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
 - B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. MFMA-4 - Metal Framing Standards Publication 2004.
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.4 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 compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Comply with MSS SP-58.
 2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - c. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems:

1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Comply with MFMA-4.
 4. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
 6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
- C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch (6 mm) diameter.
 - c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.
- D. Thermal Insulated Pipe Supports:
1. Manufacturers:
 - a. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
 - b. Buckaroos, Inc: www.buckaroos.com/#sle.
 - c. KB Enterprises: www.snappitz.com/#sle.
 2. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch (12.7 mm to 762 mm) iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 3. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - c. Maximum Service Temperature: 180 degrees F (82 degrees C).
 - d. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil (1.524 mm).

4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation.
 5. Products:
 - a. Aeroflex USA, Inc; Aerofix-U Pipe Supports: www.aeroflexusa.com/#sle.
 - b. Buckaroos, Inc; CoolDry: www.buckaroos.com/#sle.
- E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F (50 degrees C):
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 2. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
 - b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 Types 35 through 38.
- F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com/#sle.
 2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- G. Riser Clamps:
1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com/#sle.
 2. Provide copper plated clamps for copper tubing support.
 3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
- H. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- I. Strut Clamps: Two-piece pipe clamp.
1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com/#sle.
- J. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com/#sle.
- K. Pipe Hangers: For a given pipe run use hangers of the same type and material.
1. Manufacturers:
 - a. Ferguson Enterprises Inc; [____]: www.fnw.com/#sle.
 2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- L. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

1. Pipe Diameter 6 inches (150 mm) and Smaller: Provide minimum clearance of 0.16 inch (4 mm).
- M. Pipe Alignment Guides: Galvanized steel.
 1. Pipe Diameter 8 inches (200 mm) and Smaller: Spider or sleeve type.
- N. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- O. Anchors and Fasteners:
 1. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com/#sle.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
 - c. Powers Fasteners, Inc: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com/#sle.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
 - c. Powers Fasteners, Inc: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 6. Hollow Masonry: Use toggle bolts.
 7. Hollow Stud Walls: Use toggle bolts.
 8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 9. Sheet Metal: Use sheet metal screws.
 10. Wood: Use wood screws.
 11. Plastic and lead anchors are not permitted.
 12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm) minimum base metal thickness.
 - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
- P. Pipe Installation Accessories:
 1. Copper Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation
: www.holdrite.com/#sle.

2. Thermal Insulated Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation
: www.holdrite.com/#sle.
3. Overhead Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation
: www.holdrite.com/#sle.
4. Inserts and Clamps:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation
: www.holdrite.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Landscape Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Landscape Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- G. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.2 RELATED REQUIREMENTS

- A. Refer to Division 09 Identification Painting requirements.

1.3 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2015.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Piping: Pipe markers and tags.
- B. Equipment: Nameplates.
- C. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).
 - 3. Background Color: Black.
 - 4. Plastic: Conform to ASTM D709.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
- C. Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

- A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Color code as follows:

1. Potable: Green with white letters.

2.5 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

B. Color code as follows:

1. Plumbing Valves: Green.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch (20 mm) diameter and smaller.

E. Pipe markers:

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2016.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- E. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2017, with Editorial Revision (2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.
- B. Applicator Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or ASTM E84.

2.2 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. 'K' ('Ksi') Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. Maximum Service Temperature: 650 degrees F (343 degrees C).
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches (0.029 ng/Pa s m). Factory prepared to receive paint.
- E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- F. Vapor Barrier Lap Adhesive: Compatible with insulation.
 - 1. Compatible with insulation.
- G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
 - 1. ASTM C195; hydraulic setting on mineral wool.

2.3 CELLULAR GLASS

- A. Insulation: ASTM C552, Type II.
 - 1. Apparent Thermal Conductivity; 'K' ('Ksi') Value: Grade 6, 0.35 at 100 degrees F (0.050 at 38 degrees C).
 - 2. Service Temperature: Up to 800 degrees F (427 degrees C).
 - 3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/Pa s m).
 - 4. Water Absorption: 0.5 percent by volume, maximum.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Connection: Waterproof vapor barrier adhesive.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.5 JACKETS

- A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
 - b. Maximum Service Temperature: 150 degrees F (66 degrees C).
 - c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil (0.25 mm).
 - e. Connections: Brush on welding adhesive.
 - f. Factory prepared to receive paint.
2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 1. Application: Piping 1 inches ([] mm) diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and pipe insulation.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.3 SCHEDULES

- A. Refer to drawings.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.
 - 4. Pipe hangers and supports.
 - 5. Ball valves.

1.2 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 0719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- C. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- D. ASTM B32 - Standard Specification for Solder Metal 2008 (Reapproved 2014).
- E. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- F. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed 2011.
- G. ASTM B75/B75M - Standard Specification for Seamless Copper Tube 2020.
- H. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- J. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- K. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- L. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2017.
- M. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2012 (Reapproved 2018).
- N. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2014.
- O. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2017.
- P. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2015.
- Q. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe 2014.
- R. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings 2016.

- S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
 - T. AWWA C651 - Disinfecting Water Mains 2014.
 - U. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
 - V. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
 - W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
 - X. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
 - Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
 - Z. NSF 61 - Drinking Water System Components - Health Effects 2019.
 - AA. NSF 372 - Drinking Water System Components - Lead Content 2016.
- 1.4 SUBMITTALS
- A. Refer to Division 01 requirements.
 - B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.
 - D. Project Record Documents: Record actual locations of valves.
 - E. Project Record Documents: Provide minimum 18" x 24" drawing of building floor plan with all valves clearly labeled and shown in as-built locations. Provide two copies to Owner.
- 1.5 QUALITY ASSURANCE
- A. Perform work in accordance with applicable codes.
 - B. Valves: Manufacturer's name and pressure rating marked on valve body.
 - C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.
 - D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
 - E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
 - B. Provide temporary protective coating on cast iron and steel valves.
 - C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
 - D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- 1.7 FIELD CONDITIONS
- A. Do not install underground piping when bedding is wet or frozen.
- PART 2 - PRODUCTS
- 2.1 GENERAL REQUIREMENTS
- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

- 2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING
- A. Cast Iron Pipe: CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
 - B. PVC Pipe: ASTM D 2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 low-VOC solvent cement. LEED compliant.
 - C. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
 - 1. Fittings: PVC.
 - 2. Joints: Push-on, using ASTM F477 elastomeric gaskets.
- 2.3 SANITARY SEWER PIPING, ABOVE GRADE
- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- 2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING
- A. Copper Pipe: ASTM B 42, Type K, 3/4" diameter and larger shall be hard drawn, 1/2" diameter shall be annealed.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
- 2.5 DOMESTIC WATER PIPING, ABOVE GRADE
- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
- 2.6 FLANGES, UNIONS, AND COUPLINGS
- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
 - B. Flanges for Pipe Size Over 1 Inch (25 mm):
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
 - C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 2.7 PIPE HANGERS AND SUPPORTS
- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
 - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

- B. Plumbing Piping - Drain, Waste, and Vent:
 1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Vertical Support: Steel riser clamp.
 6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - C. Plumbing Piping - Water:
 1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
 5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 1. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 2. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
- 2.8 BALL VALVES
- A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.
- PART 3 - EXECUTION
- 3.1 EXAMINATION
- A. Verify that excavations are to required grade, dry, and not over-excavated.
- 3.2 PREPARATION
- A. Ream pipe and tube ends. Remove burrs.
 - B. Remove scale and dirt, on inside and outside, before assembly.
 - C. Prepare piping connections to equipment with flanges or unions.
- 3.3 INSTALLATION
- A. Install in accordance with manufacturer's instructions.
 - B. Provide non-conducting dielectric connections wherever joining dissimilar metals.
 - C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 - D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 - E. Group piping whenever practical at common elevations.
 - F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - H. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
 - I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
 - J. Excavate in accordance with Section 31 2316.
 - K. Backfill in accordance with Division 31 requirements.
 - L. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.
 - M. Install water piping to ASME B31.9.
 - N. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
 - O. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
 - P. Sleeve pipes passing through partitions, walls and floors.
 - Q. Minimize quantity of soldered joints below concrete slab.
 - R. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - S. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Support cast iron drainage piping at every joint.
- 3.4 APPLICATION
- A. Install unions downstream of valves and at equipment or apparatus connections.
 - B. Install ball valves for shut-off and to isolate equipment, part of systems.
- 3.5 TOLERANCES
- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.
 - B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.
- 3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
- A. Disinfect water distribution system in accordance with IPC and Local Health Department requirements.
 - B. Prior to starting work, verify system is complete, flushed and clean.
-

- C. Maintain disinfectant in system for 24 hours.
- D. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- E. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- F. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.8 SCHEDULES

- A. Pipe Hanger Spacing: In accordance with the IPC or MSS SP-58 whichever is more stringent.

END OF SECTION

SECTION 221113 – FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Potable water servicing piping and related components.
 - 2. Drinking Fountain and related components
- B. Provide all labor, materials, tools and equipment to install waterline, drinking fountain and non-freeze water hydrant.
- C. Related Sections:
 - 1. Section 311000 – Site Clearing, Preparation, Demolition, and Removals
 - 2. Section 312000 – Earth Moving
- D. In addition to the specifications contained herein, Work shall be performed in accordance with the following:
 - 1. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
 - 2. Arlington County Department of Environmental Services (DES) Construction Standards and Specifications, latest edition
 - 3. Arlington County Plumbing Code (Chapter 18 of the Arlington County Code).

1.02 SUBMITTALS

- A. Project Data: For each type of product indicated.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation qualification and methods.
- B. Shop Drawings:
 - 1. Complete details of layout and assembly, showing member sizes and part identification, fasteners, anchors and fittings.
 - 2. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- E. Manufacturers warranties:
 - 1. Drinking Fountain

- F. Product Samples
 - 1. Drinking fountain color sample on the same metal as the fountain

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Obtain Plumbing Trade permit for the installation of water system service.
 - 2. Comply with requirements of Arlington County DES. Including tapping of water mains and backflow prevention.
 - 3. Comply with standards of Arlington County DES for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 4. Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Provide seamless water tube AWWA type K copper pipe conforming to ASTM designation B88 requirements in accordance with Arlington County Department of Environmental Services (DES) Construction Standards and Specification, Section 2550 Water Mains and Appurtenances.
- B. Fittings shall be underground copper service flared type.
- C. National Science Foundation (NSF) Compliance:
 - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

2.02 CONCRETE VAULTS

- A. Description: concrete vault for drinking fountain drainage. Vault Model #660-CUS by Smith-Midland PCC or equal.
 - 1. Vault Access
 - a. Gasket Seal Cover #1480 by East Jordan Iron Works or approved equal.
 - b. Watertite Base Flange #1480 by East Jordan Iron Works or approved equal.

2.03 VALVES

- A. Provide in accordance with Arlington County Construction Standards and Specification, Section 2550 Water Mains and Appurtenances.

2.04 DRINKING FOUNTAIN

A. Acceptable Manufacturers:

1.

1. Acceptable Drinking Fountain Manufacturer: Most Dependable Fountains, Inc. 5705 Commander Drive, Arlington, TN 38002. Phone: (800) 552-6331, or approved equivalent.

B. Most Dependable model 10145SMSS, front approach with lock door, or an approved equal.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Section 312000 - Earth Moving, for excavating, trenching, and backfilling

3.02 INSTALLATION OF DRINKING FOUNTAIN

- A. Install in accordance with manufacturer's instructions unless more stringent requirements are indicated.
- B. Water Fountain Surface Mount installation, on concrete surface with stainless steel anchor bolts through a mounting plate that is welded to the fountain. Surface mount carrier shall be used for surface mount installation. Stainless steel anchor bolts and inserts to be provided by Contractor
- C. Concrete Footings. Shall comply with Section 033000 Cast-In-Place Concrete.
- D. Provide grout specifically recommended by manufacturer for exterior applications, non-shrink, nonmetallic grout complying with ASTM C 1107.
- E. Epoxy Sealer. After the grout has hardened, the remaining space shall be filled with an epoxy sealer fillet, such as Sonneborn Epo-Grip and Epo-Gel Epoxy system, as manufactured by Sonneborn, Shakopee, MN or "PG-2089" as manufactured by Permagile Corp, Plainview, NY or approved equal.
- F. Threads of all bolts shall have the ends upset after installation of nuts so as to render the connection vandal resistant.
- G. After installation, clean soiled surfaces according to manufacturer's written instructions. Provide touch-up paint at finish such that repair is not visible from a distance of six feet.
- H. Nuts, washers and ends of all bolts shall be painted with touch-up paint.
- I. Protect installed products until Final Completion by Project Officer.

3.03 INSTALLATION OF PIPING

- A. Water-Main Connection: Arrange with Arlington County Department of Environmental Services (DES) for tap of size and in location indicated in water main.
- C. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- D. Bury piping with depth of cover over top at least 42 inches, with top at least 12 inches below level of maximum frost penetration.

3.04 FIELD QUALITY CONTROL

- E. Piping Tests: Conduct piping tests in accordance with Arlington County Construction Standards and Specification, Section 2550 Water Mains and Appurtenances.
- F. Prepare reports of testing activities.

3.05 IDENTIFICATION

- G. Install continuous underground warning tape in accordance with Arlington County Construction Standards and Specification, latest edition.

- H. Permanently attach equipment nameplate or marker in accordance with Arlington County Construction Standards and Specification, Section 2550 Water Mains and Appurtenances, latest edition.
- I. Clean and disinfect water-distribution piping in accordance with Arlington County Construction Standards and Specification, Section 2550 Water Mains and Appurtenances, latest edition.
- J. Prepare reports of purging and disinfecting activities.

3.06 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 22 4000 - PLUMBING FIXTURES**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Drinking fountains.

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 1006 - Plumbing Piping Specialties.
- C. Section 22 3000 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- C. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- D. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018.
- E. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2017.
- F. NSF 61 - Drinking Water System Components - Health Effects 2019.
- G. NSF 372 - Drinking Water System Components - Lead Content 2016.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 requirements.
 - 2. Extra Faucet Washers: Two sets of each type and size.
 - 3. Extra Toilet Seats: One of each type and size.
 - 4. Flush Valve Service Kits: One for each type and size.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Fixtures shall be ADA compliant where scheduled on the plumbing drawings.

2.2 DRINKING FOUNTAINS

- A. Drinking Fountain Manufacturers: Refer to drawings for specification.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.

3.4 CLEANING

- A. Clean plumbing fixtures and equipment.
- B. Adjust flow and temperatures, clean aerators.

3.5 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.6 SCHEDULES

- A. Refer to the drawings.

END OF SECTION

SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the General Conditions, Supplementary General Conditions, and Special Conditions apply to this and all HVAC sections.
- B. This Section applies to all HVAC specification Sections.

1.2 JOB CONDITIONS

- A. The drawings show the general scope and arrangement of the HVAC systems and shall be followed as closely as actual conditions allow.
- B. Give consideration to all other trades. Make arrangements to avoid conflicts and interference with other work. Fully coordinate all components of HVAC systems with minor adjustments as required, including provision of offsets, transitions, fittings, and accessories to meet actual conditions.

1.3 ELECTRICAL WORK

- A. Electrical equipment and electrical motor-driven equipment specified herein shall be provided complete with motors, integral motor starters where indicated, and controls.
- B. Electrical equipment and wiring shall conform to the requirements of Division 26 - Electrical.
- C. Manual or automatic control and protective or signal devices required for the operation specified herein, and any control wiring required for control devices but not shown on the electrical plans shall be provided under this Section.

1.4 CONFORMANCE TO REGULATIONS

- A. All work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes.

1.5 REGULATORY REQUIREMENTS

- A. All products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the contractor shall be responsible for having the equipment or materials tested by a UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.6 QUALITY ASSURANCE

- A. Work shall meet or exceed minimum recommendations of:
 - 1. AGA - American Gas Association
 - 2. ANSI - American National Standards Institute
 - 3. ASME American Society of Mechanical Engineers
 - 4. ASPE - American Society of Plumbing Engineers
 - 5. ASTM - American Society for Testing and Materials
 - 6. AWS - American Welding Society
 - 7. USDOE - United States Department of Energy
 - 8. EPA - Environmental Protection Agency
 - 9. GAMMA - Gas Appliance Manufacturer's Association
 - 10. IBC - International Building Code (current adopted edition)
 - 11. IECC - International Energy Conservation Code (current adopted edition)

12. IMC - International Mechanical Code (current adopted edition)
 13. NEMA - National Electrical Manufacturers Association
 14. NIOSH - National Institute for Occupational Safety and Health
 15. NSF - National Sanitation Foundation
 16. OSHA - Occupational Safety and Health Act
 17. TIMA - Thermal Insulation Manufacturers Association
 18. UL - Underwriters' Laboratories
 19. VUSBC - Virginia Uniform Statewide Building Code (current adopted edition)
- B. Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective at the date of taking bids.
- C. The specifications, codes, and standards referenced in these specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made. In case of conflict between the referenced specifications, the more stringent requirement shall govern unless otherwise permitted by the Architect/Engineer. Major conflicts shall be referred to the Engineer for resolution.
- 1.7 MATERIALS AND EQUIPMENT
- A. Unless specifically provided otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and be new, current design, unused, and undamaged.
- B. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate equipment shall be interchangeable.
- 1.8 UTILITIES AND CONNECTIONS
- A. Verify location of all existing utilities before laying out and making connections. Report any inconsistencies to Engineer before commencing work. Contractor shall be responsible for any error resulting from failure to exercise these precautions.
- 1.9 WIRING DIAGRAMS
- A. All mechanical equipment shall be provided with complete wiring diagrams showing all power and control connections. The diagrams shall be placed in a clear plastic pouch that is permanently affixed to the equipment.
- 1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Refer to Division 01 requirements.
- B. Protect products from damage, marring, and soiling.
- C. Any marring of factory finishes shall be touched up to match the original factory finish.
- 1.11 SUBMITTALS
- A. Refer to Division 01 requirements.
- B. General: The Contractor shall submit information, for Landscape Architect's review, to demonstrate compliance of proposed Products and/or installations with the Contract Documents. This information shall include, but not be limited to: catalog data; performance data; noise levels; etc. Proposed Products that are not in compliance with the Contract Documents may be rejected. Information must be submitted on all required Products, including proposed Products that appear to be in compliance with the Contract Documents.

- C. Contractor preparation:
1. The Contractor shall review and approve each submittal and coordinate all other related or affected Work before submitting for review. All copies of each submittal shall bear the Contractor's stamp, with signature or initials, certifying review and approval; verification of field dimensions; and coordination with adjacent Work are in compliance with the requirements of the Contract Documents.
 2. The Contractor shall identify variations from the requirements of the Contract Documents on all copies of applicable submittals. No extra charges shall be paid for the providing of Products or furnishing of Work required as a result of failure to comply with this requirement.
- D. Submittal Format:
1. Each submittal shall be accompanied by a letter of transmittal listing Project Title, Contractor, Subcontractor or supplier, submitted Products, pertinent drawing and detail number, and specification section number, as appropriate.
 2. Provide a minimum of five copies of each submittal. Provide additional copies as required by Owner and/or Contractor. Each copy of a submittal shall be bound in a three-ring binder, and indexed to allow ready reference to each Product.
 3. Product data shall be clearly marked to identify the applicable Products or models. Options or modifications required by the Contract Documents shall be clearly identified.
 4. Submittals shall be complete with all associated Products. Submittals on portions of a Product or system shall not be reviewed.
 5. Provide Manufacturer's start-up procedures, testing and checklists.
 6. Contractor shall provide coordinated shop drawings of Division 23 systems. Provide 3-D shop drawings of major mechanical rooms indicating equipment, duct, piping, and service access clearances. Shop drawings shall be prepared in electronic format and submitted in electronic and printed form.
- E. Landscape Architect Procedures: Submittals will be reviewed with reasonable promptness. The Contractor shall allow 15 days for review of each submittal. The Landscape Architect's comments will be indicated on a Submittal Review Comments form, which will be attached to each copy of the submittal. Contractor shall be responsible for distributing copies of reviewed submittals as appropriate.
- F. Resubmission: Contractor shall change or correct submittals as required by the Landscape Architect and resubmit until approved. The Contractor shall identify any changes other than those required by the Landscape Architect on all copies of the resubmittal.
- G. Approval required: The ordering, fabrication and/or installation of Products before approval of all relevant submittals shall be at the Contractor's risk. Any damage to new or existing Work resulting from the installation of unapproved Products shall be repaired or replaced by the Contractor at no additional cost. Payment will not be recommended for any Work that does not have an approved submittal.
- 1.12 SUBSTITUTIONS
- A. Refer to Division 01 requirements.

- B. For a Product specified by naming one or more manufacturer and model, and followed with the statement “or approved equal,” the Contractor may submit a Product other than the Product specified by manufacturer and model, that Product shall be considered a Substitute Product and shall comply with the following conditions:
 - 1. The Contractor shall verify the Substitute Product is equal or superior in all respects to the Specified Product.
 - 2. The Contractor shall submit data on the Substitute Product in compliance with the “Submittals” paragraph herein.
 - 3. After the Substitute Product has been approved by the Architect/Engineer, the Contractor shall be responsible for coordinating the installation of the Substitute Product with all trades. The Contractor shall be responsible for any changes required to incorporate the Substitute Product into the Work.
 - 4. The Contractor waives all claims for additional costs related to the Substitute Product that becomes apparent before, during or after installation.

1.13 OPERATING AND MAINTENANCE MANUAL

- A. Refer to Division 01 requirements.
- B. General: The Contractor shall submit one copy of the Operation and Maintenance Manual to the Landscape Architect for review a minimum of 60 days prior to Instruction and Training Sessions. This copy will be returned to the Contractor with Landscape Architect's comments or approval. The Contractor shall revise and resubmit one copy of the O&M Manual as required. The Contractor shall provide four copies of the approved O&M Manual. Instruction and Training Sessions shall begin 30 days after receipt of the approved O&M Manuals. Refer to “Instruction and Training Sessions” paragraph herein.
- C. Binders: Commercial quality, 8-1/2x11 inch, three ring binders with durable plastic covers; three inch maximum ring size. Attach printed labels to the front and side of each binder stating '(PROJECT NAME) OPERATION AND MAINTENANCE MANUAL'; applicable volume number; and project title. Provide tabbed dividers for each Product and system, with typed description or applicable Specification Section. Provide a table of contents for the entire manual and insert at the front of each binder.
- D. Contents: The manual shall consist of three parts as follows:
 - 1. Part 1: Directory listing names, addresses, and telephone numbers of Landscape Architect, Architect, Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions including, but not limited to, the following:
 - a. General description and specifications of each component and of each system as a whole.
 - b. Manufacturer's catalog description of each component supplemented by approved equipment submittals.
 - c. Detailed electrical and logic descriptions.
 - d. Installation and start-up instructions, including complete calibration procedures for each component and for system as a whole.
 - e. Operating instructions including:

- 1) Sequence of operation
 - 2) Shutdown procedure
 - 3) Emergency operating procedures
 - f. Trouble shooting guide with service instructions
 - g. Preventive maintenance schedules
 - h. Parts list with names, addresses, and telephone numbers of local parts suppliers.
 - i. Names, addresses, and phone numbers of nearest service organizations
 - j. Interface requirements and capabilities.
 - k. Detailed schematics of equipment.
 - l. Complete equipment schedules.
 3. Part 3: Project documents including, but not limited to, the following:
 - a. Testing, adjusting, and balancing report
 - b. Certificates
 - c. Copies of warranties.
- E. Quality: The manual will be reviewed by the Landscape Architect to determine accuracy, completeness and quality of printing. Deficiencies will necessitate resubmittals by the Contractor. Refer to "Submittals" paragraph herein.
- 1.14 INSTRUCTION AND TRAINING SESSIONS
- A. Refer to Division 01 requirements.
 - B. After all equipment and services are in operation and receipt of the approved Operation and Maintenance Manuals, Instruction and Training Sessions shall be conducted for representatives of the Owner.
 - C. Instruction Session shall be conducted during the Owner's normal working periods and at times satisfactory to the Owner.
 1. Session shall be sufficient to address all instruction and training for the installed systems and shall last not less than one 8-hour working day.
 - D. The Training Session shall address the operation and maintenance of each piece of equipment and of the system as a whole. Preventative maintenance techniques shall be included.
 - E. Instructions and training shall be given by competent, factory-trained service and operating personnel from the appropriate manufacturer(s). The Contractor shall record the names of all personnel present at each Instruction and Training Session and shall forward a copy of the attendance log to the Architect/Engineer within seven days after each session.
- 1.15 RECORD DRAWINGS
- A. Refer to Division 01 requirements.
- 1.16 PROJECT/SITE CONDITIONS
- A. Install work in locations shown on Drawings, unless prevented by Project conditions.
 - B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.
- 1.17 WARRANTIES
- A. Refer to Division 01 requirements.

- B. Warranty periods shall begin from Date of Final Completion.
- C. All equipment shall be warranted for a minimum of one (1) year. Refer to individual Sections for other requirements.

1.18 COMMISSIONING

- A. Refer to Division 01 requirements.
- B. Start-up of all systems and sub-systems shall be coordinated by the Commissioning Agent. An experienced mechanic(s) shall be on site throughout the start-up and commissioning process to coordinate activities and insure that all equipment is functioning as intended.

1.19 CONTRACTOR COORDINATION

- A. Nomenclature for final room names and numbers may vary from the construction documents. Final names and numbers used in the shop drawings shall be coordinated with final room names and numbers assigned by the Owner and Architect.
- B. HVAC contractor(s) shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of each contractor to review the work of other trades (including, but not limited to civil, structural, architectural, plumbing, and electrical) as it affects their work, and as their work affects other trades, to insure that the construction documents are closely followed. Where discrepancies arise, they shall be referred to the Architect/Engineer for resolution before proceeding with the Work.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Unless otherwise noted, install equipment in accordance with manufacturer's printed instructions for application indicated.
- B. Install, operate, and adjust systems in accordance with the plans and specifications.
- C. All work for this division shall conform to the regulations of the applicable federal, state, and local laws, ordinances, and codes.
- D. A Request For Information (RFI) shall be submitted to the Project Officer for any portion of the Work that the Contractor determines a clarification is required. Prior to submitting a RFI the Contractor shall thoroughly research the Contract Documents to ensure information has not been overlooked. The RFI shall include references to the portion of the Contract Documents that requires a clarification. The Contractor shall allow a minimum of three business days for the Landscape Architect to respond to the RFI. The Contractor shall not proceed with that portion of the Work until a response has been returned.
- E. All Products delivered to the site(s) shall be stored in accordance with the manufacturer's printed instructions. If a manufacturer does not have printed instructions then the Product shall be adequately housed and otherwise protected against damage or corrosion. If any Product stored at the site(s) is not protected as specified herein, the Contractor shall not receive payment for that Product. That Product shall be stored by the Owner at the expense of the Contractor. Any Product damaged as a result of failure to comply with this requirement shall be replaced by the Contractor at no additional cost to the Owner.

3.2 ACCESSIBILITY

- A. Locate all equipment, which must be serviced, operated, or maintained in fully accessible positions in accordance with manufacturer's recommendations and subject to approval of Architect. Provide a minimum of two feet of clearance in front of equipment access doors and components requiring service.

3.3 PROTECTION OF OPENINGS

- A. Openings in partially installed systems, including equipment and piping, shall be plugged, capped, or otherwise closed with approved methods and materials or devices until connections are made.

3.4 PROTECTION FROM MOVING PARTS

- A. Belts, shafts, couplings, and other rotating or moving parts, located so that any person may come in proximity thereto, shall be fully enclosed or properly guarded.

END OF SECTION

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolators.

1.2 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide schedule of vibration isolator type with location and load on each.
- C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
 - 1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
 - 2. Steel springs to function without undue stress or overloading.

2.2 VIBRATION ISOLATORS

- A. Non-Seismic Type:
 - 1. Restrained Steel Springs:
 - a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
 - b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
 - 2. Elastomeric Hangers:
 - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
 - b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
 - 3. Spring Hanger:
 - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
 - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
 - 4. Combination Elastomeric-Spring Hanger:
 - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
 - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

5. Neoprene Pad Isolators:
 - a. Hardness: 30 durometer.
 - b. Thickness: Minimum 1/2 inch (13 mm).
 - c. Maximum Loading: 50 psi (345 kPa).
 - d. Rib Height: Maximum 0.7 times width.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

3.2 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.

1.2 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Automatic Controls: Tags. Key to equipment served.
- C. Control Panels: Nameplates.
- D. Ductwork: Stencilled painting.
- E. Heat Transfer Equipment: Nameplates.
- F. Major Control Components: Nameplates.
- G. Piping: Pipe markers stencil painting; tags for small diameters.
- H. Small-sized Equipment: Tags.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).
 - 3. Background Color: Black.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
 - 2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
 - 3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
 - 4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
 - 5. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

- B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors conforming to ASME A13.1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Division 09.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify piping, concealed or exposed, as scheduled herein. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Identify ducts with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- J. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 1123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 08 3100 - Access Doors and Panels.
- C. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.3 REFERENCE STANDARDS

- A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.
- B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators 2011 (Addendum A, 2012).
- C. ANSI Z223.1 - National Fuel Gas Code 2016.
- D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- F. ASME B31.1 - Power Piping 2018.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- I. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.
- J. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- K. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- L. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- M. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.
- D. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Provide temporary protective coating on cast iron and steel valves.
 - B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
 - C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- 1.7 FIELD CONDITIONS
 - A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

- 2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING
 - A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ANSI Z223.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
- 2.2 NATURAL GAS PIPING, ABOVE GRADE
 - A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.
- 2.3 FLANGES, UNIONS, AND COUPLINGS
 - A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - B. Flanges for Pipe Size Over 1 Inch (25 mm):
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - C. Dielectric Connections: Nipple with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 2.4 PIPE HANGERS AND SUPPORTS
 - A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
 - B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - 6. Other Types: As required.

2.5 BALL VALVES

- A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded ends with union.

2.6 STRAINERS

- A. Size 2 inch (50 mm) and Under:
 - 1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

2.7 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

- A. Compliance Requirements:
 - 1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
 - 2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed.
- H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- I. Install valves with stems upright or horizontal, not inverted.
- J. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- K. Sleeve pipes passing through partitions, walls and floors.

3.4 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Provide plug valves in natural gas systems for shut-off service.

END OF SECTION 23 11 23

SECTION 23 3100 - HVAC DUCTS AND CASINGS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Metal ductwork.
- B. Casing and plenums.

1.2 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2018.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- G. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.
- H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.
- I. UL 1978 - Grease Ducts Current Edition, Including All Revisions.
- J. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

1.3 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide data for duct materials and duct connections.
- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 1-inch pressure class and higher systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).
- E. Project Record Documents: Record actual locations of ducts, dampers, and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with documented experience.

1.6 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.
- C. All duct shall be stored and secured to prevent damage from precipitation and surrounding construction. Maintain duct section seals prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. VOC Content: Not more than 250 g/L, excluding water.
 - a. LEED compliant.
 - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
 - 4. For Use With Flexible Ducts: UL labeled.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Ducts: Galvanized steel, unless otherwise indicated.
- E. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
- C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- F. T's, bends, and elbows: Construct according to SMACNA (DCS).
- G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- I. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

- J. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

2.4 CASINGS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.
- H. Use double nuts and lock washers on threaded rod supports.
- I. Connect diffusers or light troffer boots to low pressure ducts directly or with 3-5 ft length of flexible duct held in place with stainless steel strap or clamp.
- J. Seal all duct seams with mastic.
- K. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Flexible duct connections.

1.2 RELATED REQUIREMENTS

- A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- D. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
- D. Project Record Drawings: Record actual locations of access doors and test holes.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fusible Links: Two of each type and size.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

- A. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
 - a. Net Fabric Width: Approximately 2 inches (50 mm) wide.
2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.

2.4 MISCELLANEOUS PRODUCTS

- A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
 1. Thickness: 2 mils (0.6 mm).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- D. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

END OF SECTION

SECTION 23 3413 - AXIAL HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Propeller fans.

1.2 REFERENCE STANDARDS

- A. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- B. NEMA MG 1 - Motors and Generators 2018.

1.3 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide data on axial fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate assembly of axial fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- D. Test Reports: Indicate performance data for adjustable axial fan blades for at least five blade settings, including maximum.
- E. Manufacturer's Instructions: Indicate installation instructions.
- F. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.6 FIELD CONDITIONS

- A. Permanent fans may not be used for ventilation during construction.

PART 2 PRODUCTS

3.1 PROPELLER FANS

- A. Performance: As scheduled.
- B. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.
- C. Accessories: As scheduled on the drawings.
 - 1. Backdraft Damper: Multiple blade with offset hinge pin, blades linked.
 - 2. Safety Screens: Expanded galvanized metal over inlet, motor, drive; to comply with OSHA regulations.
 - 3. Hood: Weathershield, to exclude rain and snow.
 - 4. Controller: As scheduled

PART 3 EXECUTION

5.1 INSTALLATION

- A. Install with resilient mountings and with flexible electrical leads; refer to Section 22 0548.
- B. Provide safety screen where inlet or outlet is exposed.
- C. Provide backdraft dampers on discharge of exhaust fans and as indicated.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

1.2 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.
- G. UL 705 - Power Ventilators Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 - PRODUCTS

2.1 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.2 WALL EXHAUSTERS

- A. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch (13 mm) mesh, 0.062 inch (1.6 mm) thick aluminum wire bird screen.
- B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.
- C. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.3 CABINET AND CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Grille: Aluminum with baked white enamel finish.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.4 DESTRATIFICATION FANS

- A. Air turbines shall consist of an aerodynamic design that has air intake at the top of the housing which directs the air through a rotor and stator combination which simultaneously removes the rotational component and compresses and accelerates the air. When the air leaves the nozzle it must be in a narrow column that is projected a specified distance in order to reach the floor of the space at a velocity sufficient to induce lateral movement at the floor. The velocity of the column shall be sufficient to entrain a portion of the surrounding air to create a torus in the moving air, which causes the space to achieve thermal equalization.
- B. The air turbine units shall be injection molded of PC/ABS 5VA plastic that meets the criteria of RTL and conforms to UL 507 standard.
- C. All sizes of air turbine units shall project a column of air that diverges not over 7 degrees at any point off vertical from the unit to the floor.
- D. All sizes of air turbine units shall achieve with an anemometer measurable air movement at the floor without the use of any ducting or tubing being added or incorporated in the air turbine unit.
- E. Units shall be equipped with low wattage motors and sized to the building height they are designed to operate in.
- F. Units shall be capable of achieving a vertical air flow column regardless of the angle of the roof or the roof support member upon which the unit is mounted.
- G. Units shall be capable of pointing the column of air off vertical up to 30 degrees in any direction.
- H. Units shall be able to be mounted in confined spaces next to the ceiling in order to capture the pool of heated air at the maximum height.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide sheaves required for final air balance.

- C. Install backdraft dampers on inlet to roof and wall exhausters.
 - D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.
- 3.2 SCHEDULES
- A. Refer to the drawings.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Registers/grilles.

1.2 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.3 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.
- B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.
- C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets 2006 (Reaffirmed 2011).

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

PART 2 - PRODUCTS

2.1 LOUVERS

- A. Type: 4 inch (100 mm) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.
- B. Fabrication: 12 gage, 0.1046 inch (2.66 mm) thick extruded aluminum, welded assembly, with factory prime coat finish.
- C. Color: Custom to be selected by the A/E.
- D. Mounting: Furnish with interior flat flange for installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09 requirements.

3.2 SCHEDULES

- A. Refer to the drawings.

END OF SECTION

SECTION 23 5533 - FUEL-FIRED UNIT HEATERS**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Gas fired duct furnaces.

1.2 RELATED REQUIREMENTS

- A. Section 23 5100 - Breechings, Chimneys, and Stacks.

1.3 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2017, with Errata (2019).
- C. NFPA 54 - National Fuel Gas Code 2018.
- D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- E. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.6 REGULATORY REQUIREMENTS**1.7 WARRANTY**

- A. Refer to Division 01 requirements.
- B. Warranty period shall begin at Date of Substantial Completion.
- C. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS**3.1 GAS FIRED DUCT FURNACES**

- A. Duct Furnaces: Gas fired, self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, heat exchanger, burner, controls, and accessories.
- B. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- C. Heat Exchanger: Type E-3 stainless steel welded construction.

- D. Gas Burner:
 - 1. Gas valve, modulating provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 2. Electronic pilot ignition, with electric spark igniter.
- E. Gas Burner Safety Controls:
 - 1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
- F. Performance:
 - 1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.
 - 2. Refer to Schedule. Gas heating capacities are sea level ratings.

PART 3 EXECUTION

5.1 EXAMINATION

- A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available.
- C. Verify that proper fuel supply is available for connection.

5.2 INSTALLATION

- A. Install in accordance with NFPA 90A.
- B. Install gas fired units in accordance with NFPA 54 and applicable codes.
- C. Provide vent connections in accordance with NFPA 211. Refer to Section 23 5100.

END OF SECTION

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric unit heaters.
- B. Electric wall heaters.

1.2 RELATED REQUIREMENTS

- A. Section 23 0719 - HVAC Piping Insulation.
- B. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.
- B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addendum (2011).

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
 - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - 2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
 - 3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- D. Verification Samples: For each finish product specified, color chip representing actual product in color and texture.
- E. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- F. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- H. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 WARRANTY

- A. Refer to Division 01 requirements.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
- B. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.
- C. Acceptable Heating Element Assemblies:
 - 1. Vertical Projection Units:
 - a. Finned tubular.
 - b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.
- D. Housing:
 - 1. Horizontal Projection Units:
 - a. Construction materials to consist of heavy gage steel with polyester powder coat or high gloss baked enamel finish.
 - b. Provide with threaded holes for threaded rod suspension.
 - c. Provisions for access to internal components for maintenance, adjustments, and repair.
- E. Air Inlets and Outlets:
 - 1. Inlets: Provide protective grilles with fan blade guard.
 - 2. Outlets: Provide directional louvers.
- F. Fan: Factory balanced, direct drive, axial type with fan guard.
- G. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.
- H. Controls:
 - 1. Disconnect.
 - 2. 24-volt relay.
 - 3. Control transformer.
 - 4. Fan override to purge residual heat when de-energized.
 - 5. Built-in thermostat.
 - 6. Summer-winter switch.
- I. Electrical Characteristics:
 - 1. Refer to Equipment schedules.

2.2 ELECTRIC WALL HEATERS

- A. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls.
- B. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.
- C. Cabinet: 0.0478 inch (1.2 mm) steel with easily removed front panel with integral air outlet and inlet grilles.
- D. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

- E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.
- F. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.
- G. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.
- H. Electrical Characteristics:
 - 1. Refer to Equipment Schedules.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are suitable for installation.
- B. Verify that field measurements are as shown on the drawings.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Units with Electric Heating Elements:
 - 1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.

3.3 CLEANING

- A. After construction and painting is completed, clean exposed surfaces of units.
- B. Vacuum clean coils and inside of units.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.4 PROTECTION

- A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 23 8300 - RADIANT HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gas fired Infrared radiant heaters

PART 2 PRODUCTS

3.1 GAS FIRED DUCT FURNACES

- A. Duct Furnaces: Gas fired, self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, heat exchanger, burner, controls, and accessories.
- B. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- C. Heat Exchanger: Type E-3 stainless steel welded construction.
- D. Gas Burner:
 - 1. Gas valve, modulating provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 2. Electronic pilot ignition, with electric spark igniter.
- E. Gas Burner Safety Controls:
 - 1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
- F. Performance:
 - 1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1 I-P; seasonal efficiency to ASHRAE Std 103.
 - 2. Refer to Schedule. Gas heating capacities are sea level ratings.

3.2 GAS FIRED INFRARED RADIANT HEATERS

- A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- B. Factory assembled including heating element, reflector, heater housing, mounting brackets, element holders, wire guards, and high temperature internal wiring for non-residential, indoor use only.
- C. Burner
 - 1. Heater shall provide control of both Gas and Air for the most efficient and complete combustion at fire rates complying with ANSI Z83.20
 - 2. Burner CSA certified for use in unvented mode or vented modes with vertical or horizontal vent terminal.
 - 3. Direct spark ignition with electronic flame safety and durable to resist breakage
 - 4. Burner Core: Assembly of durable materials, for high efficiency complete combustion, maximum heat transfer, extremely quiet operation, and extended life.
 - 5. Sight glass for burner flame and spark ignitor observation from floor level.
 - 6. Burner Blower:
 - a. Motor: Balanced-rotor, thermally protected, and permanently lubricated.
 - b. Blower Impeller: Statically and dynamically balanced.

- c. Capable of drawing in outside combustion air without using additional supply fans.
 - d. Inlet air collar supplied with burner control assembly to accept 4" O.D. supply duct.
- D. Fuel
 - 1. Type: Natural Gas
 - 2. Inlet pressure: 7-14 inches W.C.
- E. Controls
 - 1. Single stage operation
 - a. Total heater shutdown upon control lockout, including burner operation and combustion air blower, where power interruption (reset thermostat) restarts firing sequence.
 - 2. Direct spark ignition system with three (3) trials-for-ignition and upon loss of flame sensing three (3) re-trials-for-ignition.
 - 3. Flame Sensing: Independent sensing rod and circuit for reliability.
 - 4. Controls isolated from combustion air to prevent corrosion from wet/dirty air.
 - 5. Controls enclosed with a corrosion resistant housing.
 - 6. Control enclosure permit easy access to controls from three sides by removing cover.
 - 7. Call for heat signal
 - a. 115VAC Electrical Power Supply
 - 8. Electrical Power
 - a. Volts: 115 VAC, single phase, 60Hz, 3 Amps max.
- F. Combustion Tubing
 - 1. Combustion chamber tubing of 4-inch diameter, 16 ga. wall thickness, 304L stainless-steel.
 - a. Additional coating: tubing finished with a high emissivity rated, corrosion resistant, black coating.
- G. Emitter/Heat Exchanger Tubing:
 - 1. Non-Condensing Emitter: No condensation forms from combustion in emitter/heat exchanger tubing while at operating temperatures.
 - 2. Heaters utilize downstream turbulator, factory installed, in the last 10-foot long emitter/heat exchanger section.
- H. Reflector
 - 1. Reflector geometrically shaped for not less than 91.7% reflectional efficiency.
 - 2. Reflector 20 ga., 304 stainless-steel.
 - 3. Mounting and Rotation
 - a. Reflector mountable to heater without use of tools.
 - b. Reflector mounting permit heater expansion, minimizing noise and/or rattles.
 - c. Mounting incorporate ability to rotate reflector up to 45 degrees, in either direction with tubing center as the axis of rotation.
- I. Venting
 - 1. Vent in accordance with manufacturer's recommendations for the installation. Provide recommended piping.
- J. Accesories

1. Manual gas ball valve.
2. 4-inch roof exhaust venting cap for single heater.
3. 4-inch wall combustion air supply kit for single heater.
4. Heavy duty wire guard assembly (suitable for deflecting direct strikes from soccer balls without damage to the heater)

PART 3 EXECUTION

4.1 EXAMINATION

A. Gas Fired Infrared Radiant Heaters:

1. Verify that minimum distances have been maintained from all combustibles and that heater installation is not in a hazardous location.
2. Verify that gas connections have been pressure tested and all combustion venting is complete.

4.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install in accordance with NFPA 90A.
- C. Install gas fired units in accordance with NFPA 54 and applicable codes.
- D. Provide vent connections in accordance with NFPA 211.

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of Division 01, the General Conditions, Supplemental General Conditions, and Special Conditions apply to this and all Electrical Specification Sections.
- B. This Section applies to all Electrical sections.

1.2 JOB CONDITIONS

- A. The Contract Documents specify the scope and arrangement of the Work and shall be followed as closely as actual conditions allow.
- B. The Contractor shall give consideration to all other trades, and make arrangements to avoid conflicts and interference with other Work, new or existing. Contractor shall coordinate all components of the Work, and provide minor adjustments as required, including offsets, transitions, fittings, and accessories to meet actual conditions.
- C. The Contractor shall visit the job site prior to bid date to examine the conditions under which the Work is to be performed. No extra charges shall be paid for providing of Products or furnishing of Work resulting from failure to comply with this requirement.

1.3 CONFORMANCE TO REGULATIONS

- A. All Work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes.

1.4 REGULATORY REQUIREMENTS

- A. All applicable Work shall conform to the requirements of NFPA 70.
- B. All Products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the Contractor shall be responsible for having the equipment or materials tested by a UL testing firm, acceptable to authority having jurisdiction, to determine suitability of the Product for purpose specified.

1.5 MATERIALS AND EQUIPMENT

- A. Unless specifically noted otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards, be of a current design, new, unused, and undamaged.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect Products from damage, marring, and soiling.
- B. Any marring of factory finishes shall be repaired or replaced as necessary to match the original factory finish.

1.7 SUBMITTALS

- A. Contractor preparation:
 - 1. The Contractor shall review and approve each submittal and coordinated all other related or affected Work before submitting for review. All copies of each submittal shall bear the Contractor's stamp, with signature or initials, certifying review and approval; verification of field dimensions; and coordination with adjacent Work are in compliance with the requirements of the Contract Documents.
 - 2. The Contractor shall identify variations from the requirements of the Contract Documents on all copies of applicable submittals. No extra charges shall be paid for the providing of

Products or furnishing of Work required as a result of failure to comply with this requirement.

B. Submittal Format:

1. Each submittal shall be accompanied by a letter of transmittal listing Project Title, Contractor, Subcontractor or supplier, submitted Products, pertinent drawing and detail number, and specification section number, as appropriate.
2. Submittals shall be submitted electronically in PDF Format.

C. Landscape Architect Procedures: Submittals will be reviewed with reasonable promptness. The Contractor shall allow 15 days for review of each submittal. The Landscape Architect's comments will be indicated on a Submittal Review Comments form, which will be attached to each copy of the submittal. Contractor shall be responsible for distributing copies of reviewed submittals as appropriate.

D. Resubmission: Contractor shall change or correct submittals as required by the Landscape Architect and resubmit until approved. The Contractor shall identify any changes other than those required by the Landscape Architect on all copies of the resubmittal.

E. Approval required: The ordering, fabrication and/or installation of Products before approval of all relevant submittals shall be at the Contractor's risk. Any damage to new or existing Work resulting from the installation of unapproved Products shall be repaired or replaced by the Contractor at no additional cost. Payment will not be recommended for any Work that does not have an approved submittal.

1.8 SUBSTITUTIONS

A. For a Product specified by naming one or more manufacturer and model, and followed with the statement "or approved equal," the Contractor may submit a Product other than the Product specified by manufacturer and model, that Product shall be considered a Substitute Product and shall comply with the following conditions:

1. The Contractor shall verify the Substitute Product is equal or superior in all respects to the Specified Product.
2. The Contractor shall submit data on the Substitute Product in compliance with the "Submittals" paragraph herein.
3. The Contractor shall be responsible for coordinating the installation of the Substitute Product with all trades. The Contractor shall be responsible for any changes required incorporating the Substitute Product into the Work.
4. The Contractor waives all claims for additional costs related to the Substitute Product that become apparent before, during or after installation.

1.9 OPERATING AND MAINTENANCE MANUAL

A. General: The Contractor shall submit one copy of the Operation and Maintenance Manual to the Landscape Architect for review a minimum of 60 days prior to Instruction and Training Sessions. This copy will be returned to the Contractor with Landscape Architect's comments or approval. The Contractor shall revise and resubmit one copy of the O&M Manual as required. The Contractor shall provide four copies of the approved O&M Manual. Instruction and Training Sessions shall begin 30 days after receipt of the approved O&M Manuals. Refer to "Instruction and Training Sessions" paragraph herein.

- B. Contents: The manual shall consist of three parts as follows:
1. Part 1: Directory listing names, addresses, and telephone numbers of Landscape Architect, Architect, Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions including, but not limited to, the following:
 - a. General description and specifications of each component and of each system as a whole.
 - b. Manufacturer's catalog description of each component supplemented by approved equipment submittals.
 3. Part 3: Project documents including, but not limited to, the following:
 - a. Testing report(s).
 - b. Certificates
 - c. Copies of warranties.
- 1.10 RECORD DRAWINGS
- A. Refer to Division 01 requirements.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES (600 V & LESS)**PART 1 - GENERAL****1.1 ADMINISTRATIVE REQUIREMENTS****A. Coordination:**

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

1.2 SUBMITTALS

- A. **Product Data:** Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS**2.1 CONDUCTOR AND CABLE APPLICATIONS**

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- B. Comply with NEMA WC 70.
- C. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- D. **Conductor Material:**
 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
- E. **Minimum Conductor Size:**
 1. **Branch Circuits:** 12 AWG.
 - a. **Exceptions:**
 - 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
- F. **Conductor Color Coding:**
 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. **Color Coding Method:** Integrally colored insulation.

3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.

2.3 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.4 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A, 486B or UL 486C as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location shown.
 5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- F. Terminate cables using suitable fittings.
- G. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- J. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
- K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- L. Insulate ends of spare conductors using vinyl insulating electrical tape.
- M. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

<<<<<<<<<< UPDATE NOTES

PART 1 - GENERAL

2.1 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

PART 2 - PRODUCTS

3.1 GROUNDING AND BONDING REQUIREMENTS

- A. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- B. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- C. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Landscape Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- D. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Ground Rod Electrode(s):
 - a. Provide single ground electrode.
 - 4. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- E. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and

other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. --CHOOSE ONE OF THE TWO SUBPARAGRAPHS BELOW--
3. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

3.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

C. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

PART 3 - EXECUTION

4.1 INSTALLATION

A. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

B. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION

PART 3 - EXECUTION

4.1 INSTALLATION

- A. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- B. Unless specifically indicated or approved by Landscape Architect, do not provide support from suspended ceiling support system or ceiling grid.
- C. Unless specifically indicated or approved by Landscape Architect, do not provide support from roof deck.
- D. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- E. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

END OF SECTION

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- B. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
- C. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.

2.2 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Underground, Exterior: 1 inch (27 mm) trade size.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

2.5 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated,

Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees
C.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- B. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- C. Conduit Routing:
 - 1. Conceal all conduits unless specifically indicated to be exposed.
 - 2. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 3. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
- D. 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.
- E. 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. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 - 4. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 - 5. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- F. Provide grounding and bonding in accordance with Section 26 0526.

3.2 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.3 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.

END OF SECTION

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

<<<<<<<<<< UPDATE NOTES

PART 1 - GENERAL

2.1 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

PART 2 - PRODUCTS

3.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use raised covers suitable for the type of wall construction and device configuration where required.
3. Do not use "through-wall" boxes designed for access from both sides of wall.
4. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
5. Sheet Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
6. Boxes for supporting luminaires and ceiling fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
7. Boxes for ganged devices: use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
 - a. --CHOOSE ONE OF THE TWO PARAGRAPHS BELOW--
8. Wall Plates: Comply with Section 26 2726.

PART 3 - EXECUTION

4.1 INSTALLATION

- A. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- B. Box Supports:
1. Secure and support boxes 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 except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- C. Install boxes plumb and level.
- D. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- E. Provide grounding and bonding in accordance with Section 26 0526.
- 4.2 PROTECTION
- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

<<<<<<<<<< UPDATE NOTES

SPECIFYING STRATEGY

- 2.1 STEP 1: REVIEW "IDENTIFICATION REQUIREMENTS" ARTICLE UNDER PART 2.
- 2.2 STEP 2: REVIEW IDENTIFICATION PRODUCT ARTICLES UNDER PART 2.
 - A. Links for some products should already be activated according to selections made in "IDENTIFICATION REQUIREMENTS" article. Pay particularly close attention to optional paragraphs for format requirements. If any identification products need to be added or removed, revisit "IDENTIFICATION REQUIREMENTS" to see if additional changes are necessary.
- 2.3 STEP 3: REVIEW PART 3.
- 2.4 STEP 4: REVIEW PART 1.
 - A. Pay particularly close attention to "RELATED REQUIREMENTS" article for identification requirements that might need to be specified elsewhere.
- 2.5 STEP 5: COME BACK TO THIS SECTION AFTER ALL OTHER SECTIONS HAVE BEEN COMPLETED TO SEE IF ADDITIONAL CHANGES ARE NECESSARY.

2.6 -----

PART 1 - GENERAL

3.1 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

3.2 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

4.1 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 2. --CHOOSE ONLY ONE OF THE TWO PARAGRAPHS BELOW--

4.2 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 - 3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 2. Text: All capitalized unless otherwise indicated.
 3. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch (13 mm).

PART 3 - EXECUTION

5.1 INSTALLATION

- A. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
- B. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- C. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- D. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.

1.2 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

1.3 WARRANTY

A. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.2 OCCUPANCY SENSORS

A. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval. Where indicated as manual-on, occupancy sensor to turn load on when occupant interacts with lighting control and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with

electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

7. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

B. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).

C. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - d. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

2.3 OUTDOOR PHOTO CONTROLS

A. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
- B. Occupancy Sensor Locations:
 1. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- C. Outdoor Photo Control Locations:
 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- D. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.2 FIELD QUALITY CONTROL

- A. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- B. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.3 ADJUSTING

- A. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect/Engineer.
- B. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- C. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect/Engineer.

END OF SECTION

SECTION 26 2100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical service requirements.

1.2 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.3 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code 2017.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
- 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
- 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.

- B. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

- C. Utility Company charges associated with providing permanent service to be paid by Contractor.

- D. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

E. Scheduling:

- 1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

- A. Drawings prepared by Utility Company.

- B. Project Record Documents: Record actual locations of equipment and installed service routing.

1.6 QUALITY ASSURANCE

A. Comply with the following:

- 1. IEEE C2 (National Electrical Safety Code).
- 2. NFPA 70 (National Electrical Code).
- 3. The requirements of the Utility Company.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely

and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Utility Company: Dominion Virginia Power.
- D. Division of Responsibility:
 - 1. Pole-Mounted Utility Transformers:
 - a. Utility Poles: Furnished and installed by Utility Company.
 - b. Transformers: Furnished and installed by Utility Company.
 - c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
 - d. Primary: Furnished and installed by Utility Company.
 - e. Secondary - Underground Service:
 - 1) Conduits: Furnished and installed by Contractor.
 - 2) Conductors: Furnished and installed by Contractor (Service Point at utility pole).
 - 2. Terminations at Service Point: Provided by Utility Company.
 - 3. Metering Provisions:
 - a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
- E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Verify and mark locations of existing underground utilities.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Arrange equipment to provide minimum clearances and required maintenance access.
- C. Provide required trenching and backfilling in accordance with Division 31.
- D. Provide required support and attachment components in accordance with Section 26 0529.
- E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
- F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.4 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 2200 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General purpose transformers.

1.2 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.
- B. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.
- C. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.
- D. NEMA ST 20 - Dry-Type Transformers for General Applications 2014.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- F. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers; 2002.
- G. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; 2005.
- H. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency; 2000.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- J. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.
- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
 - 1. Vibration Isolators: Include attachment method and rated load and deflection.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Data: Include recommended maintenance procedures and intervals.
- E. Project Record Documents: Record actual locations of transformers.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed 86 degrees F (30 degrees C) average or 104 degrees F (40 degrees C) maximum measured during any 24 hour period during and after installation of transformers.

PART 2 PRODUCTS

2.1 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet (1,000 m).
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
 - 3. Ambient Temperature: Not exceeding 86 degrees F (30 degrees C) average or 104 degrees F (40 degrees C) maximum measured during any 24 hour period.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.2 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- C. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- D. Winding Taps:

1. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
 1. Transformers shall be low loss type with minimum efficiencies per NEMA TP-1 when operated at 35% of full load capacity.
 2. Test efficiency according to NEMA TP 2.
 3. Label transformer according to NEMA TP 3.
 - F. Sound Levels: Standard sound levels complying with NEMA ST 20
 - G. Mounting Provisions:
 1. 15 kVA through 75 kVA: Suitable for floor mounting.
 - H. Transformer Enclosure: Comply with NEMA ST 20.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Outdoor locations: Type 3R.
 2. Construction: Steel.
 - a. 15 kVA and Larger: Ventilated.
 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 4. Provide lifting eyes or brackets.
 - I. Accessories:
 1. Mounting Brackets: Provide manufacturer's standard brackets.
 2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.
- 2.3 SOURCE QUALITY CONTROL
- A. Factory test transformers according to NEMA ST 20.
- PART 3 EXECUTION
- 3.1 EXAMINATION
- A. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
 - B. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
 - C. Verify that conditions are satisfactory for installation prior to starting work.
- 3.2 FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
 - B. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
 - C. Inspect and test in accordance with NETA ATS, except Section 4.
 - D. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
- 3.3 ADJUSTING
- A. Measure primary and secondary voltages and make appropriate tap adjustments.
 - B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- 3.4 CLEANING
- A. Clean dirt and debris from transformer components according to manufacturer's instructions.

- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2416 - PANELBOARDS**PART 1 - GENERAL****1.1 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

1.2 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

PART 2 - PRODUCTS**2.1 PANELBOARDS - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings or determined in coordination study.
- C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- D. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- E. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.

- F. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- G. Load centers are not acceptable.
- H. Conductor Terminations:
 - 1. Main and neutral lug material: copper, suitable for terminating copper conductors only.
 - 2. main and neutral lug type: mechanical.
- I. Bussing:
 - 1. Phase and neutral bus material: Copper
 - 2. Ground bus material: Copper.
- 2.2 LIGHTING AND APPLIANCE PANELBOARDS
 - A. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- 2.3 OVERCURRENT PROTECTIVE DEVICES
 - A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as specified on drawings or in coordination study.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Lug Material: Copper, suitable for terminating copper conductors only.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- B. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- C. Provide grounding and bonding in accordance with Section 26 0526.
- D. Install all field-installed branch devices, components, and accessories.
- E. Provide filler plates to cover unused spaces in panelboards.

3.2 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

1.2 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- C. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.

2.2 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 1. All GFI Receptacles: Provide with integral protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.3 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- F. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- G. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- H. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the mounting system of luminaires with ceiling type and construction.

1.2 SUBMITTALS

A. Shop Drawings:

1. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- b. Include IES LM-79 test report upon request.

1.3 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- E. LED Luminaires:
 1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 LED LUMINAIRES AND DRIVERS

A. General:

1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
3. LED arrays shall be sealed, high performance, long life type; inimum 70% rated output at 50,000 hours.
4. LED luminaires shall deliver a minimum of 60 lumens per watt.
 - a. LED's shall be "Bin No. 1" quality.
5. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
6. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
7. Luminaires shall have internal thermal protection.
8. LED drivers shall include the following features unless otherwise indicated.
 - a. Minimum efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -4 degrees F (-20 degrees C).
 - c. Input Voltage: 120 - 277V ($\pm 10\%$) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: > 0.95 .
 - f. Total Harmonic Distortion: $< 20\%$.
 - g. Comply with FCC 47 CFR Part 15.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- C. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- D. Install accessories furnished with each luminaire.
- E. Bond products and metal accessories to branch circuit equipment grounding conductor.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1.2 SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- b. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.4 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Provide products that are listed and labeled as complying with UL 1598, where applicable.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

E. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

F. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

G. LED Luminaire Components: UL 8750 recognized or listed as applicable.

2.2 BALLASTS

A. All Ballasts:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products according to manufacturer's instructions.
- B. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- C. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- D. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- E. Install accessories furnished with each luminaire.
- F. Install lamps in each luminaire.

END OF SECTION

SECTION 310000 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor, material and equipment to perform all work pertaining to earthwork as called for on the approved plans and as specified herein.

1.02 RELATED DOCUMENTS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- C. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
- D. Local Governing Authority and Code Requirements – Chapter 57 Arlington County Code
- E. Arlington County DES Construction Standards and Specifications
- F. Virginia Department of Transportation Road and Bridge Specifications
- G. Tree Protection Standards and Specifications – as indicated in Construction Drawings

1.03 SUMMARY

- A. This Section includes the following:
 - 1. Excavation for footings, steps, subgrades for slabs-on-grade, walks, pavements, lawns and grasses.
 - 2. Subsurface drainage backfill for trenches.
 - 3. Excavating and backfilling for utility trenches (vault, water hydrant and water pump).

- B. Related Sections include the following:

- 1. 311000 – Site Clearing, Demolition and Removals
 - 2. 033000 – Cast in Place Concrete
 - 3. 321313 – Concrete Pavement
 - 4. 329200 – Seeding, Mulching, and Topsoil

1.05 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Project Officer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Project Officer. Unauthorized excavation, as well as remedial work directed by Project Officer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.06 SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile.
 - 2. Controlled low-strength material, including design mixture.
- B. Samples: 12-by-12-inch Sample of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.07 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Coordination, Field Engineering, Cutting and Patching, and Regulatory Requirements."

1.08 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Project Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Officer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Protect all existing pipes, poles, wires, fences, trees, and landscape plant materials, and other structures that are to remain in place. In case of damage, notify the appropriate agency to affect repair in a manner resulting in a condition at least equal to the condition prior to damage.

- D. Excavations near existing structures shall not be closer than the distance from finished grade to the bottom of the foundation without sheeting and shoring to protect the existing structure.
- E. On paved surfaces, do not use or operate tractors, bulldozers, or other power-operated equipment, the treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. Placing mats or using other methods of protection may be allowed subject to the approval of the Project Officer. Promptly restore all surfaces that have been damaged to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.
- F. The Contractor shall be solely responsible for the stability of excavations and meeting of all State and Federal OSHA requirements. Provide all sheathing, lagging, bracing, and other support required to retain the stability of excavations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups CL, ML, SC, GC, GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or crushed stone, slag, and natural or crushed sand: with or without soil mortar.
- E. Base Course: designated as Type I or Type II as follows: Type I shall consist of crushed stone, crushed slag, or crushed gravel with or without soil mortar or other admixtures. Crushed gravel shall consist of particles of which at least 90 percent by weight of the material retained on the No. 10 sieve shall have at least one face fractured by artificial crushing. Type II shall consist of gravel, stone or slag screenings; fine aggregate and crushed coarse aggregate; sand-clay-soil mortar or other admixtures.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Crushed stone Virginia Department of Transportation (VDOT) size 57, 68, or 78 in accordance with VDOT specification section 203 Table II-5

- H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: Equal to or smaller than 0.300mm.
 - 7. Permittivity: 0.8 second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - 4. Tear Strength: 90 lbf; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in section 022300 Site Clearing, Demolition, and Removals.
- C. Protect and maintain erosion and sedimentation controls, which are specified in section 015000 Temporary Erosion and Sediment Control, during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

- A. Explosives: Use of explosives is prohibited.

3.04 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by the Geotech. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.
 - 1. Clearance: As indicated on details.
- C. Trench Bottoms: Excavate trenches deeper than bottom of pipe elevation to allow for bedding course.
 - 1. Width and Depth: As indicated on details.

3.08 SUBGRADE INSPECTION

- A. Notify Project Officer when excavations have reached required subgrade.
- B. If Project Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Project Officer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Project Officer, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Project Officer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Project Officer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within tree protection areas and drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of final backfill soil material at 95 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: As indicated in drawings and specifications.

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
- 6.. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing for site work. The Project Officer may engage a qualified independent geotechnical engineering testing agency to perform testing for critical structures and building foundations.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Project Officer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 5,000 sf or less of building slab, but in no case fewer than 3 tests for building slabs and at least 1 test every 500 linear feet of paved roadway, but in no case fewer than 2 tests for pavements.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted bedding and final backfill layer, at least 1 test for each 300' or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Project Officer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 310000

SECTION 311000 - SITE CLEARING, DEMOLITION & REMOVALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees and landscaping to remain.
 - 2. Tree removal
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above-grade site items.
 - 6. Disconnecting and capping or sealing site utilities.
- B. Footings, bases and foundations for the above mentioned removals shall be removed under Division 31, Section "Earthwork"
- C. See Division 1 Section "Temporary Erosion and Sediment Control" for temporary erosion and sedimentation control measures.
- D. See Division 31 Section "Tree Protection and Root Pruning" for requirements related to tree protection.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil, items identified by the Project officer as salvage, or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Project Officer and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Items: Carefully remove items indicated by the Project officer to be salvaged and store on Owner's premises where indicated in the Demolition Plans.
- C. Utility Locator Service: Notify Miss Utility at (800) 552-7001 for utility location services 72 hours prior to site clearing.

- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Erect temporary tree protection fencing around existing trees to remain as indicated on the drawings and as specified in Division 2 Section "Tree Protection and Trimming"
- C. Protect existing site items to remain from damage during construction.
 - 1. Restore damaged existing site items to their original condition, as acceptable to Project officer.

3.2 TREE REMOVAL

- A. General
 - 1. Remove all trees marked for removal on the Demolition Plans in a manner that will protect the adjacent trees to be preserved, vegetation and other site elements to include but not limited to the existing site fence, adjacent properties, power lines, playground, and basketball court that are outside of the Limits of Disturbance (LOD)
- B. Tree removal
 - 1. Remove all other trees using techniques as required.

3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.

- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Project Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Officer's written permission.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain.
 - 2. Grind down stumps and remove roots larger than 2 inches, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Chip removed tree branches, and trunks and legally dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 6 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.6 EXISTING SITE ITEMS

- A. Remove existing above-grade items as indicated and as necessary to facilitate new construction.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

SECTION 311300 - TREE PROTECTION & ROOT PRUNING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protection of existing trees to remain.
2. Pruning of existing trees roots that are affected by execution of the Work, whether temporary or permanent construction.
3. Trunk Protection

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated in Section 2.1
- B. Certification: From Arlington County arborist or contract arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Requirements: From Arlington County arborist or contract arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Contract arborist Qualifications: Copy of ISA certification or local jurisdiction license.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.
- B. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- C. Urban Forester Notification: The Contractor shall notify the Project Officer 72 hours prior to the following events, so that the County's Urban Forester can be present to supervise work:
 1. Tree protection fencing installation, to discuss locations and trees to be saved on-site.
 2. Tree or root-pruning operations.
 3. Work within tree protection zones.
 4. Tree planting.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 6' Height Tree Protection Fence/Construction Fence (Chain Link): See plan.
- B. Tree Protection Signs: Shall be of heavy-duty sheet aluminum or weatherproof plastic material measuring 12 inches by 18 inches. Signs shall state "NO ENTRY, TREE PRESERVATION AREA, CALL 703-228-6557 TO REPORT VIOLATIONS" in both English and Spanish. Signs shall be mounted on fence every 50 feet maximum.
- C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.
 - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- D. Wood Chip Mulch. Refer to Section 329100 – Seeding, Sodding, and Topsoil

PART 3- EXECUTION

3.1 PREPARATION

- A. Prior to the placement of tree protection fencing, the Contractor shall meet on-site with the Project Officer and County Urban Forester to review trees to remain and protective measures required.
- B. Tree Protection Fence/Construction Fencing and Tree Protection Fence: Install tree protection fencing and signs around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove all tree protection fence when construction is complete.
- C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- D. No personnel, vehicles, equipment, construction materials, or construction debris shall be allowed inside the tree protection areas at any time during construction without the written consent of the Project Officer. If a violation is observed, the Contractor will be notified by the Project Officer and shall immediately rectify the situation. Continued and subsequent violations will result in a fine of \$500 per day of violation.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.

- C. Where utility trenches are required within tree protection zones, root pruning shall take place prior to trenching.
- D. Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.

3.3 ROOT PRUNNING:

- A. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Arlington County arborist or contract arborist's written instructions.
- B. The Contractor shall be responsible for any damage to trees within the Tree Protection Area caused by the Contractor's personnel, vehicles, or equipment at the site. Any damage to a tree to remain shall result in a payment by the Contractor to the Project office for the amount of damage based on the latest edition of the Council of Tree and Landscape Appraisers Guide for Plant Appraisal published by the International Society of Arboriculture (ISA). All trees are to be valued as landscape trees.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION 311300

SECTION 312500 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

1. This Section includes temporary measures throughout the life of the project to control erosion and siltation.
2. Such measures shall include, but are not limited to:
 1. Stabilized Construction Entrance
 2. Silt Fence
 3. Inlet Protection
 4. Super Silt Fence
3. Temporary erosion and siltation control measures as described herein, shall be applied to erodible material exposed by any activity associated with construction, consistent with state and local control standards.

1.2 GENERAL REQUIREMENTS

- A. The Contractor is responsible for providing and maintaining facilities adequate to control erosion and sedimentation. The Project Officer reserves the right to order the performance of other temporary measures not specifically described herein to correct an adverse erosion or siltation condition.

1.3 APPLICABLE SPECIFICATIONS

- A. The following specifications are hereby incorporated into this specification section by reference.
 1. Arlington County Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code).
 2. Virginia Soil and Water Conservation Commission Erosion and Sediment Control Handbook.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials shall be at the Contractor's Option, in accordance with the Removals Plan and all applicable standards listed above.

PART 3 - EXECUTION

3.1 TIMING OF INSTALLATION

- A. No grading operations will be allowed until temporary erosion and sediment control measures have been installed in accordance with the Erosion and Sediment Control Plan and all applicable standards listed above.

3.2 MINIMIZE EXPOSED SOIL

- A. The Contractor shall limit the surface area of earth material exposed by grubbing and stripping of topsoil and excavation to that which is necessary to perform the next operation within a given area.
- B. Unless specifically authorized by the Project Officer, the grubbing of root mat and stumps shall be confined to the area over which excavation is to be actively executed within 30 days following the grubbing operations.
- C. The stripping of topsoil shall be confined to the area over which excavation is to be actively executed within 15 days following the stripping operations.
- D. Excavation and embankment construction shall be confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work.
- E. No disturbed area, including stockpiles, is to remain denuded longer than 30 days without temporary seeding or otherwise stabilizing the area.

3.3 CLEANING AND MAINTENANCE

- A. Control measures shall be periodically cleaned of silt and maintained. Immediately after every rainstorm, all control measures shall be inspected, and any deficiencies corrected by the Contractor.

END OF SECTION 312500

SECTION 321313 – CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior concrete pavement for, but not limited to, the following:
 - 1. Walkways.
 - 2. Landings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For concrete pavement mixture.
- C. Delivery tickets for concrete including the date, time, truck identification, concrete plant, plant inspector, ticket and load number concrete class and design mix, moisture content of aggregates, quantity and location of placement.
- D. 24" x 24" on-site mock up of each color with specified finish.
- E. Color of expansion joint sealant.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 SUBBASE

- A. Coarse aggregates shall meet the size and grading requirements of Contract Documents.

2.2 PERVIOUS CONCRETE

- A. Comply with ASTM C94/C94M and the following requirements:

1. Aggregates—Nominal maximum aggregate size shall not exceed 1/3 of the specified pavement thickness.
2. Admixtures—Chemical admixtures that facilitate the production and placement of pervious concrete shall be permitted. The use of such admixtures shall be notified to the Landscape Architect.
3. Fibers—The use of fibers in pervious concrete mixtures is permitted when approved by the Landscape Architect.
4. Pigments—Use pigments complying with ASTM C979 if specified in Contract Documents.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed, sizes as shown on the drawings.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. The design of the concrete mix, equipment, workmanship, and materials shall conform to the applicable requirements of Division 3 sections, except as hereinafter specified. Minimum compressive strength after 28 days shall be 3000 psi. Maximum size of aggregate shall be 1-01/2 inches, but not less than 3/4 inch. Air content by volume shall be 4-1/2 per-cent, plus or minus 1-1/2 percent.
 1. Provide Class A3 General Use (3,000 psi) concrete for walkways and landings.
- B. Portland Cement air-entrained, ASTM C 150, Class A3 General Use (3,000 psi) per VDOT 217.

2.3 CURING MATERIALS

- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- D. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- E. Water: Potable.
- F. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- G. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- H. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.4 EXPANSION JOINT FILLER

- A. Joint filler shall be ½ inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.
- B. If bituminous fiber material is used, a bond breaker such as one-half (1/2") wide polyethylene tape or five eighths inch (5/8") diameter expanded polyethylene foam backer rod shall be installed as recommended by the manufacturer.

2.5 EXPANSION JOINT SEALANT

- A. Expansion Joint Sealant: Sealant shall be one-component polyurethane-base elastomeric sealant. Asphalt cement will not be approved as a substitution. Sealant color shall match color of adjacent pavement. Where joints fall between pavement sections of different colors, color shall be selected by Project Officer to match one of the pavement colors.
 - 1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - 1. SikaFlex-1a by Sika Corporation.
 - 2. Sonoclastic NP-1 by Sonneborn and Chem Rex Inc.
- B. Approved equal requirements: Premium-grade, high performance, moisture cured, polyurethane based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C-920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive concrete with Project Officer present for compliance with requirements for installation tolerances and other conditions which might affect the performance of the concrete. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SETTING FORMWORK FOR PERVIOUS CONCRETE

- A. Set, align, and brace forms so that the hardened pavement meets the tolerances specified below:
 - 1. Elevation: +3/4 in. (+19 mm), -0 in. (-0 mm)
 - 2. Thickness: +1-1/2 in., -1/4 in. (+38 mm, -6 mm)
 - 3. Contraction joint depth: +1/4 in. (6 mm), -0 in. (-0 mm)
 - 4. Mechanically sweep pavement before testing for compliance with tolerances.
- B. Apply form release agent to the form face, which will be in contact with concrete, immediately before placing concrete.
- C. The vertical face of previously placed concrete may be used as a form.
 - 1. Protect previously placed pavement from damage.
 - 2. Do not apply form release agent to previously placed concrete.
- D. Placement width shall be as specified in Contract Documents. Concrete placement width shall not exceed 20 ft (6 m) unless otherwise specified.

3.3 BATCHING, MISING, AND DELIVERY FOR PERVIOUS CONCRETE

- A. Batch and mix in compliance with ASTM C94/C94M except that discharge shall be completed within 60 minutes of the introduction of mixture water to the cement. Increase time to 90 minutes when using an extended set control admixture. Water addition is permitted at the point of discharge.

3.4 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Forms shall be set to alignment and grade and to conform smoothly to the shapes and dimensions indicated on the Drawings. All curves, where shown on the drawings or as require, shall be smooth. No tangents or broken segments shall be accepted.
- C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
- D. Edge top surface to a radius of not less than 1/4in. for pervious concrete.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. Construct expansion and contraction joints at right angles to the lines of the sidewalks and pads.
- B. Control joints in sidewalks and pads shall be formed 1/4 depth of the slab with a tool designated for that purpose, and shall be spaced as indicated on Drawings, or if not shown, as directed by Project Officer. Saw-cut joints are not acceptable under any circumstances.
- C. Where structures, such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk area, place premolded expansion joint around the structure for the full depth of the concrete.
- D. Form expansion joints using 1/2 inch thick pre-molded expansion joint fillers, full depth of the concrete, conforming to the shape of the sidewalks and curb and gutters. Place expansion joints where walks or exterior concrete slabs abut other vertical surfaces, including but not limited to building perimeter, curbs, columns, retaining or cheek walls, etc. Place expansion joints elsewhere as indicated on Drawings or as directed by Architect.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. For pervious concrete:
 - 1. Unless otherwise specified, construct joints at the locations, depths, and with horizontal dimensions indicated in Contract Documents.
 - 2. When jointing requirements are not indicated on the Project Drawings, submit drawings describing proposed jointing in accordance with ASTM, ACI, and NRMCA and the requirements of 3.4.f.1 through 3.4.f.12. Do not proceed with Work until the jointing requirements are accepted by the Landscape Architect.
 - 3. Indicate locations of contraction joints, construction joints, and isolation joints. Spacing between contraction joints shall not exceed 20 ft (6 m).
 - 4. The larger horizontal dimension of a slab panel shall not exceed 125% of the smaller dimension.
 - 5. The angle between two intersecting joints shall be between 80 and 100 degrees, as specified in Contract Documents.
 - 6. Joints shall intersect pavement free edges at 90-degree angles and shall extend straight for a minimum of 1-1/2 ft (0.5 m) from the pavement edge where possible.
 - 7. Align joints of adjacent pavement panels.
 - 8. Align joints in attached or adjacent curbs within 1/4 in. (6 mm) of joints in pavement.

9. Contraction joint depth shall be 1/4 to 1/3 of the pavement thickness. Minimum joint width for saw-cutting is 1/8 in. (3 mm). When using an early-entry dry-cut saw, the depth of the cut shall be at least 1 in. (25 mm).
10. Use isolation joints only where pavement abuts fixed objects, such as buildings, foundations, and manholes.
11. Extend isolation joints through the full depth of the pavement. Fill the entire isolation joint with isolation joint material.
12. Create contraction joints by one of the following methods:
 - a. Tool contraction joints to the specified depth and width in fresh concrete immediately after the concrete is compacted.
 - b. Sawcut concrete after concrete has hardened sufficiently to prevent aggregate from being dislodged and soon enough to control pavement cracking. To minimize drying, ensure that curing materials are removed only as needed to make cuts.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed pavement surfaces with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Final surface texture for pervious concrete:
 13. Compact fresh concrete to stay within the requirements of 3.2.a.
 14. Compact the concrete along the slab edges with hand tools.
 15. Compact concrete to a dense, pervious surface.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screening, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing shall be stated as soon as it is possible to apply the curing medium without damaging the surface. Curing shall continue uninterrupted for a minimum period of 14 days. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40° F.
- F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.
- G. Curing for pervious concrete:
 - 1. Begin curing within 20 minutes of concrete discharge unless longer working time is accepted by the Landscape Architect.
 - 2. Completely cover the pavement surface with a minimum 6 mil (0.15 mm) thick polyethylene sheet. Cut sheeting to a minimum of a full placement width.
 - 3. Cover all exposed edges of pavement with polyethylene sheet.
 - 4. Secure curing cover material without using dirt.
 - 5. Cure pavement for a minimum of 7 uninterrupted days, unless otherwise specified.
- H. Hot- and cold-weather construction:
 - 1. When hot weather is anticipated, submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot weather.
 - 2. In cold weather, comply with ACI 306.1, recording concrete temperature no less than twice per 24-hour period.

3.8 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, and equipment required to install the chain link backstops, fencing and gate(s) system as indicated on the drawings and/or specified herein. Said work shall include any incidentals required to provide a finished job.

1.02 RELATED SECTIONS

- A. Section 033000 – Cast-In-Place Concrete
- B. Section 321313 – Concrete Pavement
- C. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCES

- A. ASTM:
 - 1. A90/A90M - Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
 - 2. A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. A924/A924M - Specification for General Requirements of Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - 4. B6 - Specification for Zinc
 - 5. B117 - Practice for Operating Salt Spray (Fog) Apparatus
 - 6. D1499 - Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics
 - 7. D3359 - Test Methods for Tension Testing of Adhesive by Tape Test
 - 8. E8/E8M - Test Methods for Tension Testing of Metallic Materials
 - 9. E8/E8M - Practice for Installation of Chain-Link Fence
 - 10. F626 - Specification for Fence Fittings
 - 11. F668 - Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
 - 12. F934 - Specification for Standard Colors for Polymer-Coated Chain- Link Fence Materials
 - 13. F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
- B. Chain Link Fence Manufactures Institute (CLFMI):

1.04 DEFINITIONS

- A. Definitions of terms used in this Section, such as chain link fabric, selvage, knuckle, twist, and diamond count, shall conform to ASTM F 552

1.05 SYSTEM DESCRIPTIONS

- A. Design Requirements: Provide components having dimension for structural capacity required for height and loading. Based structural design on exposure and wind load designated by code for site.
- B. The contractor shall supply a total color chain link fencing system of the design, style and strength defined herein. The system shall include all components (i.e., framework, chain link fabric and fittings) required.

1.06 SUBMITTALS

- A. Product Data: Submit complete manufacturer's descriptive literature and specifications.
- B. Shop Drawings: In accordance with the construction drawings, submit complete Shop Drawings comprehensively describing fabrication and installation of all decorative screens, chain link fences, solid steel picket fence, and plant protection fence describing and detailing typical line post, terminal post, gate, fabric, materials, hardware assemblies, and all proposed fence alignment sections.
- C. In the preparation of Shop Drawings, use terminology conforming to ASTM F552
- D. Product Data indicating material compliance and specified options.
- E. Samples: If requested, samples of materials (e.g., finials, caps and accessories).
- F. Provide painted sample of one 12-inch rail, if requested, section for approval by the Owner.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Regularly engaged and specializing, for preceding 5 years, in the fabrication and installation of equivalent fencing systems.
- B. The installer must be experienced in fence installations. Contractor shall provide three representative fence projects for review.
- C. Regulatory Requirements: In additions to complying with applicable codes and regulations, comply with pertinent recommendations contained in the Standard Specifications and the CLFMI Product Manual.
- D. Contractor shall provide a warranty stating that the fencing is secure and stable, tight, corrosion-free, in proper alignment, complete in detail and finish, and free of hazardous conditions. Any defects that develop within one year from the date of Physical Completion shall be replaced at the expense of the Contractor.

1.08 PRODUCT HANDLING AND STORAGE

- A. All materials are to be new and delivered to the site in an undamaged condition.

- B. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft.

PART 2 - PRODUCTS

2.01 MATERIALS – DECORATIVE SCREEN

- A. Refer to plans.

2.02 MATERIALS – CHAIN LINK FENCE

- A. Framework for color chain link fence systems shall conform to Ameristar PermaCoat PC-40 FencePipe (industrial weight), as manufactured by Ameristar Fence Products in Tulsa, Oklahoma or approved equivalent.
- B. The zinc used in the galvanizing process shall conform to ASTM B6. Weight of zinc shall be determined using the test method described in ASTM A90 and shall conform to the weight range allowance for ASTM A653, Designation G-210.
- C. The framework shall be manufactured in accordance with commercial standards to meet the strength (50,000 psi minimum yield strength) and coating requirements of the following standards:
1. ASTM F1043, Group IC, Electrical Resistance Welded Round Steel Pipe, heavy industrial weight.
 2. M181, Type I, Grade 2, Electrical Resistance Welded Steel Pipe
 3. RR-F-191/3, Class 1, Grade B, Electrical Resistance Welded Steel Pipe
- D. The exterior surface of the electrical resistance weld shall be recoated with the same type of material and thickness as the basic zinc coating.
- E. The manufactured framework shall be subjected to the PermaCoat process, a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.
- F. The material used for the base coat shall be a zinc-rich (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be two (2) mils. The material used for the finish coat shall be a thermosetting "no-mar" TGIC polyester powder; the minimum thickness of the finish coat shall be two (2) mils. The stratification-coated pipe shall demonstrate the ability to endure a salt-spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours. Additionally, the coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the crosshatch test, Method B, in ASTM D3359. The polyester finish coat shall not crack, blister or split under normal use.
- G. The color of all framework shall be black in accordance with ASTM F934.

- H. The strength of Ameristar PermaCoat PC-40 FencePipe shall conform to the requirements of L.ASTM F1043; the minimum weight shall not be less than 90% of the nominal weight (see Table L. The strength of line, end, corner and pull posts shall be determined by the use of 4’ or 6’ cantilevered beam test. The top rail shall be determined by a 10’ free-supported beam test (see Table 1). An alternative method of determining pipe strength is by the calculation of bending moment (see Table 1). Conformance with this specification can be demonstrated by measuring the yield strength of a randomly selected piece of pipe from each lot and calculating the section modulus. The yield strength shall be determined according to the methods described in ASTM E8. For materials under this specification, the 0.2 offset method shall be used in determining yield strength. Terminal posts, line posts and top/bottom rails shall be precut to specified lengths.

TABLE 1

| Fence Industry O.D. | Decimal O.D. Equivalent | | Pipe Wall Thickness | | Weight | | Section Modulus inches ³ | Min. Yield Strength psi | Max. Bend. Moment lb. in. | Calculated Load (lbs.) | | |
|---------------------|-------------------------|-------|---------------------|------|---------|--------|-------------------------------------|-------------------------|---------------------------|------------------------|------------|-------|
| | inches | (mm) | inches | (mm) | Lb./ft. | (kg/m) | | | | 10’ Free Supported | Cantilever | |
| | | | | | | | | | | | 4’ | 6’ |
| 1-5/8" | 1.66 | 42.16 | 0.111 | 2.82 | 1.84 | 2.74 | 0.1961 | x 50,000 | = 9,805 | 327 | 204 | 136 |
| 2" | 1.9 | 48.26 | 0.12 | 3.05 | 2.28 | 3.39 | 0.281 | x 50,000 | = 14,050 | 468 | 293 | 195 |
| 2-1/2" | 2.375 | 60.33 | 0.13 | 3.3 | 3.12 | 4.64 | 0.4881 | x 50,000 | = 24,405 | 814 | 508 | 339 |
| 3" | 2.875 | 73.03 | 0.16 | 4.06 | 4.64 | 6.9 | 0.8778 | x 50,000 | = 43,890 | 1,463 | 914 | 610 |
| 4" | 4 | 101.6 | 0.16 | 4.06 | 6.56 | 9.76 | 1.7819 | x 50,000 | = 89,095 | 2,970 | 1,856 | 1,237 |

2.03 FABRIC – CHAIN LINK FENCE

- A. The material for color chain link fence fabric shall be manufactured from galvanized steel wire.
- B. The weight of zinc shall meet the requirements of ASTM F668, Table 4. Galvanized wire shall be PVC or Powder coated to meet the requirements of ASTM F668. The class of the fence fabric shall be (specify Class 1 – Extruded, Class 2A – Extruded and Bonded, or Class 2B – Fused and Bonded).
- C. Selvage: Top edge knuckled and bottom edge knuckled.
- D. Color: The coating color for the fence fabric shall be match existing. Reference ASTM F668 and ASTM F934.
- E. Wire Size: The size of the steel wire core shall be 9 gauge (See Table 2); the finished size of the coated wire shall be 6 gauge (See Table 2).

- F. Height and Mesh Size: The fabric height shall be determined by the contractor per each fence height with a mesh size of 2” inches for all chain link fence.

TABLE 2

| Finished Gauge | Finished OD (NOM) | Core Diameter (NOM) | PVC Coating Thickness | Mesh Sizes Available | Fabric Extrusion Type | Minimum Breaking Strength |
|----------------|-------------------|---------------------|-------------------------------|---------------------------------------|-----------------------|---------------------------|
| 6 | .192 (4.88 mm) | .148 (3.76 mm) | .015 - .025 (0.38-0.64 mm) | 2 (50 mm) 1 ¾ (44 mm) | CLASS 2A | 1290# |
| 8 | .162 (4.11 mm) | .120 (3.05 mm) | .015 - .025 (0.38-0.64 mm) | 2 (50 mm) 1 ¾ (44 mm) 1 (25 mm) | CLASS 2A | 1,850# |
| 9 | .148 (3.76 mm) | .120 (3.05 mm) | .015 - .025 (0.38-0.64 mm) | 2 (50 mm) 1 ¾ (44 mm) 1 (25 mm) | CLASS 2A | 1,850# |

2.04 FITTINGS AND ACCESSORIES – CHAIN LINK FENCE

- A. Fittings shall be hot-dipped galvanized pressed steel in accordance with ASTM F 626-89a. All fittings shall be industrial quality.
- B. All fittings except nuts and bolts shall have the PVC coating extruded and adhered to the galvanized steel core wire per ASTM F 668-88, Class 2a. or powder coated and Black in Color. All other materials shall be 10 to 15 mils PVC coating minimum. No hand painting is allowed, except for minor touching up.
- C. After installation, spray all nuts and bolts with two coats of flat alkyd enamel paint (color to match fence) suitable for metal.
- D. Post tops shall be pressed steel and designed as a weather tight closure cap for tubular posts, and shall be vinyl or powder coated.
- E. Accessory Materials: The material for fence fittings shall be manufactured to meet the requirements of ASTM F626. The coating for all fittings shall be the same Permacoat color coating system required for the framework (see 2.02); the color of all fittings and fasteners shall be black in accordance with ASTM F934. All fasteners shall be stainless steel.
- F. Wire Ties: Manufacturer’s 11 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 11 gauge galvanized steel wire for rails and braces. Hog ring ties for attachment of fabric to tension wire. Match finish of fabric (black)
- G. Tension Wire: Provide No. 6 gage coil-spring wire at bottom of fabric. Equip each section with galvanized turnbuckle. Match finish of fabric (black)
- H. Concrete Compressive Strength: 3,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.

- I. Tension bars shall be of one piece lengths equal to full height of fabric with a minimum cross section of 3/16" x 3/4".
- J. Tension Wire (IF APPLICABLE) Contractor shall provide a No. 7 W & M gauge galvanized high carbon coiled, tension wire (vinyl or powder coated), stretched along the bottom of fabric and fastened to the fabric at intervals of not more than 18 inches, using steel hog rings. Tension wire shall be attached with brace band, and nut and bolt. Tension wire shall be terminated around the bolt to itself with a minimum of three complete wraps.

PART 3 - EXECUTION

3.01 INSTALLATION – CHAIN LINK FENCE

A. General

- 1. Install work in accordance with ASTM F 567 and the manufacturer's recommendations.
- 2. Install posts at a maximum spacing of 8 feet on center plumb and true in the concrete futsal curb
- 3. Install corner or slope posts where changes in line or grade exceed a 30-degree deflection angle.
- 4. Provide continuous top rails.
- 5. Provide bottom rails.
- 6. Provide braces at end posts, both sides of corner, slope and pull posts.
- 7. Provide a post top for each post with openings to permit through passage of top rail.

B. Posts

- 1. Center and align posts in adjacent curb or paving.
- 2. Place concrete around posts in continuous pour to 1 inch above grade. Vibrate or tamp for consolidation. Slope top surface to drain away from post.
- 3. Tops of all footings to be 6" from finish grade if not installed in retaining wall, trowel tops of footings, and slope or dome to direct water away from posts.
- 4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
- 5. Allow concrete to attain at least 75 percent of its minimum 28-day strength before installation of rails, tension wires, and fabric.
- 6. Do not install such times less than 7 days after placement of concrete.
- 7. Do not stretch and tension fabric and wire, until concrete has attained full design strength.

C. Rails and Bracing

- 1. Install fence with a top rail and bottom tension wire.
- 2. Install rails continuously through post caps and extension arms, bending to radius for curved runs. Splice with 6-inch long rail sleeve.
- 3. Equip each pull post, and both sides of corner posts, with brace rails and adjustable 3/8-inch diameter truss rods.
- 4. Provide bracing to the midpoint of the nearest line post at all end, corner, slope pull posts.
- 5. Provide expansion couplings as recommended by the fencing manufacturer.

D. Fabric

1. Install fabric on outward side of fence and anchor to framework so that fabric remains in tension after pulling force is removed
2. Leave approximately 1 inch between finish grade and bottom selvage.
3. Excavate high points in the ground to clear the bottom of the fence.
4. Place and compact fill to within 1 inch of the bottom of the fabric in depressions.
5. Pull fabric taut and tie to posts, rails and tension wires
6. For tying fabric, refer to construction drawings for spacing and materials section this spec for gauge strength
7. Install stretcher bars by threading through or clamping to fabric at 4 inches on centers, and secure to posts with fabric bands spaced vertically at 14 inches on centers.
8. Install tension wires parallel to the line of fabric by weaving through the fabric and tying to each post with not less than number 6-gage tie wire.
9. Bend end of wire tight to surface to minimize hazards to persons and clothing.

E. Miscellaneous

1. Use U-shaped tie straps, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.

F. Fasteners

1. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
2. Peen the ends of bolts to prevent removal of nuts.
3. Repair coatings damaged in shop or during field erections, using a hot applied repair compound applied in accordance with it manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. TESTS

1. Upon completion of this portion of the work, conduct fabric tension (deflection) tests.

B. ADJUSTING

1. Adjust fabric tension and clean surfaces of the work including wire fabric
2. Touch-up abraded surfaces of galvanizing with manufacturer' recommended paint.

END OF SECTION 323113

SECTION 329100 – PLANTING PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes erosion control materials, soil amendments, mulching and topsoil.
- B. Provide all labor, materials, tools and equipment as required to have topsoil, planting soil mix, soil stabilization, amendments, and mulch applied per the specifications on all areas disturbed by construction to receive plant materials as indicated in the approved plans.
- C. Related Sections:
 - a. Section 310000 Earthwork
 - b. Section 311000 Site Clearing, Preparation, Demolition and Removals
 - c. Section 311300 Tree Protection and Root Pruning
 - d. Section 312500 Temporary Erosion and Sediment Control
 - e. Section 329200 Seeding and Sodding
- D. In addition to the specifications contained herein, Work shall be performed in accordance with the:
 - a. Drawings and general provisions of the contract, including general and supplementary conditions
 - b. Arlington County Department of Parks & Recreation Design Standards as shown on the plans and available online at:
<http://parks.arlingtonva.us/design-standards/>

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient.

- C. Planting Soil/Backfill Soil Mixture: Existing soil modified as specified to be suitable for planting.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- F. ISA: International Society of Arboriculture
- G. CBAY: Chesapeake Bay, typically referring to CBAY watershed.
- H. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester
- I. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.03 SUBMITTALS

- A. Samples of all materials specified shall be submitted to the Project Officer for approval with coordination of the Landscape Architect. All approvals shall be in writing.
- B. Samples:
 - a. Existing Topsoil: Provide 1-pound sample of existing topsoil with the following soil test reports.
 - i. Fertility: pH, nitrate nitrogen, ammonia nitrogen, phosphate phosphorous, potassium, calcium, magnesium, zinc, iron, manganese.
 - ii. Suitability: total salinity, boron, sodium, potassium, calcium, magnesium, chloride, sulfate.
 - iii. Physical properties including organic content and particle size distribution.
 - b. Imported Topsoil: If imported topsoil is required, Contractor shall provide a 1-pound sample of the imported topsoil with the soil test reports as noted above for "Existing Topsoil."
 - c. Imported Topsoil for Bioretention Areas: If bioretention areas are indicated in the approved plans, the Contractor shall submit soil sample per specifications.
 - d. Mulches and Organic Matter/Compost: Sample of mulch and organic matter/compost may be requested in lieu of inspection.
 - e. Product certificates: Contractor shall submit for each type of manufactured

product, to be approved by the Project Officer in coordination with Landscape Architect or Urban Forester and complying with the following:

i. Manufacturer's certified analysis for standard products.

E. Geotextile/Soil Stabilization/Erosion Control Fabric: Sample

1.04 QUALITY ASSURANCE

A. Contractor shall have all existing and furnished topsoil to be used for seeding and sodding, and for planting areas tested by a state laboratory or recognized commercial soil-testing laboratory in order to determine recommendations for the types and quantities of soil amendments. The results of this test will determine the rates and types of fertilizers, lime, soil conditioners, and other amendments, if necessary.

1. Soil tests shall use a representative sample of on-site soils. If existing soil has been undisturbed and is suitable as determined by the soil test, no additional amendments are required.

2. Adjustments should be made based on soil test results.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall conform to those stipulated below, unless otherwise approved in writing by the Project Officer with confirmation by the Landscape Architect or County Urban Forester.

B. Specified materials to be applied in amounts and methods herein stipulated.

C. Delivery tickets indicating date, weight, analysis and vendor's name, to be submitted to Project Officer.

2.02 SOIL AMENDMENTS

A. Lime: Application rates for liming materials and lime material type chosen shall be determined by required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.

a. When required and unless test results indicate otherwise, lime material shall be dry and free flowing pulverized limestone, hydrate lime or burnt lime that contains at least 50% total oxides (calcium oxide plus magnesium oxide). Ground limestone shall be ground to such fineness that at a minimum of 50% will pass through a 100 mesh sieve and 98% - 100% will pass through a 20 mesh sieve. Lime mate-

rial shall meet the Virginia Agricultural Liming Materials Act, Code of Virginia Section 3.1-126.1.

- B. Fertilizer: Fertilizer type and application rate shall be determined by results of required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester:
 - a. When required and unless test results indicate otherwise, commercial-grade complete fertilizer will be of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - i. Composition: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium, by weight.
 - b. All fertilizers shall be uniform in composition, free flowing, and suitable for application with approved equipment.
 - c. Fertilizers shall be delivered to the site fully labeled according to applicable state fertilizer laws and shall bear the name, trade name, or trademark and warranty of the product.
- C. Delay mixing fertilizer with planting soil if planting will not proceed within 2 days.
- D. Spread fertilizer and lime with approved equipment.

2.03 EXISTING TOPSOIL

- A. Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation period and stockpiled.
 - a. Contractor shall verify suitability of stockpiled soil to produce or to be amended to produce viable planting soil for lawns and planting beds as described herein.
- B. Existing topsoil is to be used to extent possible for lawn areas and is to be amended per the specifications to become the Planting Soil/Backfill Soil Mixture for use in planting pits and bed areas.
- C. Prior to use for lawn areas or in planting soil mix, Contractor shall remove all stones, roots, plants, sod, clods, and clay lumps larger than 1/2 –inch in any direction, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris and other extraneous materials that are harmful to plant growth.
- D. After removal of debris and extraneous materials noted above, the Contractor shall obtain soil tests for the existing soil per the requirements in section 1.04 “Quality Assurance.”
- E. Contractor shall submit soil test results to the Project Officer for approval with confirmation by the Landscape Architect or Urban Forester.

- F. Contractor shall supplement the existing soil as recommended in soil test results to achieve a viable planting soil for lawns and/or planting beds. Contractor shall supplement with imported topsoil per the specifications from off-site sources when quantities of approved, existing topsoil are insufficient for lawns and planting beds.
- G. Contractor shall submit a sample of the topsoil that has been amended based on soil test results for approval by the Project Officer with confirmation by Landscape Architect or Urban Forester prior to use in lawn areas or planting beds or pits.
- H. Topsoil installed on grade shall attempt to match existing soil texture, except for situations where clay subsoil exists. In the event that clay subsoil exists, use loam or silt loam topsoil.
- I. Imported topsoil rather than existing topsoil is to be used for planting in bioretention areas, unless otherwise indicated on the approved plans.

2.04 PLANTING SOIL MIX/BACKFILL SOIL MIXTURE

- A. The planting soil mix (also known as backfill soil mixture) shall consist of existing topsoil that has been approved for planting per the specifications above and approved organic matter.
- B. The planting soil mix/backfill soil mixture shall be composed of $\frac{3}{4}$ approved existing topsoil and $\frac{1}{4}$ approved organic matter as described in the Arlington County DPR Standard planting details, unless otherwise indicated by the Project Officer with confirmation by the Landscape Architect or Urban Forester.

2.05 IMPORTED TOPSOIL

- A. Contractor shall add imported topsoil when required on the drawings, when quantity of existing topsoil is insufficient or when determined to be necessary due to soil testing results.
- B. Topsoil shall be the natural, original surface soil, a sandy loam uniform in composition and shall be in a friable condition and shall contain less than 3 percent subsoil, hardpan material, stones and clods larger than 1/2 inch in diameter in any direction. It shall also be free of sticks, tree or shrub roots, debris and other material undesirable for plant growth. The area and the topsoil shall be free of undesirable plant such as, but not limited to, Bermuda grass, nut sedge, mugwort or noxious weeds as set forth in the Federal Seed Act.
- C. The topsoil shall contain at least 5 percent organic matter. It shall be a sandy loam consisting of at least 5 but not more than 20% clay, at least 10 but not more than 80% sand. It shall have a pH between 5.5 to 6.5. Soluble salts (salinity) shall not exceed 500 ppm. Soil fertility shall be "High" in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.
- D. Topsoil which has been manufactured by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH and soluble salts requirements.

Agricultural limestone at not more than 5 pounds per cubic yard of topsoil any be used to adjust the pH provided it is well mixed in a manner which does not destroy the structure of the soil.

2.06 IMPORTED TOPSOIL FOR BIO-RETENTION AREAS

- A. If bioretention is specified in the approved plans, soil for bioretention areas shall comply with the Filter Media and Surface Cover section of the Virginia Department of Environmental Quality's (DEQ) Design Specification No. 9 for Bioretention, Version 2.0, January 1, 2013.

2.07 MULCHES AND ORGANIC MATTER

- A. Straw Mulch for Seeded Areas: Provide air-dry, clean, mildew and seed-free, salt hay or threshed straw of wheat, rye, oats or barley.
- B. Wood Chip Bark Mulch for Planted Areas: Wood Chip Bark Mulch shall be double-shredded hardwood bark mulch, uniform in size and free of stones, clods, non-organic debris or other foreign material and aged for at least 6 months from an approved source. Insufficiently or improperly aged mulch containing high bacterial counts or high levels of bark or other materials resistant to decomposition shall not be used. Mulch shall not contain the trunk of trees.
- C. Organic Matter/Compost Mulch: Well-composted, trash-free, stable, and weed-free organic matter such as composted bark, leaf mold or other plant debris material that has been composted to a point of decay and is mature.
 - a. pH range of 5.5 to 8; moisture content 35 to 55 percent by weight
 - b. 100 percent passing through 1-inch sieve
 - c. Peat moss shall not be used.
 - d. Organic amendments shall be commercially prepared and shall comply with the U.S. Compost Council Seal of Testing Assurance Program's Test Methods for the Examination of Composting and Compost (STA/TMECC) criteria, or as modified in approved plan documents.

2.08 SOIL STABILIZATION/EROSION CONTROL FABRIC

- A. ECS-2B Double New Straw Biodegradable Rolled Erosion Control Product, or an approved equal shall be used in all planting beds/reforestation areas.
 - a. Shall meet Type 2.D specifications for ECTC and HFWA FP-03 Section 713.17
 - b. Shall have two (2) layers of organic jute netting sewn together with biodegradable thread.
 - c. Overlap sections 12" and secure with manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat

enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

- C. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches.
- D. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped grades, of 3 inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
 - a. Products: Subject to compliance with requirements and plan documents, the products below, or an approved equivalent, be used:
 - i. Invisible Structures, Inc.; Slopetame 2
 - ii. Tenax Corporation – USA; Tenweb.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All identified areas within the project limits shall have approved topsoil mix spread on them and be prepared for seeding and sodding by bringing ground surfaces to grades shown on the drawings. Planting pits and bed areas identified on the approved plans shall be prepared in accordance with the applicable DPR Landscape Standard details.
 - 1. No seeding shall be done on frozen ground or when the temperature is 32F or lower. Refer to specification 329200, "Seeding and Sodding." Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, sidewalks and areas.
 - 2. Rototilling shall not be performed within the critical root zone of trees to be preserved.
 - 3. The soil shall not be tilled or amended when the soil's moisture capacity is above field capacity or when the soil is frozen.
 - 4. Contractor shall identify utilities, existing irrigation and underground utilities. All areas on either side of the utility marking shall be amended by hand.
 - 5. Contractor shall verify that no foreign or deleterious material or liquid has been deposited in soil within a planting area.
 - 6. Contractor shall proceed with installation only after both unsatisfactory conditions have been corrected and rough grading has been completed and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.
 - 7. Contractor shall protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs and plantings from damage caused by planting operations.

- a. Protect adjacent and adjoining areas from hydro-seeding and hydro-mulching overspray.
 - b. Protect grade stakes set by others until directed to move them.
8. Surfaces shall conform to finish grade, free of water retaining depressions, soil friable, free of clay and of uniformly firm texture.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1/2 inch in any direction and sticks, roots, rubbish, and other extraneous matter including grass vegetation and turf and legally dispose of them off of Arlington County property. Do not mix into surface soil.
1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix. Delay mixing amendments with soil if planting will not proceed within 2 days.
 2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 3. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove stones larger than 1/2 inch in any dimension and sticks, roots, trash, and other extraneous matter. Legally dispose them off of Arlington County property. Do not mix into surface soil
 2. Loosen surface soil to a depth of at least 6 inches, apply soil amendments and fertilizers according to the planting soil mix proportion and mix thoroughly into the top 4 inches of soil.
- D. Finish Grading: Grade landscape areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Adjust for the thickness of sod, where applicable. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- E. If bioretention areas are specified in the approved plans, the Contractor shall construct these areas in accordance with the Virginia DEQ Stormwater Design Specification No. 9, Version 2.0, January 1, 2013.
- F. Contractor shall avoid unnecessary compaction of the soil during grading.

- G. Contractor shall ensure appropriate slopes of the swales, berms and final grades.
- H. Immediately following each day's work, contractor shall clean all dirt, excess soil, debris and trash from the site. Contractor shall protect and store additional soils in stockpiles protected from saturation, erosion, weed growth and contamination with plastic sheeting or tarps.
- I. Amendments for seeding and sodding areas shall be applied after determining by soils test as follows:
 - 1. Lime as specified shall be spread uniformly over designated area. Rate depends on soil tests. Soil tests shall be made before lime application at 8 to 10 plugs per acre taken by the method prescribed the United States Department of Agriculture.
 - 2. Fertilizer shall be spread after the lime has been applied. Rate shall be as recommended per the soil tests.
 - 3. Fertilizer shall be spread with approved equipment and at an even rate over the area to be seeded or sodded.
 - 4. Work lime and fertilizer into top 4 inches of topsoil and grade to smooth surface ready for seeding.
- J. Restore areas if eroded or otherwise disturbed after finish grading and before planting.
- K. Prepared lawns and planting areas shall be inspected and approved by Project Officer in coordination with Landscape Architect prior to seeding, sodding or planting.
- L. If the graded areas develop volunteer weed growth, the growth shall be eliminated at the expense of the Contractor.

3.02 SOIL STABILIZATION MATERIALS

- A. Prepare planting area as specified.
- B. Moisten prepared planting area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Install Soil Stabilization from top of slope, overlapping joints by 12 inches, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- D. Plant shrubs, trees and perennials through Soil Stabilization fabric by carefully separating fabric layers to allow space for planting.
- E. Remove non-biodegradable stabilization materials after plant establishment.

END OF SECTION 329100

SECTION 329200 – SODDING, SEEDING, AND TOPSOIL

PART 1 - GENERAL

1.01 SUMMARY

- A. The work includes, but is not limited to the provision of all material, services, labor, and equipment necessary to perform the following as required per the plans for the establishment of turf, meadow grasses and/or wildflowers:
 - a. Seeding
 - b. Sodding
 - c. Hydro-seeding
 - d. Plugging
- B. Related Sections:
 - a. Section 310000 – Earthwork
 - b. Section 329100 – Planting Preparation
 - c. Section 311300 – Tree Protection and Root Pruning
 - d. Section 312500 – Temporary Erosion and Sediment Control
- C. In addition to the specifications contained herein, Work shall be performed in accordance with the:
 - a. Drawings and general provisions of the contract, including general and supplementary conditions.
 - b. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
 - c. Arlington County Department of Parks & Recreation (DPR) Design Standards as shown on the plans and available online at:

<http://parks.arlingtonva.us/design-standards/>

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient. Refer to Section 329100 “Planting Preparation.”
- C. Planting Soil/Backfill Soil Mixture: Existing soil modified as specified to be suitable for planting. Refer to Section 329100 “Planting Preparation.”
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- E. ISA: International Society of Arboriculture
- F. CBAY: Chesapeake Bay, typically referring to CBAY watershed.

G. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester

H. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.03 SUBMITTALS

A. Samples of all materials shall be submitted to the Project Officer for approval with confirmation by the County Landscape Architect prior to delivery to site.

B. Contractor shall submit qualifications per section 1.04 "Quality Assurance" to Project Officer for approval.

C. Samples:

a. Seed Mix: Certification of grass seed including the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and the date of packaging.

b. Sod: Sod grower's name, together with substantiating information as to field location from which sod is to be cut and species, percent purity and mixture of grass sod to be applied. Samples or photos of sod mix may be requested in lieu of inspection.

c. Special Seed Mixes: Contractor shall submit product data per section 2.03.

1.04 QUALITY ASSURANCE

A. Contractor qualifications:

a. Evidence of completion of at least three (3) projects of similar nature and scope to this project completed within the last five (5) years that have resulted in successful turf and meadow establishment

b. Contractor shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

c. Experience: Three to Five years' experience in turf installation.

B. Contractor shall maintain an experienced full-time supervisor on Project site when work is in progress.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall conform to those stipulated below, unless otherwise approved in writing by the Project Officer with confirmation by the Landscape Architect.
- B. Specified materials to be applied in amounts and methods herein stipulated.
- C. Delivery tickets indicating date, weight, product data including all analyses for purity and other information as required herein, and vendor's name, to be submitted to Project Officer for approval.

2.02 SEED

- A. Grass seed shall be fresh, clean, dry new crop seed complying with purity and germination requirements stipulated herein. All cultivars must be on the current “Virginia Turfgrass Variety Recommendations” or in the top 25 for transitional zone sites-overall of the latest National Turfgrass Evaluation Program (NTEP) as approved by Project Officer with confirmation by the Landscape Architect. The Turf-type Tall Fescue component shall be comprised of a minimum of two cultivars with each cultivar comprising neither less than 30 percent nor more than 70 percent of the blend. The use of K-31 Tall Fescue or Common Kentucky Bluegrass in the mix is prohibited. The mix shall have 2.5 percent maximum inert matter, 0.5 percent maximum crop seed, and 0.1 percent maximum weed seed and 0.0 percent noxious weed. The mix shall comply with the current Virginia Seed Law and Virginia Seed Regulations and approximate the following:

| <u>Kind of Seed</u> | <u>% by Weight</u> | <u>% Purity</u> | <u>% Germination</u> |
|-----------------------|--------------------|-----------------|----------------------|
| Turf-type Tall Fescue | 80 | 97 | 85 |
| Bluegrass | 10 | 97 | 80 |
| Perennial Ryegrass | 10 | 97 | 90 |

- B. Substitution of seed type or percent only on approval of Project Officer in coordination with Landscape Architect. Seed to be free of noxious weed seed.

2.03 SOD

- A. Cultivated Grass Sod shall be certified and obtained from State Certified nurseries and have been grown on natural native mineral soils comparable to those afforded at the job site. Sod containing netting is not acceptable. Sod grower’s information and sod information to be submitted for approval by Project Officer per section 1.03 “Submittals.” Failure to obtain advance approval will constitute grounds for rejection of all sod delivered to the site. Invoices for all sod to clearly state point of origin and have attached to them a facsimile of the Grower's Nursery Certificate issued by the U.S. Department of

Agriculture or Certified Delivery Ticket per truckload. All grass sod shall meet the following basic requirements.

- a. Sod shall be free of disease and soil borne insects.
- b. Sod shall be free of clover, broadleaf weeds and noxious weeds. Sod considered free of such weeds if less than 2 such plants are found per 100 square feet of area.
- c. Sod shall be of uniform color and density and contain:

| Kind of Seed | % by Weight |
|-----------------------|-------------|
| Turf Type Tall Fescue | 90 |
| Kentucky Bluegrass | 10 |

- d. All cultivars must be on the current approved list of the Virginia Turfgrass Variety Recommendations and the sod shall be certified by the Virginia Sod Certification Program. Provide appropriate certifications at the time of installation.
- e. Sod sample shall be submitted to and approved by Project Officer in coordination with the Landscape Architect before cutting. Sod placed on the job shall conform to the approved sample or shall be removed and replaced at the Contractor's expense.
- f. Sod shall have been mowed prior to stripping and shall have been maintained for a minimum of three months.
- g. Sod shall be relatively free of thatch. Thatch build up that significantly detracts from the appearance of the sod may be sufficient cause for rejection.
- h. Sod shall be machine stripped at a uniform soil thickness of approximately 3/4-inch. Measurement for thickness to exclude tip growth and thatch.

- i. Individual pieces of sod shall be cut to supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads, torn or uneven ends shall not be permitted.
- j. Root development shall be such that standard size pieces will support their own weight and retain their size and shape when suspended vertically from a firm grasp on uppermost 10% of the area.
- k. Under moderate moisture conditions, weight shall not exceed 7 pounds per square foot. Minimum weight shall not be less than 4 lbs. per square foot.

2.04 SPECIALTY SEED (WILFLOWERS, BIORETENTION, and/or REFORESTATION)

- A. When specialty seed is explicitly specified in approved plans, and unless otherwise indicated, the specialty seed mix shall be as follows:
 - a. Virginia Northern Piedmont Riparian Mix variation. Fresh, clean and dry new seed, of mixed species as follows:
 - i. 22% River Oats, PA/VA Ecotype (*Chasmanthium latifolium*)
 - ii. 15% Indiangrass, PA Ecotype (*Sorghastrum nutans*)
 - iii. 15% Virginia Wildrye, PA Ecotype (*Elymus virginicus*)
 - iv. 10% Beaked Panicgrass, VA Ecotype (*Panicum anceps*)
 - v. 10% Big Bluestem, 'Niagara' (*Andropogon gerardii*)
 - vi. 10% Switchgrass (*Panicum virgatum* 'Shelter')
 - vii. 10% Autumn Bentgrass, PA ecotype (*Agrostis perennans*)
 - viii. 8% Mistflower, VA Ecotype (*Eupatorium coelestinum*)
 - b. Seed carrier: Inert material, sharp clean sand mixed with seed at a ratio of not less than two parts seed carrier to one part seed.
- B. Contractor shall supply the germination test results and the percent purity of the seeds upon delivery to the site to the Project Officer. All seed shall be cleaned, processed, analyzed

for purity, stored, and germination tested before being used. Every seed variety contains different germination rates and requirements.

C. Execution:

- a. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- b. Brush seed into top 1/8 inch of soil, roll lightly and water with light spray.
- c. Protect seeded areas by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch and roll surface smooth.
- d. Water newly planted areas and keep moist until established.

2.05 SOILS & SOIL AMENDMENTS

- A. Refer to Section 329100 "Planting Preparation" soils and soil amendment specifications.

2.06 MULCHES/ ORGANIC MATTER

- A. Refer to Section 329100 "Planting Preparation" for mulch specifications.

2.07 SOIL STABILIZATION/EROSION CONTROL FABRIC

- A. Refer to Section 329100 "Planting Preparation" for specifications.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Refer to Section 329100 "Planting Preparation" for specifications.

3.02 SEEDING - GRASS

- A. All areas within the project limits that are not shown for paving, sodding, or special treatment shall be seeded with the specified seed mix.
- B. Seeding shall take place between August 15th and October 15th or between March 15th to May 15th. Approval from Project Officer/Landscape Architect will be required before seeding is to begin.
- C. Use 4" of prepared topsoil as base for areas to be seeded.

- D. No seeding shall be done during windy weather (winds over 5 mph) or when ground is wet or otherwise non-tillable. No seed shall be done on frozen ground or when the temperature is 32 or lower.
- B. Seed shall be uniformly distributed by hydro-seeding methods as specified:
 - a. Slurry
 - i. Seed as specified at a rate of 350 lbs./acre.
 - ii. Mulch: virgin wood fiber type applied at a rate of 1200 lbs./acre.
 - iii. Tackifier: Guar type or approved equal applied at a rate of 40 lbs./acre.
 - iv. Fertilizer: 19-19-19 granular applied at a rate of 500 lbs./acre.
 - v. Lime: Flowable liquid lime at a rate of 5 gallons per acre.
 - vi. Dye: Slurry must be green with dye added if not included with the mulch.
 - vii. Application rate: 3000 gallons per acre. Agitation must be maintained throughout mixing and application.
 - viii. Slurry shall be applied within 8 hours of the start of mixing.
- C. In lieu of hydro-seeding, seed may be drilled or an alternate method may be used. If an alternate method is used, seeding will have to be run in two directions. The second direction being at right angles to the first direction. Requests for using alternate methods shall be approved by the Project Officer prior to application of seed.
- D. Sow seed at the rate of 5 to 8 lb/1000 sq. ft.
- E. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.
- F. Protect seeded areas with slopes not exceeding 6:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
- G. Areas indicated on plan or exceeding 6:1 slope shall be protected with erosion control fabric, jute mat, or similar slope protection, installed according to manufacturer's written instruction, and/or as approved by the Project Officer.

3.03 SODDING

- A. All sod shall be transplanted within 24 hours from the time it is harvested unless stacked at its destination in a manner satisfactory to the Project Officer. Do not lay down if dormant or if the ground is frozen or muddy.
- B. All sod in stacks shall be kept moist and protected from exposure to air and sun and from freezing. Any sod permitted to dry out may be rejected whenever, in judgment of Project Officer, its survival after placing is doubtful. No payment shall be made for rejected sod. In any event, no more than forty-eight hours shall lapse between cutting and planting of sod is permitted.
- C. Before placing or depositing sod upon any surfaces, all shaping and redressing of such surfaces as described under Seeding Soil Preparation shall be completed. The bed area

for sod shall be dug out so that when the sod is installed the adjacent soil will be flush with the top of the sod root mat. Areas shall be watered lightly before the placing of sod; sod shall not be placed on dry surfaces. Completed areas to be sodded shall be a smooth, uniform, well-tilled surface true to line and cross section. Any raking required shall be done immediately prior to placement of the sod at no additional cost to Owner.

- D. No sod shall be placed at any time temperature is below 32 degrees Fahrenheit. No frozen sod shall be used and no sod shall be placed upon frozen, powder dry or excessively wet soil.
- E. Use 4" of prepared topsoil as base for areas to be sodded.
- F. Sod shall be lifted from trucks or storage piles by hand and placed with closed joints and no overlapping. All cracks, seams and voids shall be closed with small pieces of sod. After laying sod shall be sprinkled thoroughly and then tamped. "Tamping" consists of firmly closing seams between strips by use of hand tampers or approved rollers. All sod shall be thoroughly rolled after closing all seams. Correct any slipping of sod.
- G. Adequate water and watering equipment must be on hand before sodding begins and sod shall be kept moist until root system adheres to original seed bed and becomes established and accepted by Project Officer.
- H. Sod shall be laid with long edges parallel to contours, except in swales or ditches where it shall be placed perpendicular to the flow line. Only sod placed in swales or ditches shall be staked using 2 stakes per roll of sod. Stakes shall be wood wedges ½" x 1" x 12". Successive strips to be neatly matched and all joints staggered. Sod will be laid in all areas indicated on landscape plans.

3.04 REFORESTATION

- A. Prepare planting area per the specifications.
- B. Reforestation process:
 - a. Reforestation seed mix shall be applied prior to installation of Erosion Control Fabric. Rake seed lightly into the top 1/8 inch of soil, roll lightly and water with fine spray.
 - i. Do not use wet seed or seed that is moldy or otherwise damaged.
 - ii. Do not seed against existing trees or vegetation to remain within reforested area limits.
 - iii. Top dress seed by applying composted mulch within 24 hours after seeding operation. Soak areas, scatter mulch uniformly to a thickness of 1/2 inch and roll surface smooth.

- b. Install erosion control fabric from top of slope, overlapping joints by 12 inches, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
 - c. Moisten prepared planting area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
 - d. Plant shrubs, trees and perennials through erosion control fabric by carefully separating fabric layers to allow space for planting.
- C. Remove non-degradable erosion-control measures after grass establishment period.

3.05 PROTECTION

- A. Install post and rope barriers around seeded areas. Tie cloth or ribbon to rope at 10' intervals.
- B. Install "KEEP OFF LAWN" signs at appropriate locations.
- C. Remove non-biodegradable erosion control measures after plant establishment period.

3.06 MAINTENANCE

- A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.
- B. Water to ensure uniform seed germination and to keep surface of soil damp:
 - a. Each watering shall consist of 1 gallon per 3 sq. yd. of seed or sod
 - b. Apply water slowly so that surface of soil will not puddle and crust
- C. Cut lawn areas when grass reached height of 3". Maintain minimum height of 2". Do not cut more than 1/3 of blade at any one mowing.
- D. After first mowing of lawn, water grass sufficiently to moisten soil from 3" to 5" deep.
- E. Reseed damaged grass areas showing root growth failure, deterioration, bare or thin spots and erosion.

3.07 GUARANTEE

- A. The Contractor shall be responsible for maintaining all sodded and seeded areas in a healthy, vigorous condition in accordance with Section 3.05 "Maintenance" at his/her own expense until all contracted work is completed and accepted by Project Officer with confirmation by the Landscape Architect or Urban Forester.
- B. The Contractor shall, at his own expense, replace any seed or sod which has died or been damaged during the establishment period.

- C. Cost of seed and sod will be withheld from final payment until final approval is given by Project Officer.

3.08 ACCEPTANCE

- A. Seeded areas will be accepted when an even, healthy, close and uniform stand of turf, 3” tall, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10sq. ft. and bare spots not exceeding 4 by 4 inches is properly established. Bare spots in excess of 4” shall be re-seeded at a rate per section 3.02 of this specification.
- B. Sodded areas shall be accepted provided all requirements, including maintenance, have been complied with and sod is well established in a healthy, vigorous growing condition. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.
- C. Upon completion, all debris and waste material resulting from seeding/sodding/mulching activities shall be removed from the project area and legally disposed of. Any damaged areas shall be restored to their original condition.
- D. Upon acceptance by Project Officer at Final Completion, Arlington County shall assume all lawn maintenance responsibilities.

END OF SECTION 329200

SECTION 334000 STORM DRAINAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Site storm sewer drainage piping, fittings, accessories, and bedding.
- B. Inlet basins and site surface drainage.

1.02 RELATED SECTIONS

- A. Section 310000 - Earthwork
- B. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- C. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
- D. Local Governing Authority and Code Requirements – Chapter. 57 Arlington County Code
- E. Arlington County DES Construction Standards and Specifications
- F. Construction Drawings

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - 1. A 536 Ductile Iron Castings
 - 2. D 1056 Flexible Cellular Materials
 - 3. D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
 - 4. D 3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 5. D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - 6. D 5926 Poly (Vinyl Chloride) (PVC) Gaskets for Drain and Sewer Systems.
 - 7. F 477 Elastomeric Seals for Joining Plastic Pipe
 - 8. F 1336 Poly (Vinyl Chloride)(PVC) Gasketed Sewer Fittings
 - 9. F 2619 Standard Specification for High-Density Polyethylene (PE) Line Pipe
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
 - 1. M 252 Corrugated Polyethylene Drainage Pipe
 - 2. M 294 Corrugated Polyethylene Pipe

1.04 SUBMITTALS

- A. Product Data: Provide data on all pipe materials, pipefittings, and accessories.
- B. Shop Drawings: Provide shop drawings for inlet and manhole installation
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

1.05 PROJECT CONDITIONS

- A. Accurately record actual locations of pipe runs, connections, inlets, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated.
- B. Coordinate work with replacement of storm sewer inlets and connection to existing storm sewer system.

1.07 QUALITY ASSURANCE

- A. A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification, together with a report of the test results, and the date of each test was completed, shall be signed by a person authorized by the manufacturer.

PART 2 - PRODUCTS**2.01 PE PIPE AND FITTINGS**

- A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 - 2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
- B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 2594M, Type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - 2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.02 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- C. Unshielded, Flexible Couplings:
 - 1. Description: Elastomeric sleeve with stainless steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, Flexible Couplings:
 - 1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, Flexible Couplings:
 - 1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.03 INLETS AND CATCH BASINS

- A. Lid and frame as manufactured by Advance Drainage Systems, Inc or equivalent.
 - 1. Manufactured or supplied by the inlet manufacturer or equivalent per details shown on Construction Drawings.
 - 2. Shall be made specifically for each drain basin to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
 - 3. Shall be capable of supporting H-10 loading for pedestrian traffic.
 - 4. Metal used from the manufacture of the castings shall conform to ASTM A 536 grade 70-50-05 for ductile iron and shall be provided painted black.
- B. Drain Basins as manufactured by Advance Drainage Systems, Inc or equivalent.
 - 1. Shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration, to be ADS or equivalent manufactured to dimensions specified on Construction Drawings.
- C. Structure construction in accordance with manufacturer's instructions and details shown on Construction Drawings.
 - 1. The drainage pipe connection stubs shall be manufactured from PVC stock and formed to provide a watertight connection with the specified pipe system.

2. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible electrometric seals.
3. The pipe bell spigot shall be joined to the main body of the drain basin. This pipe stick used to manufacture the main body and pipe stubs of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings: ASTM F1336 Standard for PVC Gasketed Sewer Fittings.

2.04 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 60 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.05 PIPE OUTLETS

- A. End Sections: HDPE Flared End Section by Advance Drainage Systems, Inc. or equivalent.
1. The invert of the pipe and the end section shall be the same elevation.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified on construction drawings and per Arlington County DES Construction Standards and Specifications.

3.02 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

- D. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
 2. Install piping-NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 3. Install piping with 24-inch minimum cover.
 4. Install PE corrugated sewer piping according to ASTM D 2321.
 5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.04 CATCH BASIN INSTALLATION

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Refer to Construction Drawings and manufacturer's instructions and requirements.

3.05 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
1. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

- B. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.06 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.07 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damage piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924.)
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334000

APPENDIX

The following information is provided as information only. The Contractor is to coordinate with the pre-engineered membrane structure manufacturer (Clear Span) to provide a complete installation to achieve the warranty from Clear Span.



TYPICAL ASSEMBLY SEQUENCE

1. MAIN FRAME AND END FRAME
2. MAIN COVER
3. END PANEL(S) (IF EQUIPPED)
4. SIDE PANEL(S) (IF EQUIPPED)
5. ACCESSORIES (DOORS, WINDOWS, ETC.)

I-Beam Building: Main Frame Assembly



Actual building may differ. Consult main building drawings for details.

General Information



READ THIS DOCUMENT BEFORE YOU BEGIN

This guide includes helpful hints and important information needed to safely erect the I-beam building frame. Please read these instructions **before** you begin.

If you have any questions before or during assembly, contact your project manager.

SAFETY PRECAUTIONS

- Wear eye and head protection.
- Wear gloves when handling building components.
- Use a portable GFCI (Ground Fault Circuit Interrupter) when working with electric power tools and cords.
- Use lifts and other power tools suitable to accomplish the procedures outlined in this document and in the detailed final drawings.
- Safety harnesses are required for all workers in elevated positions.

WARNING: For safety reasons, those who are not familiar with recognized construction methods and techniques must seek the help of a qualified contractor.

SAFETY AND ASSEMBLY NOTICE

THE ASSEMBLY OF A CLEARSPAN BUILDING SYSTEM MUST CONFORM TO ALL AUTHORITIES HAVING JURISDICTION IN THE REGION WHERE THE BUILDING ERECTION WILL OCCUR. CLEARSPAN WILL NOT BE RESPONSIBLE FOR FAILURE TO COMPLY WITH ESTABLISHED BUILDING CODES AND RESTRICTIONS BY A CONTRACTOR SUPPLIED BY THE CUSTOMER. IN THOSE AREAS WHERE SUCH AUTHORITIES DO NOT EXIST, THE BUILDING ASSEMBLY MUST CONFORM TO THE REQUIREMENTS IDENTIFIED IN THIS DOCUMENT AND THE APPROVED BUILDING DRAWINGS.

ADDITIONALLY, CLEARSPAN WILL NOT BE RESPONSIBLE FOR ANY DAMAGE OR INJURY DIRECTLY OR INDIRECTLY RESULTING FROM THE ERECTION OF THE BUILDING REGARDLESS OF THE EXISTENCE OF CODES AND RESTRICTIONS AND WHETHER THESE WERE FOLLOWED OR IGNORED.

PRE-ASSEMBLY PROCEDURE

The following general series of steps will help plan the erection of the building:

1. Verify that all parts are included in the shipment. Notify Customer Service for questions or concerns.

ATTENTION: Inspect the shipment for damage. Record any damage on the bill of lading before it is signed. If damage is found after opening a container, contact the carrier or carrier agent immediately. Contact your sales representative for additional information immediately when damage is discovered.

2. Unload shipment.
3. Read these instructions, the final drawings, and all additional documentation included with the shipment **before** you begin.
4. Gather the tools, bracing, lifts, ladders, and required personnel. See sample tool and equipment list.
5. Check the weather **before** you begin and plan accordingly.
6. Read the warranty information and complete the documentation as instructed.

RECOMMENDED UNLOADING PROCEDURES

- Set all I-beam column sections/bundles and related braces on 4" x 4" blocks as needed to keep the components off the ground and out of water, snow, mud, etc.
- Set all end wall columns, end framing, and remaining straight frame members on 4" x 4" blocks to keep components off the ground and out of water, snow, mud, etc.
- Protect all covers, end panels, and cardboard shipping containers and contents from the elements. Set on pallets off the ground and cover with plastic film or place in a building for use when needed.
- Do not position components and column bundles in the staging area or any place where cranes must pass or be positioned for the assembly and erection of building components.

REQUIRED TOOLS

The following list identifies the basic equipment and some main tools needed to assemble a typical I-beam building. *The size of the required personnel lifts will vary as will the equipment needed to unload and move building components. Additional hand tools and supports may be needed depending on the structure size, location, and existing restrictions and codes.*

- Tape measure or measuring device.
- Cordless drills & drill bit set; drill bit size varies with connections and building size.
- Corded and cordless impact wrenches.
- Impact socket set & 3/4" extra long, deep impact socket for cover installation.
- Wrench set up to 1-1/4" (covers most cases).
- Utility knife and blades (for fabric).
- Hammer & rubber mallet.
- Chop saw & concrete saw with abrasive blade, or skill saw with metal cutting blades.
- Generator or power source & extension cords.
- Pry bars & alignment bars for bolt installation.
- Cordless reciprocating saw (Sawzall®) & metal blades.
- Lubricant for keder cover installation. (Liquid dish soap recommended.)
- Two (2) large clevises for pulling covers.
- Plastic or other material to place under fabric to keep it clean during set up and installation.
- Hand files (round and flat) to remove metal burrs from metal after cutting.
- Two (2) pairs of duck-billed pliers.
- Heat gun/heat welder for end panel and side panel seams (larger buildings).
- Hammer drill (for anchor bolt installation). May not apply to all applications.

EQUIPMENT

- Aerial Lifts: Reach determined by height of foundation plus peak height of building. Add about 5' extra.
- Telescopic Handlers (telehandler): Sizes determined by building size, weight of beam sections, and lifting plan.
- Crane: For certain building sizes/weights determined by lifting plan.

General Information

SPECIAL ASSEMBLY NOTE: BEFORE YOU BEGIN

MANY OF THE PROCEDURES DESCRIBED BELOW AND WITHIN THIS GUIDE CAN OCCUR SIMULTANEOUSLY. SOME, HOWEVER, MUST BE COMPLETED BEFORE MOVING ON TO THE NEXT PROCEDURE.

TO BETTER UNDERSTAND THE ENTIRE ASSEMBLY PROCESS AND TO PREVENT DAMAGE OR POSSIBLE INJURY, READ THROUGH THIS ENTIRE GUIDE **BEFORE** YOU BEGIN.

ASSEMBLY NOTE: Install Tek screws using a clutched drill driver running approximately 750 RPM while applying approximately 50 lbs of force.

Do not use an impact driver!

BLIND BOLTS

SOME CONNECTIONS ARE COMPLETED USING BLIND BOLTS. CONSULT THE CHART TO DETERMINE DRILL BIT SIZE FOR THE BLIND BOLT.

| BLIND BOLT HOLE SIZES & INSTALLATION TORQUE | | |
|---|---------------|---------------------|
| BLIND BOLT DIAMETER | HOLE DIAMETER | INSTALLATION TORQUE |
| 1/4" | 7/16" | 14 FT-LB |
| 5/16" | 9/16" | 18 FT-LB |
| 3/8" | 3/4" | 33 FT-LB |
| 1/2" | 13/16" | 59 FT-LB |
| 5/8" | 1 1/16" | 140 FT-LB |
| 3/4" | 1 5/16" | 221 FT-LB |

NOTE: REFER TO BLIND BOLT TECHNICAL DATA FOR MORE INFORMATION IF USING BLIND BOLTS.

REVIEW THE MAIN BUILDING DRAWINGS FOR USE AND PLACEMENT OF BLIND BOLTS.

BASIC ASSEMBLY PROCEDURES

The steps that follow describe the typical sequence to ensure the proper building assembly. When present, local restrictions and building codes may require additional or alternative steps. Failure to follow these steps or adhere to recognized codes and standards or both may result in an improperly assembled building system and *will void the warranty and all protection the building owner is entitled to.*

Complete these steps in the order they are presented. Consult the procedures later in this guide for additional details pertaining to the general steps listed below.

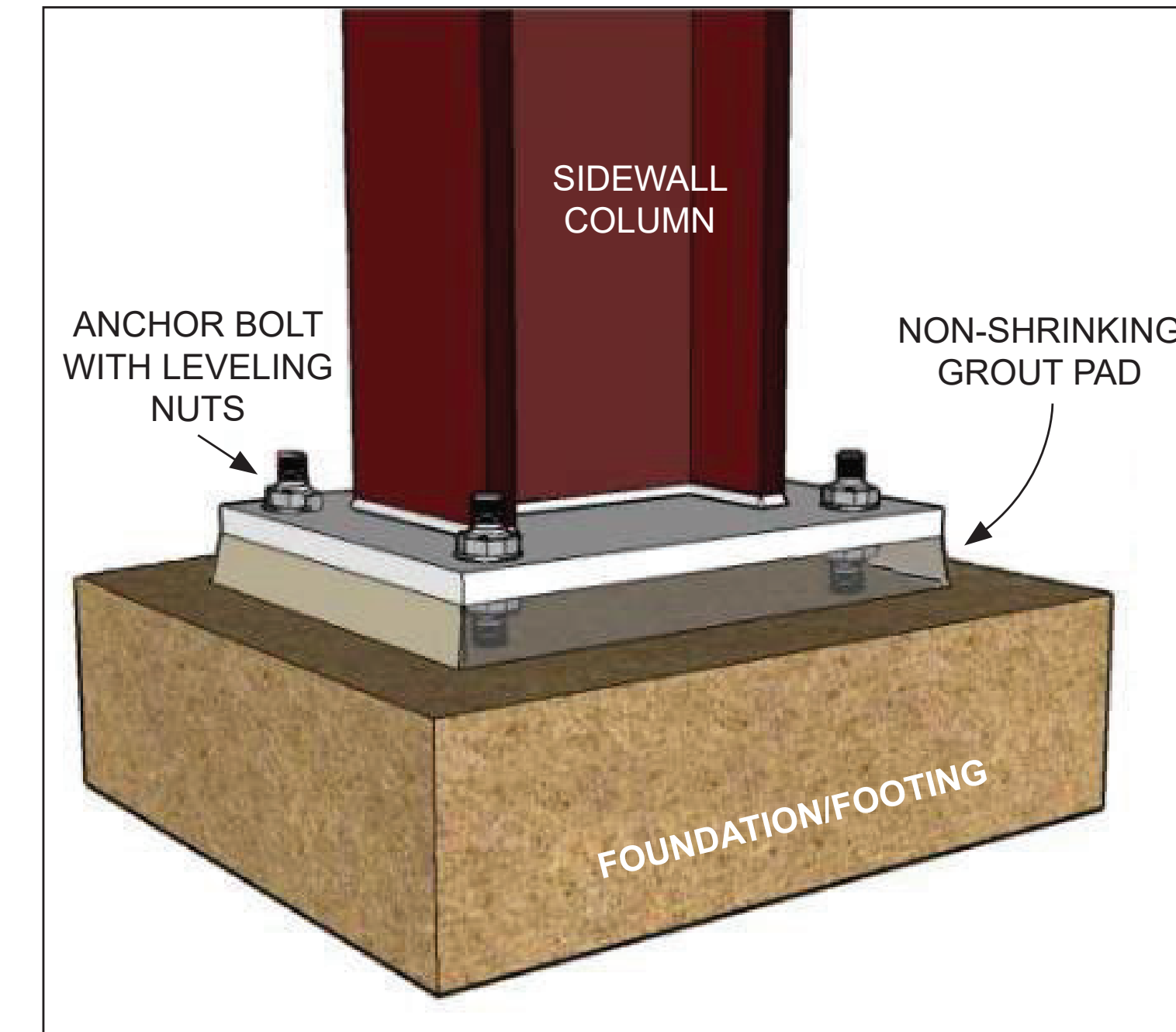
ATTENTION: WHEN POSSIBLE, ATTACH FRAME COMPONENTS TO COLUMNS ON THE GROUND AND THEN STAGE FOR LIFTING INTO POSITION.

Basic assembly steps:

1. Verify that foundation is square and prepared, or install helical anchors.
2. Install anchor bolts as needed.
3. Attach first set of columns to anchor bolts and plumb to ensure they are vertical. Brace in place.
4. Install next set of columns, plumb, and install lateral bracing between the installed columns.
5. Attach keder to upper frame components for cover installation *before setting frame* on installed columns.
6. Set upper beams in position and secure to vertical columns. Prepare as needed before lifting.
7. Install all roof lateral and angle bracing between the installed end rafter and the second/first interior rafter.
8. Square this set of rafters before continuing.
9. Continue to set assembled rafters and install bracing until all rafters are set. See details in the procedure that follows.
10. Set end wall columns, headers, and door framing (if any). Consult main building drawings for details.
11. Install all main cover(s) and tighten.
12. Install sidewall panels and end panels (if equipped).
13. Install all doors and windows (if applicable).

ANCHOR BOLTS AND COLUMN INSTALLATION

In those instances when leveling nuts are needed on anchor bolts to plumb the sidewall columns, application of non-shrinking grout between the column base and foundation is required. Consult the foundation contractor for additional information and details. Example is shown below.



DASHED LINES SHOW GROUT POSITION BETWEEN SIDEWALL COLUMN BASE AND HELICAL FOUNDATION ANCHOR.

Foundation and Anchor Bolts

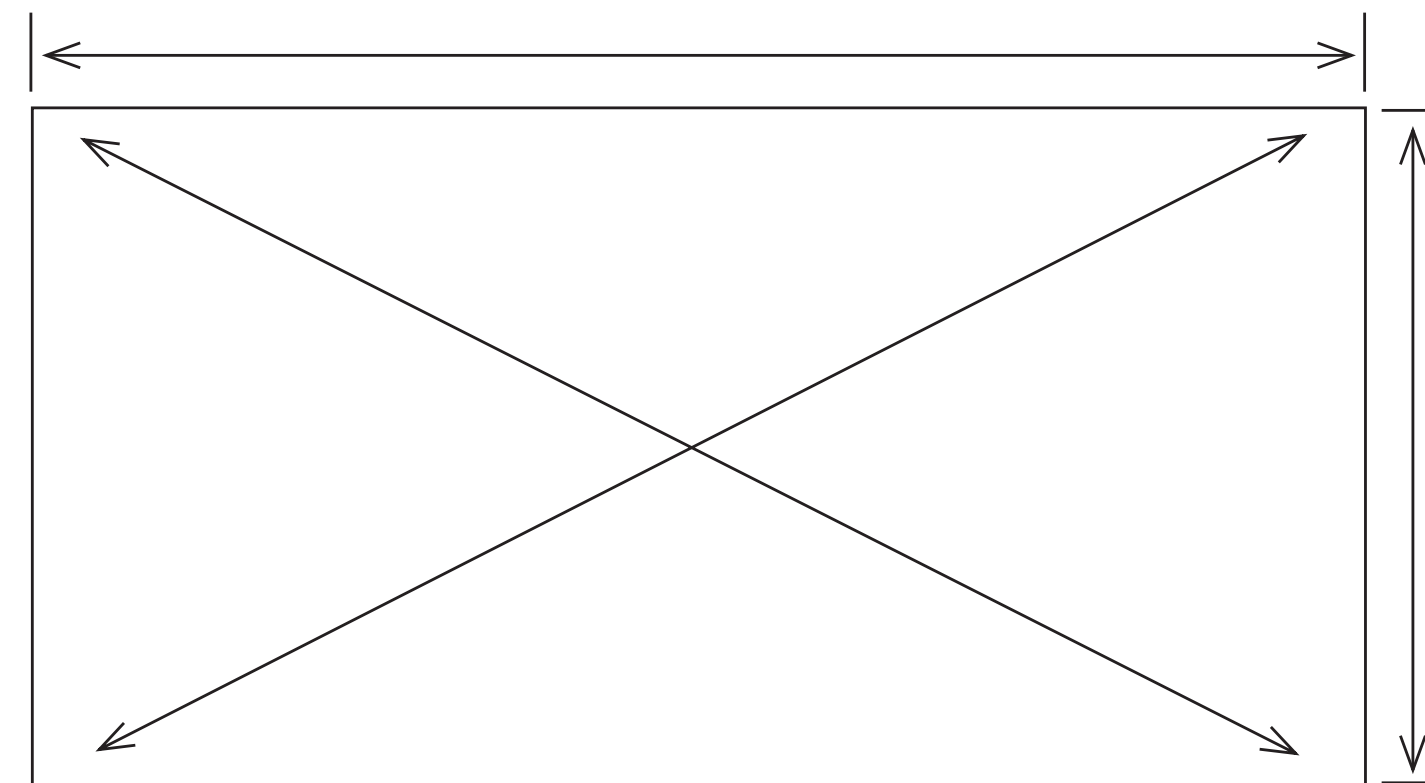
1

CHECK FOUNDATION

Consult the information that follows to check the foundation before you begin.

Engineered Foundations

1. Check the foundation against the engineer's final drawings to ensure the actual dimensions match those shown on the drawing. Contact the engineer of record if the dimensions exceed acceptable tolerances.
2. Check the foundation for square by measuring from corner-to-corner and comparing the dimensions.



Sample Foundation

3. Verify foundation is level and capable of supporting the building.

ATTENTION: There are several ways to address issues that arise when a foundation is not level or flat. Use of leveling nuts is one possibility. This option typically requires longer anchor bolts. Consult with the foundation contractor for additional details about this and other leveling options.

4. Address all other concerns by contacting the engineer who designed the foundation and the contractor who constructed the foundation.
5. Continue with the next procedure.

SETTING ANCHOR BOLTS

After foundation has passed inspection, set anchor bolts for columns. Consult the following information and the main building diagrams for typical anchor bolt installation.

- For uniform anchor bolt installation, create a template for anchor bolt pattern to set anchors and prepare for column installation.
- Use the building drawings to confirm anchor bolt locations. If issues are found, contact foundation contractor and foundation engineer for resolution.

ATTENTION: Do not install anchor bolts or set columns *until foundation issues are resolved*.

- When epoxy is used, prepare foundation and apply epoxy according to manufacturer's instructions. Use epoxy that meets or exceeds the recommendations of the engineered requirements.
- Verify epoxy drying times and follow manufacturer's instructions.
- Consult the final building drawings for the anchor bolt requirements and properties. Anchor bolt requirements are typically determined prior to construction based on building use, substrate, and required structural properties of anchor to meet reaction forces.



Photo above shows anchor bolts set in concrete. Consult the services of a qualified foundation contractor as needed to install the anchor bolts for your building.

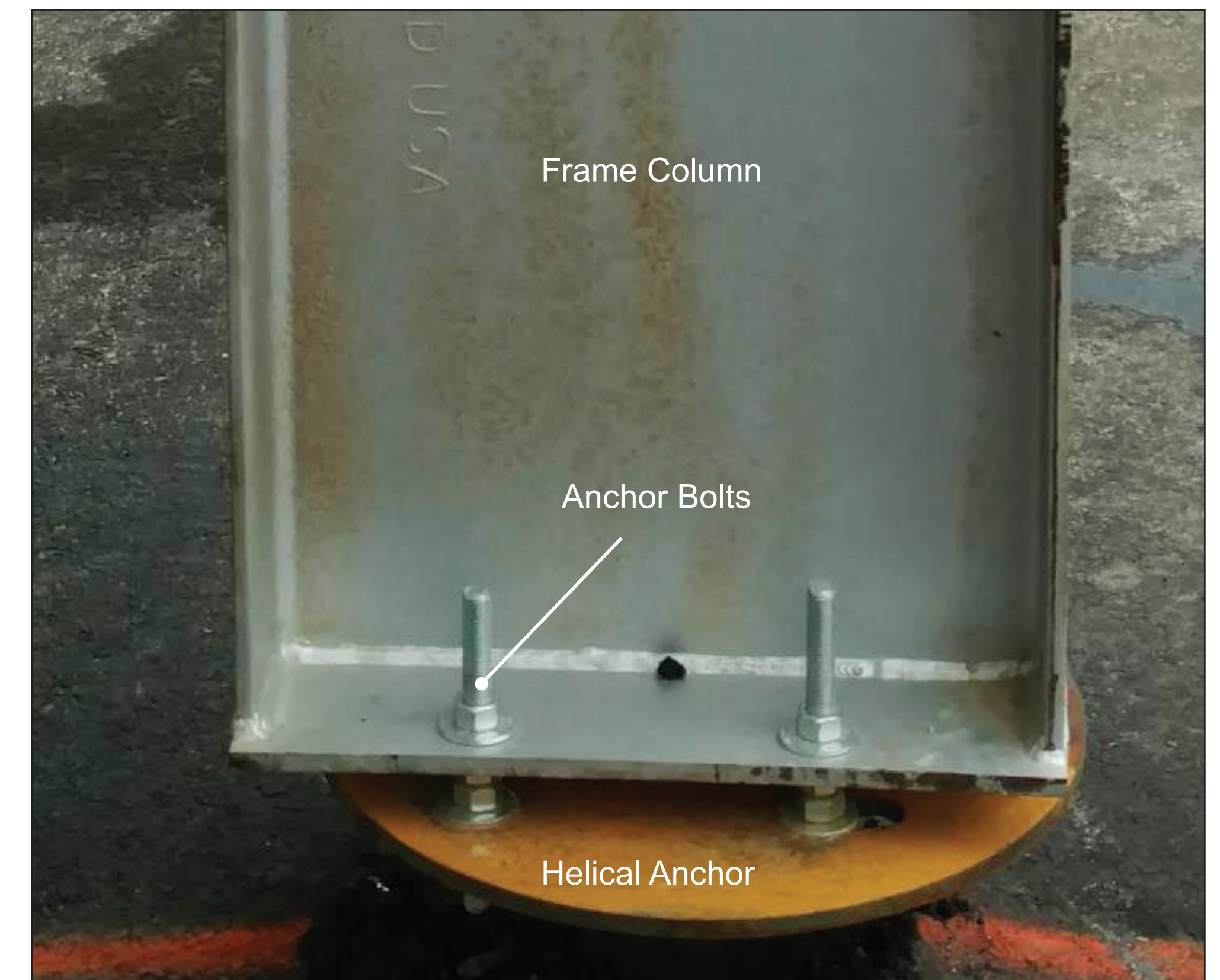


Photo above shows anchor bolts attached to a helical anchor. Review the main building and foundation drawings for additional details. Use the leveling nuts to plumb the column and lock the column in place.

After setting anchor bolts and allowing concrete and epoxy to set, continue by preparing and setting the sidewall columns.

Attach Eave Extensions (EE) – if equipped

2

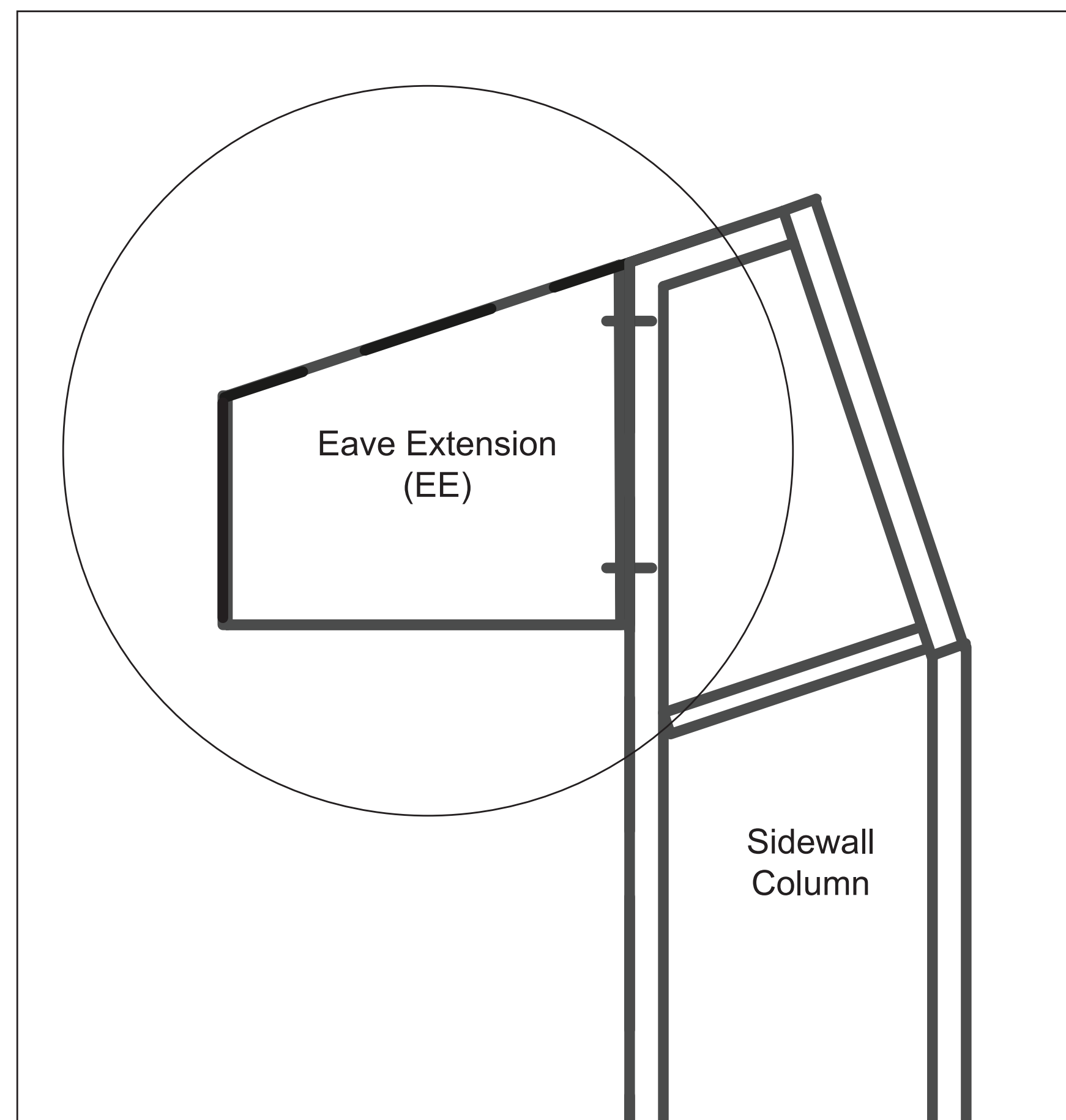
PREPARE COLUMNS BEFORE SETTING IN PLACE (IF POSSIBLE)

Some buildings include eave extensions which attach to the top of each column. Depending on personal preference, available equipment, and crew members, eave extensions can be installed *before or after* columns are secured to the foundation. Details on this page show the eave extensions. If the building is without eave extensions, continue with the next page. Refer to the main building drawings for details.

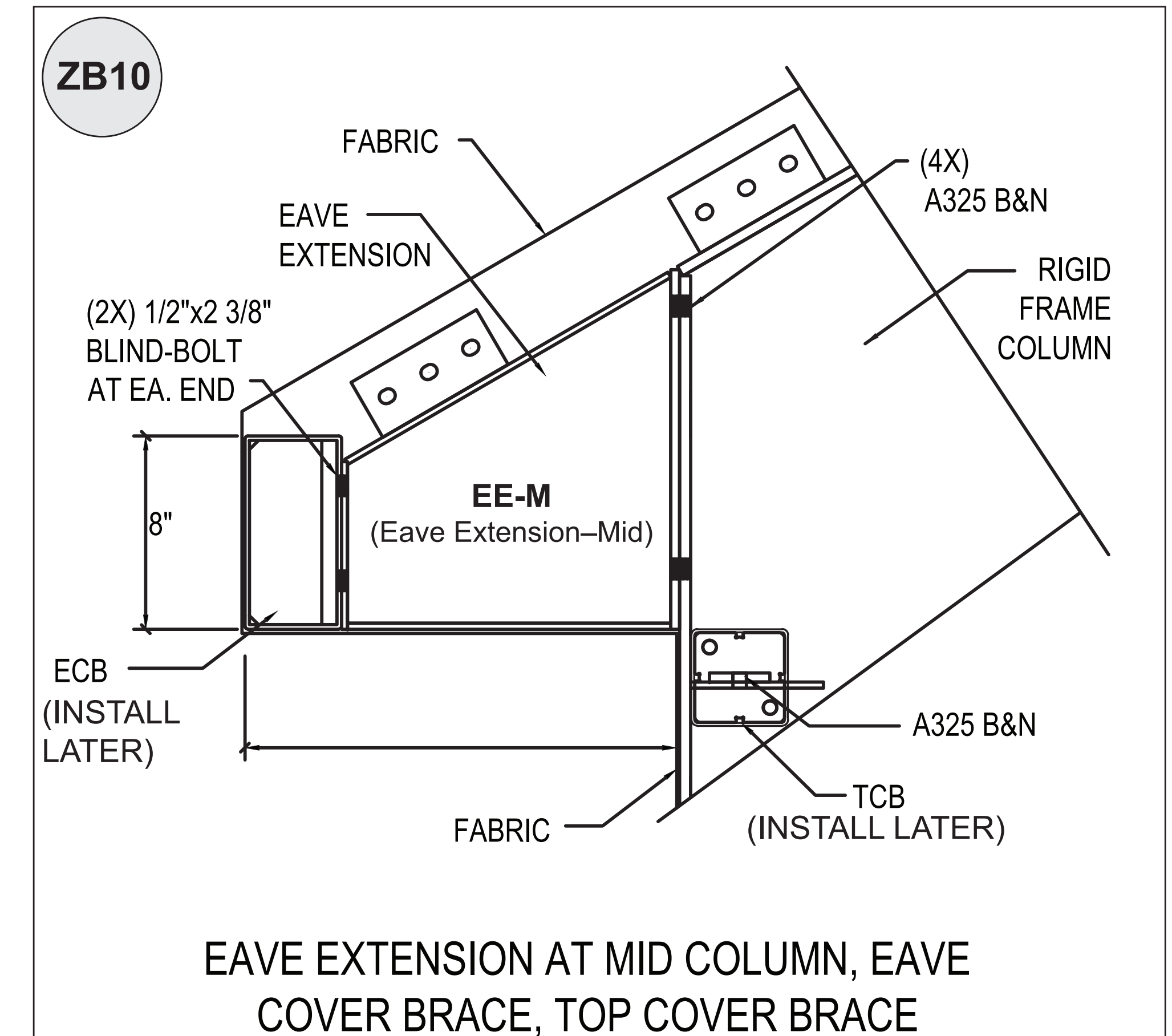
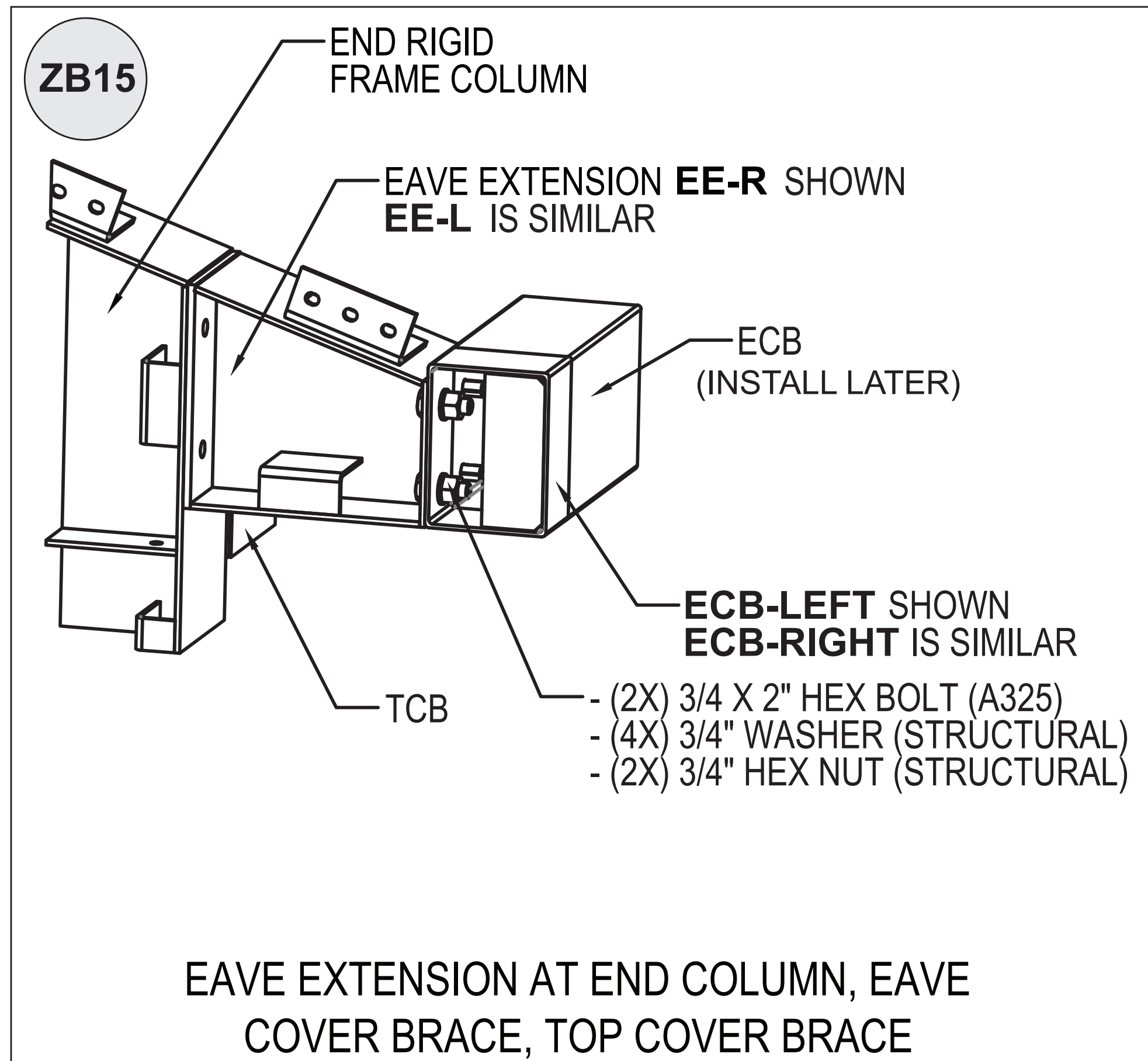
Complete these steps:

1. Locate one corner and one interior columns. Refer to main drawings for building for fastener details.
2. Attach the appropriate eave extension (EE), if applicable, to columns. Eave extensions differ. Consult main building drawings for details. **If frame is without eave extensions, continue with the next step.**

NOTE: For some applications, the preferred procedure is to install the eave extensions after setting the columns. Available crew workers and equipment all affect how to proceed. If you are installing these components after setting the columns, skip this step and continue with the next step.



3. Attach a clevis in a bolt hole and lift corner frame column. Set column on anchors, plumb, and tie off (or leave cabled to lift if there are enough available lifts).
4. Attach a clevis in a bolt hole and lift interior frame column. Set column on anchors, plumb, and tie off (or leave cabled to lift if there are enough available lifts).



Lift is used to steady column as it is plumbed and secured to anchor bolts.

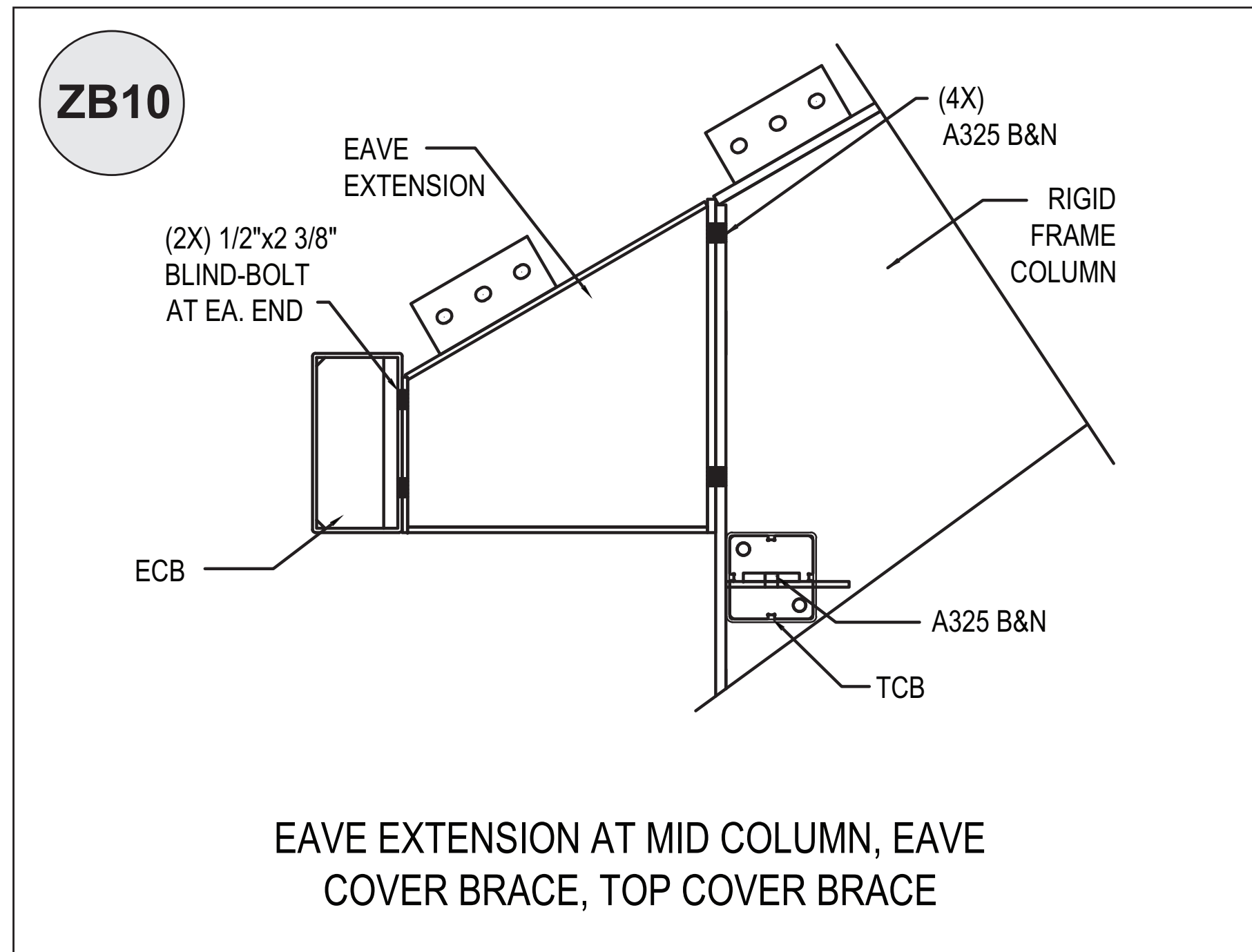
Lift to remain in place as other columns are added to the frame.

If lift is not available for holding first or subsequent columns during assembly, employ other methods to stabilize the column. **DO NOT ALLOW COLUMN(S) TO STAND UNSUPPORTED!**

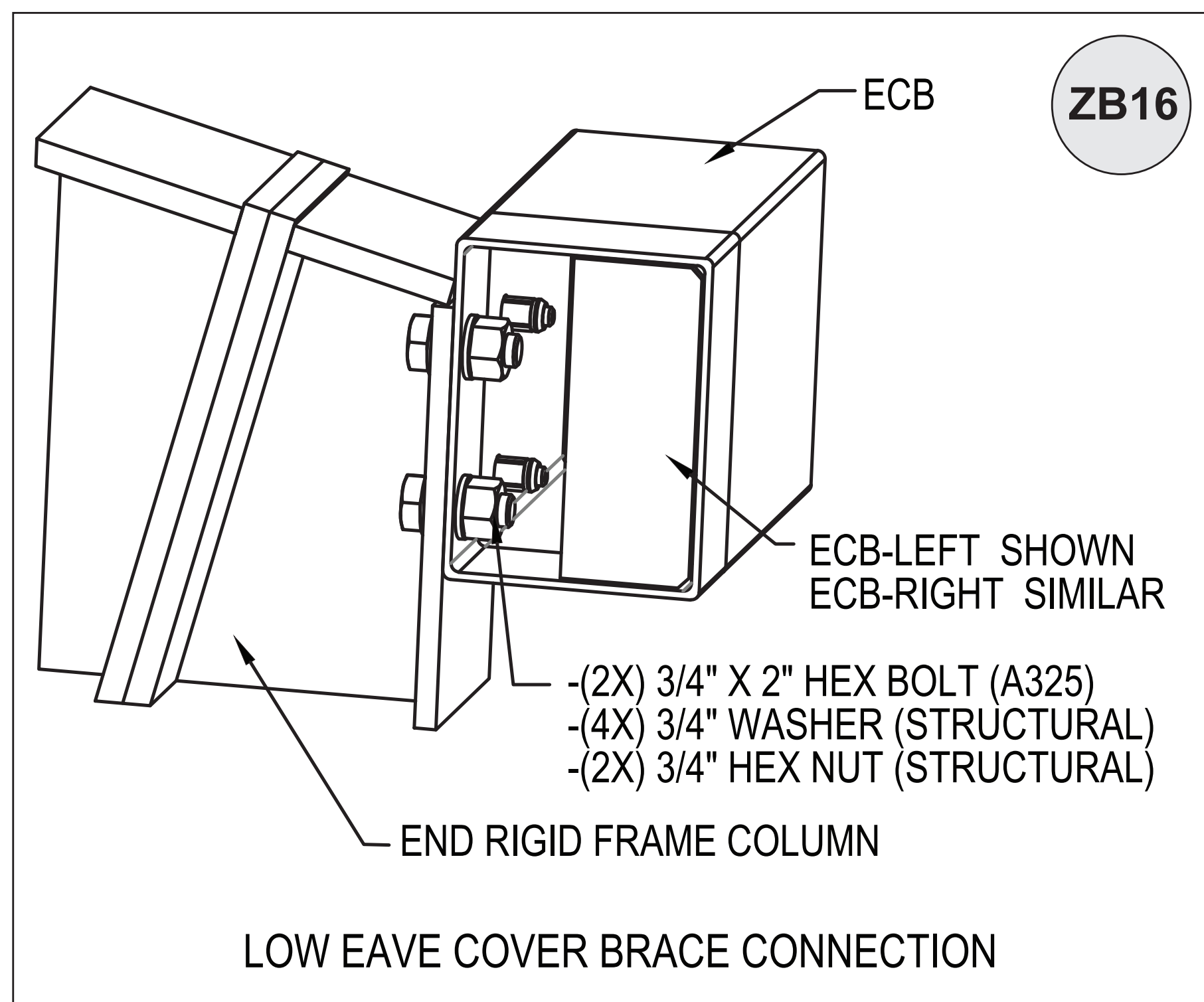
Set Columns: Install Top Cover Braces (TCB) and Eave Cover Braces (ECB)

2

5. Attach top cover brace (TCB) between the first two columns as shown on the main drawing details and the photo.

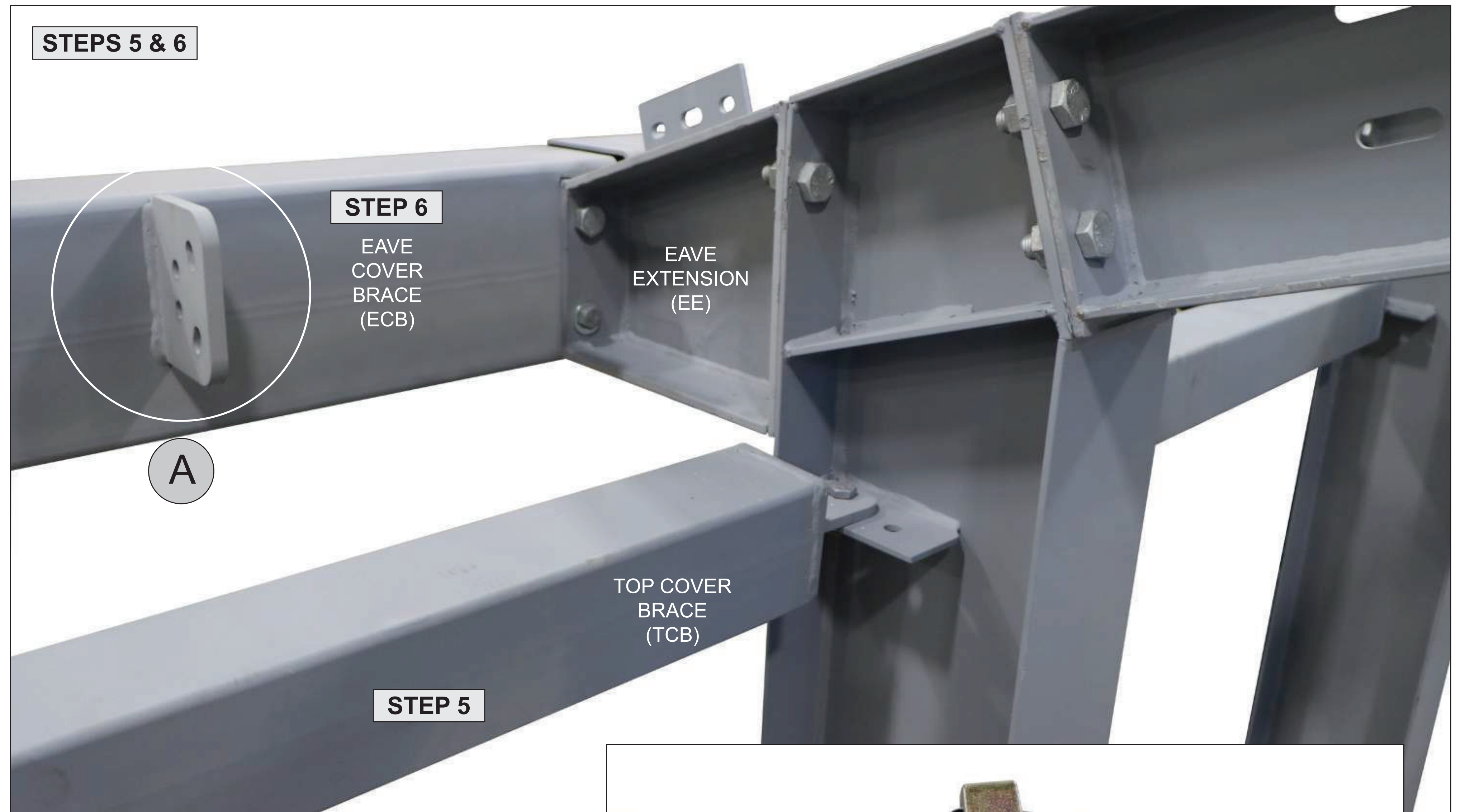


6. Attach the eave cover brace (ECB). See photo at the right and details below.



ATTENTION: Diagram above shows sidewall column without an eave extension. Attach eave cover brace directly to column. For some applications (and to save time), it is best to secure the main cover winches to the eave cover braces before attaching the ECB between the columns. *See inset photo at the right.*

7. Continue with the next procedure.



Set Columns: Install Top Cover Braces (TCB) and Eave Cover Braces (ECB) — continued

2

Photos on this page show setting columns in place along one side for a typical frame assembly. In some instances, it is necessary to set a pair of columns at one end and then install the upper beams to complete the rafter assembly. All braces between the first and second rafters are then installed. That procedure is then repeated by working toward the other end of the frame. See bottom-left photo. Shaded end bay was constructed, square, and completed first.



Set Columns: Install Lateral Braces (LB) & Flange Braces (FB) — if equipped

3

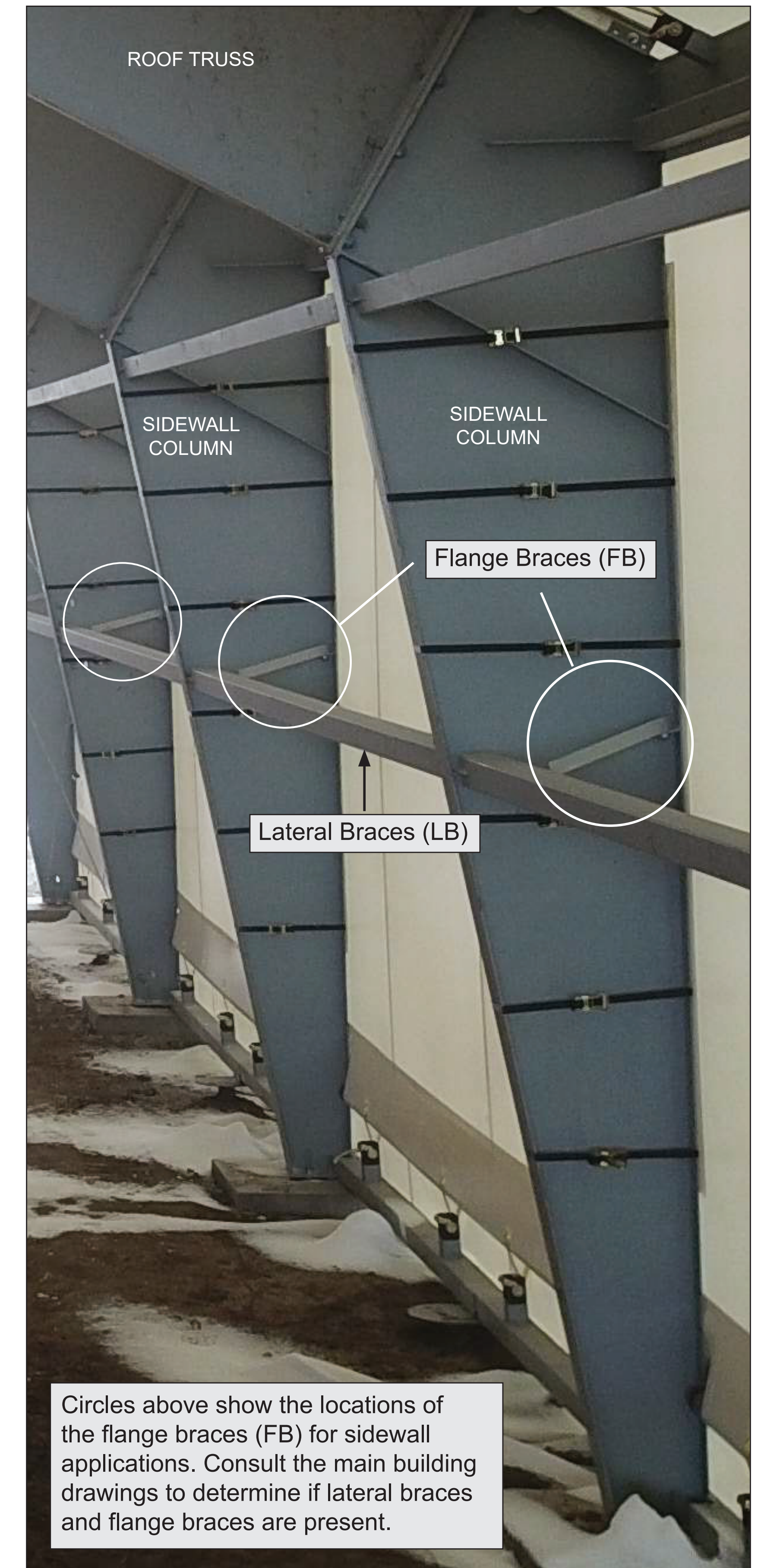
Most buildings include lateral and flange braces that install between each column along the sidewall. Review the main building drawings to determine if these braces are part of the building. If so, locate them and install. At this point in the construction, the first two columns are secured to the foundation. (Photos below show the construction of a frame with additional columns and upper columns installed for reference.)

Complete these steps:

1. Install lateral braces (LB) and flange braces (FB) if equipped. Sample building may differ from actual building. Depending on height, some buildings may include additional lateral and flange braces between the columns. Dashed lines show straps/cable anchored to stabilize columns.



2. After installing the braces between the first set of columns, continue with the next procedure.

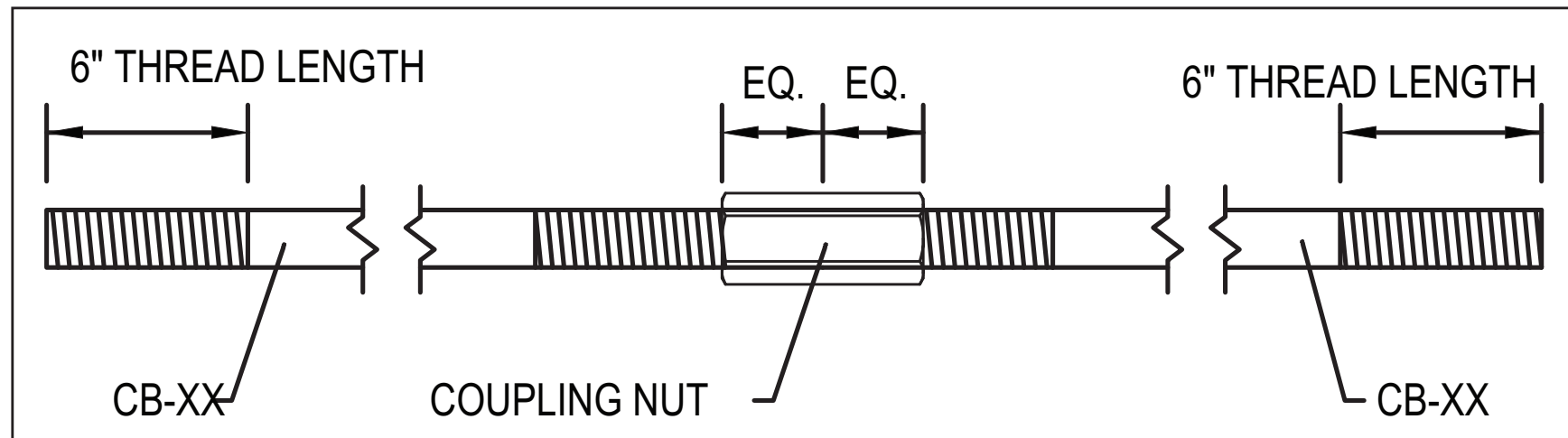


Install Rod Bracing (all frames) — Sidewall Columns

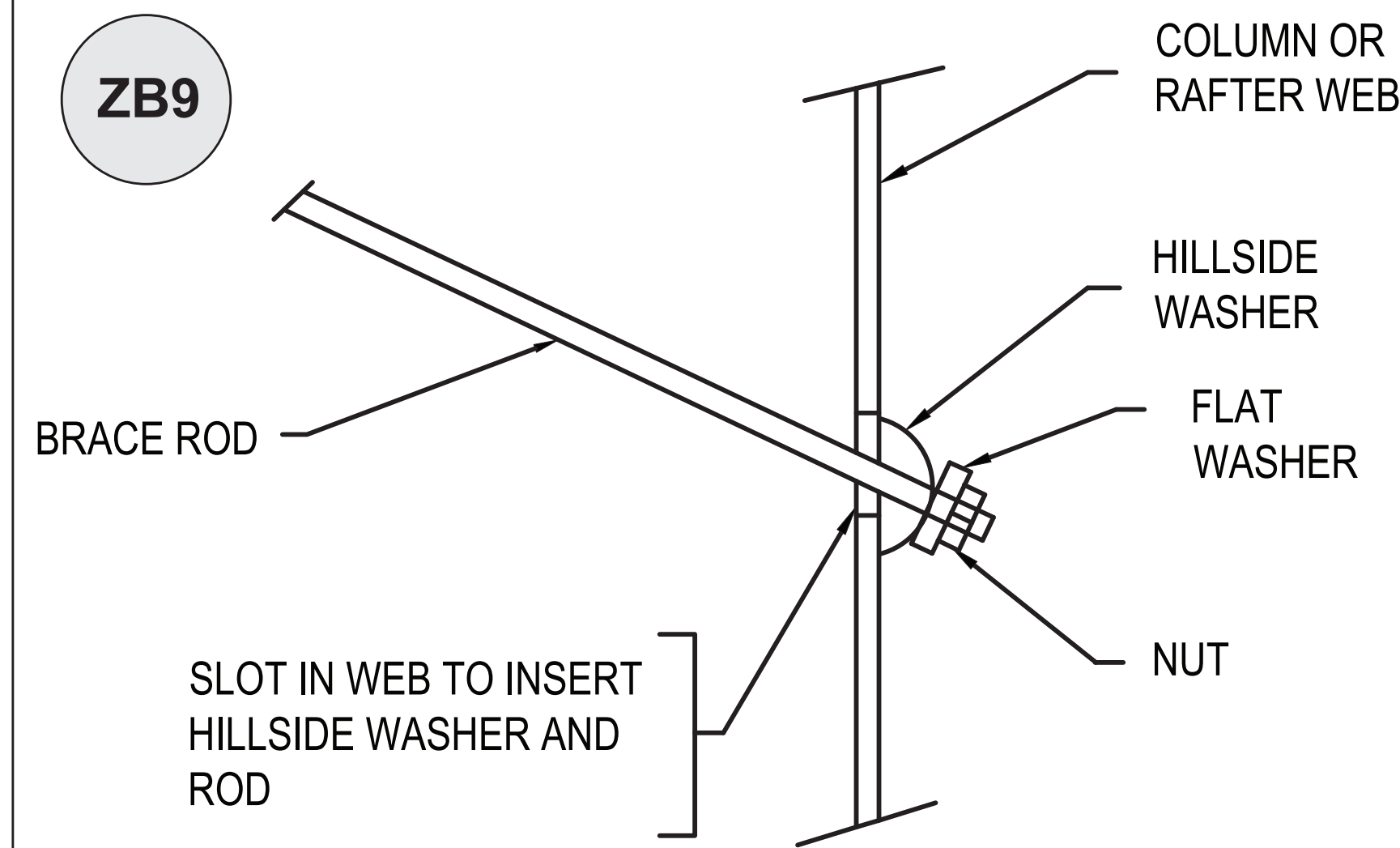
4

Rod bracing is typically found at frame end bays and some interior bays, depending on building length, height, and overall design. This bracing is installed in sidewall and roof positions between assembled rafters. Rod bracing is used to square a set of end rafters prior to the installation of remaining rafters. It is also used to plumb sidewall columns. Failing to square the end rafters before assembling the remainder of the frame may cause cover and frame installation issues. Install the rod bracing to continue.

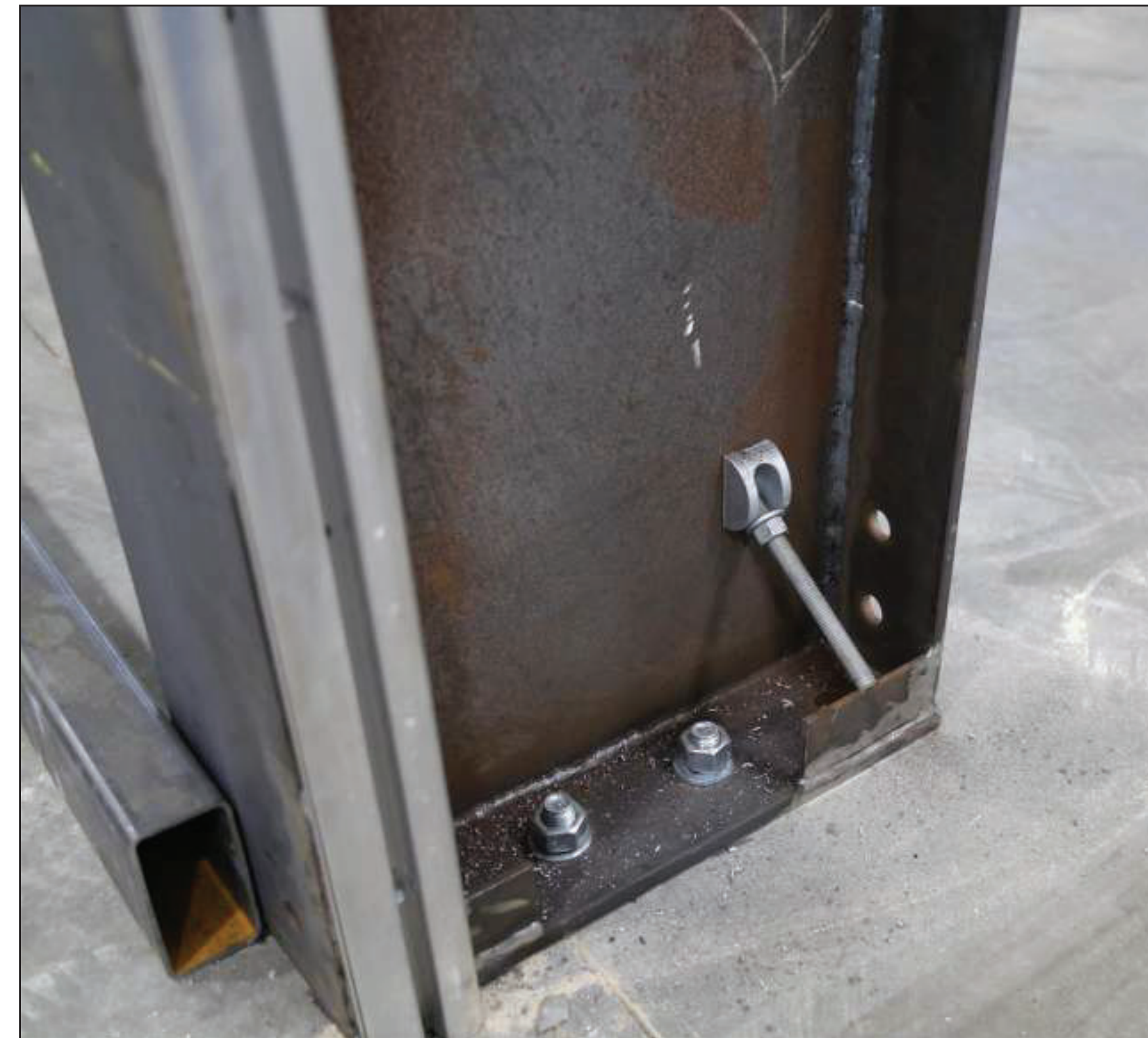
ATTENTION: CONSULT THE MAIN BUILDING DRAWINGS FOR ROD BRACING LOCATIONS THROUGHOUT THE FRAME. USE THE DIAGRAMS AND PHOTOS ON THIS PAGE TO ASSEMBLE AND INSTALL THE ROD BRACING.



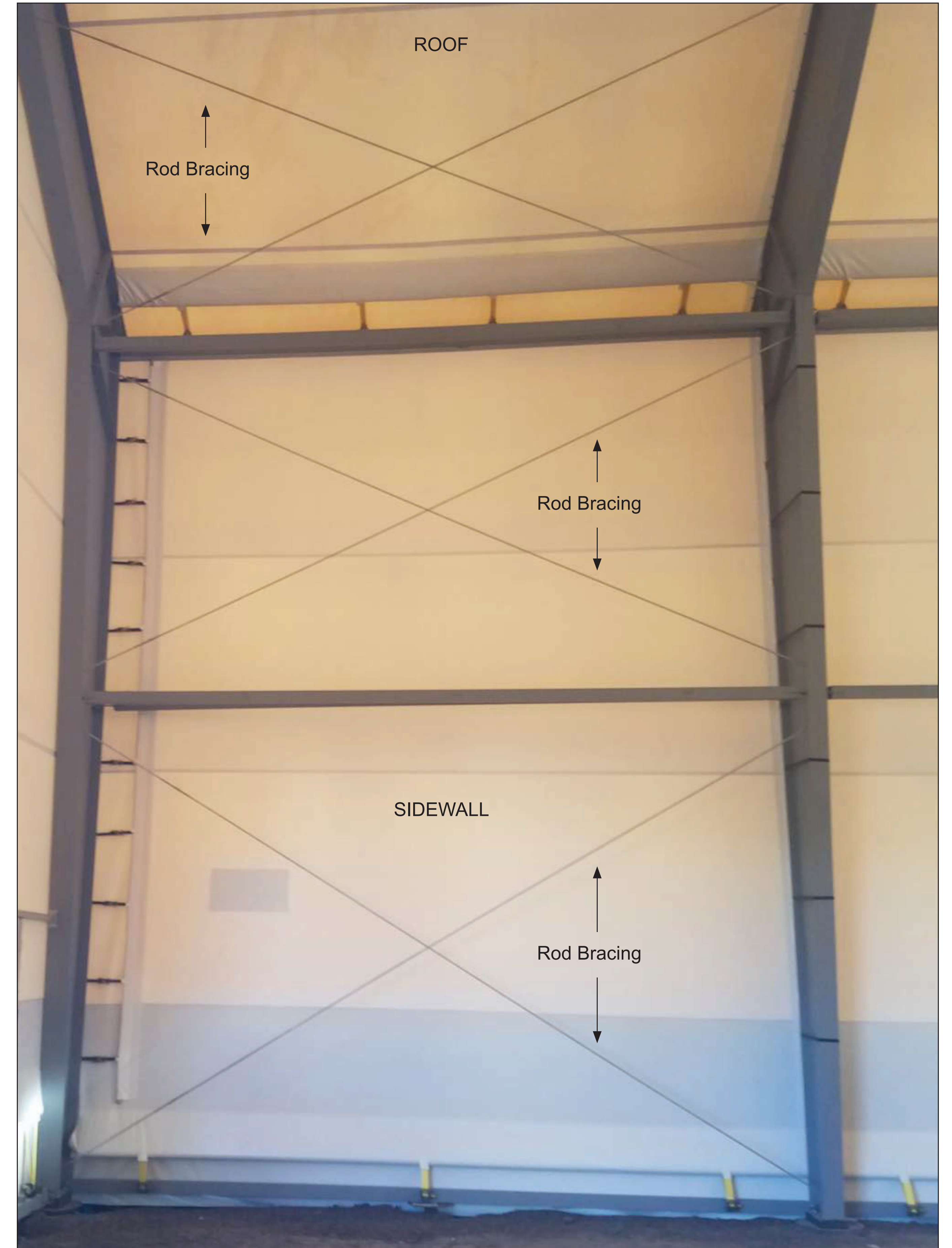
NOTE: MARK EACH ROD HALF THE WIDTH OF THE COUPLING NUT FROM THE END TO ENSURE THAT THEY MEET AT THE CENTER OF THE COUPLING NUT



ATTENTION: After installing the rod braces between the standing columns, continue by repeating the previous steps and sections to stand and secure all remaining columns. See the next section.



ATTENTION: ACTUAL FRAME COMPONENTS AND DESIGN MAY DIFFER FROM THE EXAMPLES SHOWN THROUGHOUT THIS GUIDE.



Set Columns for Remainder of Frame

5

To this point, the first columns are set. Repeat the steps needed to set, plumb, and secure all remaining columns.

ATTENTION: In some instances, it may be necessary to begin the installation of upper truss components before setting all sidewall columns. If so, that information is presented in the next section.



The photo above shows all sidewall columns set. All braces, including rod bracing, are installed and sidewall columns are steadied using a series of tie straps and ground anchors.

IMPORTANT: DO NOT ALLOW WALLS TO STAY WITHOUT BRACING AND ADDITIONAL TIE STRAPS! Once upper truss components are installed at one end for the end and first interior set of columns, straps and the additional column-to-ground bracing is removed.

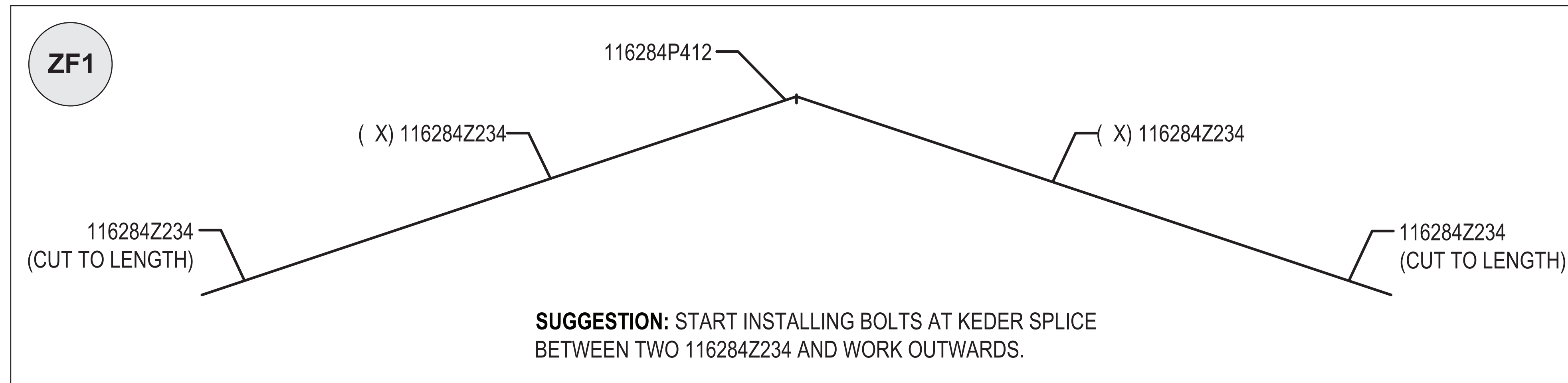
After setting sidewall columns, continue with the next section.

Frame Assembly — Keder Rail Installation (Main Cover): Roof Truss Sections

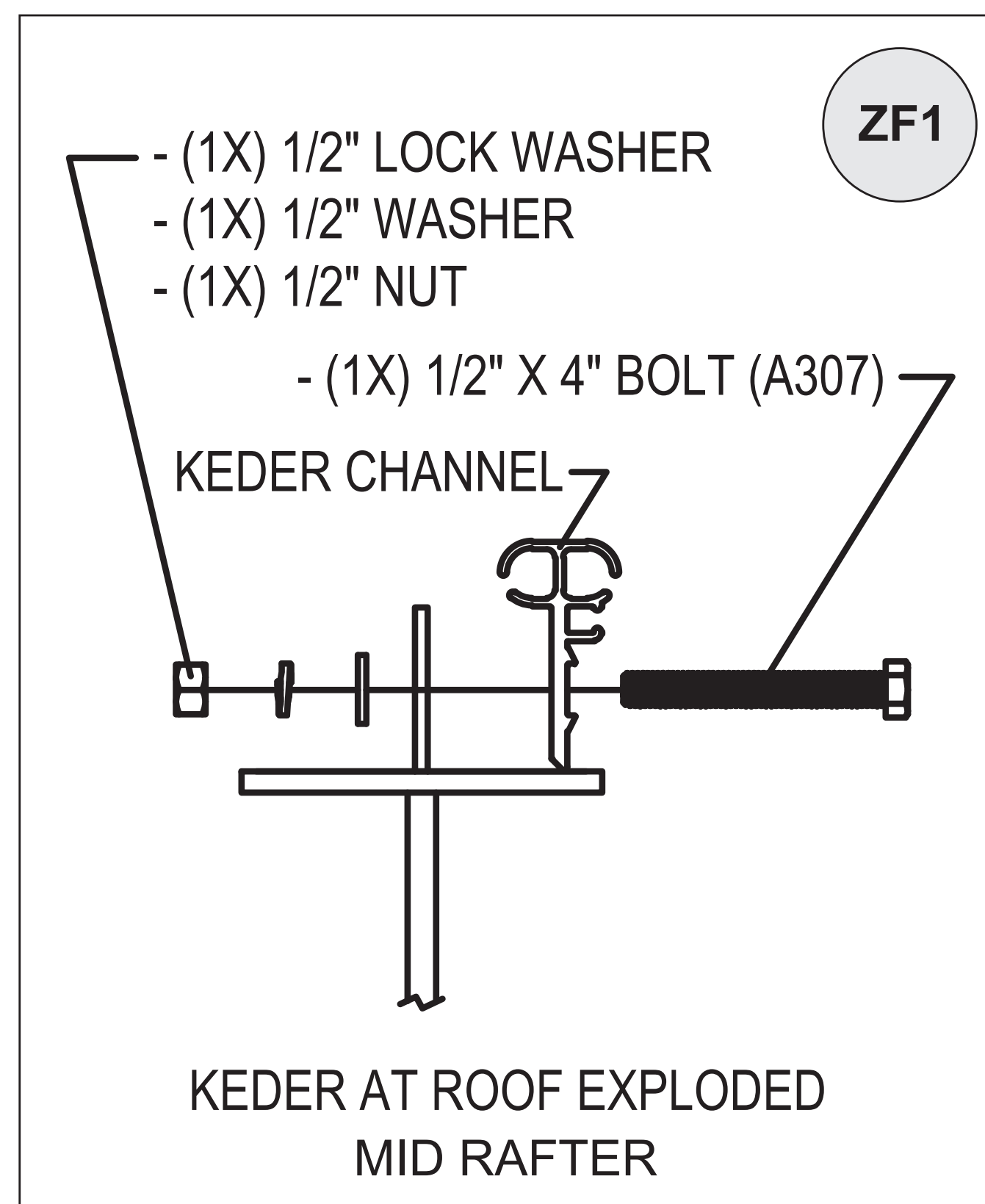
6

For easier assembly and to reduce time in a lift, attach keder rail sections (when possible) to the roof trusses *before* lifting and attaching the trusses to the installed sidewall columns. Review the main building drawings to determine keder rail part numbers and positions. Use the diagrams and photos in this section as guides to install keder rails. Keder rails to remain loosely installed until covers are pulled. Final tightening of keder occurs during cover installation. Review the information in this section and in the main building drawings and **attach the keder rails to the roof truss components before setting the roof trusses in position when possible.**

ATTENTION: WIDE BUILDINGS (GREATER THAN 70') TYPICALLY INCLUDE ROOF TRUSSES CONSISTING OF MULTIPLE SECTIONS. IT IS BEST TO ASSEMBLE THESE ON THE GROUND, THEN ATTACH THE KEDER TO THE ASSEMBLED BEAM. BEAM IS THEN LIFTED, ATTACHED TO ONE SIDEWALL COLUMN, AND SUSPENDED BY THE CRANE. THESE STEPS ARE REPEATED WITH THE FINAL CONNECTIONS MADE AT THE PEAK TO JOIN THE INDIVIDUAL BEAMS. THAT PROCEDURE IS SHOWN IN SECTION 7.



INSTALL THE LOWER KEDER PIECES (AT THE EAVE POSITIONS) AFTER SETTING ROOF TRUSSES AND SECURING THEM TO THE SIDEWALL COLUMNS. ADDITIONAL INFORMATION AND DETAILS REGARDING THESE LAST SECTIONS OF KEDER ARE FOUND IN THE COVER INSTALLATION GUIDE. ATTACH PEAK KEDER SECTION AFTER BEAMS ARE CONNECTED.



IMPORTANT

INSTALL KEDER RAILS ACCORDING TO THE DIAGRAMS IN THE MAIN BUILDING DRAWINGS. INSTALL ON THE SAME SIDE OF THE MOUNTING BRACKETS THROUGHOUT THE LENGTH OF THE FRAME FOR EACH ROOF TRUSS.

IT IS POSSIBLE TO INSTALL INCORRECTLY. TAKE CARE TO NOTE ORIENTATION OF KEDER RAILS ON ROOF TRUSSES.

ADDITIONAL DETAILS ARE FOUND IN THE COVER INSTALLATION GUIDE.



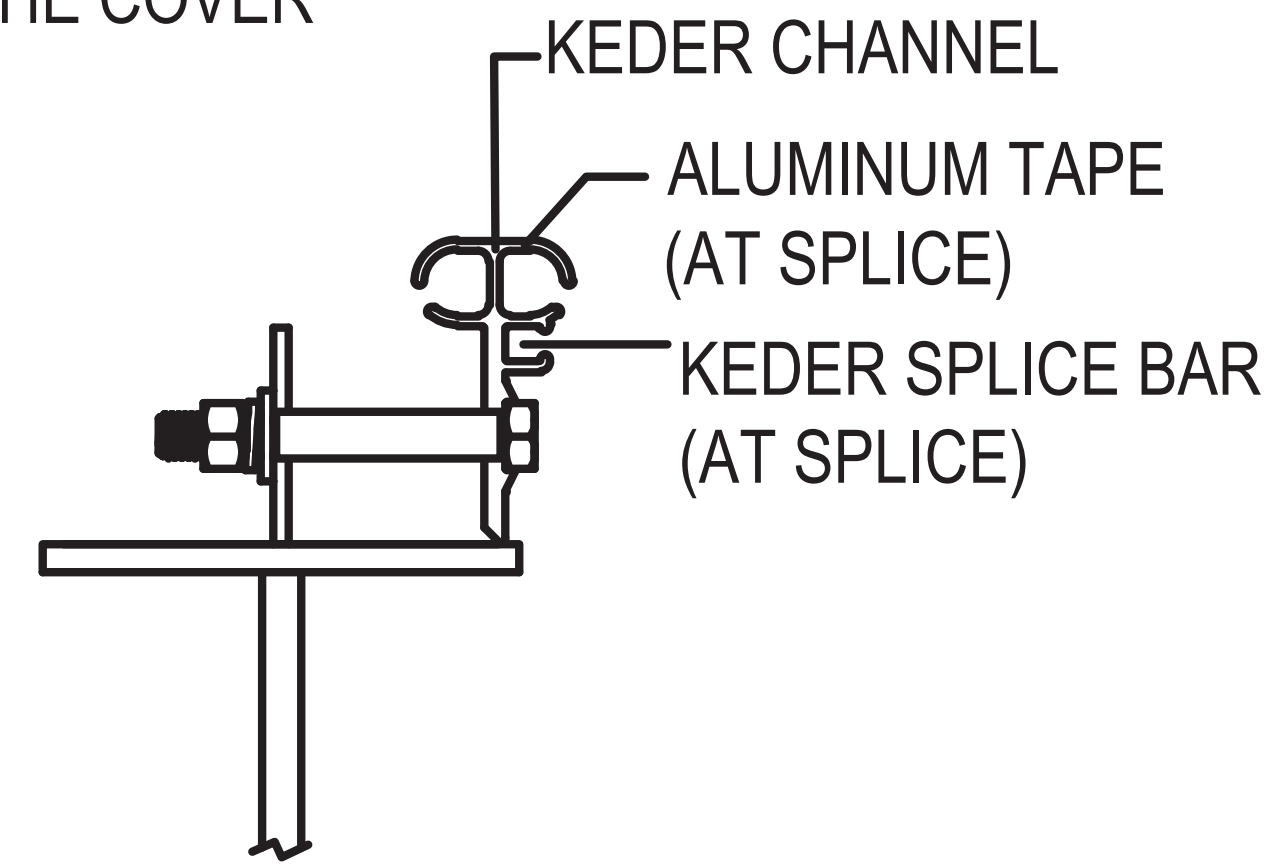
Frame Assembly — Keder Rail Installation (Main Cover): Roof Truss Sections

6

ADDITIONAL KEDER INSTALLATION DETAILS ARE SHOWN BELOW. CONSULT MAIN BUILDING DRAWINGS FOR DETAILS SPECIFIC TO YOUR BUILDING.

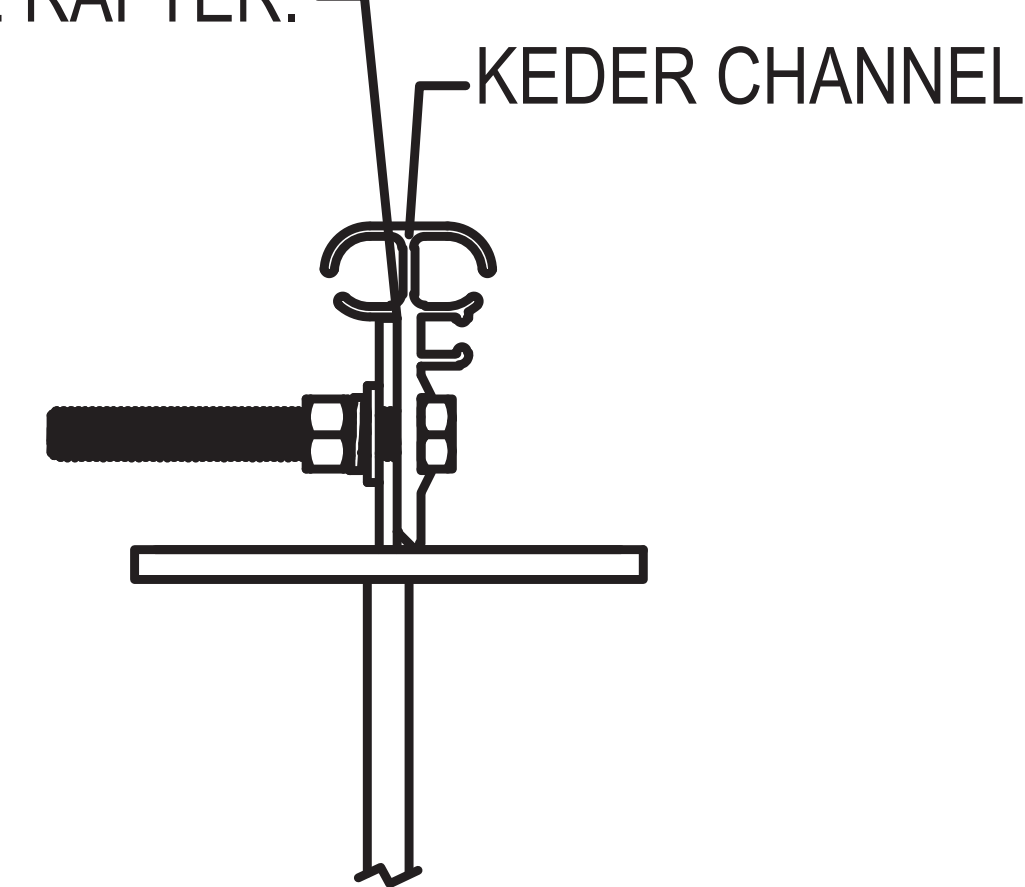
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NOTE: USE LUMBER AS NEEDED TO SPACE THE KEDER AT THE CORRECT DISTANCE FOR RUNNING THE COVER

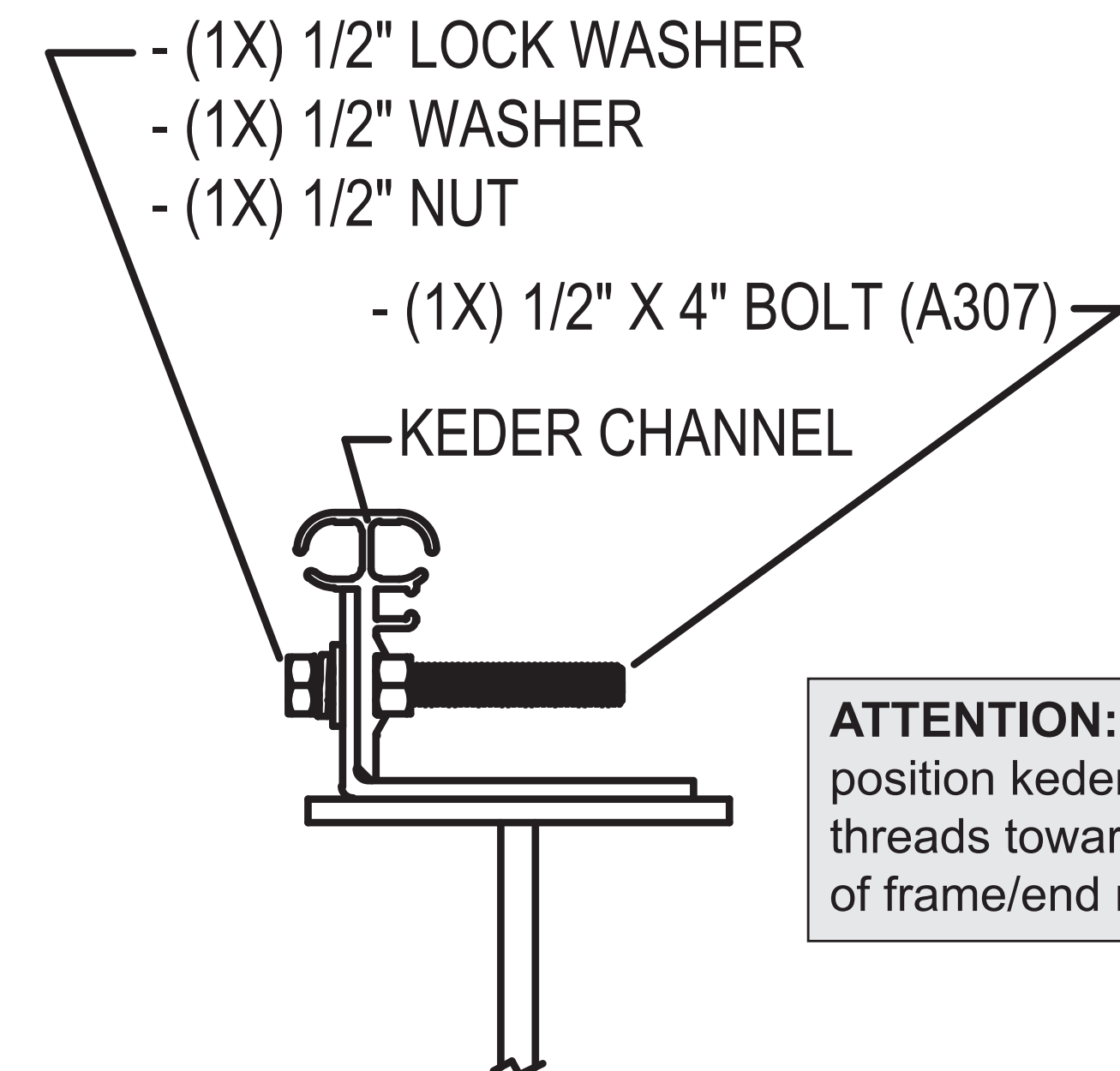


KEDER AT ROOF STAGED
MID RAFTER

NOTE: REMOVE THE STAGING LUMBER AFTER THE COVER IS INSTALLED TO TIGHTEN THE KEDER TO THE RAFTER.

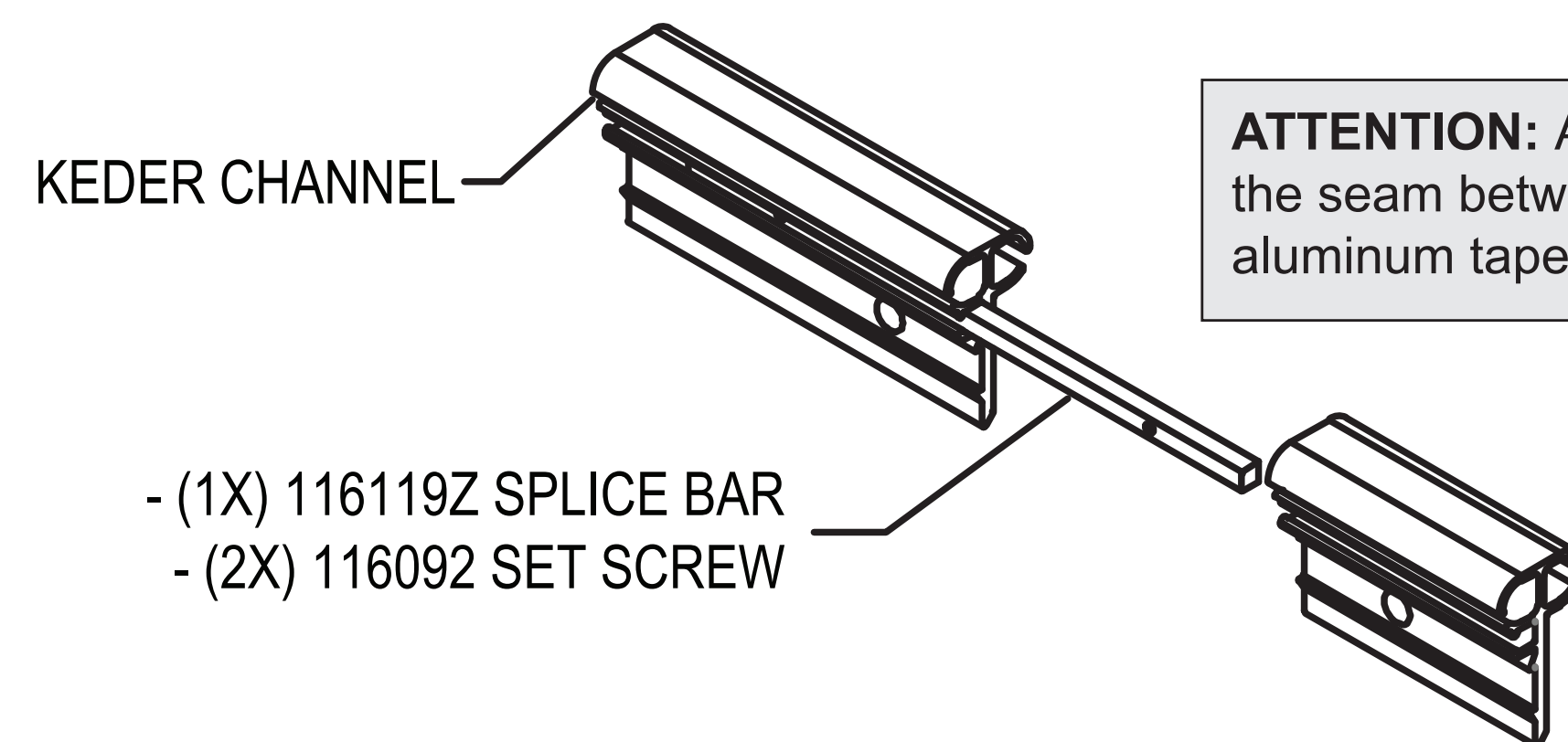


KEDER AT ROOF
MID RAFTER



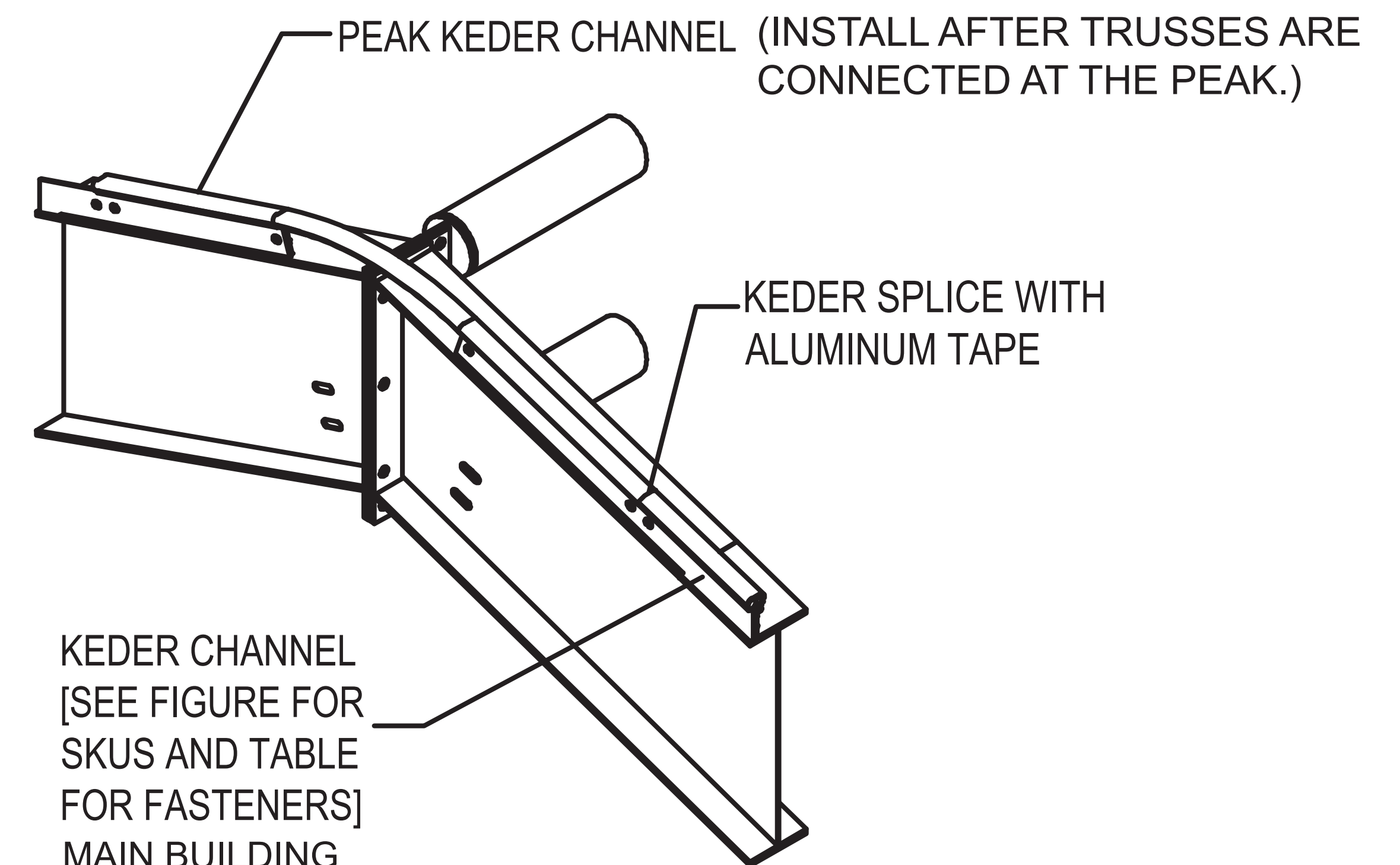
KEDER AT ROOF (END FRAME)

ATTENTION: For end rafter, position keder mounting bolt threads toward opposite end of frame/end rafter.



ATTENTION: After splice installation, seal the seam between the keder channels with aluminum tape. See next page.

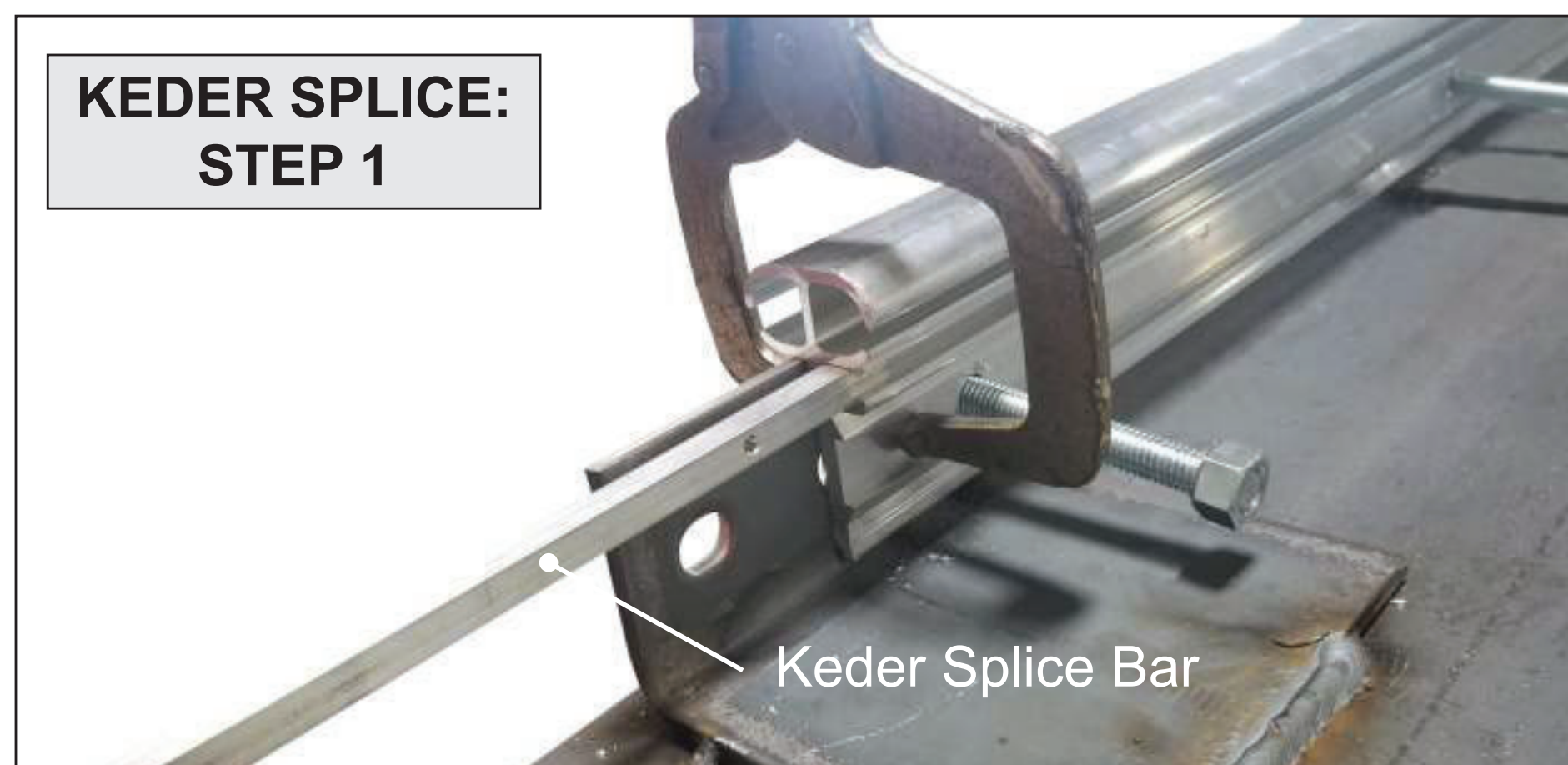
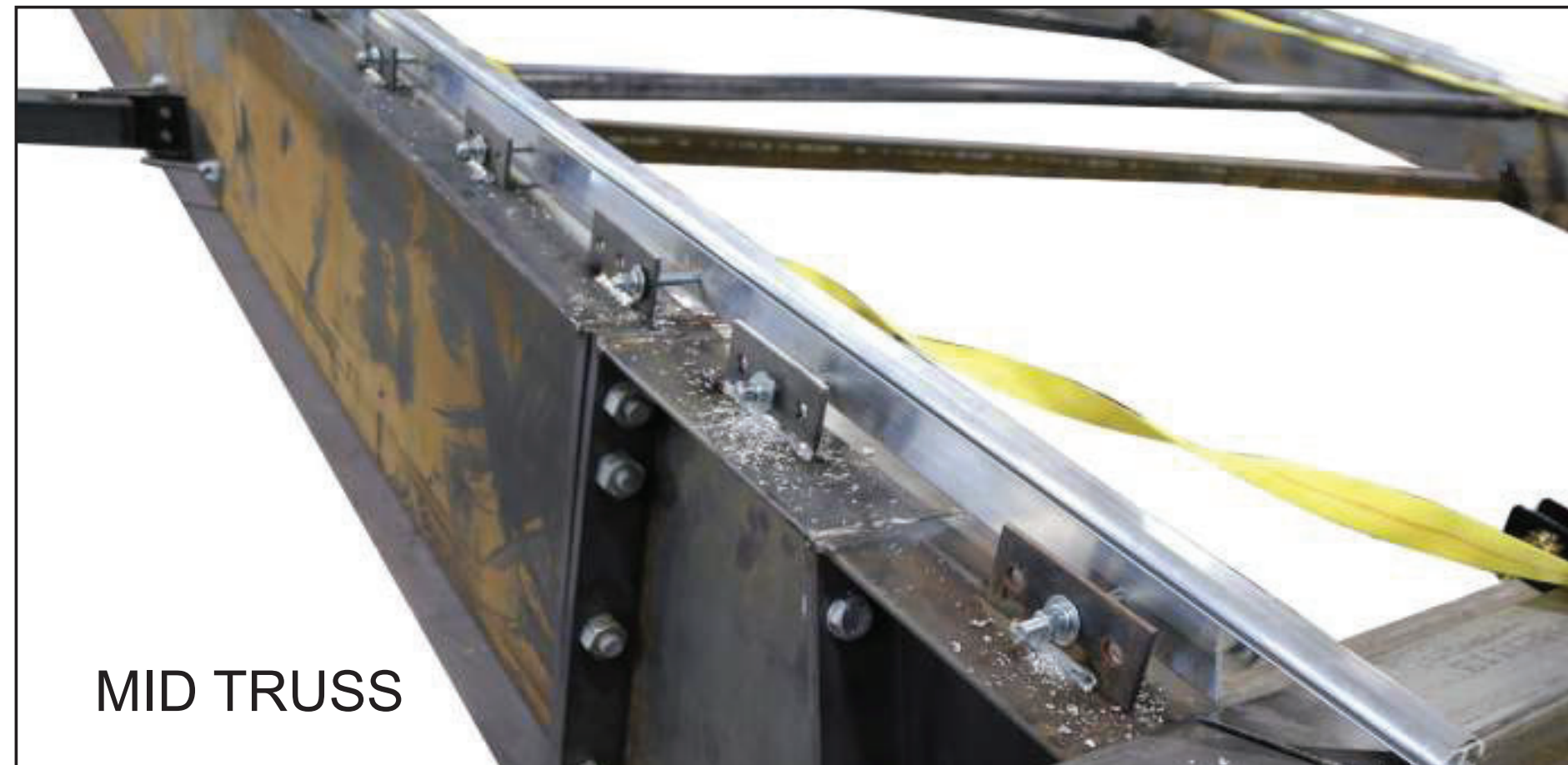
NOTE: CENTER SPLICE BAR BETWEEN THE 2 CHANNELS BEFORE TIGHTENING SET SCREWS



Frame Assembly — Keder Rail Installation (Main Cover): Roof Truss Sections – continued

6

Use the photos on this page to better understand how to connect keder rails to the roof truss components. Actual components may differ from those shown in the sample photos. When in doubt consult the main building drawings and follow the details presented there. Photos show attaching keder rails to an assembled roof truss attached to sidewall columns. On small buildings with heights reached using a small lift, this procedure is managed more easily. **ALLOW MOST MAIN MOUNTING BOLTS TO REMAIN LOOSE; SLIGHTLY TIGHTEN A FEW TO PREVENT MOVEMENT DURING TRUSS LIFTING AND INSTALLATION. DURING COVER INSTALLATION, MOUNTING BOLTS TO REMAIN LOOSE.**



STEP 1: SLIDE KEDER SPLICE BAR INTO THE INSTALLED KEDER CHANNEL. KEDER SPLICE BAR: 116119Z; SET SCREWS: 116092.



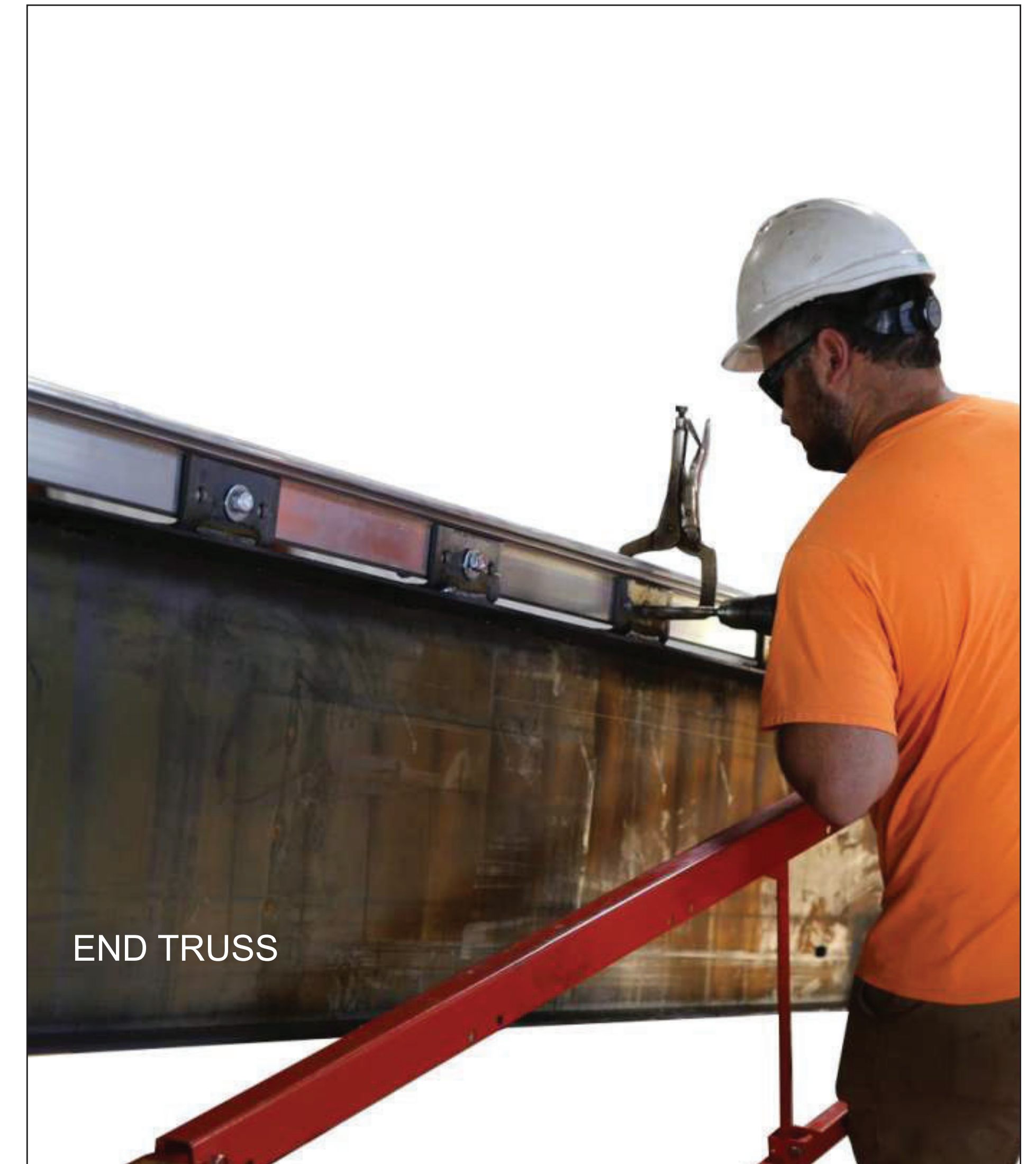
STEP 2: CENTER SPLICE BAR BETWEEN THE TWO KEDER RAILS. INSTALL SET SCREW TO SECURE SPLICE BAR IN PLACE.



STEP 3: SLIDE KEDER CHANNEL INTO POSITION AND INSTALL MAIN MOUNTING BOLTS.



STEP 4: INSTALL FINAL SET SCREW TO SECURE SPLICE BAR TO KEDER CHANNEL. **APPLY ALUMINUM TAPE TO SEAL SEAM.**

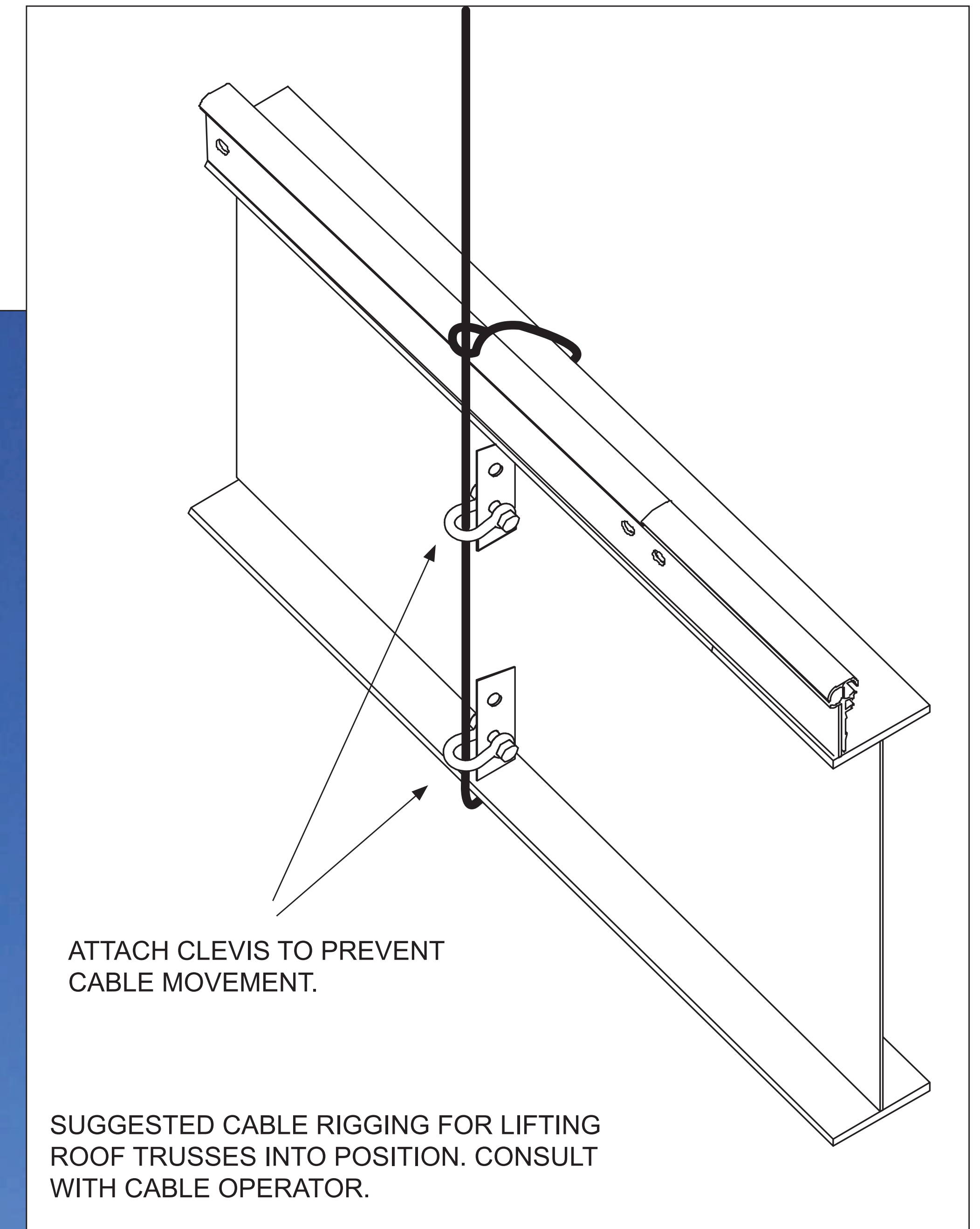


Lift and Install Roof Trusses

7

GENERAL COMMENTS: HOW TO LIFT SEGMENTS

ATTENTION: This page shows typical rigging for lifting an assembled beam for installation. Only certified crane operators experienced with the construction of similar structures should be employed to assemble the building. Consult with the crane operator before you begin building construction.



Lift and Install Roof Trusses

7

ATTENTION: CONSULT MEMBER TABLES IN THE BUILDING DRAWINGS FOR RAFTER SEGMENT WEIGHTS TO BETTER DETERMINE SAFE LIFTING TECHNIQUES. USE THE TABLES AND A SITE LAYOUT TO DETERMINE CRANE SIZING AND CRANE SETUP LOCATIONS.

These general steps describe installing roof rafters where site area is limited and available equipment is unable to lift multiple rafters at the same time.

1. For buildings wider than 70', connect the individual beam sections to prepare for lifting. Photo below shows lifting a roof truss that consists of two (2) smaller sections bolted together.
2. Before lifting the beams into place, keder rails are attached to the assemble beams. See previous section.



3. Lift end rafter and bolt to sidewall columns. If frame width is greater than 70', attach beams to columns then connect beams at the peak. Tie off the rafter, or leave anchored to lift (or crane) if possible.



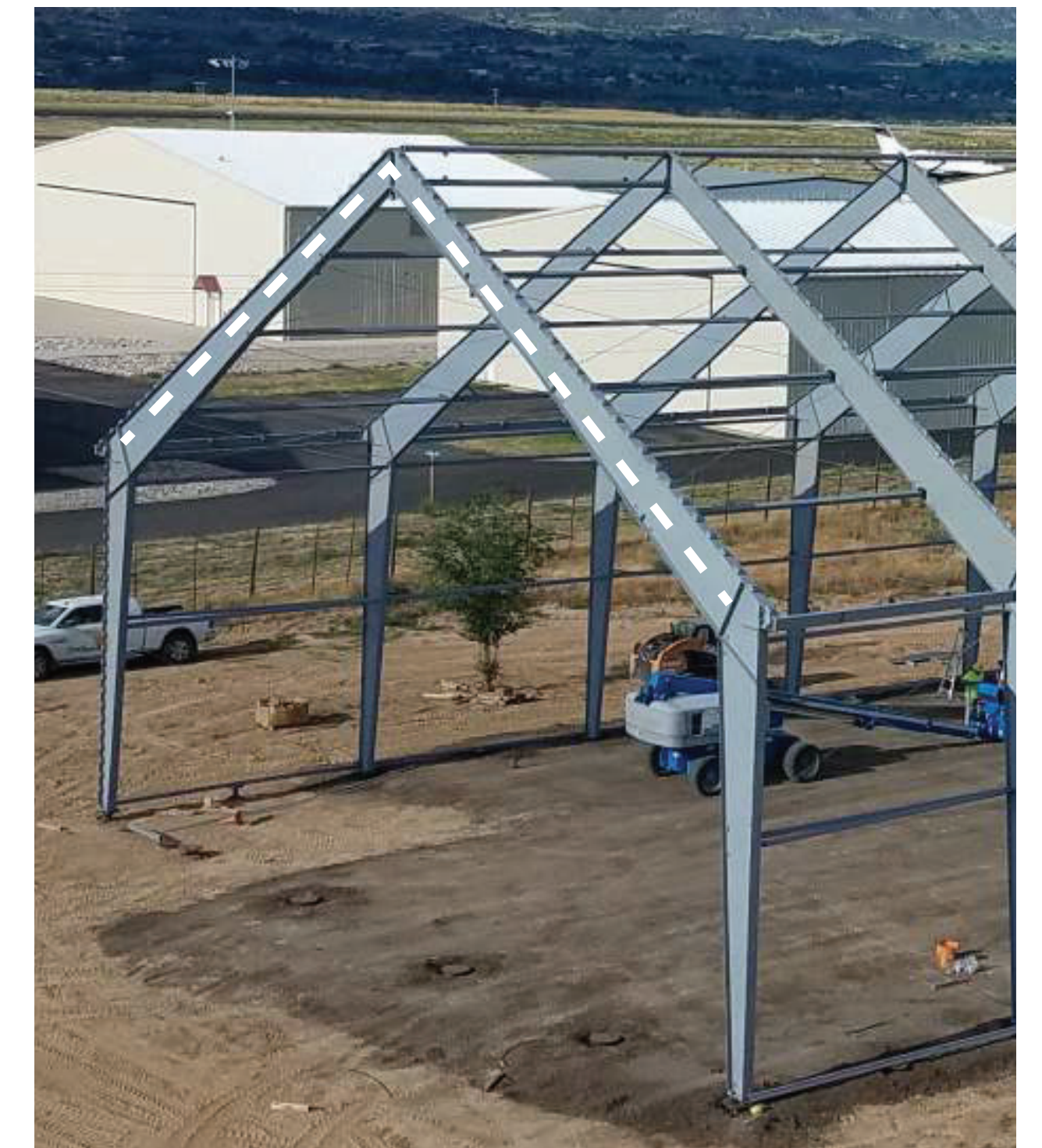
4. Lift the first interior beam and repeat previous step to secure to sidewall columns and at the peak if frame is greater than 70' wide. See photo in right column. Leave rafter anchored to lift (or crane) if possible.

ATTENTION: The frame at the right is less than 70' wide, which allows assembly of the two-piece roof truss on the ground. Once assembled, the truss is lifted by crane into place and attached to the installed sidewall columns. See dashed line in photo.

See the photo below for lifting roof trusses for building widths greater than 70'.

Photo shows the installation of roof trusses for a building that is greater than 70' wide. In this case, the roof sections are first assembled on the ground according to the main building diagrams and details. Steps are slightly different for building widths that are 70' and less.

Circles above show where to connect the beams and columns.

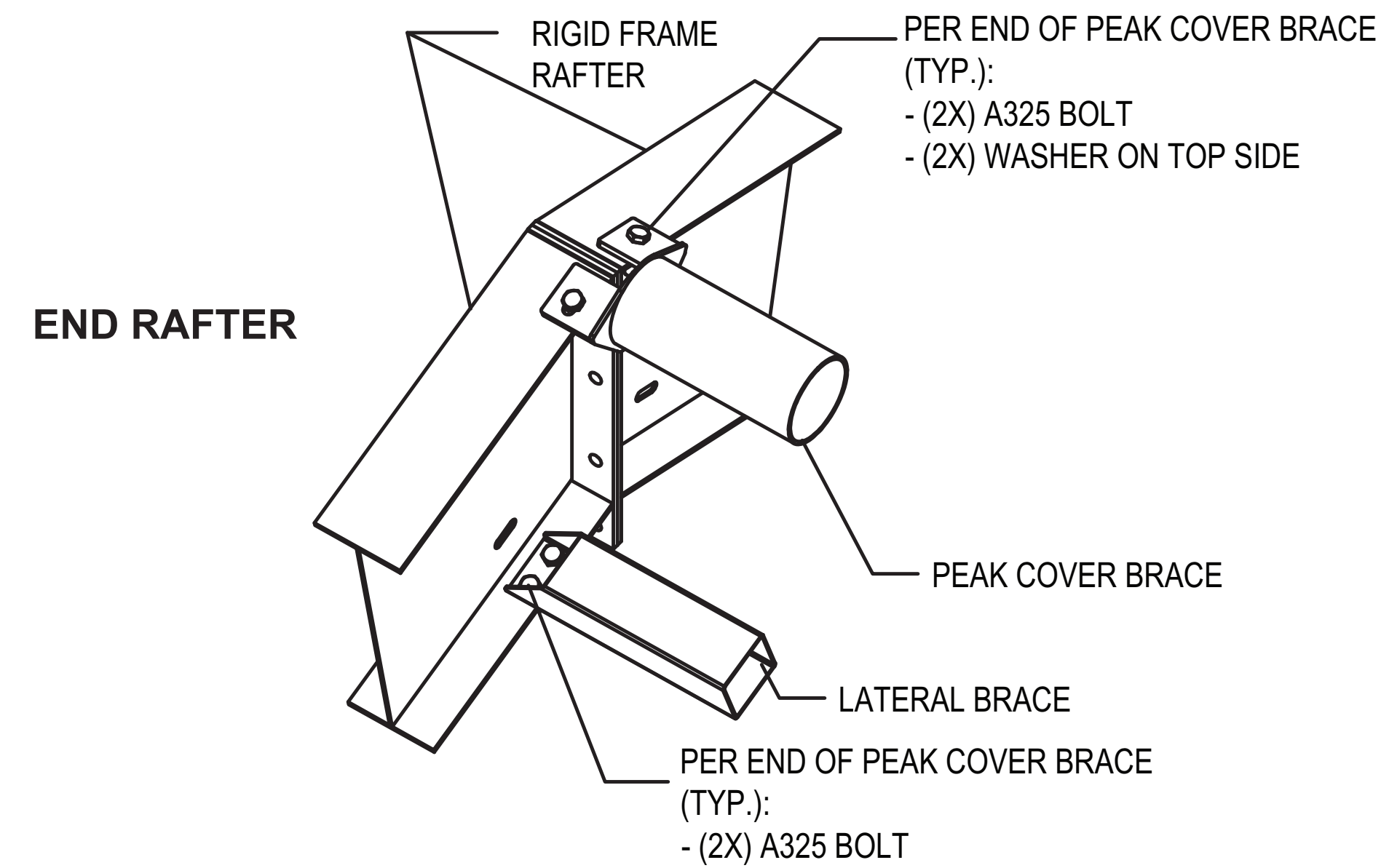


Lift and Install Roof Trusses — continued

7

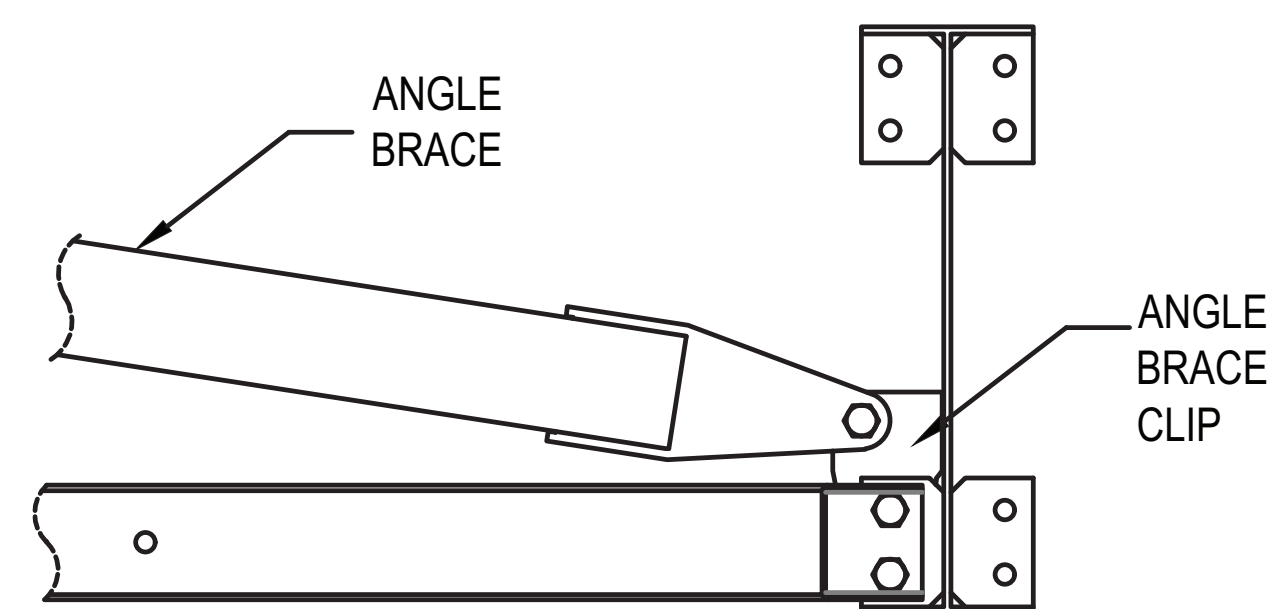
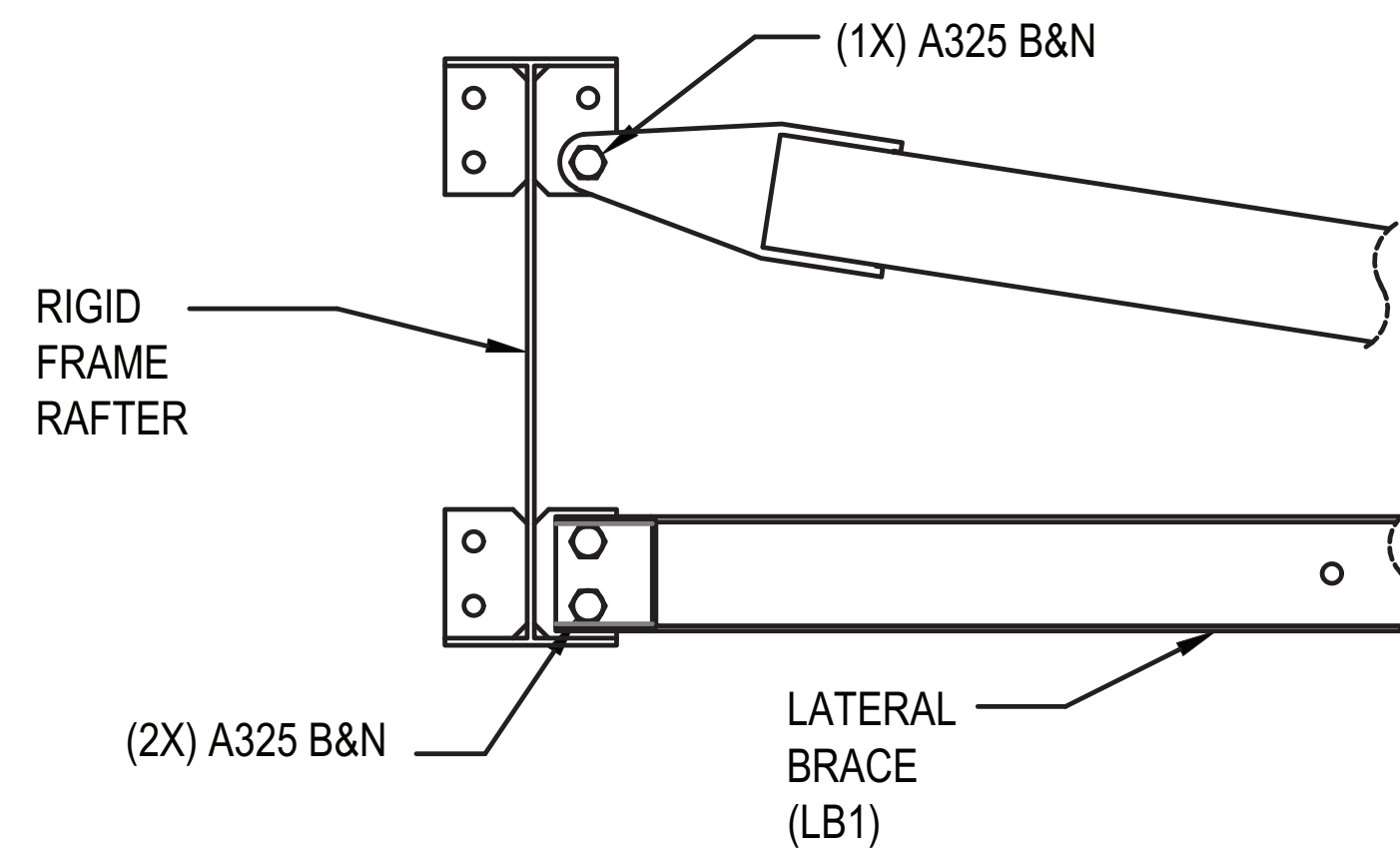
5. Install lateral braces (LB) and angle braces (AB) between the end rafter and the first interior rafter to secure the first bay of the assembled frame. **NOTE:** There is no angle brace (AB) at the peak.

ZB31



END RAFTER

FIRST INTERIOR RAFTER



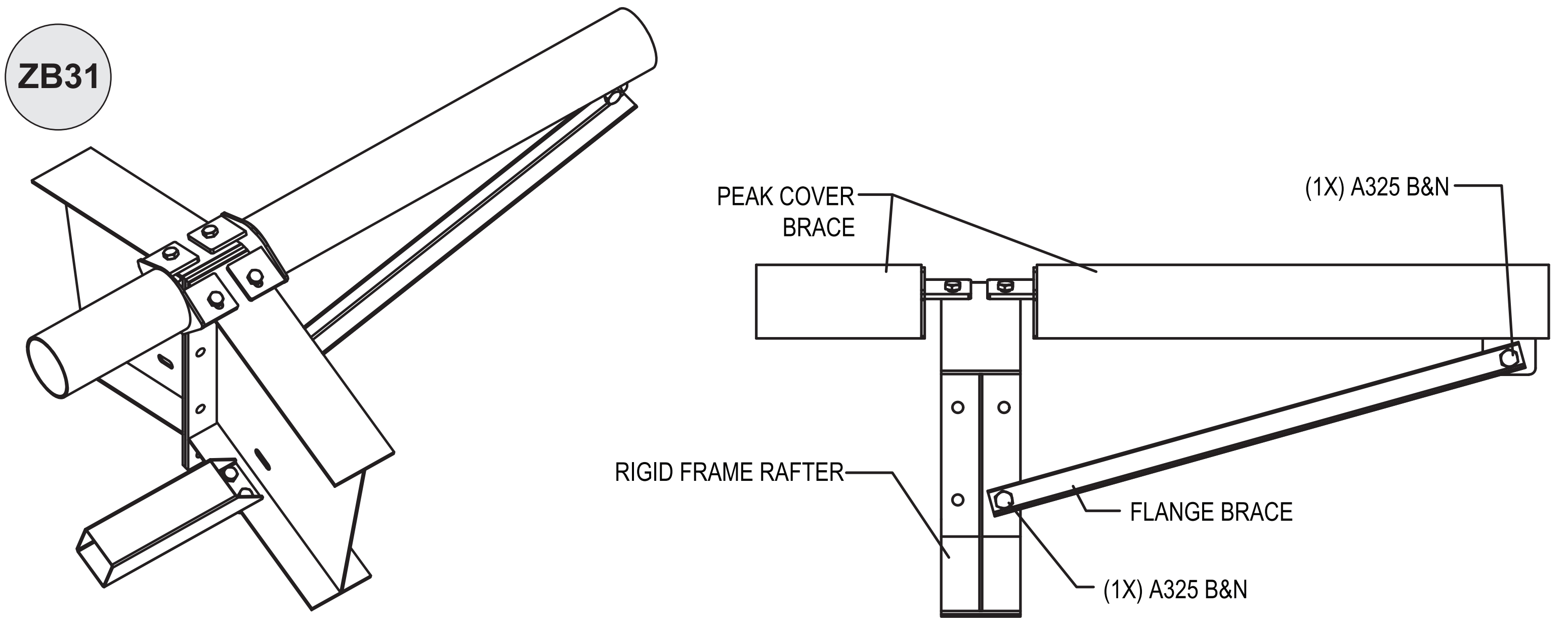
ZB19

LATERAL BRACE TO EXPANDABLE ENDWALL RIGID FRAME (WITH ANGLE BRACE)

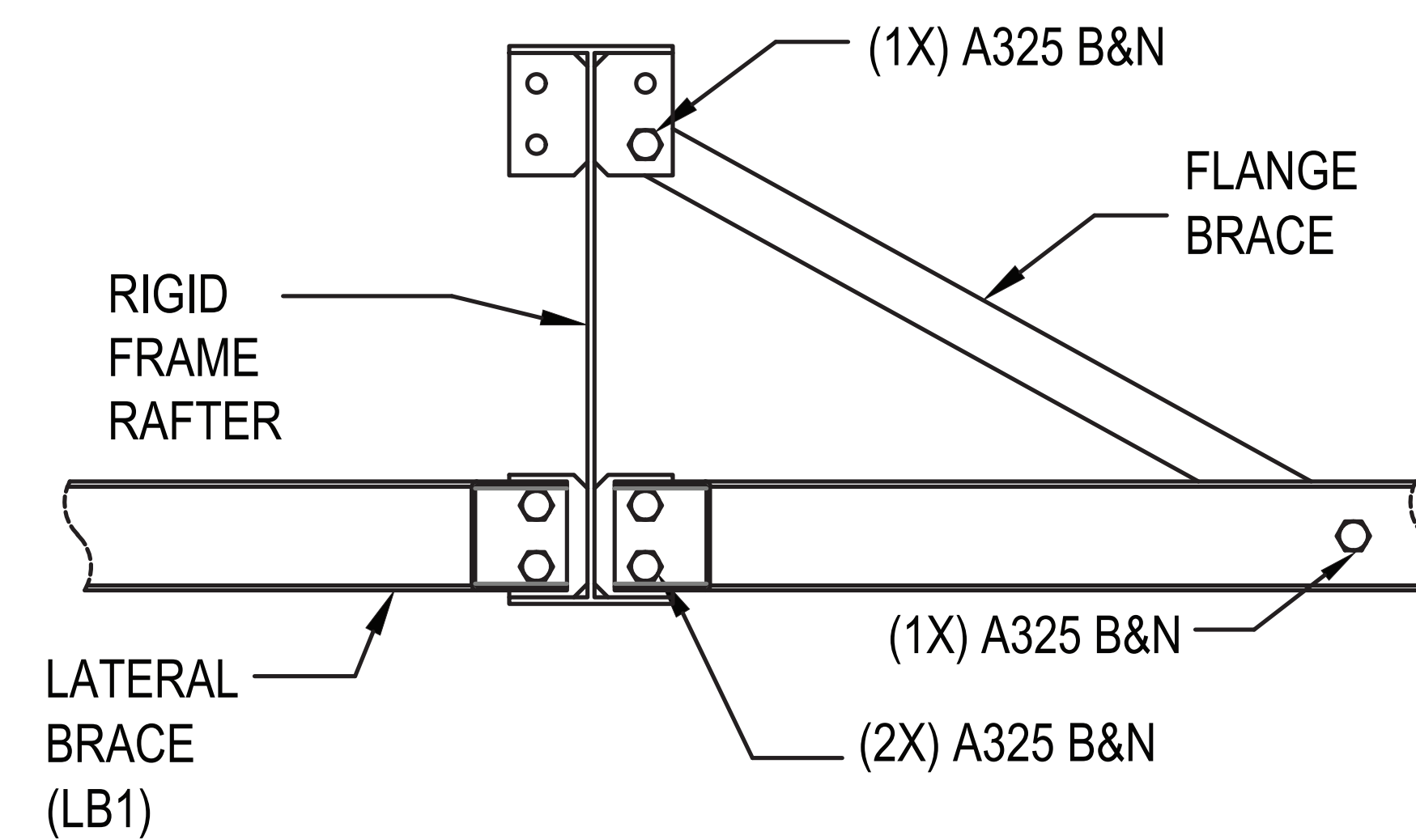
6. Install the peak cover brace (PCB) between the two rafters. See top diagram in this column.

7. Install rod bracing. Refer to Section 4.
 8. Plumb and square the first set of rafters at the end bay.
NOTE: End bay must be square to allow proper installation of remaining rafters and covers.
 9. Repeat all steps as needed to set or construct the next interior rafter.
 10. Install lateral braces (LB) and flange braces (FB) to connect the rafter to the adjacent rafter.

ZB31



ZB21



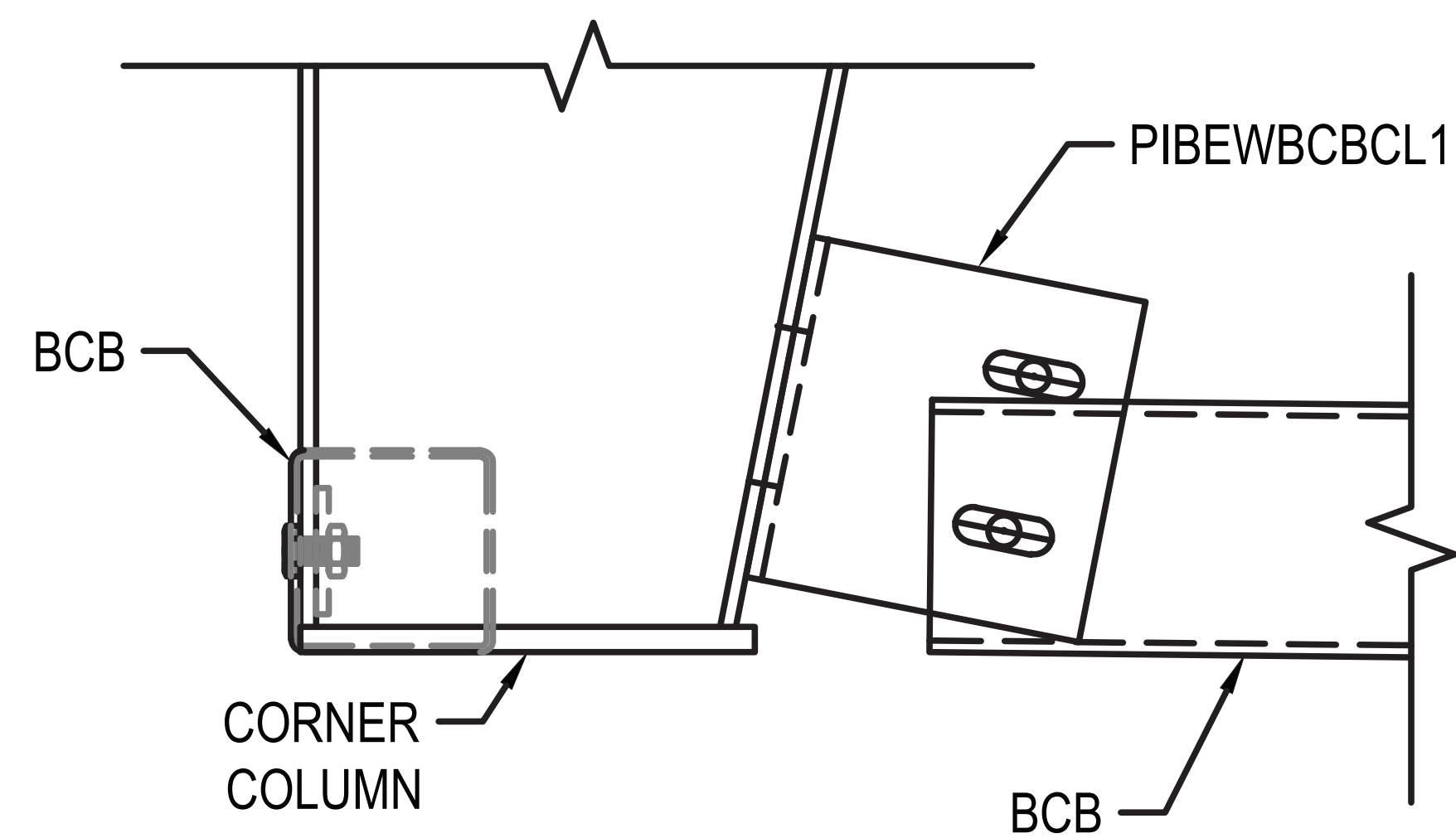
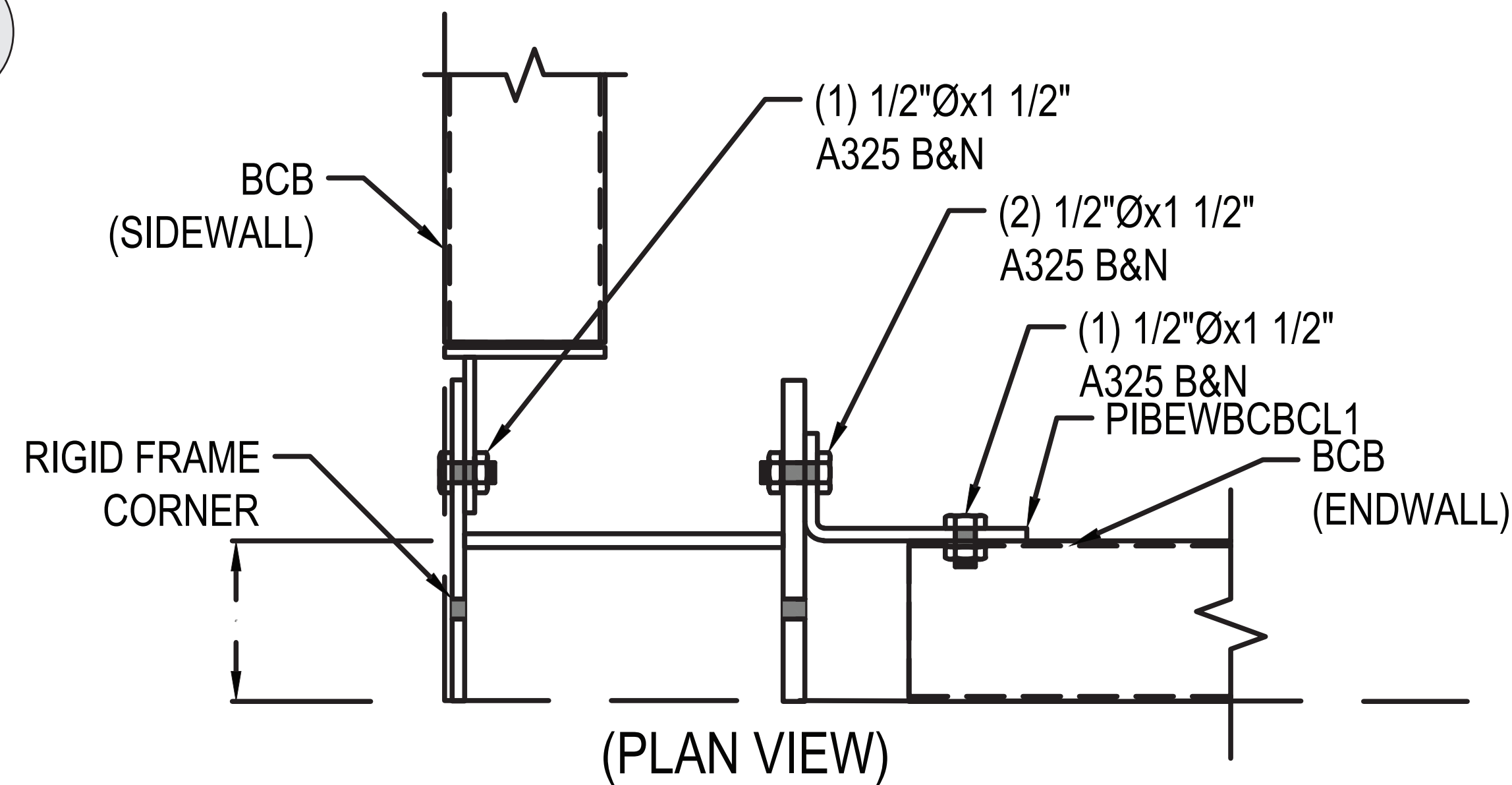
LATERAL BRACE TO INTERIOR RIGID FRAME

Lift and Install Roof Trusses — continued

7

11. Repeat steps as needed until all rafters are set and bracing is installed.
12. Install sidewall bottom cover braces (BCB). Connect these to frame columns and to the foundation at mid bay locations.

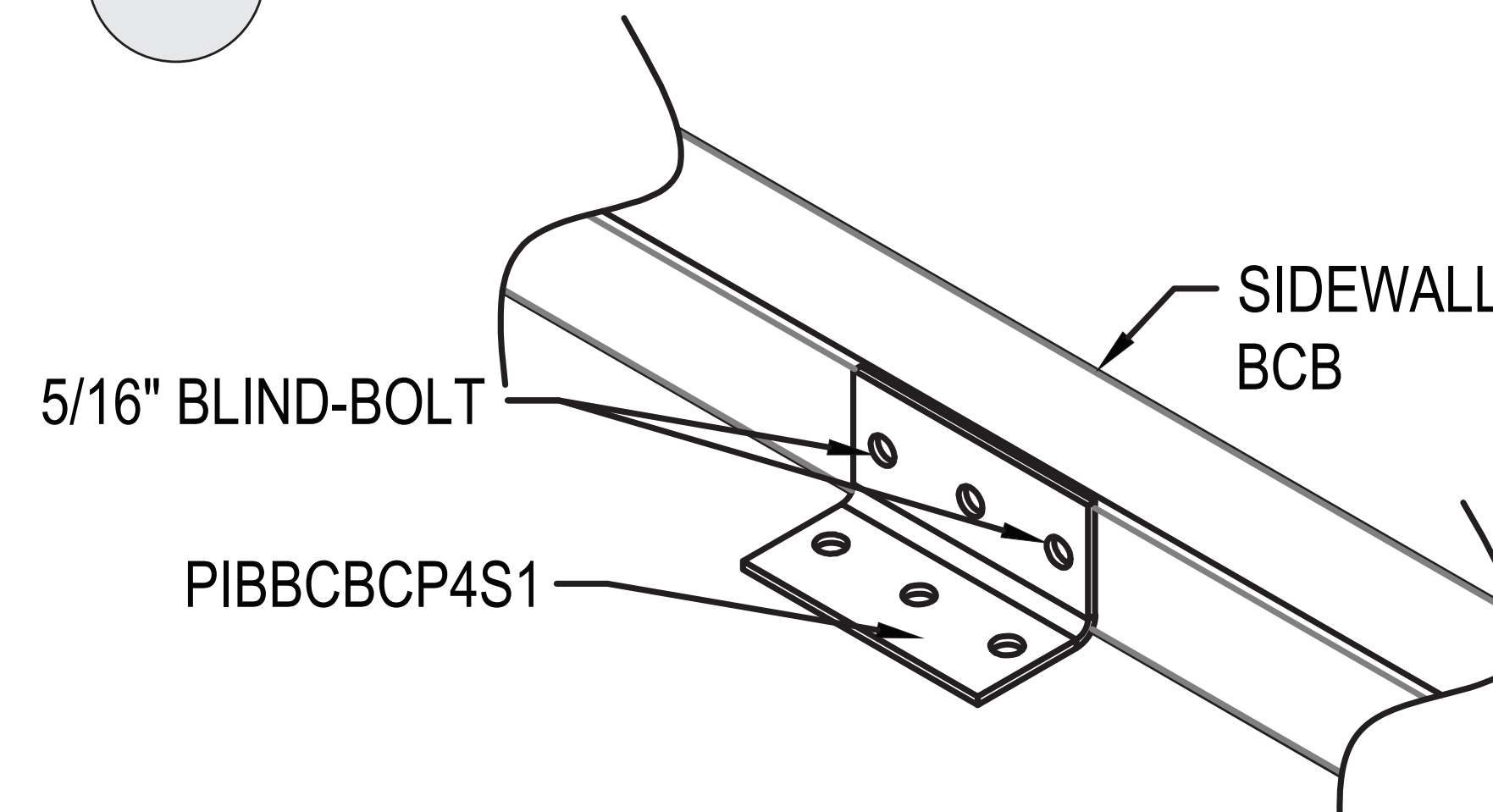
ZE18



BOTTOM COVER BRACE (BCB) TO CORNER COLUMN FLANGE

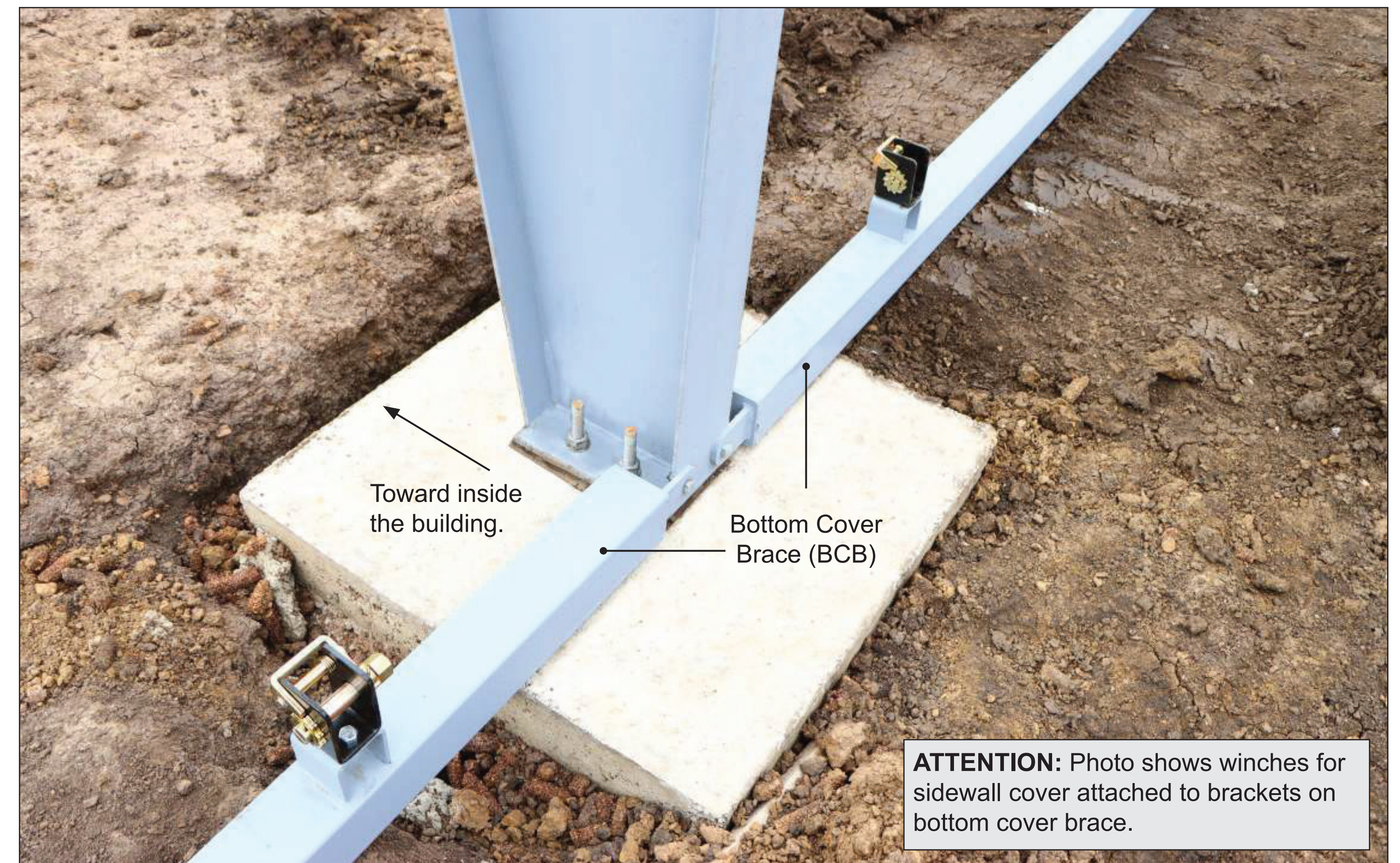
13. Attach winches to mounting brackets if equipped. See Side Panel Cover installation guide for additional details if needed.
14. Continue with the next section.

ZS6



ATTENTION: Install 5/16" blind bolts in outer holes of angled bracket.

IMPORTANT: Consult the main building drawings for sidewall BCB connection details when there is no slab, wall, or piers between sidewall columns. Photo below shows PIBBCBCP4S1 bracket welded to helical anchor and BCB. **Use bolts when provided.**



Lift and Install Roof Trusses — continued

7

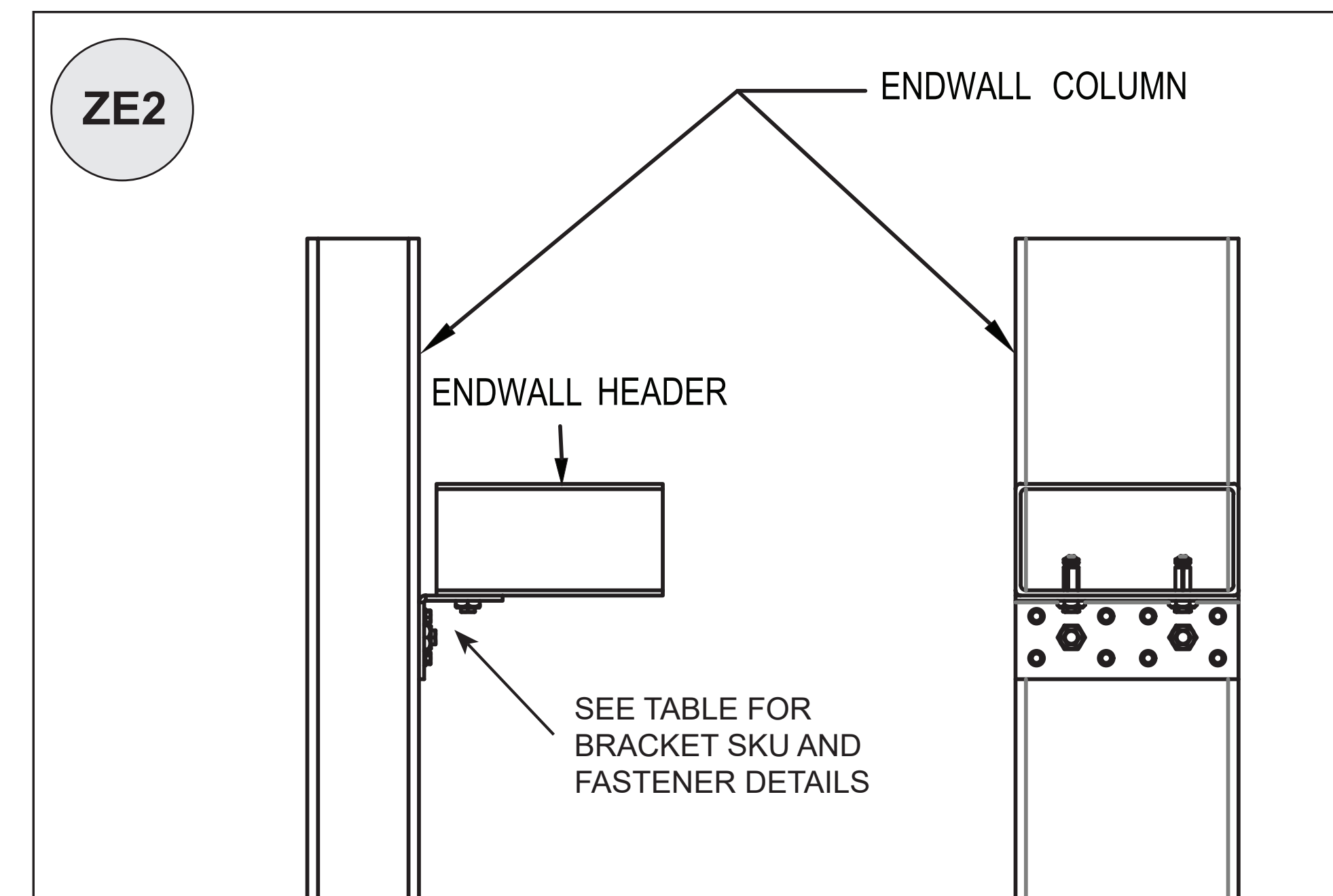
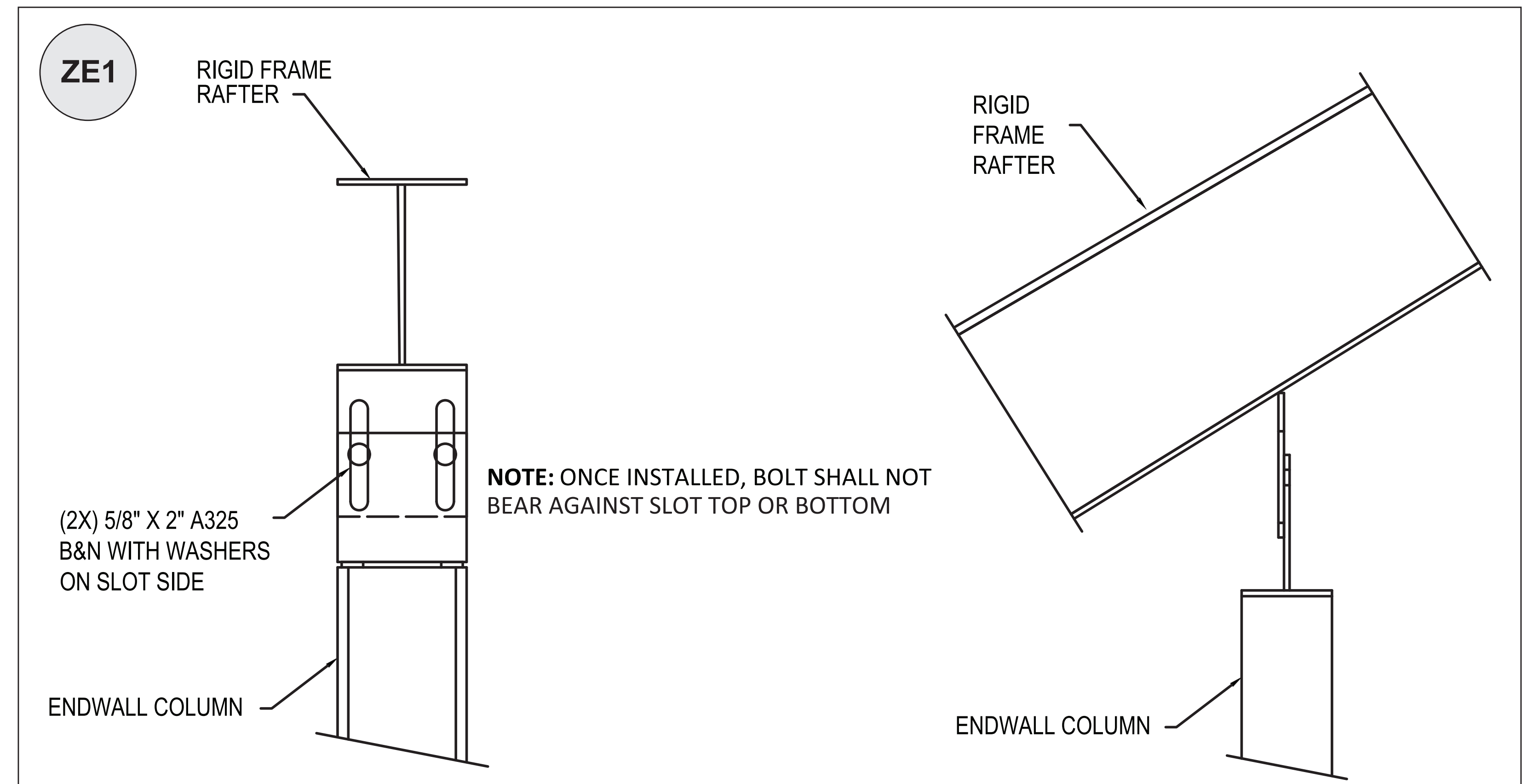
ACTUAL BUILDING MAY DIFFER IN DESIGN, SIZE, AND STYLE; CONSULT THE MAIN BUILDING DIAGRAMS FOR DETAILS. SAMPLE SHOWN INCLUDES FEATURES COMMON TO MOST CLEARSPAN BEAM BUILDINGS.



Install End Wall Frame — Typical Details

8

For buildings with end wall framing, review the information on this page and those details presented in the main drawings for the building. Details typical to the end frame construction are presented below.

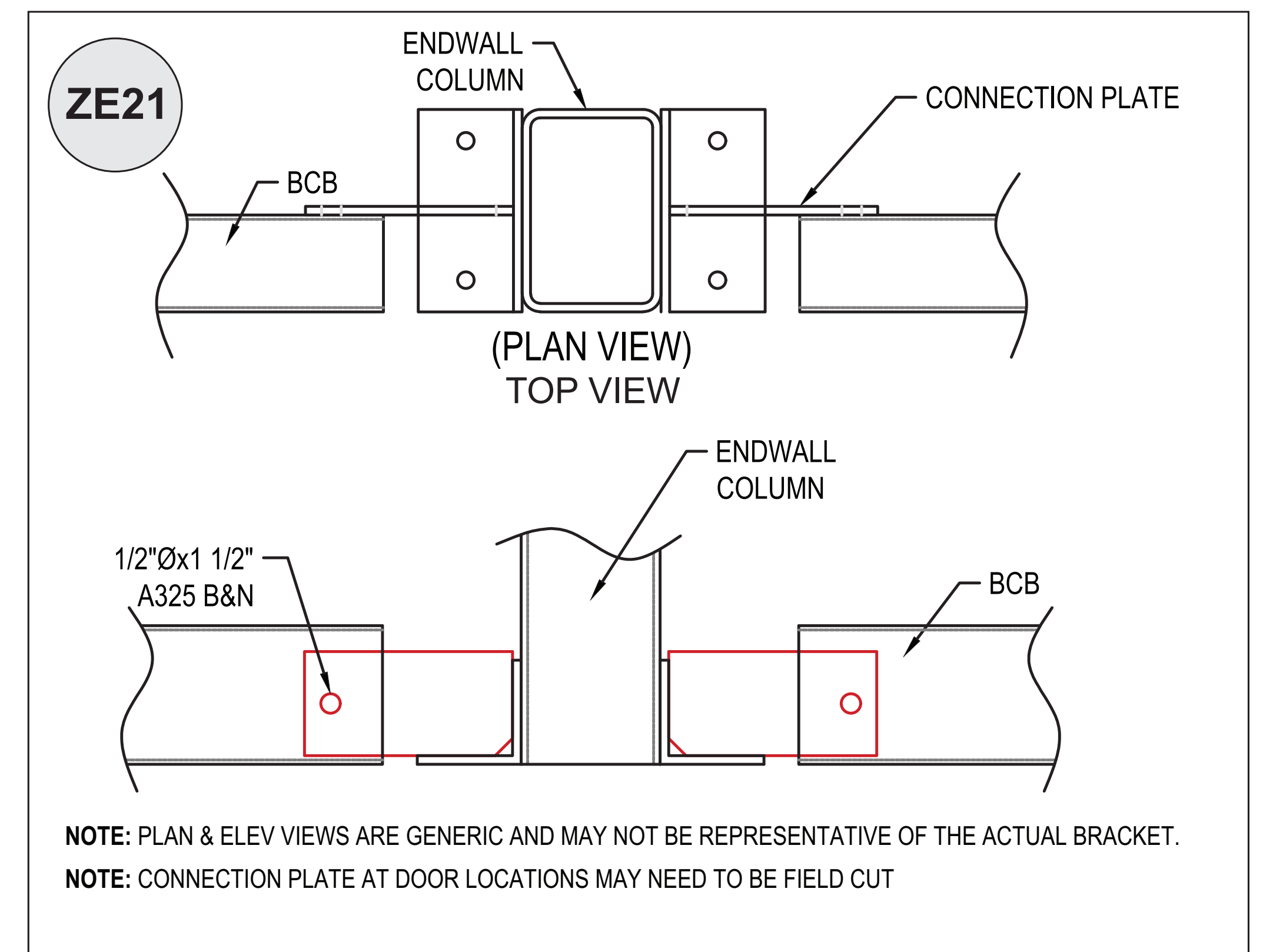
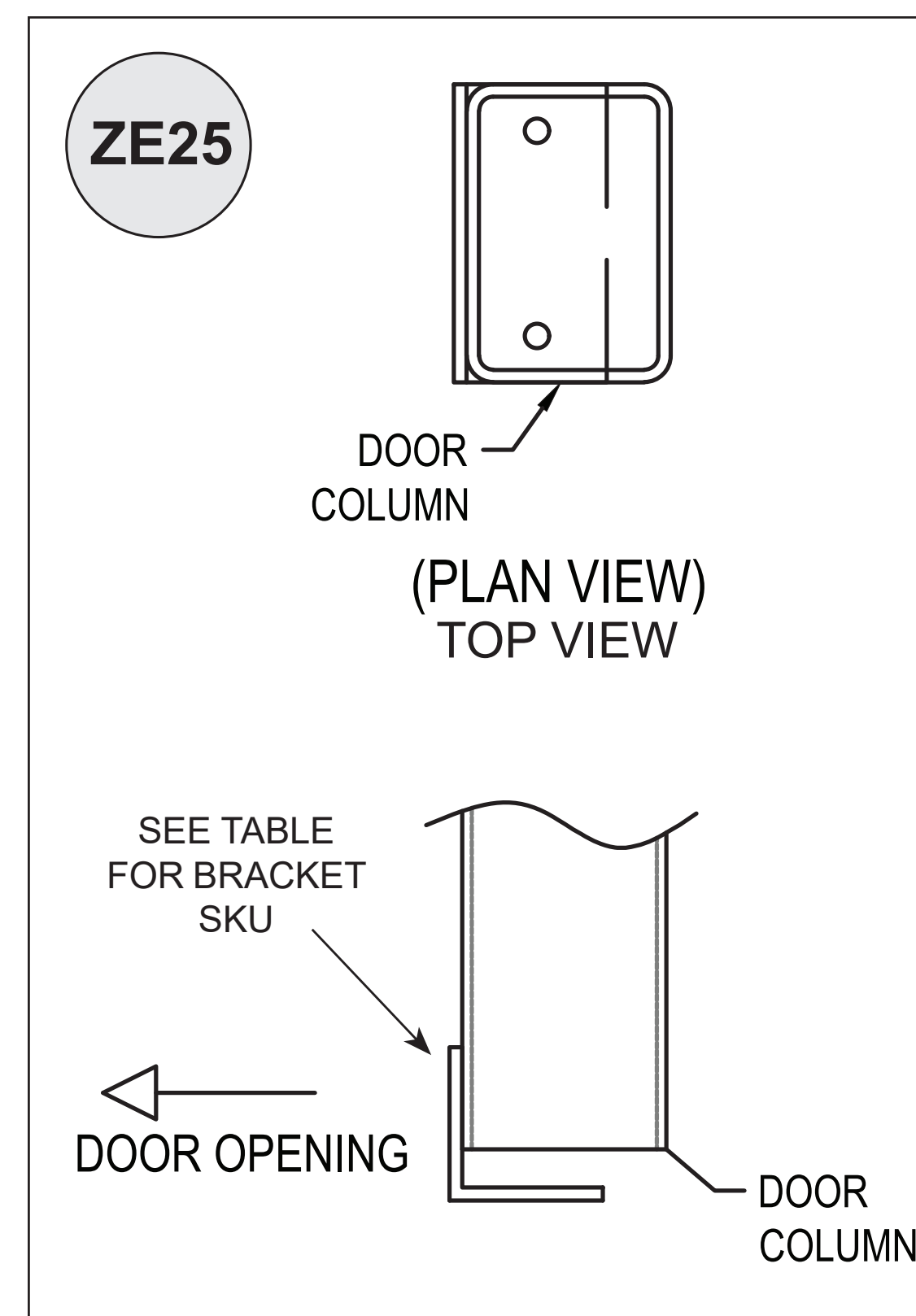
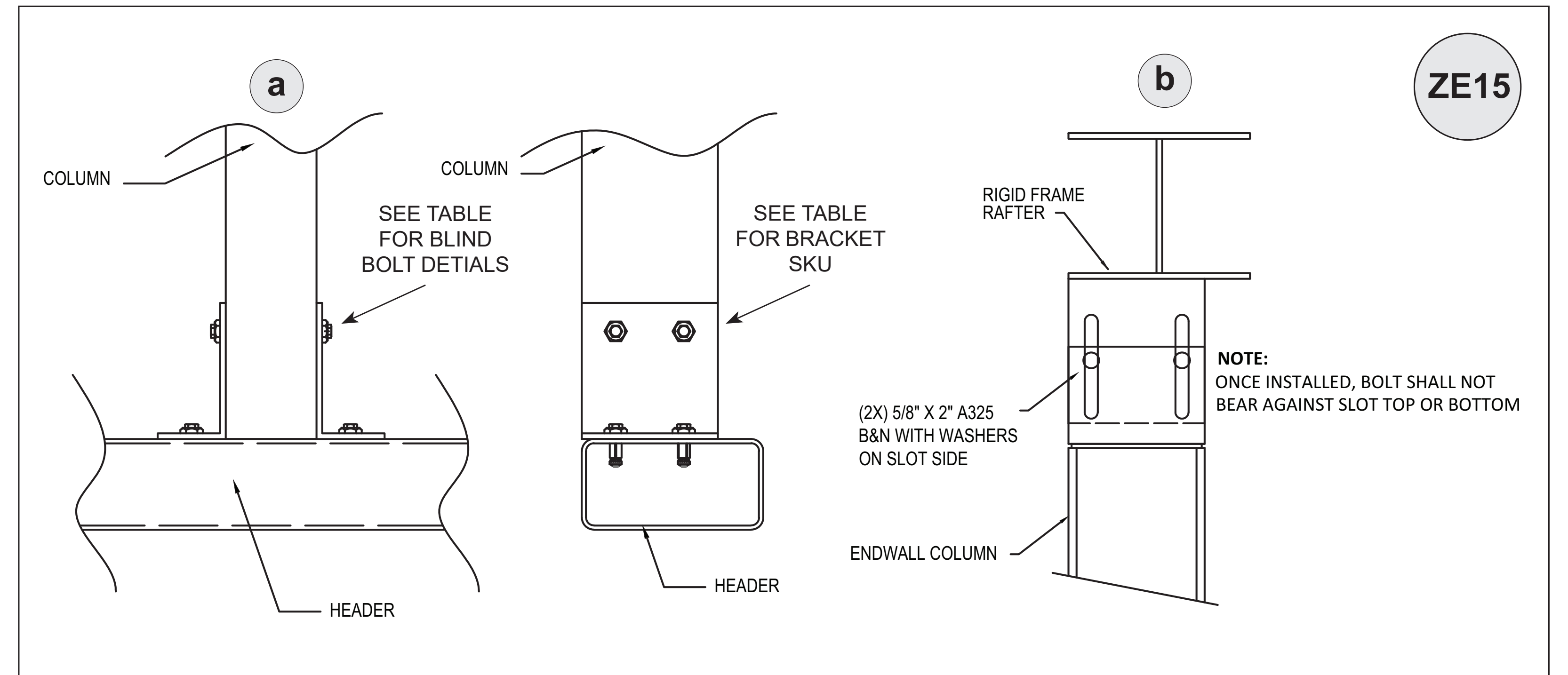


ATTENTION: WHEN INSTRUCTED, CONSULT THE TABLE IN THE MAIN BUILDING DRAWING FOR THE SAME DETAIL TO IDENTIFY PART NUMBERS, FASTENERS, QUANTITIES, AND OTHER IMPORTANT DETAILS.

CONSULT THE MAIN BUILDING DRAWINGS FOR END WALL DIAGRAMS AND CRITICAL DIMENSIONS REGARDING DOORS AND OTHER ACCESSORIES IF EQUIPPED.

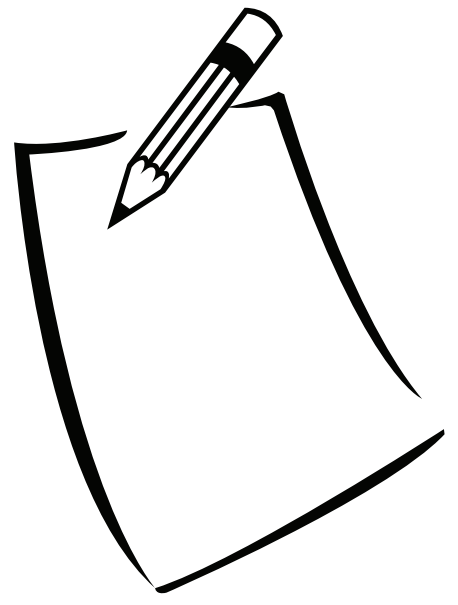
Install End Wall Frame – Typical Details (continued)

8



ATTENTION: WHEN INSTRUCTED, CONSULT THE TABLE IN THE MAIN BUILDING DRAWING FOR THE SAME DETAIL TO IDENTIFY PART NUMBERS, FASTENERS, QUANTITIES, AND OTHER IMPORTANT DETAILS.

NOTES

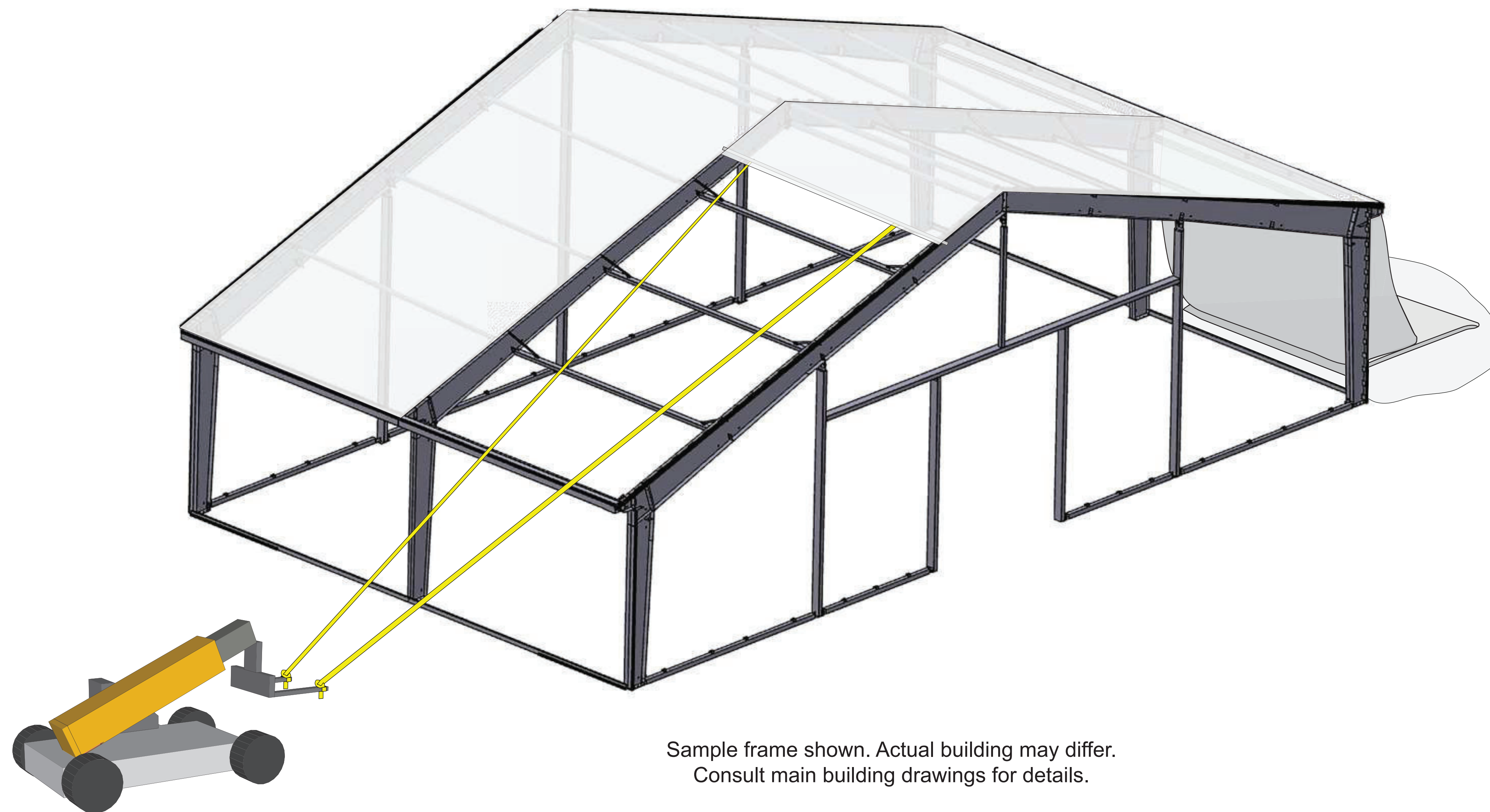




TYPICAL ASSEMBLY SEQUENCE

1. MAIN FRAME AND END FRAME
- 2. MAIN COVER**
3. END PANEL(S) (IF EQUIPPED)
4. SIDE PANEL(S) (IF EQUIPPED)
5. ACCESSORIES (DOORS, WINDOWS, ETC.)

Beam Building: Main Cover Installation



Sample frame shown. Actual building may differ.
Consult main building drawings for details.

General Information



READ THIS GUIDE BEFORE YOU BEGIN

This guide includes helpful hints and important information needed to safely install main covers. Please read these instructions **before** you begin.

If you have questions before or during cover installation, contact your project manager.

SAFETY PRECAUTIONS

- Wear eye and head protection.
- Wear gloves when handling building components.
- Use a portable GFCI (Ground Fault Circuit Interrupter) when working with electric power tools and cords.
- Use lifts and other power tools suitable to accomplish the procedures outlined in this document and in the detailed final drawings.
- Safety harnesses are required for all workers in elevated positions.

WARNING: For safety reasons, those who are not familiar with recognized construction methods and techniques must seek the help of a qualified contractor.

SAFETY AND ASSEMBLY NOTICE

THE ASSEMBLY OF A CLEARSPAN BUILDING SYSTEM MUST CONFORM TO ALL AUTHORITIES HAVING JURISDICTION IN THE REGION WHERE THE BUILDING ERECTION WILL OCCUR. CLEARSPAN WILL NOT BE RESPONSIBLE FOR FAILURE TO COMPLY WITH ESTABLISHED BUILDING CODES AND RESTRICTIONS BY A CONTRACTOR SUPPLIED BY THE CUSTOMER. IN THOSE AREAS WHERE SUCH AUTHORITIES DO NOT EXIST, THE BUILDING ASSEMBLY MUST CONFORM TO THE REQUIREMENTS IDENTIFIED IN THIS DOCUMENT AND THE APPROVED BUILDING DRAWINGS.

ADDITIONALLY, CLEARSPAN WILL NOT BE RESPONSIBLE FOR ANY DAMAGE OR INJURY DIRECTLY OR INDIRECTLY RESULTING FROM THE ERECTION OF THE BUILDING REGARDLESS OF THE EXISTENCE OF CODES AND RESTRICTIONS AND WHETHER THESE WERE FOLLOWED OR IGNORED.

PRE-COVER INSTALLATION PROCEDURE

The following steps will help prepare for cover installation:

1. Verify that all parts are included in the shipment. Notify Customer Service for questions or concerns.

ATTENTION: Inspect the shipment for damage. Record any damage on the bill of lading before it is signed. If damage is found after opening a container, contact the carrier or carrier agent immediately. Contact your sales representative for additional information immediately when damage is discovered.

2. Unload shipment. See below.
3. Read these instructions, the final drawings, and all additional documentation included with the shipment **before** you begin.
4. Gather the tools, bracing, lifts, ladders, and required personnel. See sample tool and equipment list.
5. Check the weather **before** you begin and plan accordingly.
6. Read the warranty information and complete the documentation as instructed.

RECOMMENDED UNLOADING PROCEDURES

- Protect all covers, end panels, and cardboard shipping containers and contents from the elements. Set on pallets off the ground and cover with plastic film or place in a building for use when needed.
- Do not position components and column bundles in the staging area or any place where a crane must pass or be positioned for the assembly and erection of building components.

REQUIRED TOOLS FOR COVER INSTALLATION

The following list identifies the basic equipment and some main tools needed to install the main cover panels. *The size of the required personnel lifts will vary as will the equipment needed to unload and move building components. Additional hand tools and supports may be needed depending on the structure size, location, and existing restrictions and codes.*

- Tape measure or measuring device.
- Cordless drills & cordless impact wrenches.
- Impact socket set & 3/4" **extra long (5")**, deep impact socket for cover installation.
- Utility knife and blades (for fabric).
- Chop saw & skill saw with metal cutting blades.
- Generator or power source & extension cords.
- Pry bars & alignment bars for bolt installation.
- Cordless reciprocating saw (Sawzall®) & metal blades.
- Lubricant for keder cover installation. (Liquid dish soap recommended.)
- Two (2) large clevises for pulling covers.
- Plastic or other material to place under fabric to keep it clean during set up and installation.
- Hand files (round and flat) to remove metal burrs from metal after cutting.
- Two (2) pairs of sheet metal Vice-Grip® pliers (or similar adjustable locking pliers).
- Heat gun/heat welder for end panel and side panel seams (larger buildings).

EQUIPMENT

- Aerial Lifts: Reach determined by height of foundation plus peak height of building. Add about 5' extra.

GENERAL PROCEDURES TO INSTALL COVER PANELS

SECTION 1: Keder Channel Preparation & Installation — Last Sections for Roof Trusses

SECTION 2: Stage Keder Channel for Cover Installation & Attach Keder Channel to Top Cover Brace (TCB)

SECTION 3: Install Soffit Panels & Facia Trim (if equipped)

SECTION 4: Attach Keder Channel to Eave Cover Brace (ECB)

SECTION 5: Install Cover Panels

SECTION 6: Terminate Cover Panels at Eave Cover Brace (ECB)

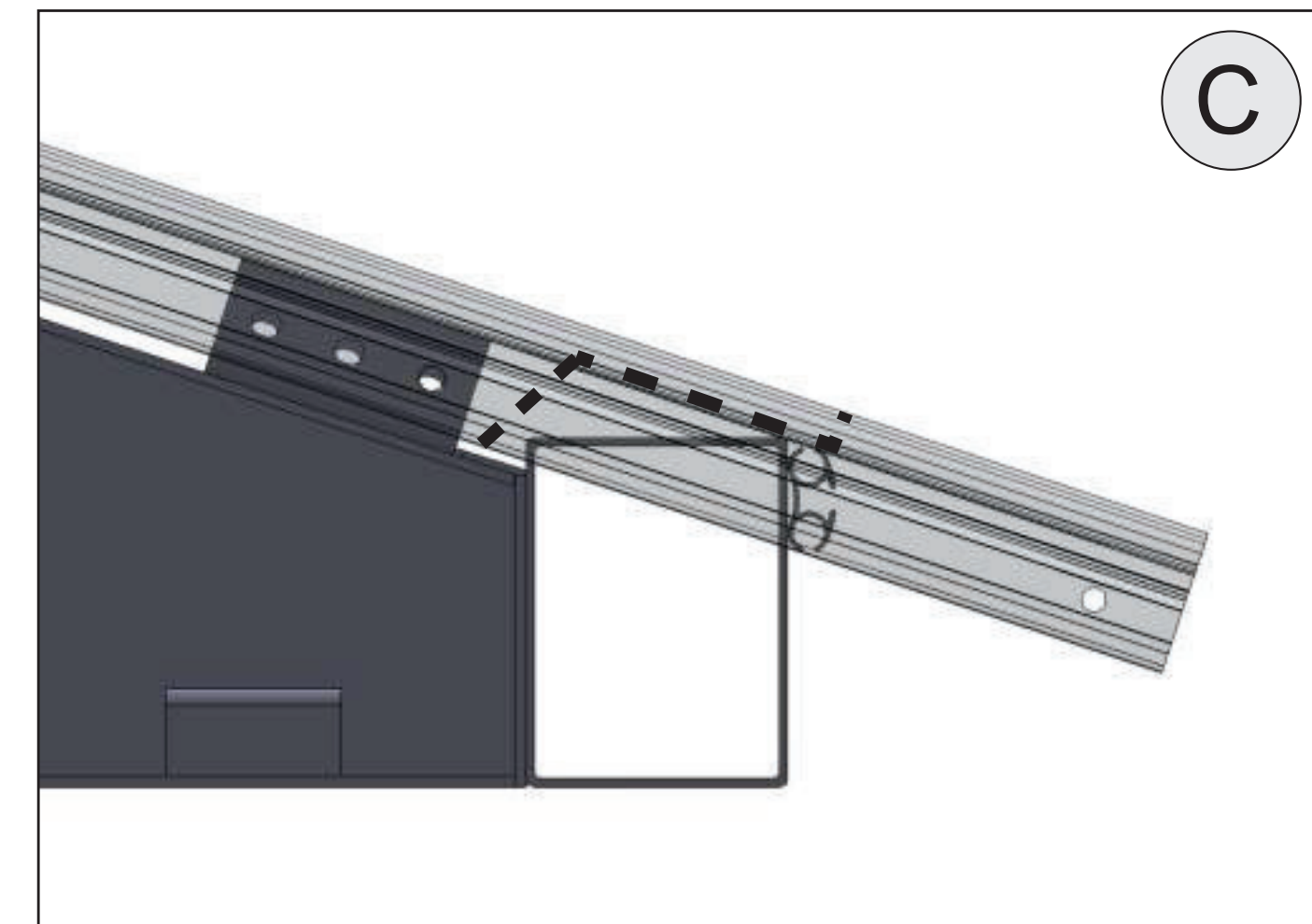
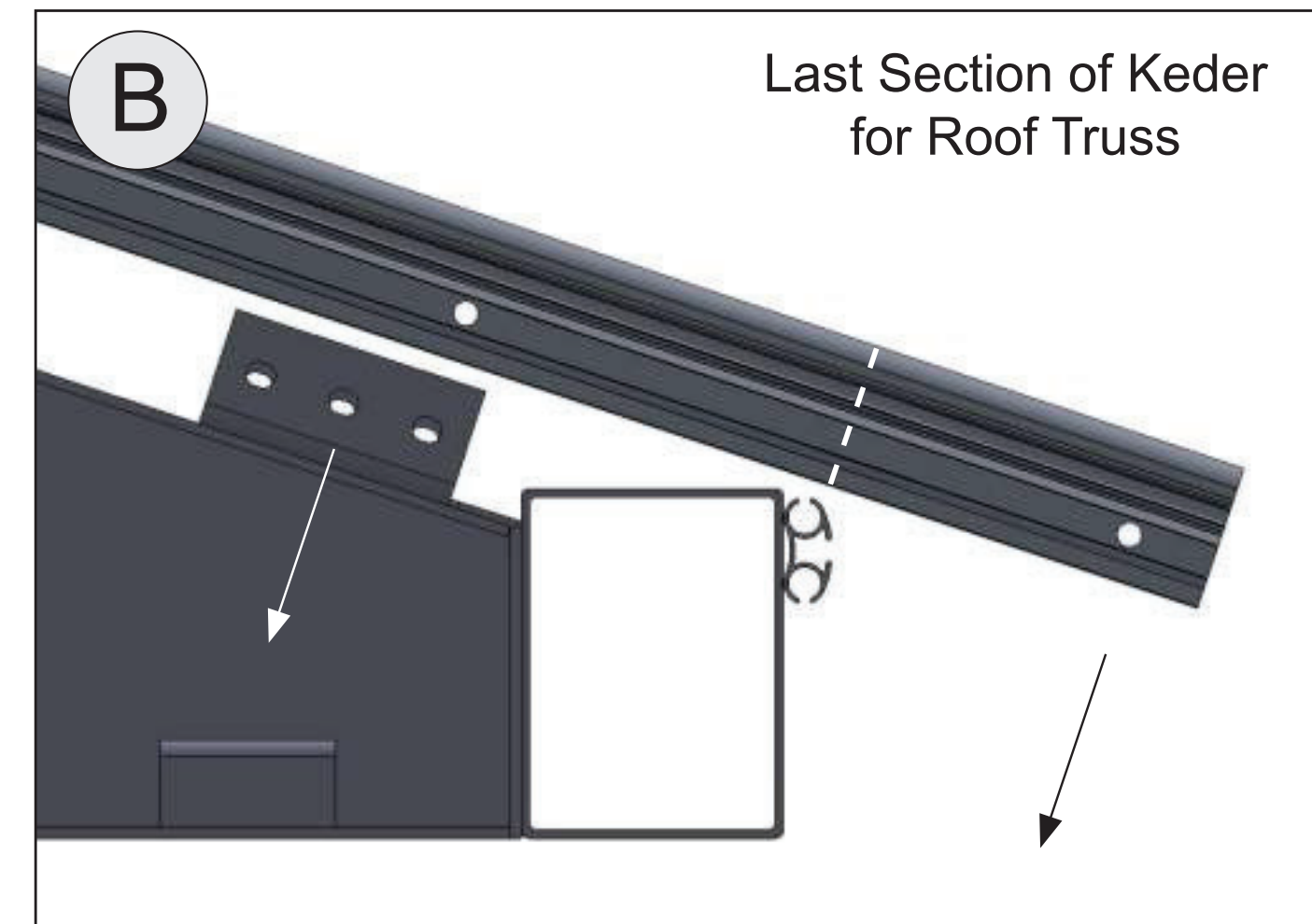
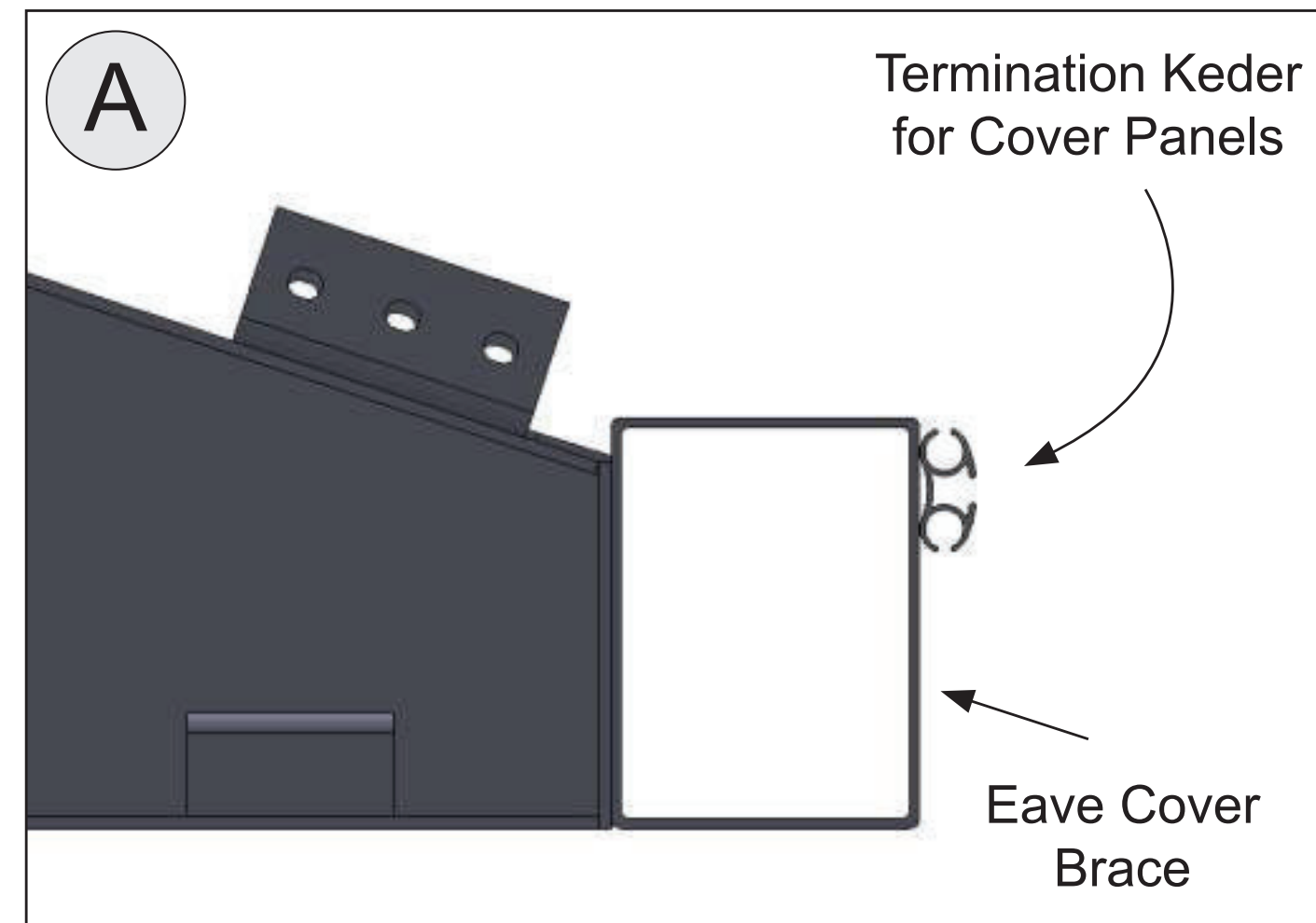
Keder Channel Preparation and Installation — Last Sections for Roof Trusses

1

To this point, all main sections of keder channel are attached to the tops of the assembled and installed roof trusses. The information on this page describes how to prepare the last section of keder channel for installation at the eave position. Prepare and install the remaining keder channels before cover installation begins.

Complete these steps:

1. Verify that the main mounting bolts for the installed keder channels are loose for panel installation — all interior roof trusses.
2. Temporarily clamp a section of the keder channel to the eave cover brace (ECB). **This will help determine the length of the final section of keder for each roof truss. See A.**

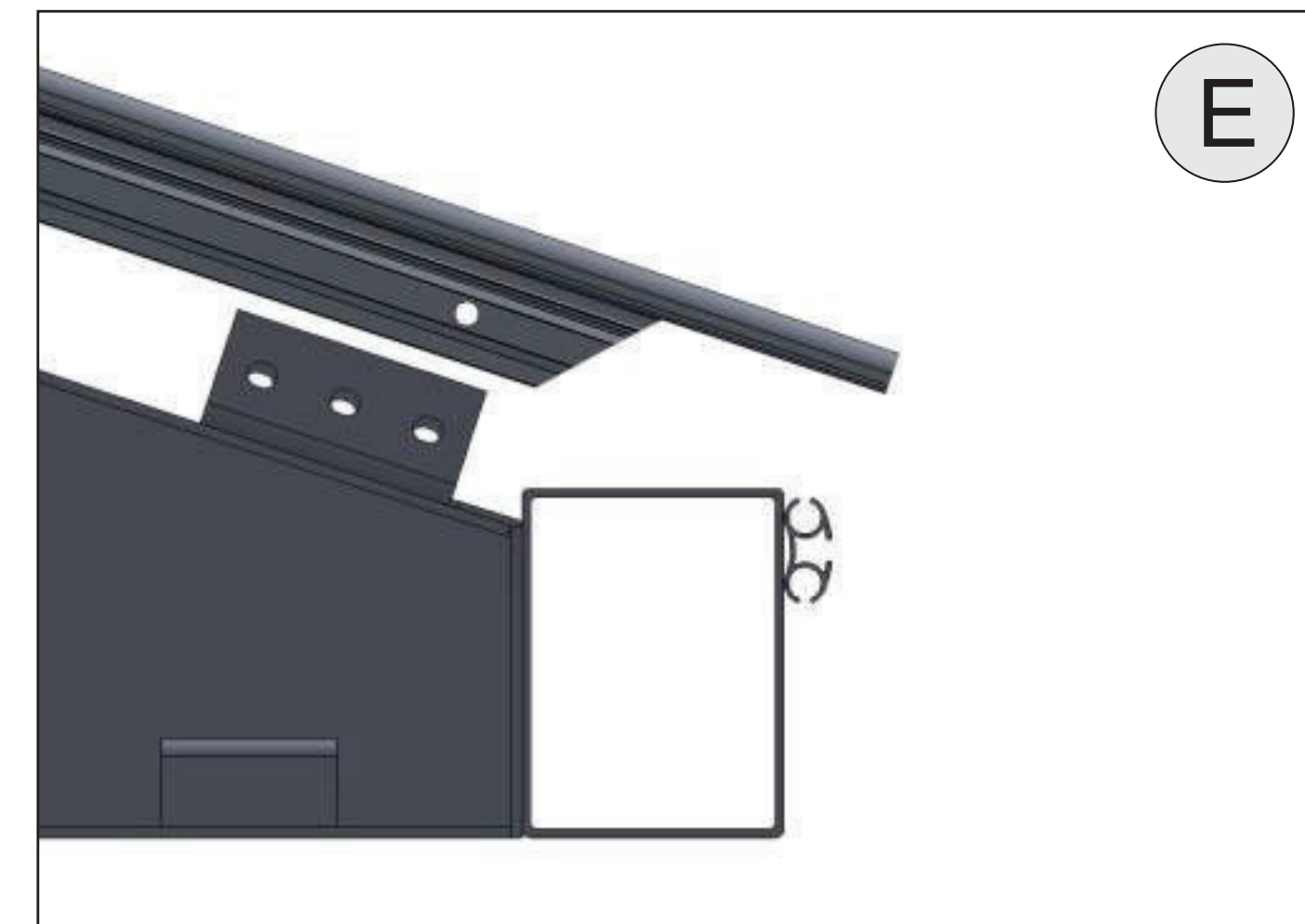


NOTE: If the building is without a soffit panel and fascia, install all keder channel to terminate the main cover panels at this time if desired. Consult the main building drawings for additional details.

3. Move to one end rafter and slide the final piece of keder channel into place to judge where to mark the channel to remove material for installation (B).

ATTENTION: This first piece will serve as a template for all remaining pieces of keder to be installed at the eave position.

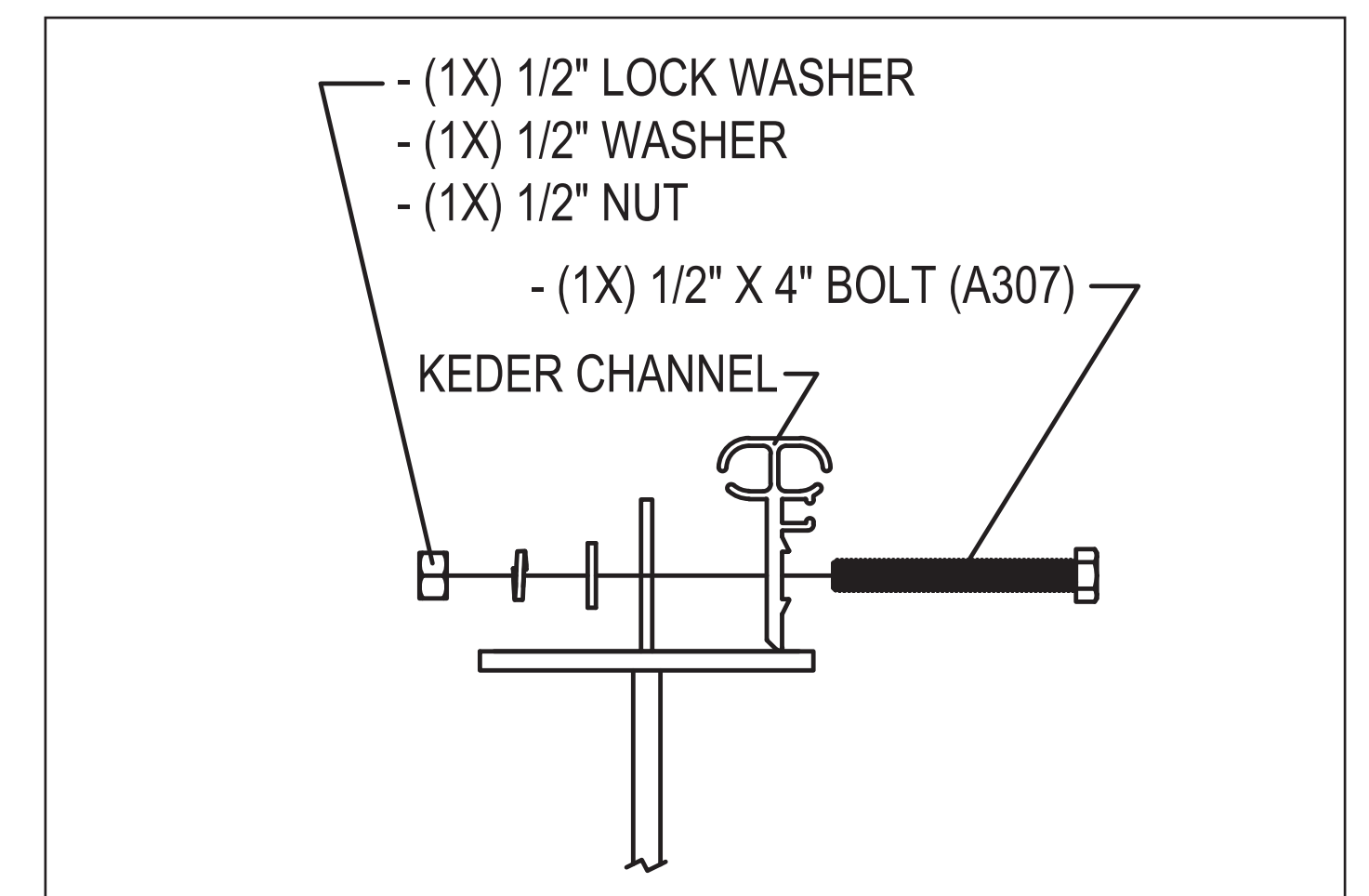
4. Mark the keder channel and cut to remove flange to allow for installation (D).
5. Test fit the channel and make final cuts for proper fit (E).
6. Use the modified profile to mark and cut all lower sections of keder channel for remaining roof trusses.



7. Attach the keder sections to the roof trusses by installing the keder channel splice components (F). (See frame assembly guide if needed.)
8. Seal the splice seam by applying aluminum tape as described in the main frame assembly guide.
9. Move to the end rafter and tighten all mounting bolts to firmly secure the keder channel to the rafter.

IMPORTANT: Do not tighten the mounting bolts on any other rafter at this time. These are tightened after each cover panel is installed.

10. Remove the termination keder (A) if the building includes soffit panels and fascia.
11. Continue with the next procedure.



Stage Keder Channel for Cover Installation & Attach Keder Channel to Top Cover Brace (TCB)

2

After installing the final sections of keder for cover installation, move to one frame end bay and stage the keder for pulling the first cover panel. Next, if building is equipped with soffit panels, attach the keder channel to the top cover braces (TCB) as shown.

STAGE KEDER CHANNEL FOR COVER INSTALLATION — RECOMMENDED

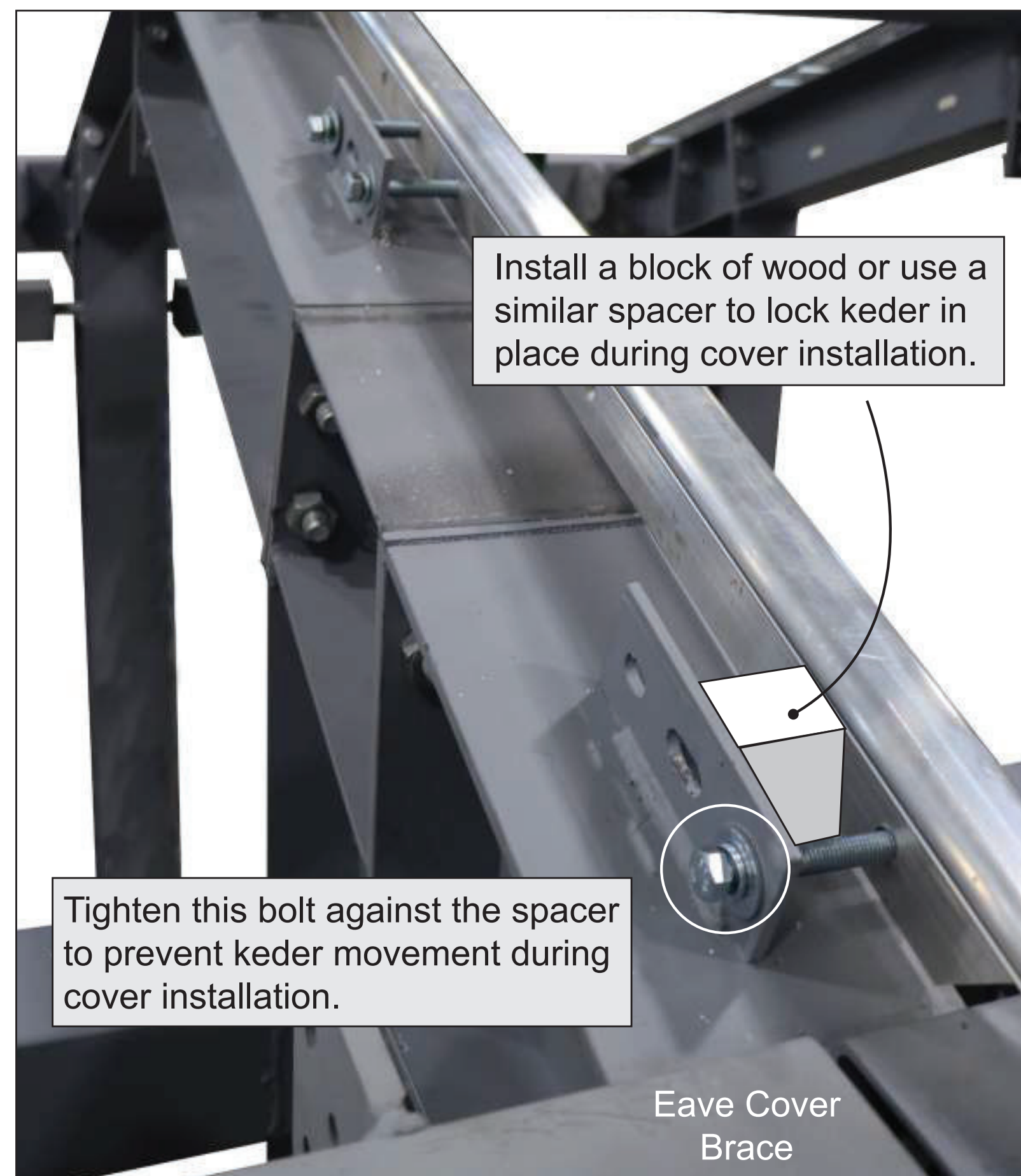
ATTENTION: For best results, especially for buildings wider than 73', staging the keder channels as shown below *before pulling a cover panel* is helpful.

Complete these steps to stage the keder:

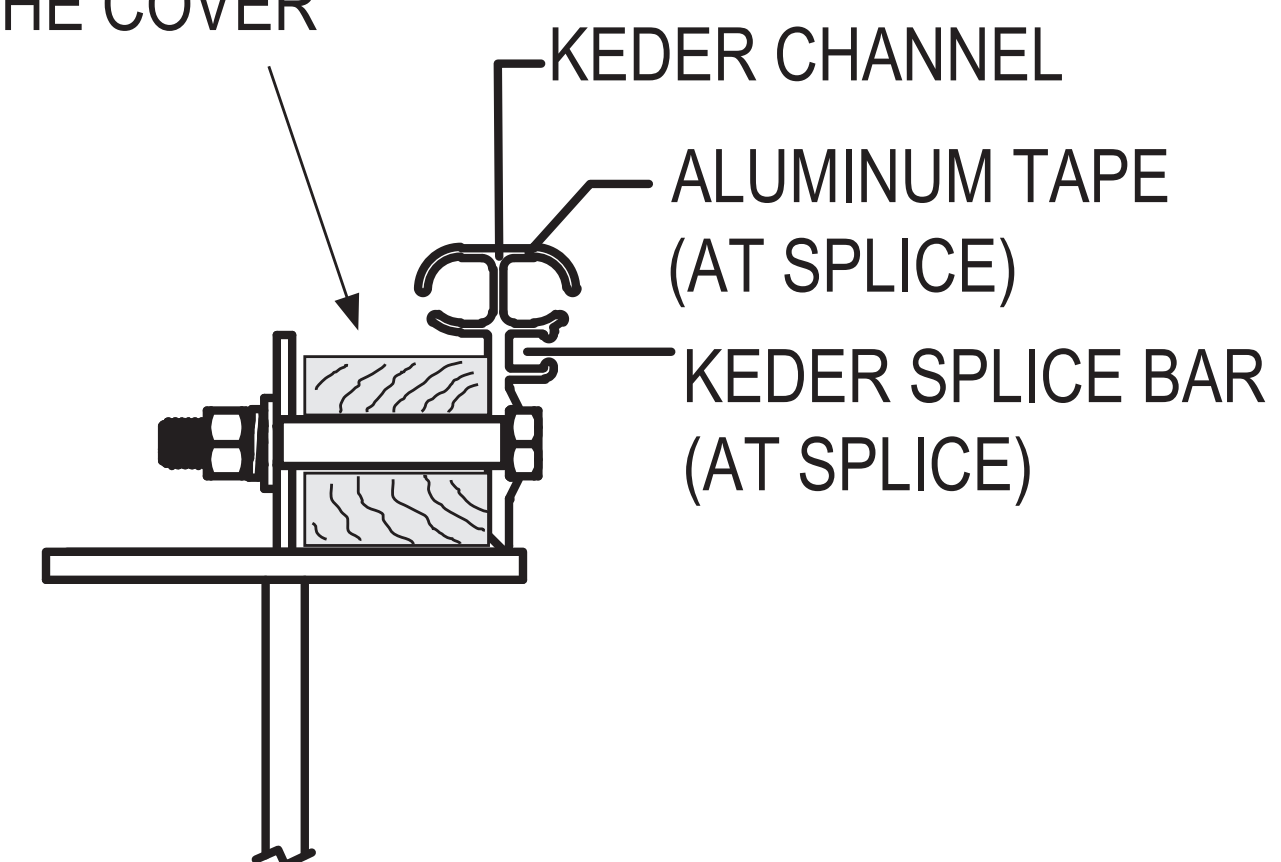
1. Move to the first bay at one end of the assembled frame and ensure all mounting bolts are tight regarding keder channels attached to the *end rafter*.
2. Move to the first interior rafter and loose all mounting bolts if needed. See photo below.
3. At the eave position where cover will be staged for pulling (later procedure), place a wood block or similar spacer between the keder channel and mounting flange welded to the roof truss.
4. Slightly tighten the mounting bolt(s) to hold block in place.
5. Move toward the top of the roof truss and repeat the steps to add another block spacer. This helps keep the keder channel running parallel with the roof truss during cover installation and prevents movement of the keder channel.

ATTENTION: The number of spacers depends on the length of the roof truss segment.

6. Move to the other side of the same interior roof truss and install the spacers as needed along that section.
7. Read the information in the next column and proceed as instructed.



NOTE: USE LUMBER AS NEEDED TO SPACE THE KEDER AT THE CORRECT DISTANCE FOR RUNNING THE COVER



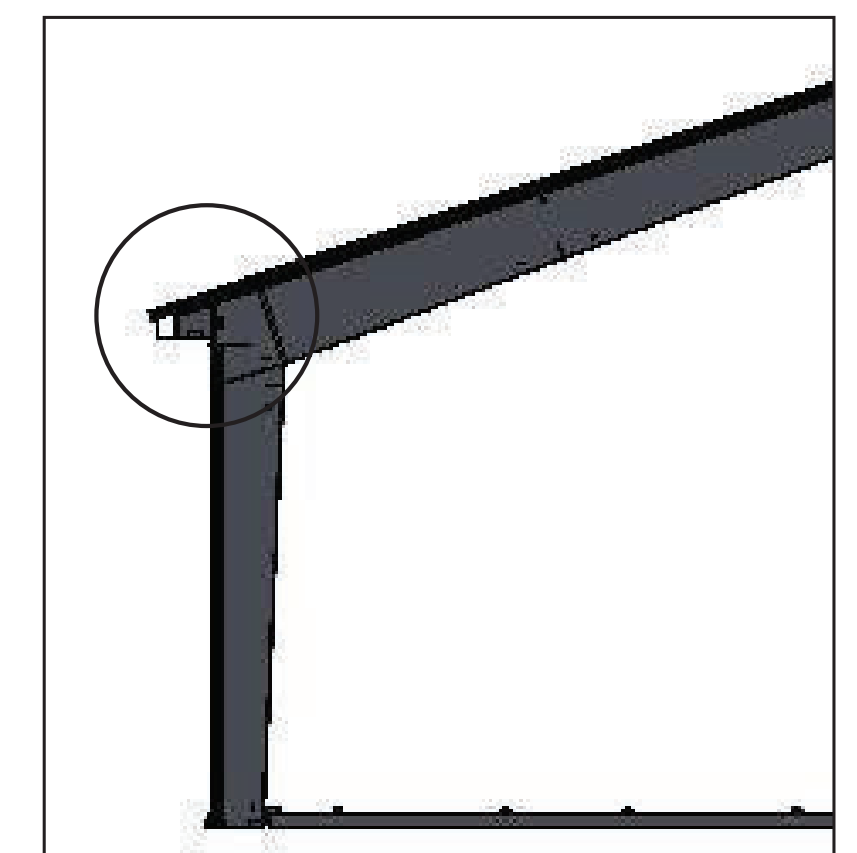
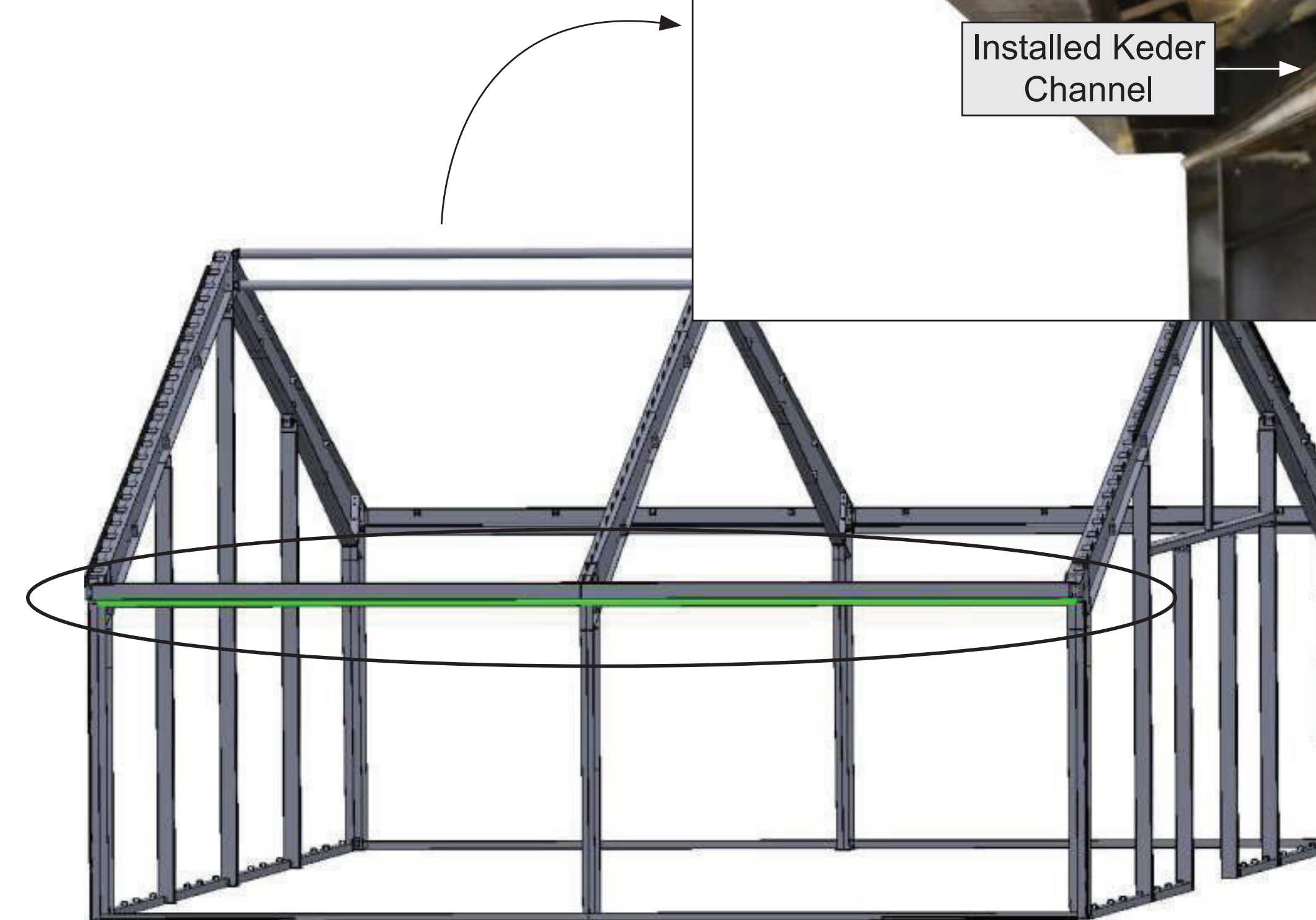
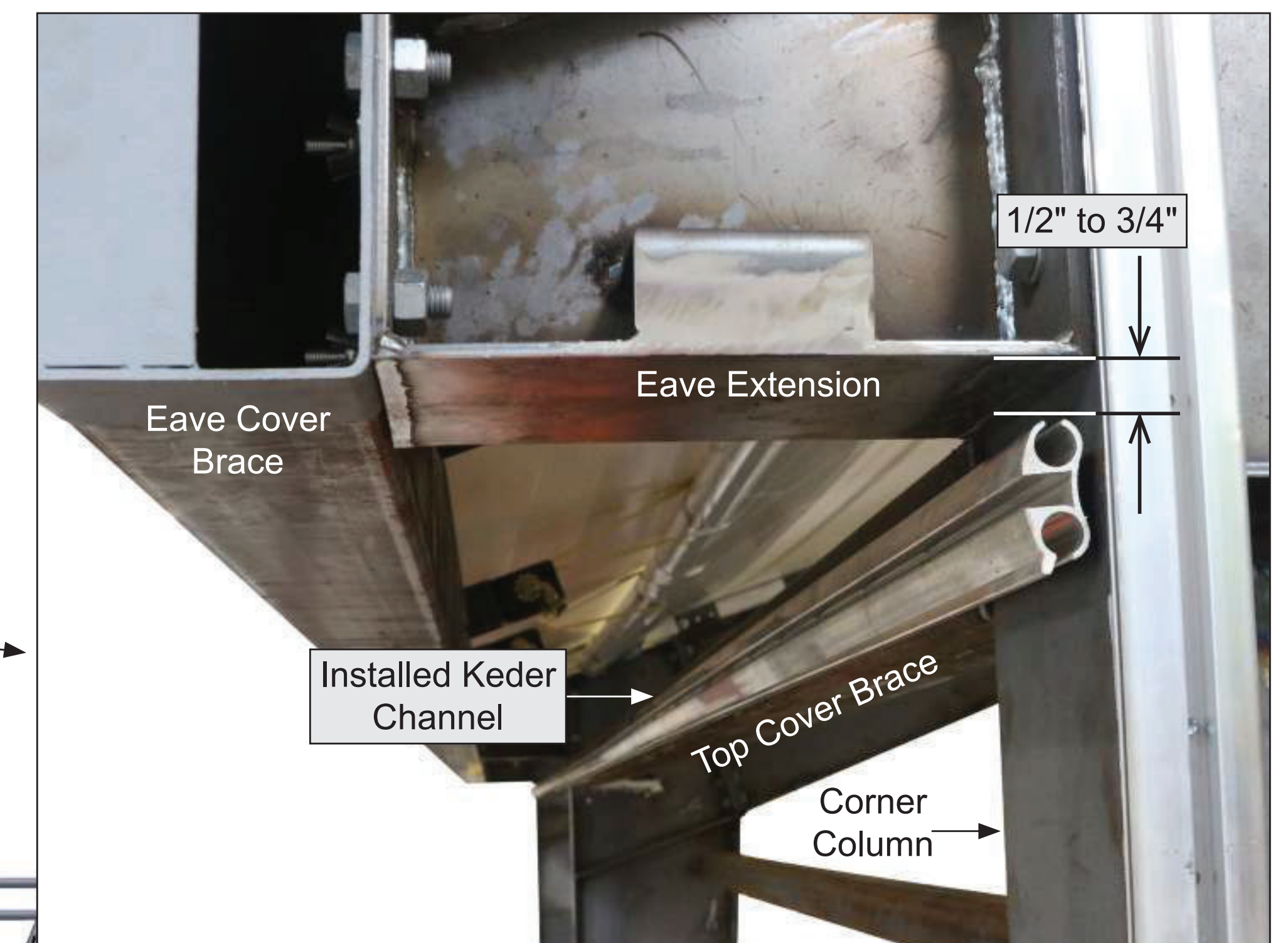
KEDER AT ROOF STAGED

ATTACH CHANNEL TO TOP COVER BRACE (TCB) — APPLIES TO BUILDINGS WITH SOFFIT OR SIDE PANELS ONLY

ATTENTION: THIS KEDER IS USED TO INSTALL AND SECURE SOFFIT PANELS AND SIDEWALL PANELS. IF BUILDING INCLUDES AT LEAST ONE OF THESE OPTIONS, INSTALL THE KEDER AS SHOWN BELOW. IF BUILDING IS WITHOUT THESE ITEMS, SKIP TO AND CONTINUE WITH SECTION 4. REVIEW MAIN BUILDING DRAWINGS FOR ADDITIONAL DETAILS AND KEDER PART IDENTIFICATION.

Complete these steps:

1. Review the diagrams in the main building drawings and locate the fasteners and keder sections to install.
2. Measure approximately 1/2" to 3/4" down from the underside of the eave cover brace (ECB) or eave extension (EE), depending on building design, and mark. Snap a chalk line to mark the dimension on each sidewall column.
3. Clamp or hold the keder channel in place and secure to top cover brace. Space screws according to the details presented in the main drawings for the building.
4. Continue installing the keder along the first side.
5. Cut the last section to length if needed.
6. Repeat to install keder along the remaining side.
7. Continue with the next section.



Install Soffit Panels & Facia Trim (if equipped)

3

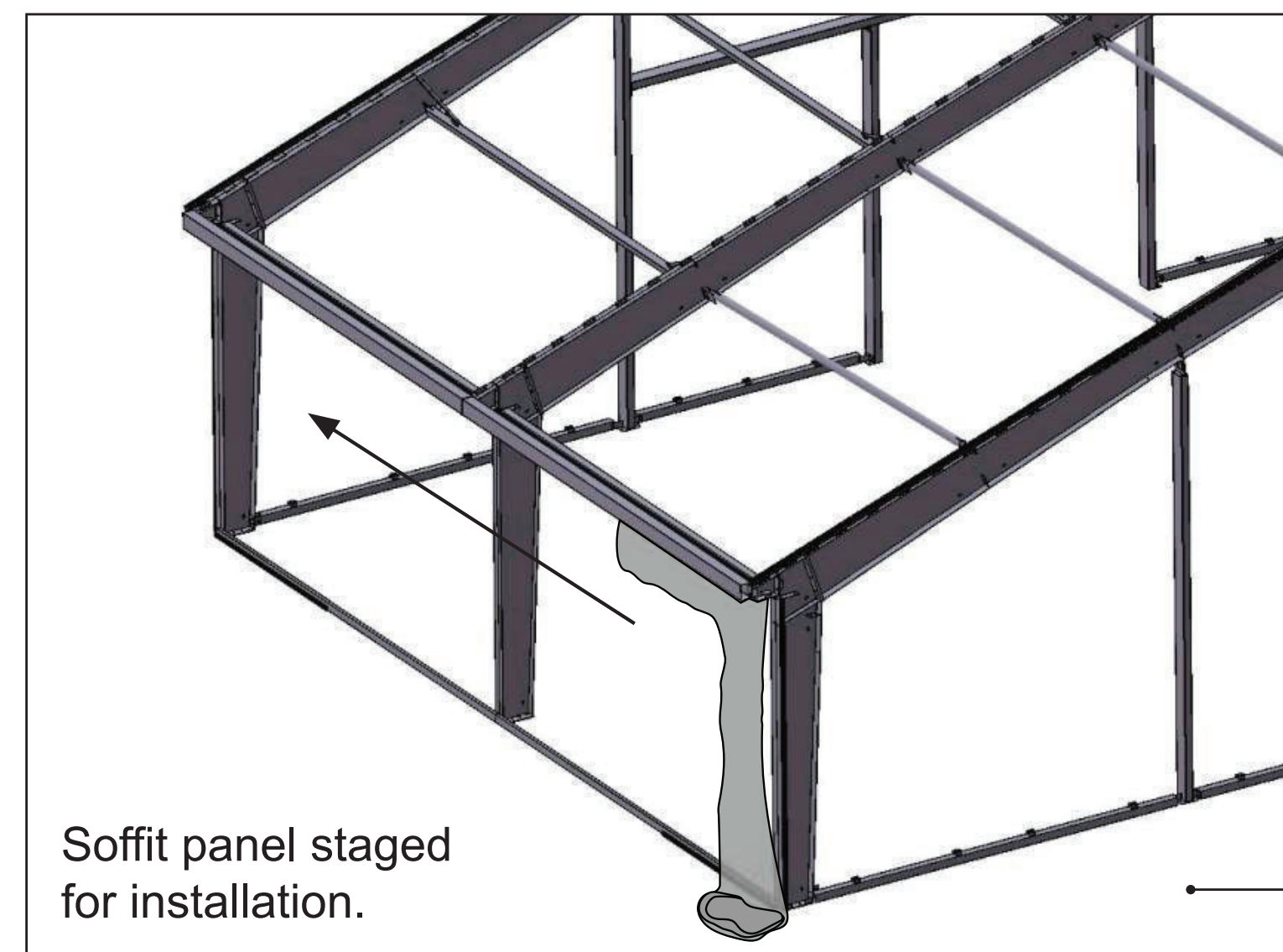
Review the main building drawings to determine the details and part numbers for the soffit panels and facia trim and to identify the required fasteners to install these items. Review the diagrams below before installing the soffit panels and facia trim.



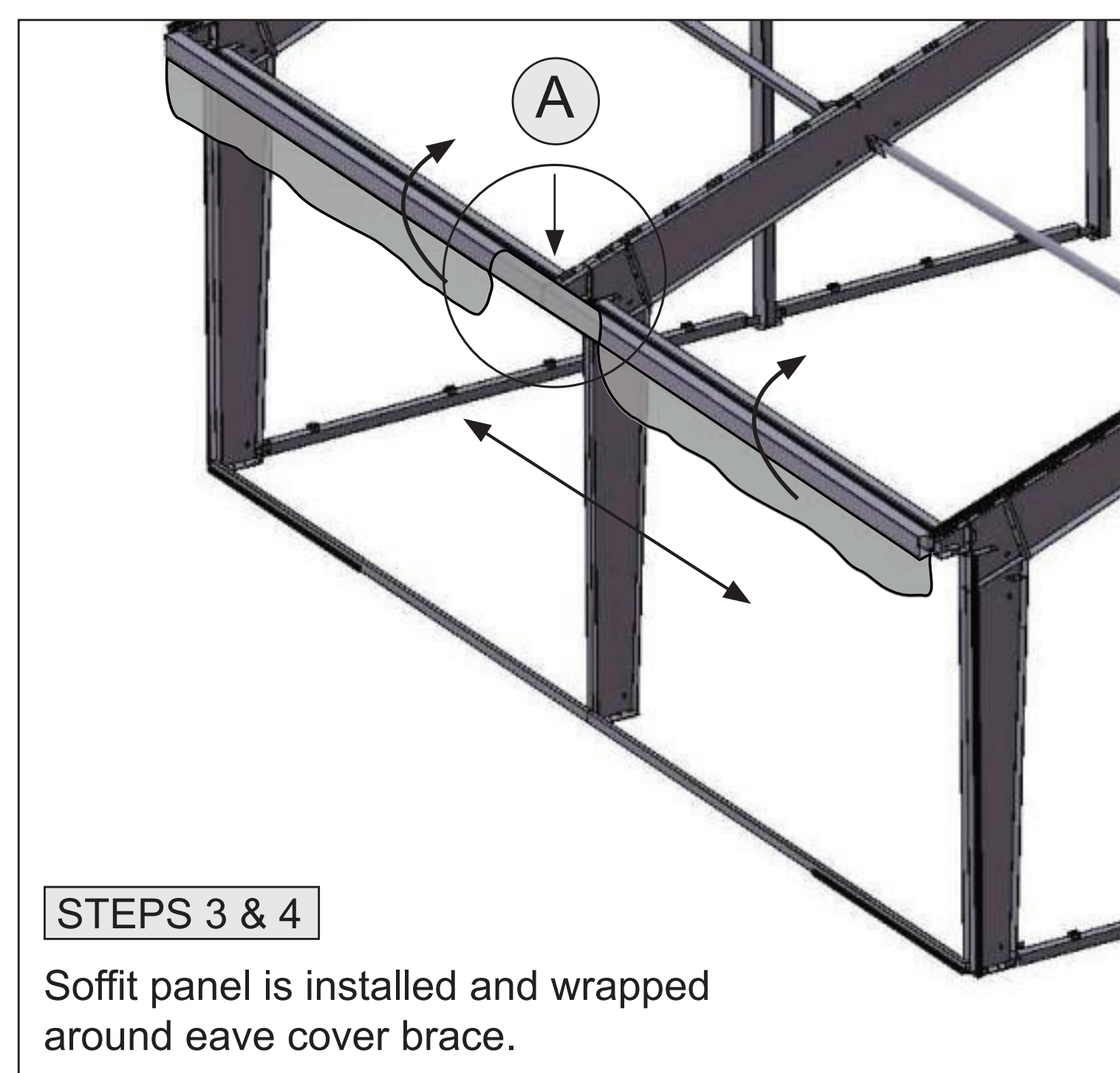
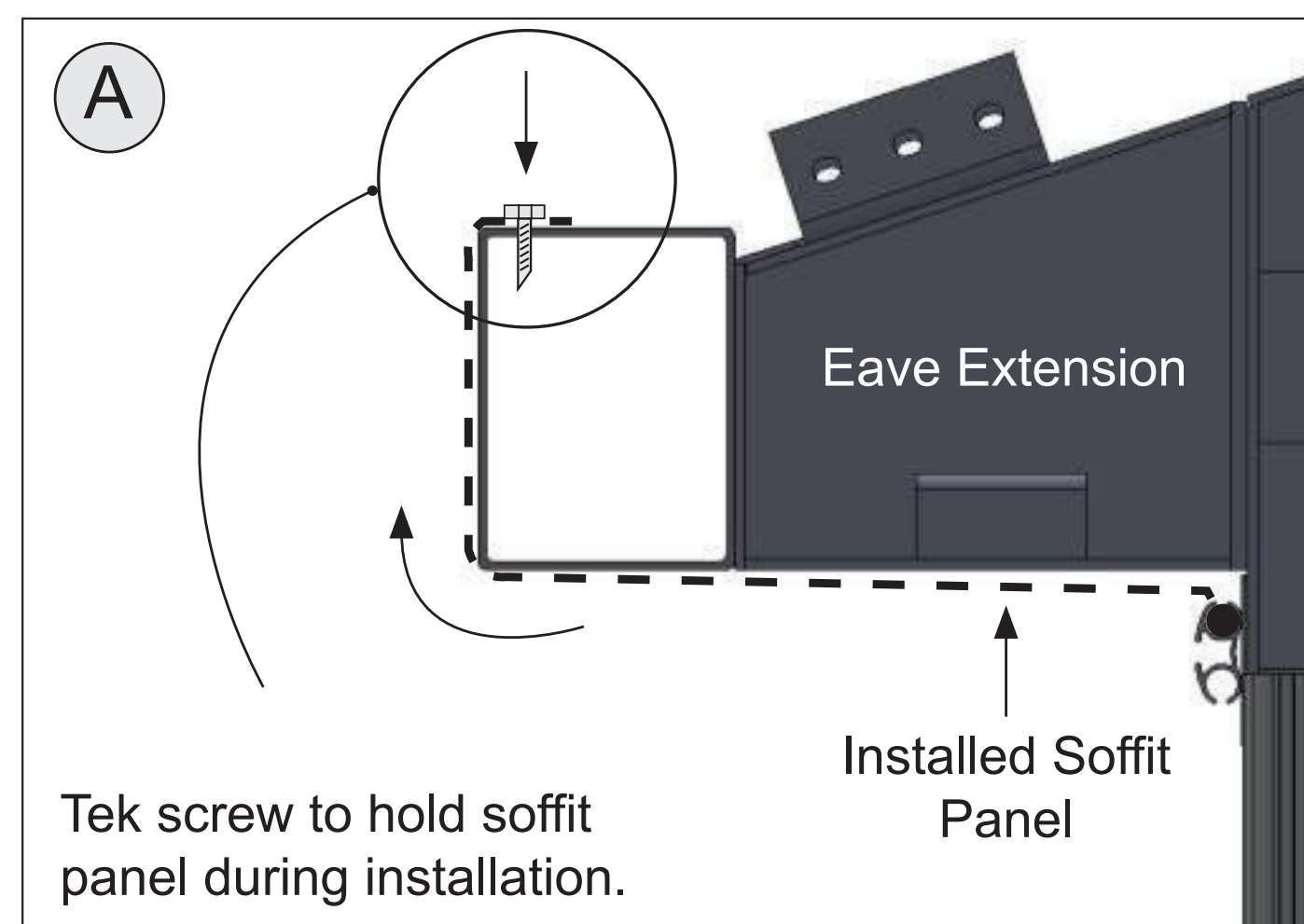
ATTENTION: IF THE BUILDING IS WITHOUT SOFFIT PANELS AND FACIA TRIM, SKIP THIS SECTION AND CONTINUE WITH THE NEXT SECTION.

Complete these steps:

1. Take a soffit panel and feed the keder into **the upper channel of the keder channel** attached at the eave position.
2. With assistance, pull the soffit panel into the channel until panel hangs down at the top of the sidewall. Center the panel in the channel end-to-end. Use liquid soap to lubricate panel rope and keder channel if necessary.

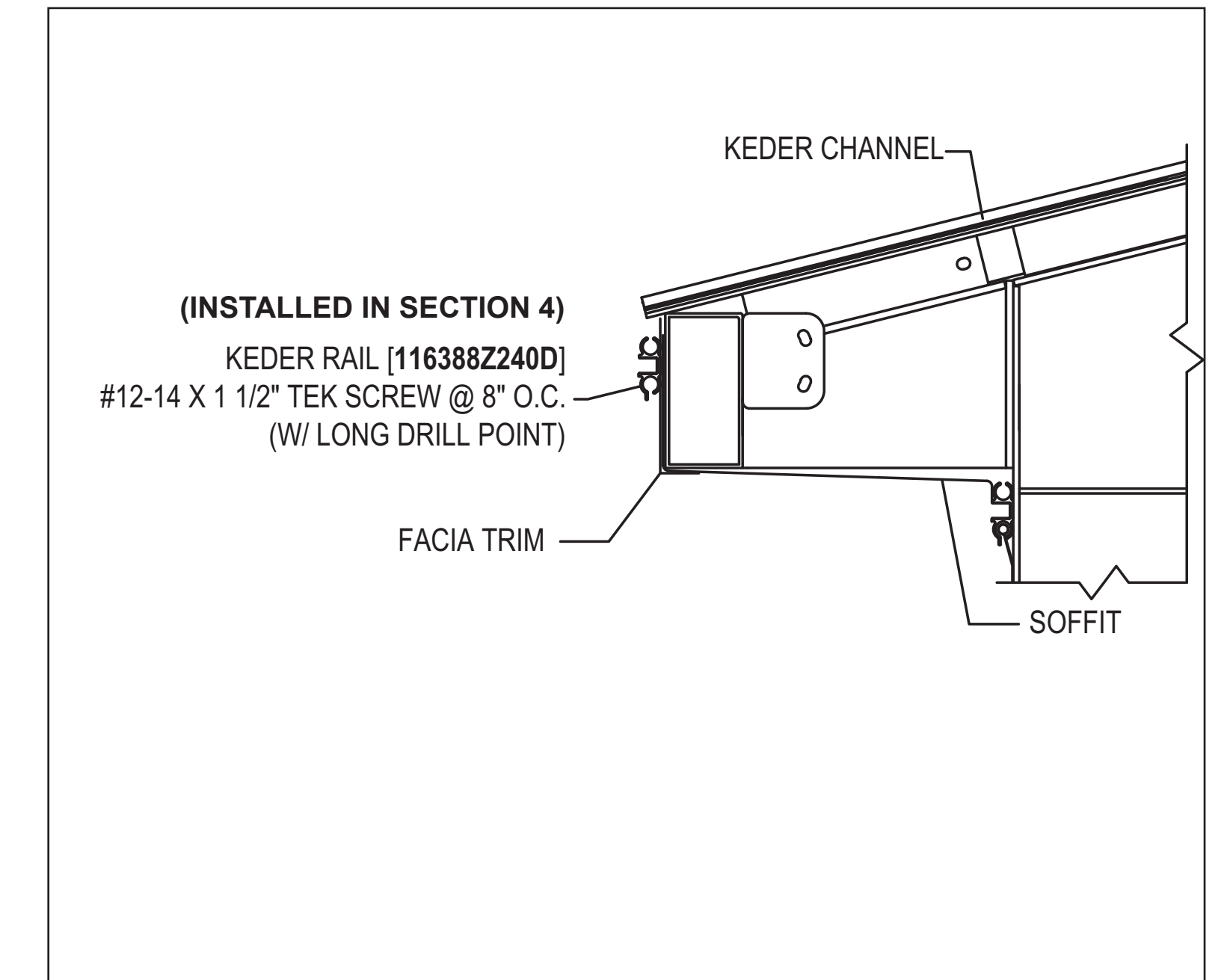


3. Beginning at the middle, wrap the free edge of the panel up and around the eave cover brace until it reaches the top surface of the brace. See A below.
4. Using a Tek screw, secure the edge to the top of the eave cover brace.



ATTENTION: The procedures on this page describe the installation of the soffit panel and facia trim for one side of the building. Repeat these steps as needed to complete the installation for the other side.

5. Working in both directions from the center, continue pulling the edge up and around the eave cover brace and securing it to the brace. Space Tek screws as needed to hold the panel edge in place. Keep the panel stretched end-to-end to remove wrinkles. Use just enough screws to hold panel; see note that follows.

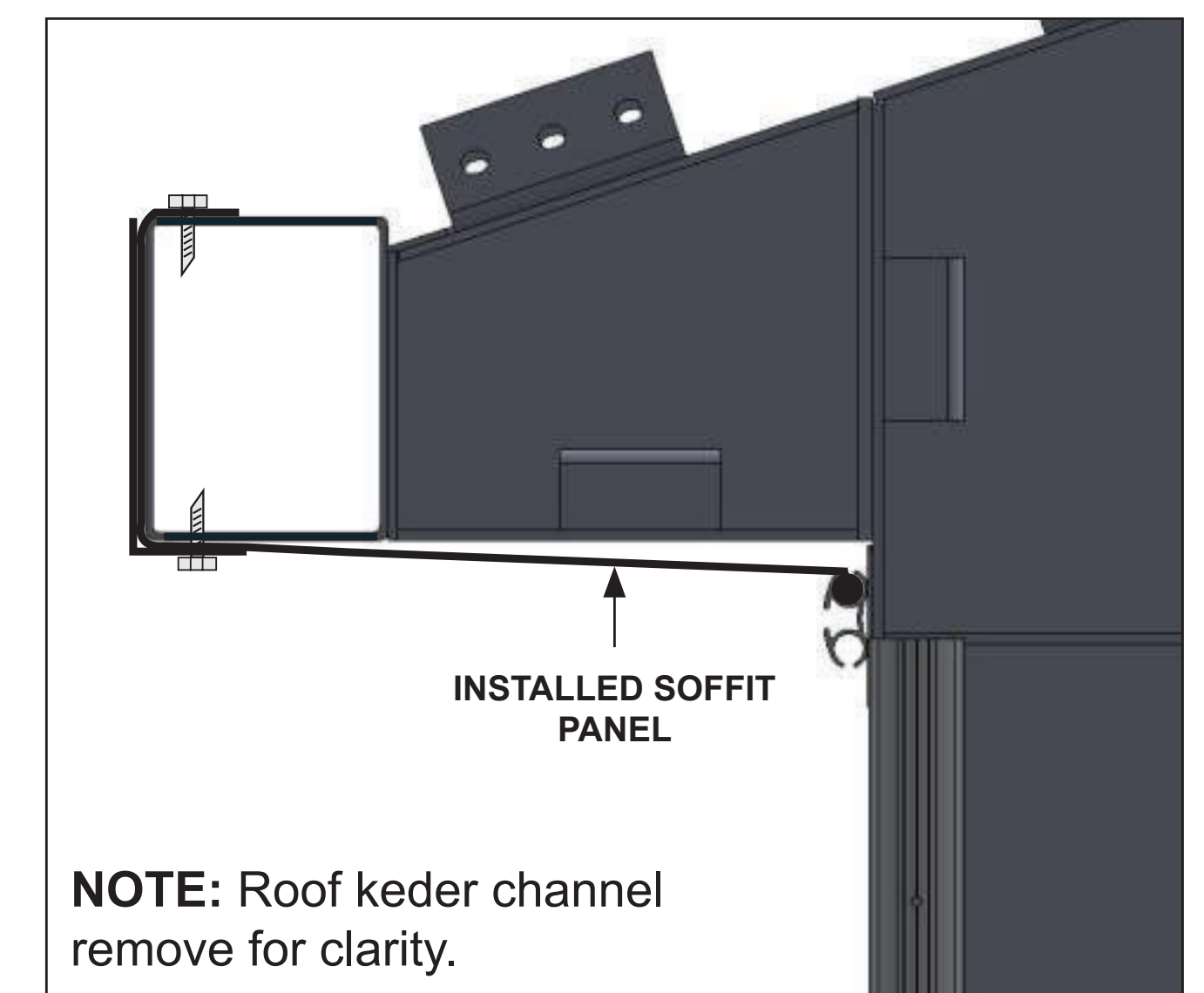
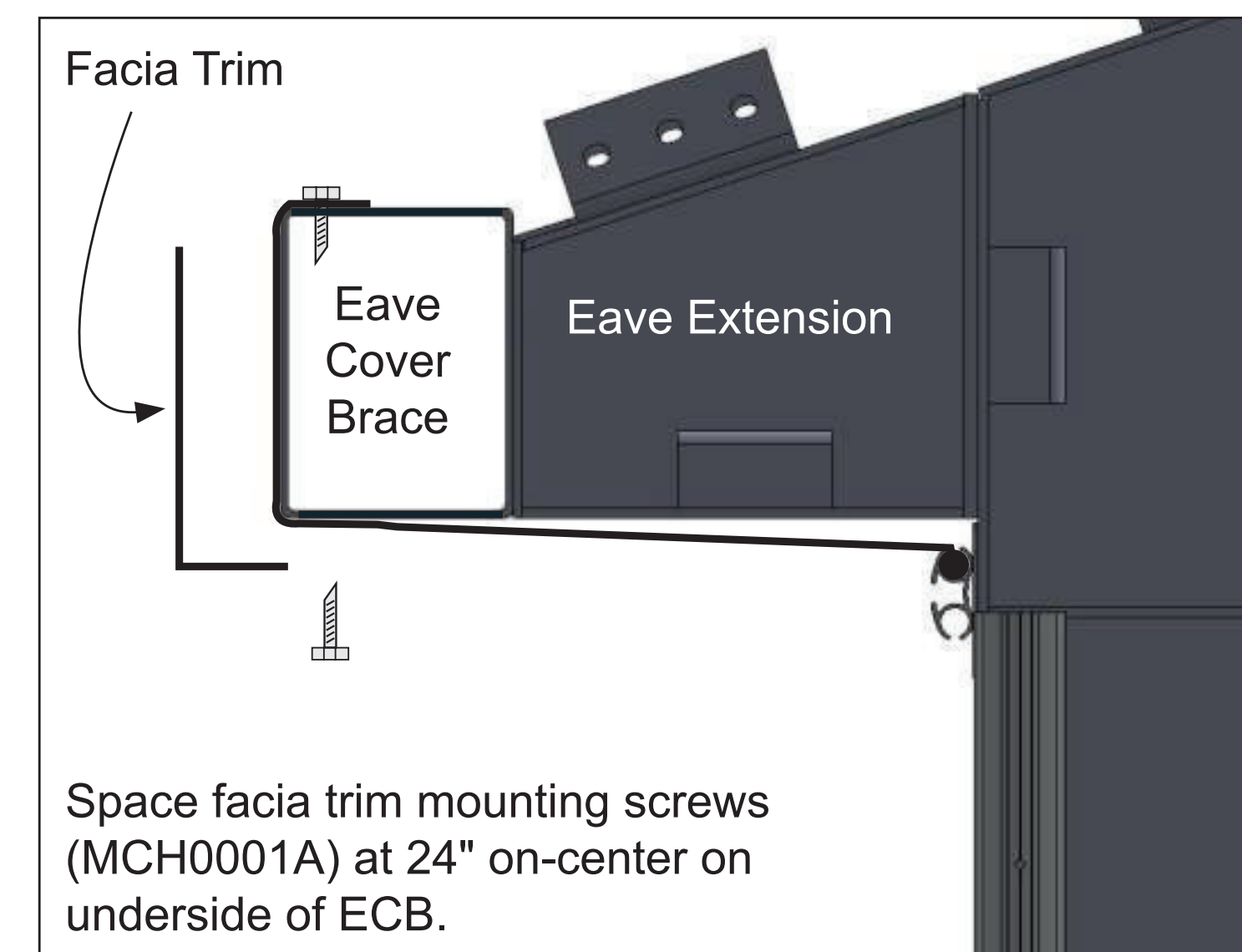


NOTE: The installation of facia trim over the panel and the keder channel over the trim will secure the soffit panel as needed. See drawing details for clarification if needed.

6. Once panel is temporarily secured, continue by installing the facia trim.

ATTACH FACIA TRIM (MCT0003XXX) TO EAVE COVER BRACE (ECB)

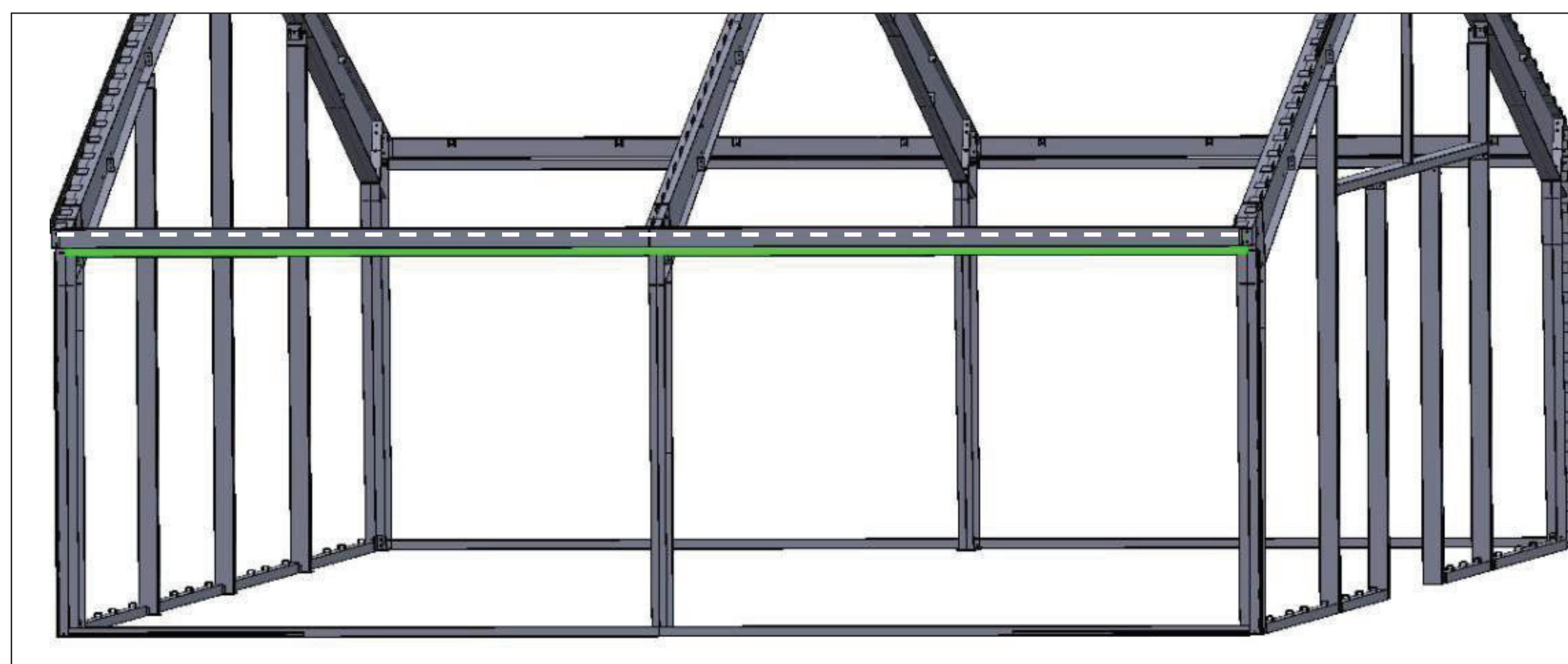
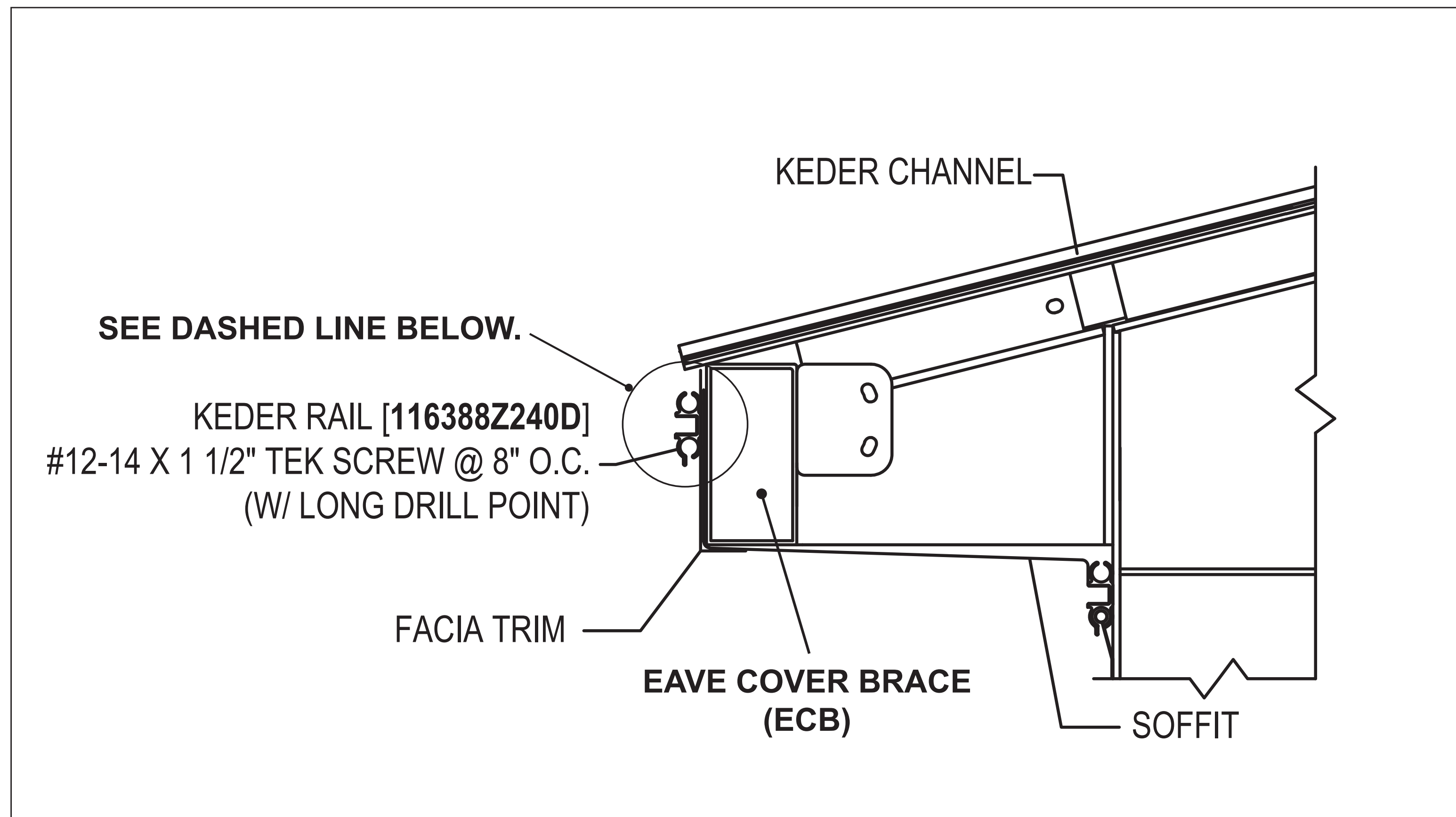
After installing the soffit panel, attach the facia trim to the eave cover brace as shown below. Top edge of facia trim is secured once the keder channel for cover termination is installed. See next section.



Attach Keder Channel to Eave Cover Brace (ECB)

4

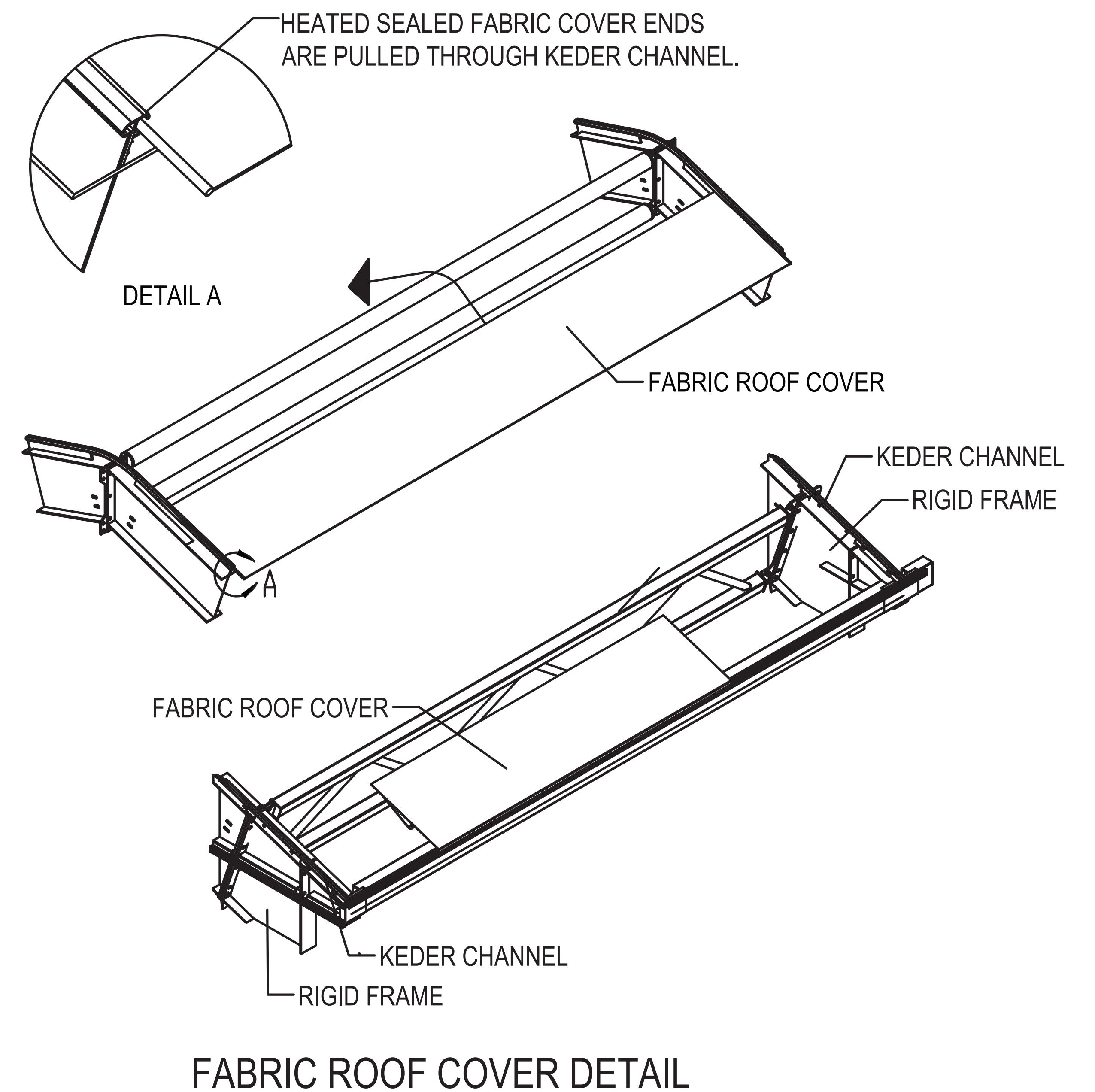
The keder channel to terminate the main cover attaches to the eave cover brace. When a soffit panel and fascia trim are present, the keder channel also secures these items. Use the information below and in the main building drawings to attach the keder channel to the eave cover brace for cover termination along both sides.



Dashed line shows where to install the cover termination keder channel. Cut the last section to required length.

ADDITIONAL DETAIL FOR COVER INSTALLATION (SECTION 5)

NOTE : INSTALL COVER BY PULLING EACH END OF FABRIC COVER THROUGH ADJACENT KEDER CHANNELS SIMULTANEOUSLY.



Install Cover Panels

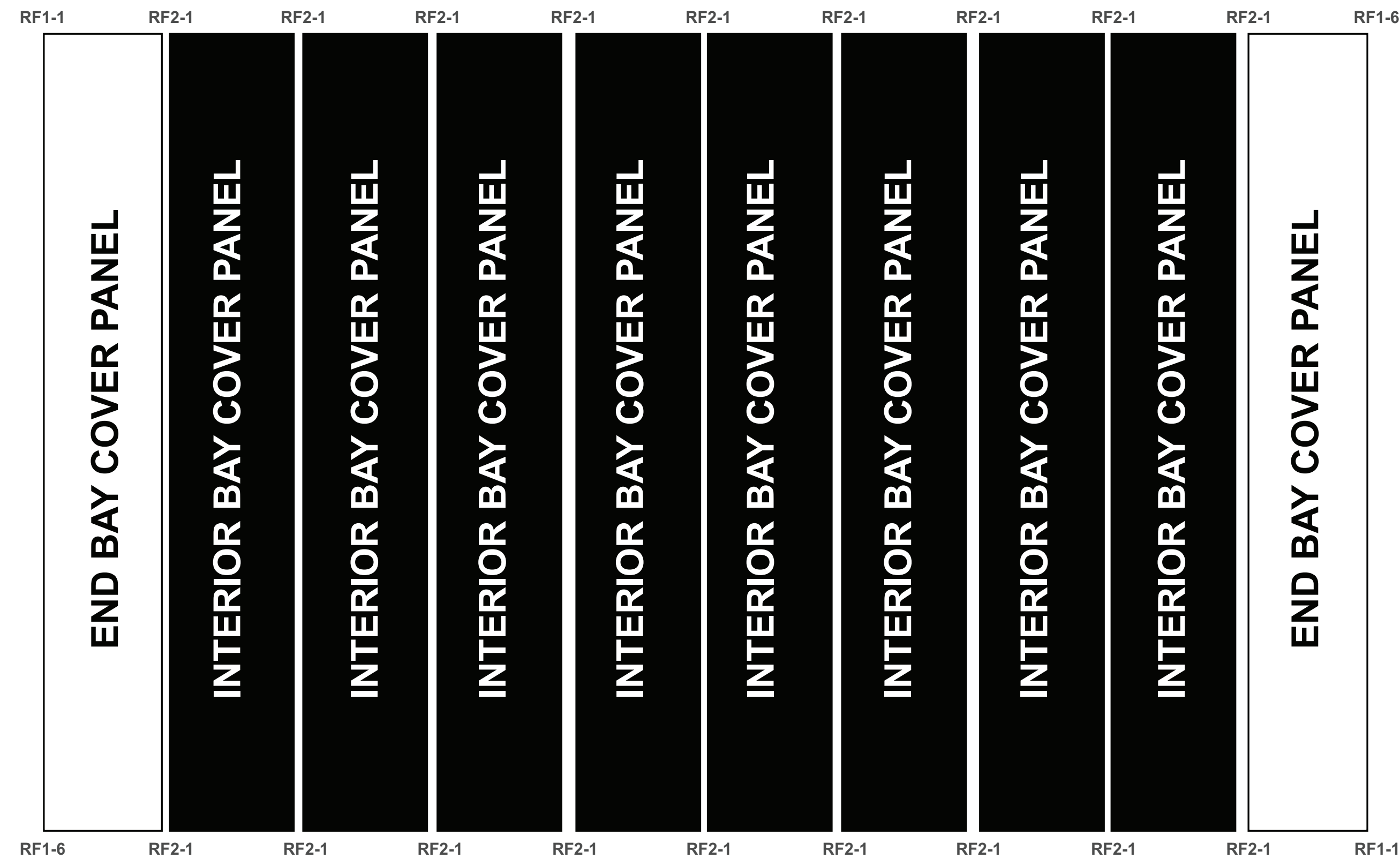
5

Install cover panels beginning at one end of the assembled frame and working toward the other. Information in this section describes the installation of a single cover panel. Repeat the steps as needed to install all panels.

ATTENTION: Install the first cover panel beginning *at one end bay of the building frame*.

Complete these basic cover installation steps:

1. Consult the Roof Framing Plan in the main building drawing packet to identify cover panel ID numbers and locations throughout the building length.



SAMPLE PANEL LAYOUT DIAGRAM

ATTENTION: Depending on building design, typically the end bay main cover panels differ in size compared to the interior bay cover panels. **ALWAYS CONSULT THE MAIN BUILDING DRAWINGS BEFORE COVER INSTALLATION BEGINS.** Sample layout diagram above shows interior panels of the same size; end bay panels are the same.

For some buildings, interior cover panels may also vary in size. Consult the main building documents for details.

2. Pick the panel that corresponds with the end bay where you want to install the first panel. Move to that end bay and cover the ground where cover panel will be staged to protect and keep the cover cleaner during preparation.
3. Move cover panel into position at the base of the sidewall. Partially unroll/unfold roof cover panel to ensure it will unroll/unfold as desired when it is pulled onto the frame. Tensioning pockets remain on the underside of the cover panel once it is pulled into place.

4. Select a 24' long 3.50" pipe to use to pull cover panel onto frame. (Pipe length is longer than the rafter spacing of the frame.) Secure a 3.50" pipe cap (112161) to each end of the pipe.
5. Confirm you have selected the correct panel to install at the first end bay and insert the 24' long pipe into the end pocket of the cover panel. Center the pipe in the pocket once installed.



6. Measure approximately 12" **from the pocket edge** and cut the panel pocket as shown to prepare for pull strap installation. **CUT ONLY THE PANEL POCKET! DO NOT CUT THROUGH THE PANEL!**



7. Repeat the step to prepare cover pocket at the other end of the pipe.

Install Cover Panels — continued

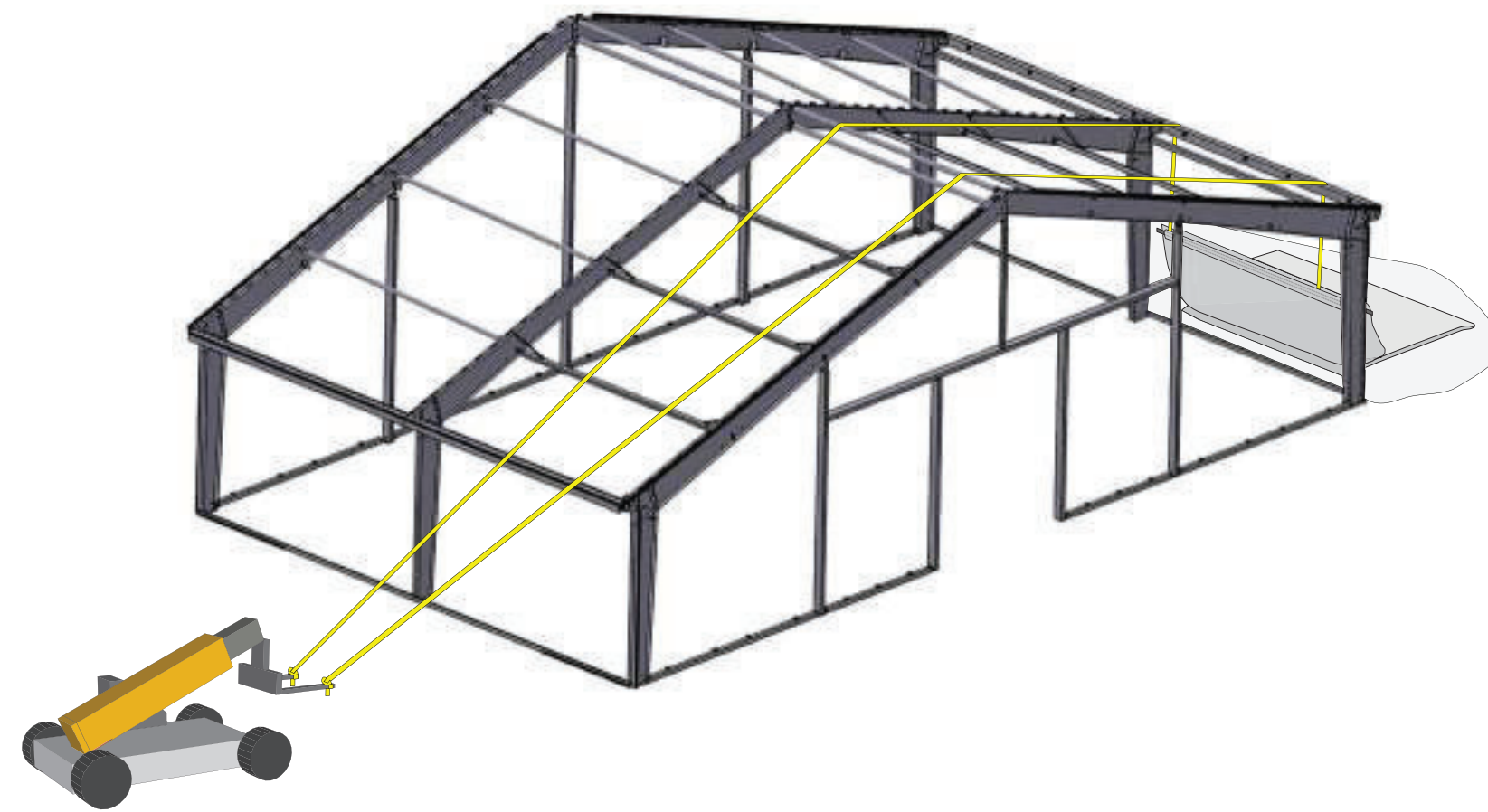
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INSTALL COVER PANELS — CONTINUED

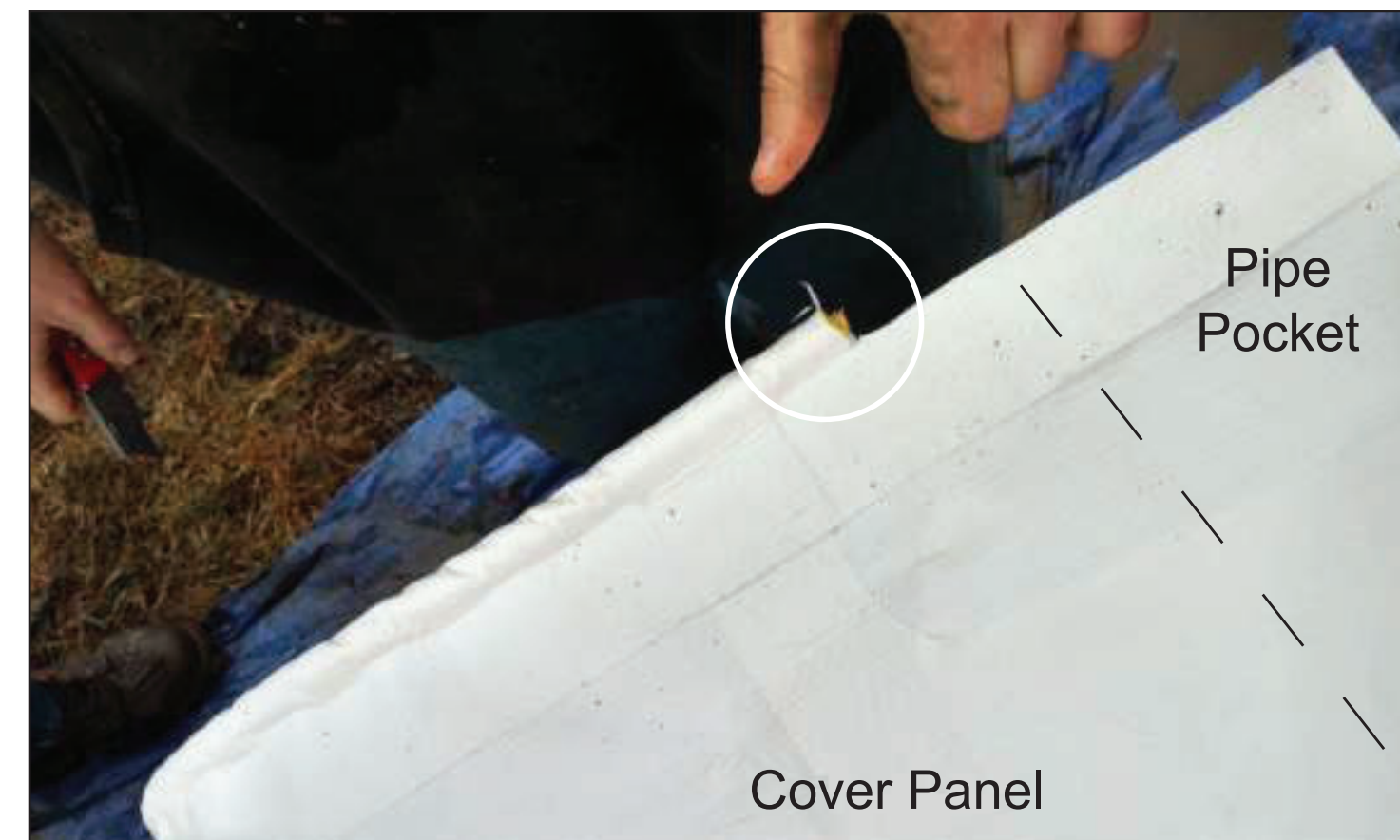
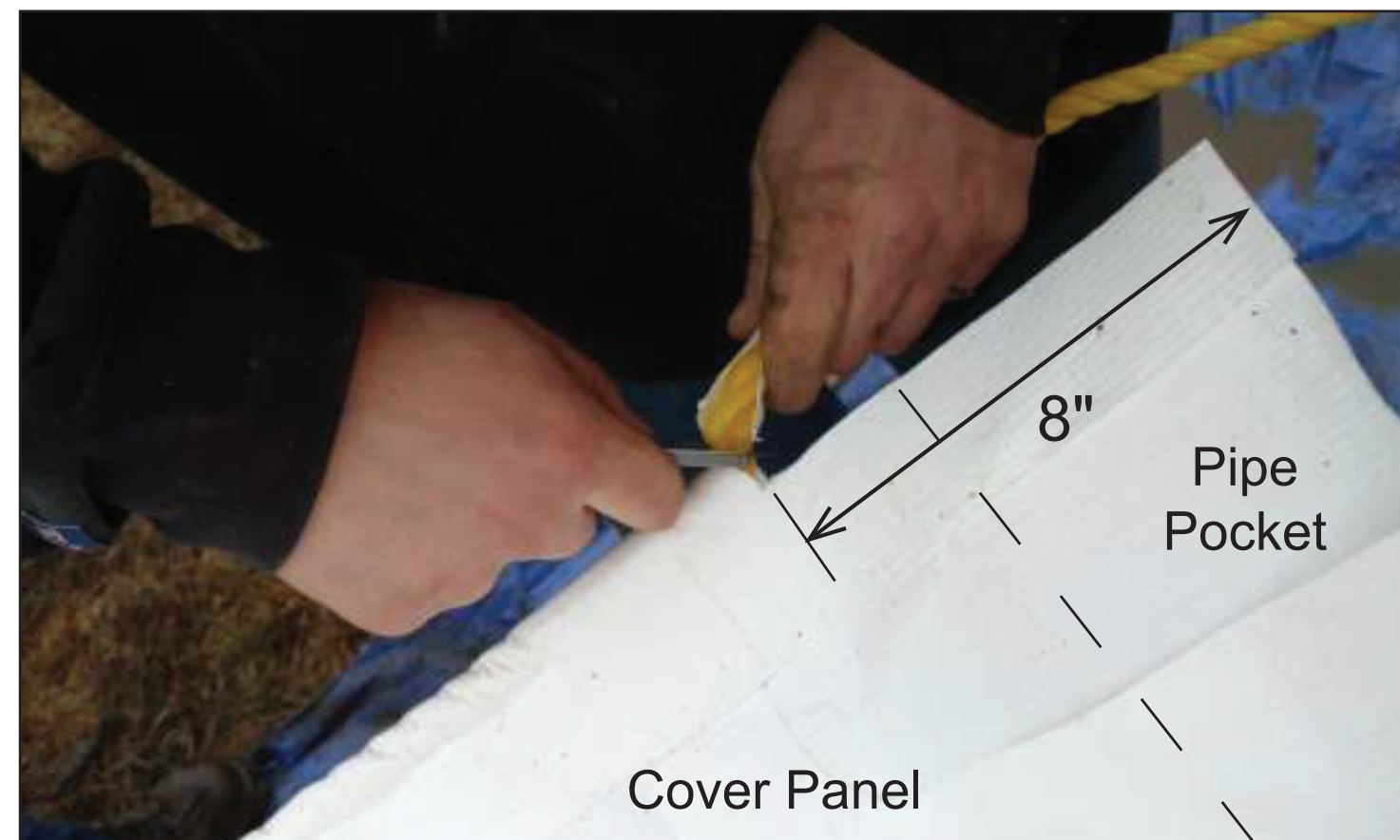
8. Position the lift (or pulling vehicle) opposite the cover panel on the other side of the frame bay.
9. Take two lengths of yellow strap — each long enough to reach over the top of the frame to the other side. Tie one end of each strap to the pipe at the points prepared in the previous steps.



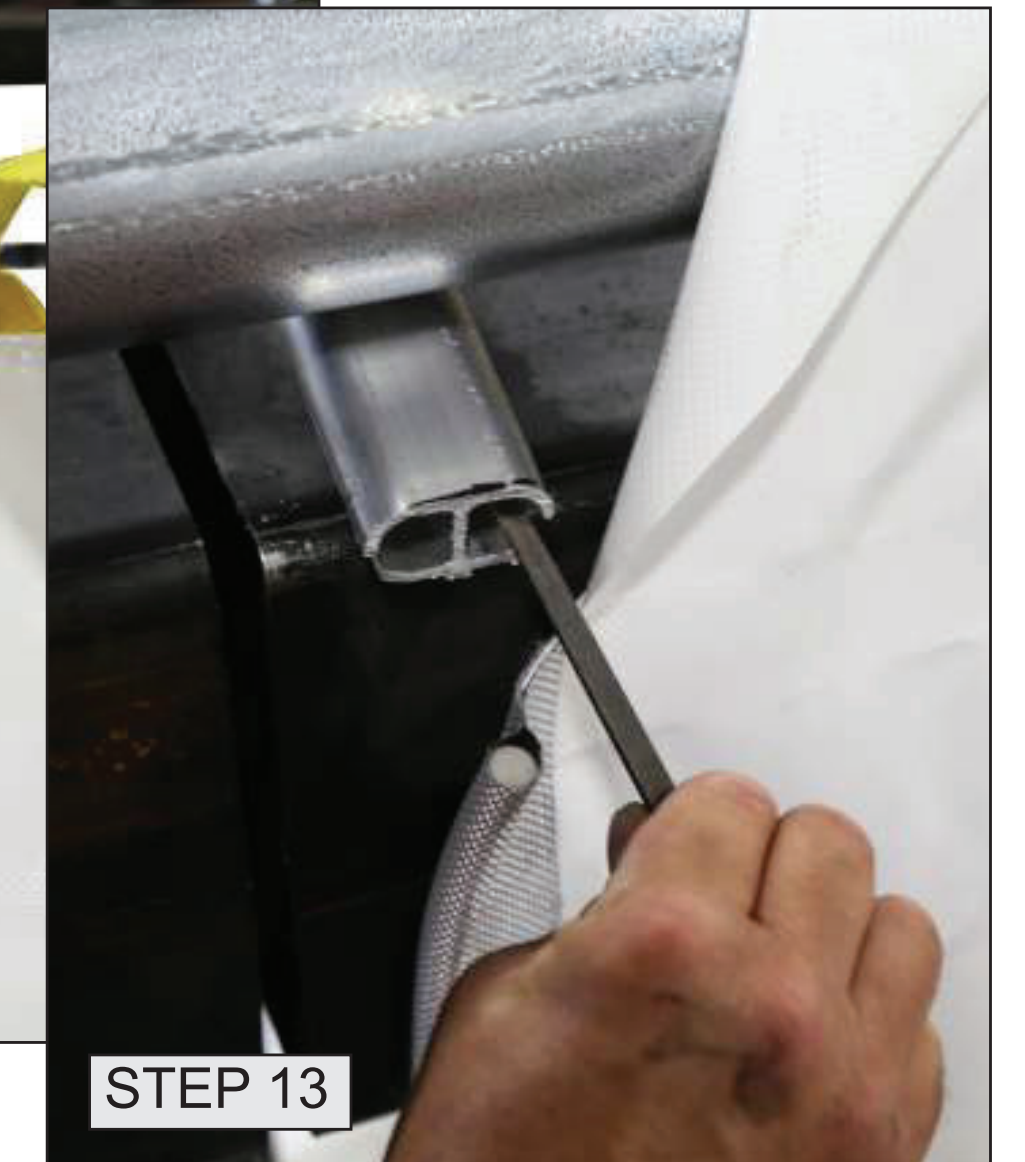
10. Toss the straps over the frame peak and tie the straps to the lift.



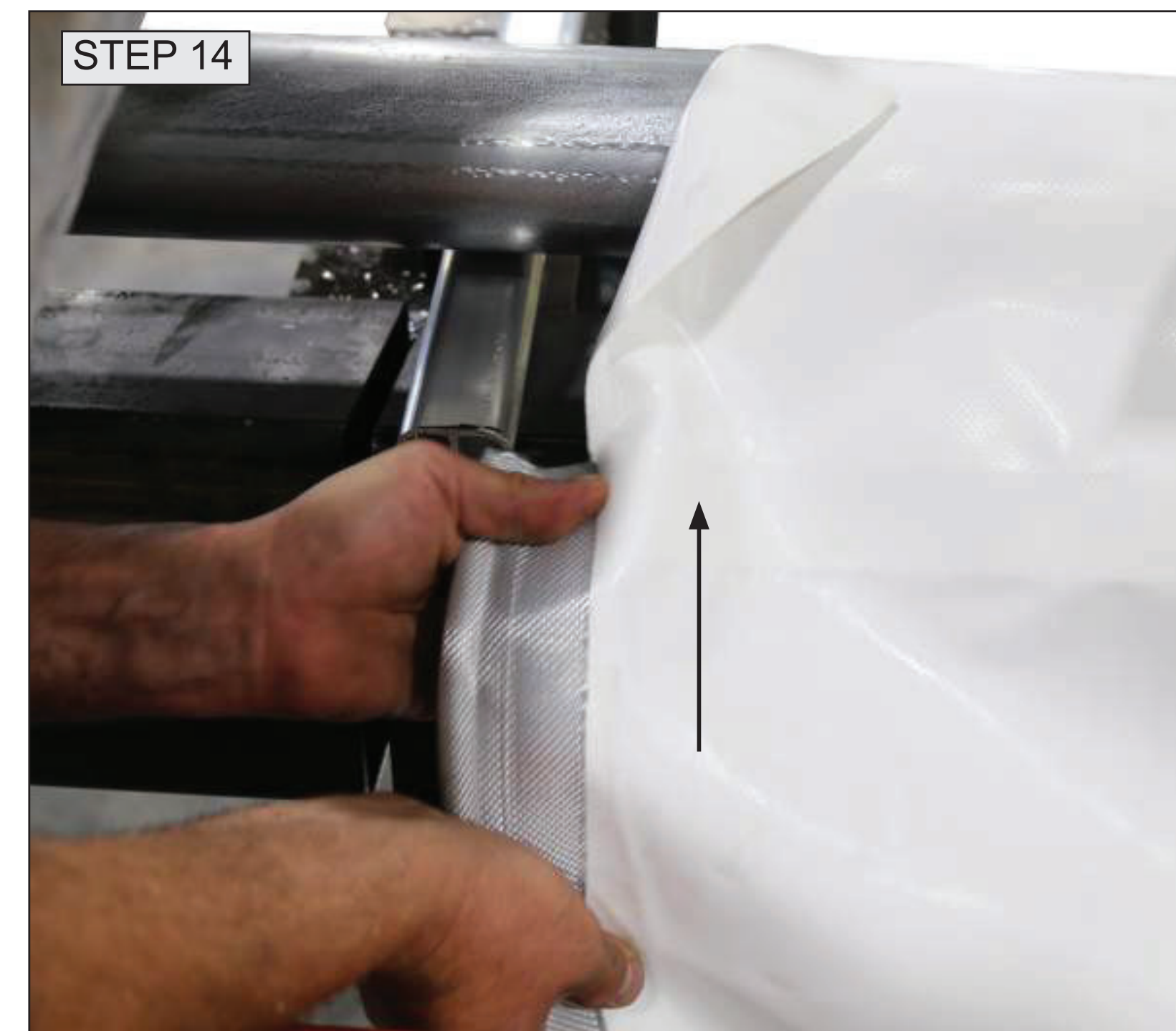
11. Prepare each keder edge along the panel as shown by trimming the rope back from the panel end.



12. Carefully lift the pipe and panel and position pipe ends on top of the keder channels attached to the rafters.
13. File smooth any burrs or sharp edges at both ends of the keder channels using a round metal file or similar tool.



14. After preparing keder channel for panel installation, feed the keder cords into the keder channel on both rafters.



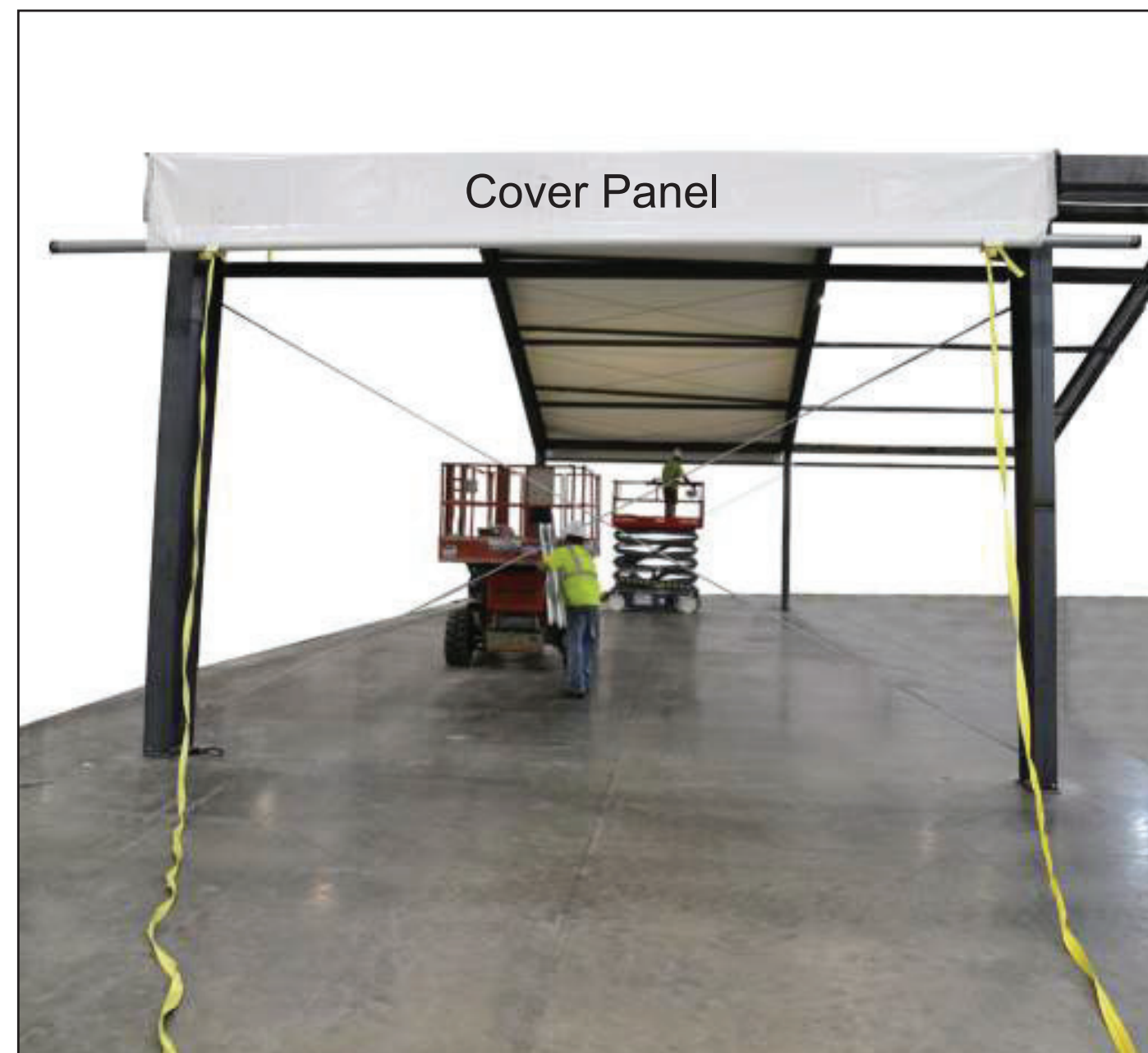
ATTENTION: See Section 2 for details regarding staging keder channels for panel installation if needed.

Install Cover Panels — continued

5

INSTALL COVER PANELS — CONTINUED

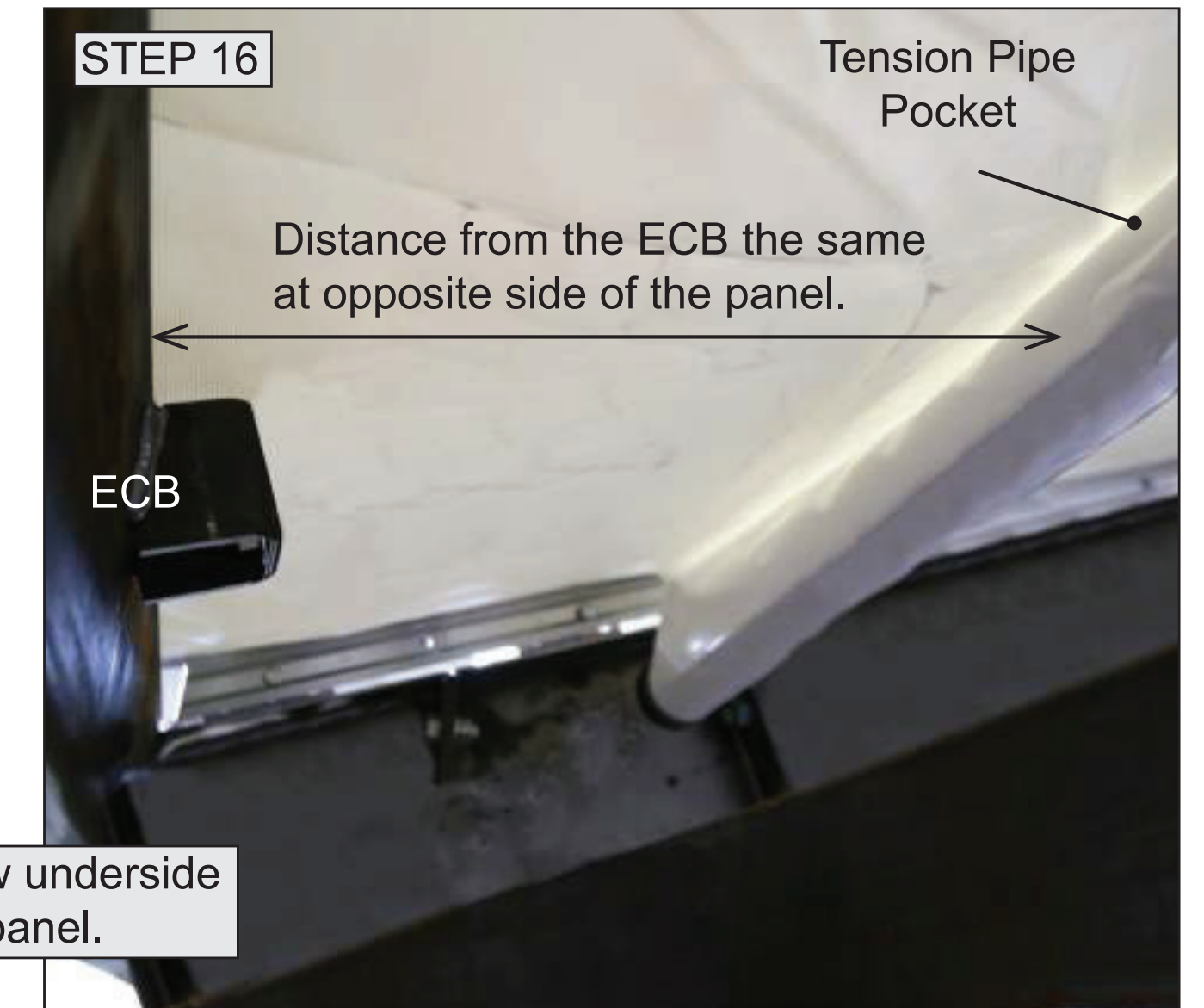
15. Carefully pull the keder-to-keder cover into place.



IMPORTANT: To ensure easier installation without damaging the panel, lubricate the keder channel and keder rope using a liquid soap mixture. Keder channel attached to interior rafter is tightened after panel is installed.

16. Verify cover is centered in the frame end-to-end and that the tension pipe pocket is equal distance from the eave cover brace (ECB) at both ends of the cover panel.

17. Carefully cut the pipe pocket at the mid point between the rafters to allow for the installation of the two (2) tension pipes for each pocket.



18. Take the first 3.50" diameter tension pipe, install the rubber end caps at each end, and slide it into the panel pocket from the center.



ATTENTION: Typical length of the tension pipes for a 20' wide on-center rafter spacing is 115". Consult main building drawings for additional details before inserting pipes into tension pipe pockets.

19. After inserting first pipe into pocket, take the second tension pipe and repeat the steps to install it in the remaining half of the pocket.

Install Cover Panels — continued

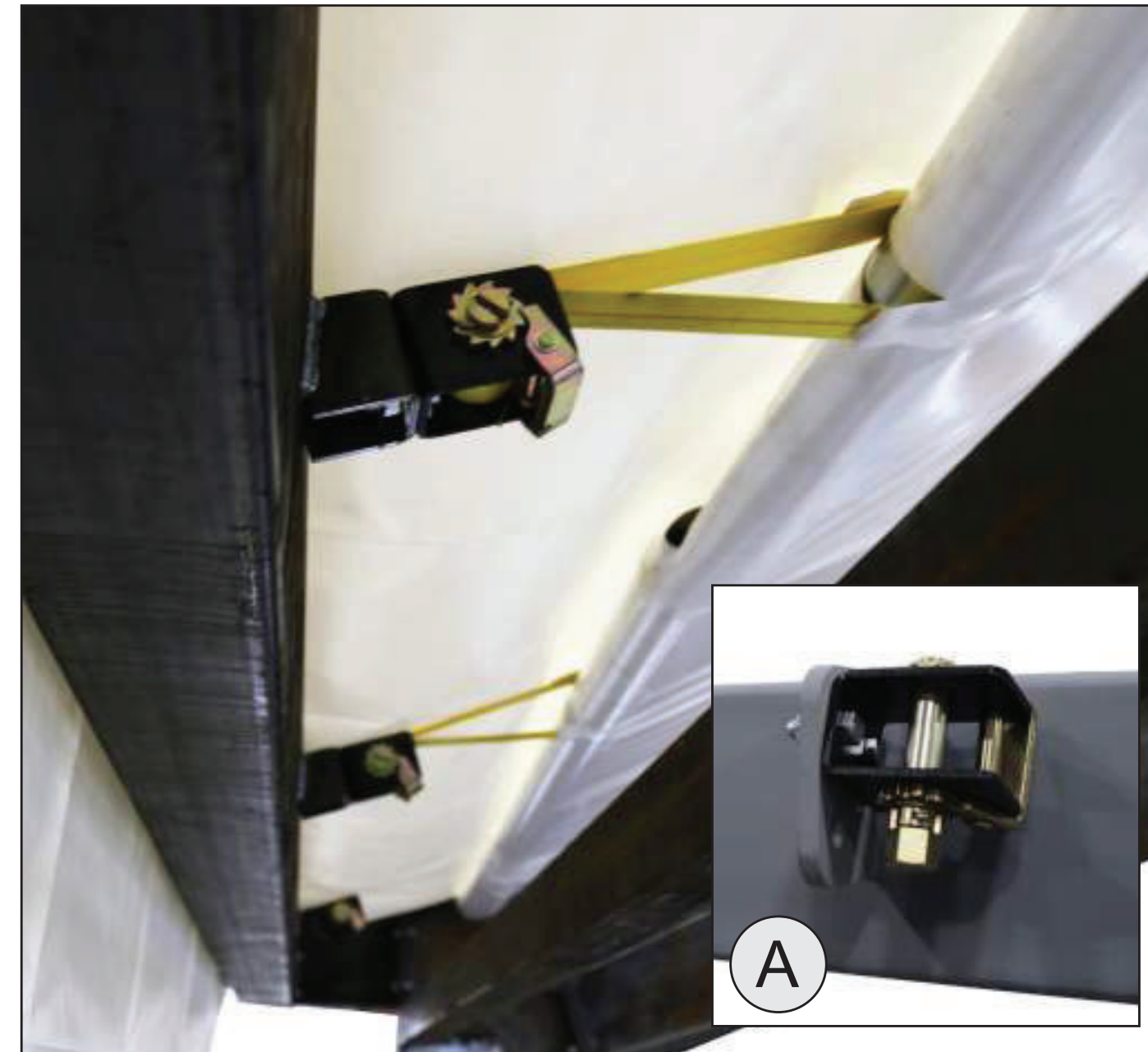
5

INSTALL COVER PANELS — CONTINUED

20. Locate the winch positions on eave cover brace (ECB) and cut a section of the pipe pocket to expose the tension pipe that aligns with each winch position.

ATTENTION: If winches were not attached to the ECB during the frame assembly, install those now. The panel position will shift slightly in the direction the panel is tensioned when keder channel on the interior rafter is tightened. Be sure to account for this change in position when cutting strap positions in the panel pocket.

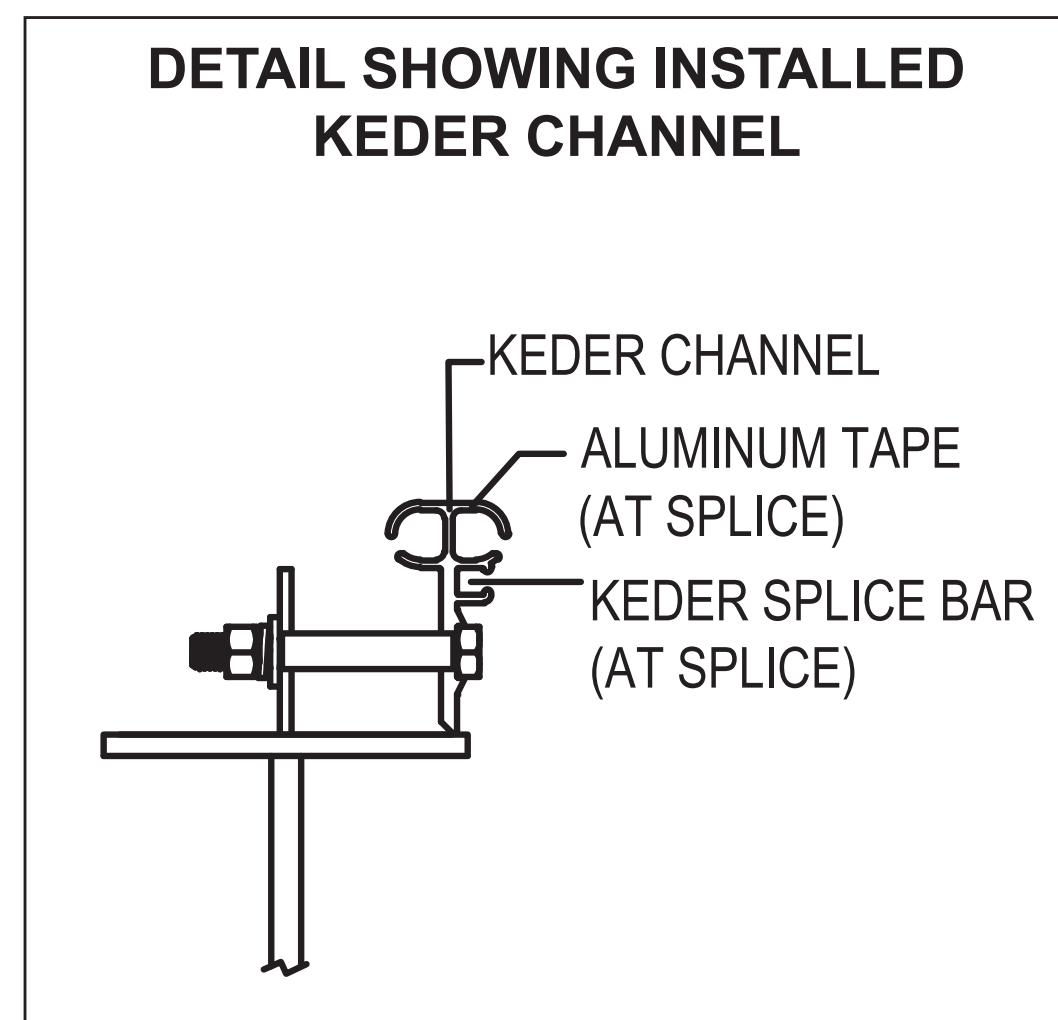
21. Measure and cut the 2" straps to the required length. Install by wrapping each strap around the pipe and insert the strap ends into the ratchet or winch. Move to the opposite end of the panel and repeat the steps to install winches and straps.



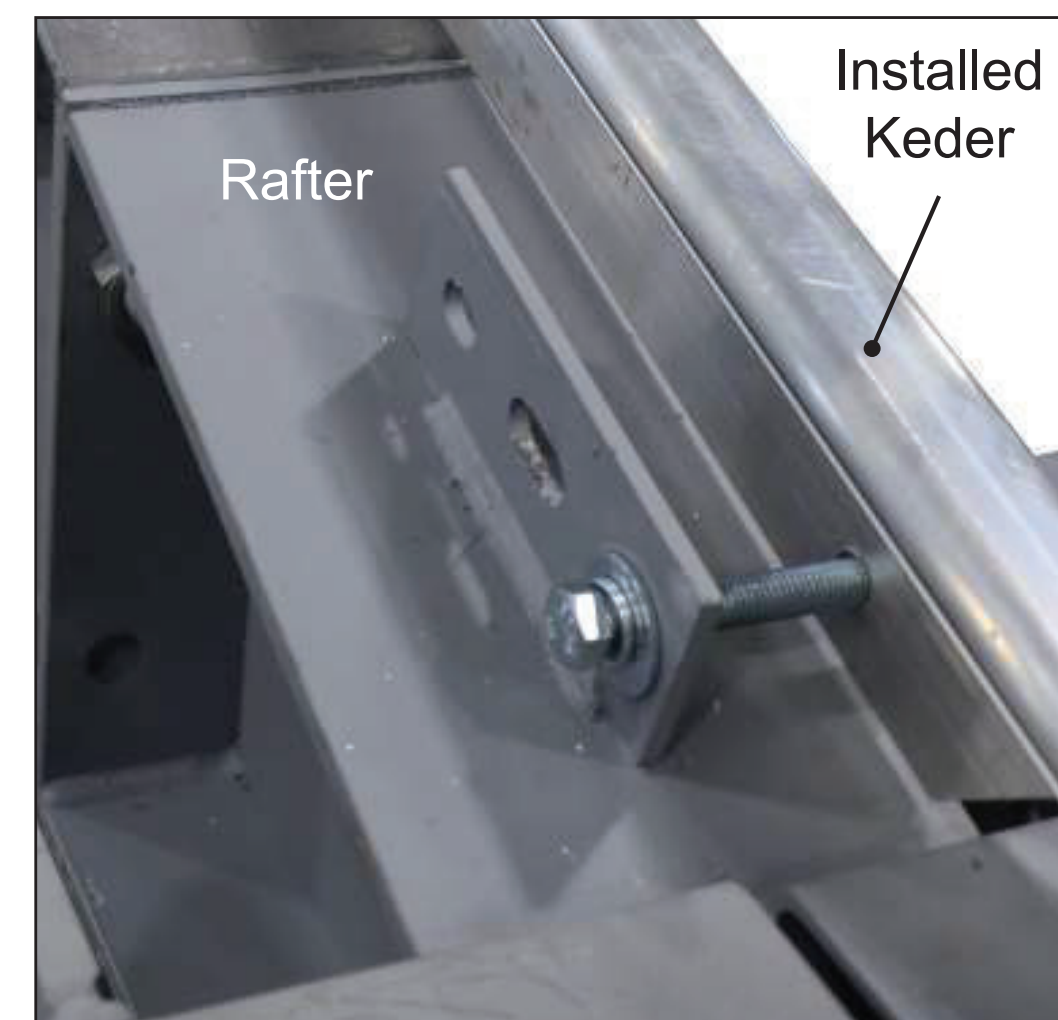
IMPORTANT: When measuring strap length, remember that straps wrap around the pipe and **both ends are inserted** into a ratchet or winch. (Inset A shows another winch and mounting flange combination common to some buildings.)

22. Slightly and evenly tighten all winches to remove slack. Ensure that distance from ECB to tension pipe at each end of the panel remains the same. See previous page.

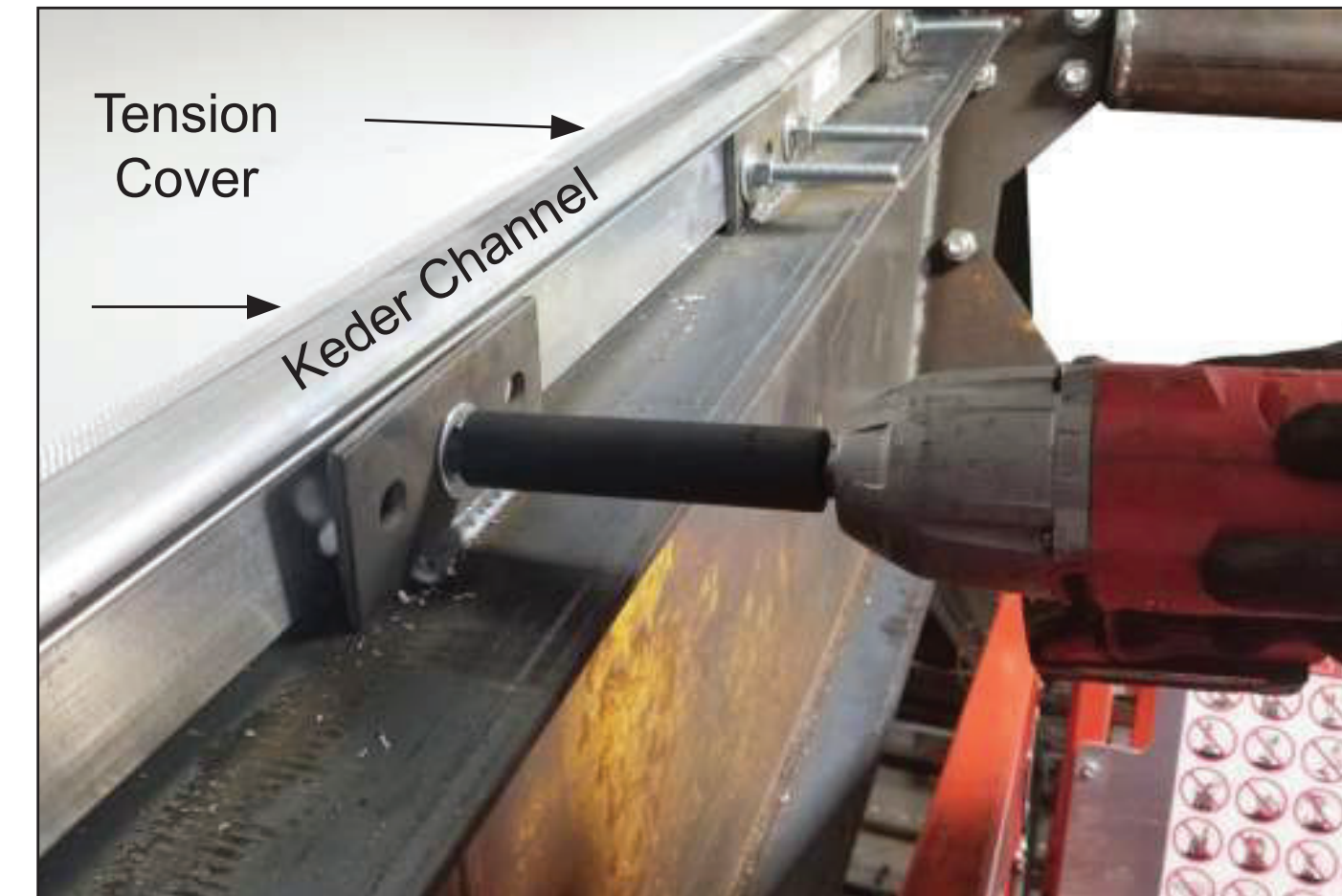
23. Move to the keder channel attached to the top of the rafter and remove any spacers used to stage keder channel. Review Section 2 if needed.



Remove wood blocks (or spacers) used to stage keder channels during panel install.



24. Tighten keder mounting bolts to tension cover from rafter-to-rafter. For best results and to avoid stripping threads, tighten adjacent bolts in multiple steps.



25. Once keder channel is fully tightened and cover is stretched, return to the winches at both ends of the panel at the eave cover brace and tighten the straps. See photos for Step 21.

ATTENTION: The panel ends can be terminated at this time, or additional panels can be installed depending on factors such as weather, available lifts, and crew size. See **Section 6** on next page for details.

26. Repeat all steps as needed to pull, stretch, and secure all remaining cover panels.

27. Continue with the next procedure.



IMPORTANT: To prevent stripping bolt threads and for best results, tighten the bolts evenly and in short increments throughout the length of the cover panel. *All bolts to be tight when cover is fully stretched and anchored.*

Terminate Cover Panels at Eave Cover Brace (ECB)

6

Once a panel is installed and tightened, the ends are typically terminated at the eave cover brace. Review the photos and details on this page and in the main building drawings to terminate the cover panels.

ATTENTION: ACTUAL TERMINATION PROFILE MAY DIFFER FROM THAT SHOWN IN THE EXAMPLE BELOW; HOWEVER, STEPS TO TERMINATE THE COVER ARE SIMILAR.



1. With assistance, pull cover flap tight and align poly lock strip in channel.



2. Using a dead-blow mallet, set poly lock strip in channel to lock cover.



Remove excess cover flap.

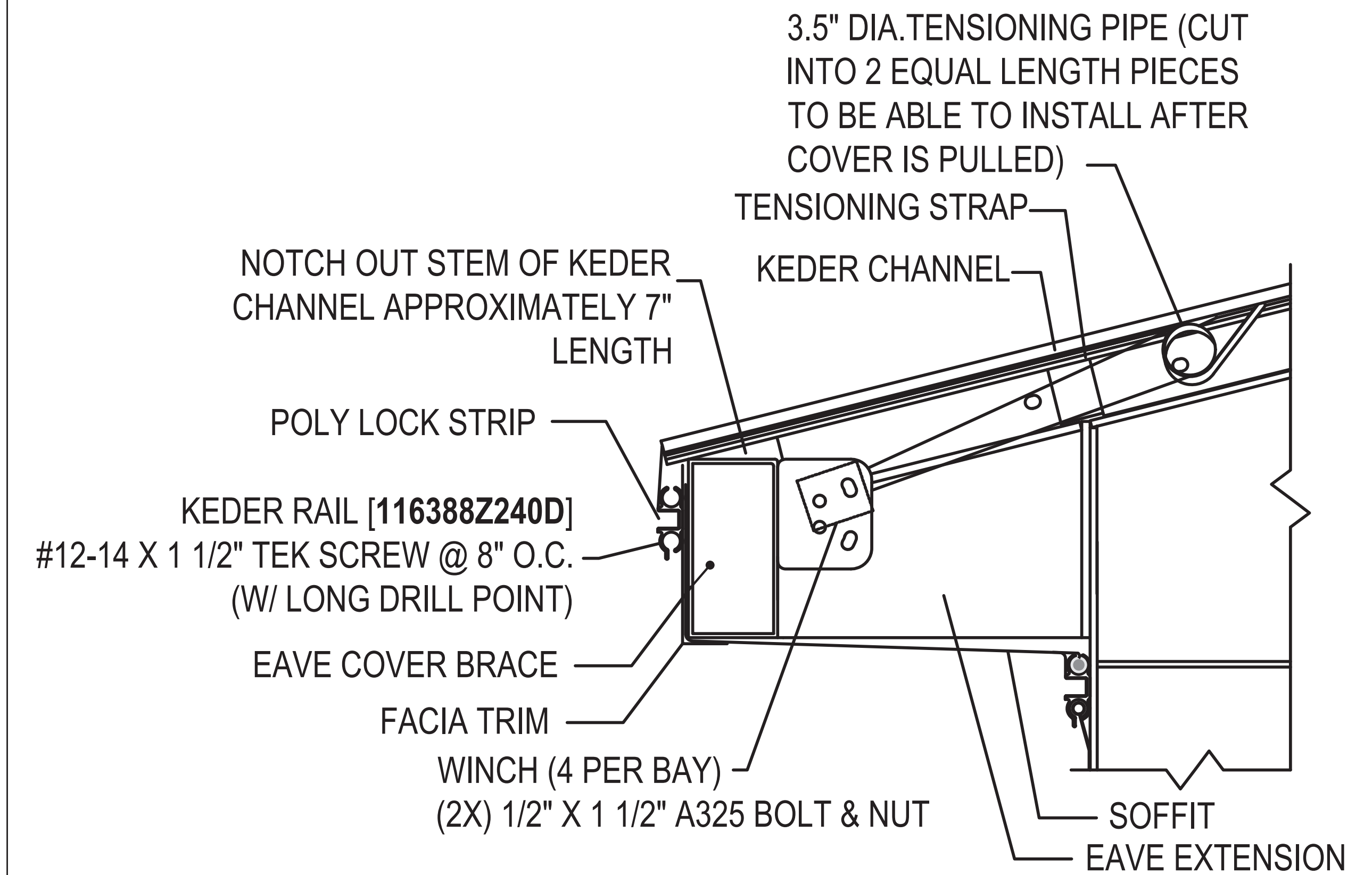
3. Once poly lock is seated, carefully trim excess cover material.



NOTE: ACTUAL BUILDING MAY INCLUDE FACIA TRIM AND SOFFIT PANEL.

4. Repeat steps to terminate the remaining side and all other covers.

ADDITIONAL DETAIL FOR COVER INSTALLATION



EAVE FABRIC TRANSITION CONNECTION DETAIL

ATTENTION: SOME BUILDING FRAMES DO NOT INCLUDE EAVE EXTENSIONS.

Product Data Sheet
Typical Properties

| | |
|------------------------|--|
| Product: | Coated PVC/PVDF |
| Item ID: | 28CPPVDF##G75 (## - Width) |
| Fabric: | 1500D x 1500D Polyester, 22x27PVC |
| Coating: | Double Fluorinated PVDF (Double-Sided) |
| Topcoat: | Polish |
| Standard Embossing: | 29 oz/sq. yd. |
| Weight: | 30 mil |
| Thickness: | 81", custom widths available |
| Standard Width: | White |
| Standard Color: | Warp: 540#/1" / Fill: 580#/1" (ASTM D-751 Strip Method) |
| Tensile Strength: | 240# Warp and Fill (ASTM D-751 Tongue Method) |
| Tear Resistance: | Warp: 120# / Fill: 110# (ASTM D-751) |
| Trapezoidal Tear: | 25 #/2" (ASTM D-751) |
| Adhesion: | NFPA 701 Test 1&2, CFM Title 19 |
| Flame Resistance: | 20 years pro-rated |
| UV Resistance: | -40°F (ASTM D-2136) |
| Cold Crack Resistance: | Yes |
| Mildew Resistance: | |
| Self-Cleaning: | Yes |
| RF Weldable: | Yes |

OFFICE PHONE:
FROM FAX

PROJECT: Gunston Bubble Turf Replacement

DATE: 06/25/18

TO: Arlington County, Virginia
2100 Clarendon Boulevard
Arlington, VA 22201

REF: Submittals

JOB# 1721-004
Project # 257700

ATTN: Aaron Wohler

| WE ARE SENDING: | SUBMITTED FOR: | ACTION TAKEN: |
|---|--|---|
| <input checked="" type="checkbox"/> Shop Drawings | <input checked="" type="checkbox"/> Approval | <input type="checkbox"/> Approved as Submitted |
| <input type="checkbox"/> Letter | <input type="checkbox"/> Your Use | <input type="checkbox"/> Approved as Noted |
| <input type="checkbox"/> Prints | <input type="checkbox"/> As Required | <input type="checkbox"/> Returned After Loan |
| <input type="checkbox"/> Change Order | <input checked="" type="checkbox"/> Review and Comment | <input type="checkbox"/> Resubmit |
| <input type="checkbox"/> Product Data | | <input type="checkbox"/> Submit |
| <input type="checkbox"/> Samples | SENT VIA: | <input type="checkbox"/> Returned |
| <input type="checkbox"/> Specifications | <input checked="" type="checkbox"/> Attached | <input type="checkbox"/> Returned for Corrections |
| <input type="checkbox"/> Other: Made from Submittal | <input type="checkbox"/> Separate Cover Via: Mail | <input type="checkbox"/> Due Date: |

| ITEM NO. | COPIES | DATE | ITEM | NUMBER | REV. NO. | DESCRIPTION | STATUS |
|----------|--------|------------|------|------------|----------|----------------------------------|--------|
| 01 | 1 | 06/25/2018 | SUT | 116833-001 | 002 | Dwg: Title: Soccer Field Rink SD | OPN |

Remarks:
If there are any questions or concerns, please contact our office.



ARLINGTON
VIRGINIA

DEPARTMENT OF PARKS
AND RECREATION

| | |
|---|--|
| <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> REJECTED (SEE BELOW) | <input type="checkbox"/> APPROVED AS NOTED (SEE BELOW) <input type="checkbox"/> REVISE AND RESUBMIT (SEE BELOW) |
|---|--|

This approval is only for the general conformance with design concept of project and general compliance with Contract Documents. Contractor is responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades. Approval of submittals shall not relieve Contractor from responsibility for full compliance with the Contract Documents.

NOTATIONS:

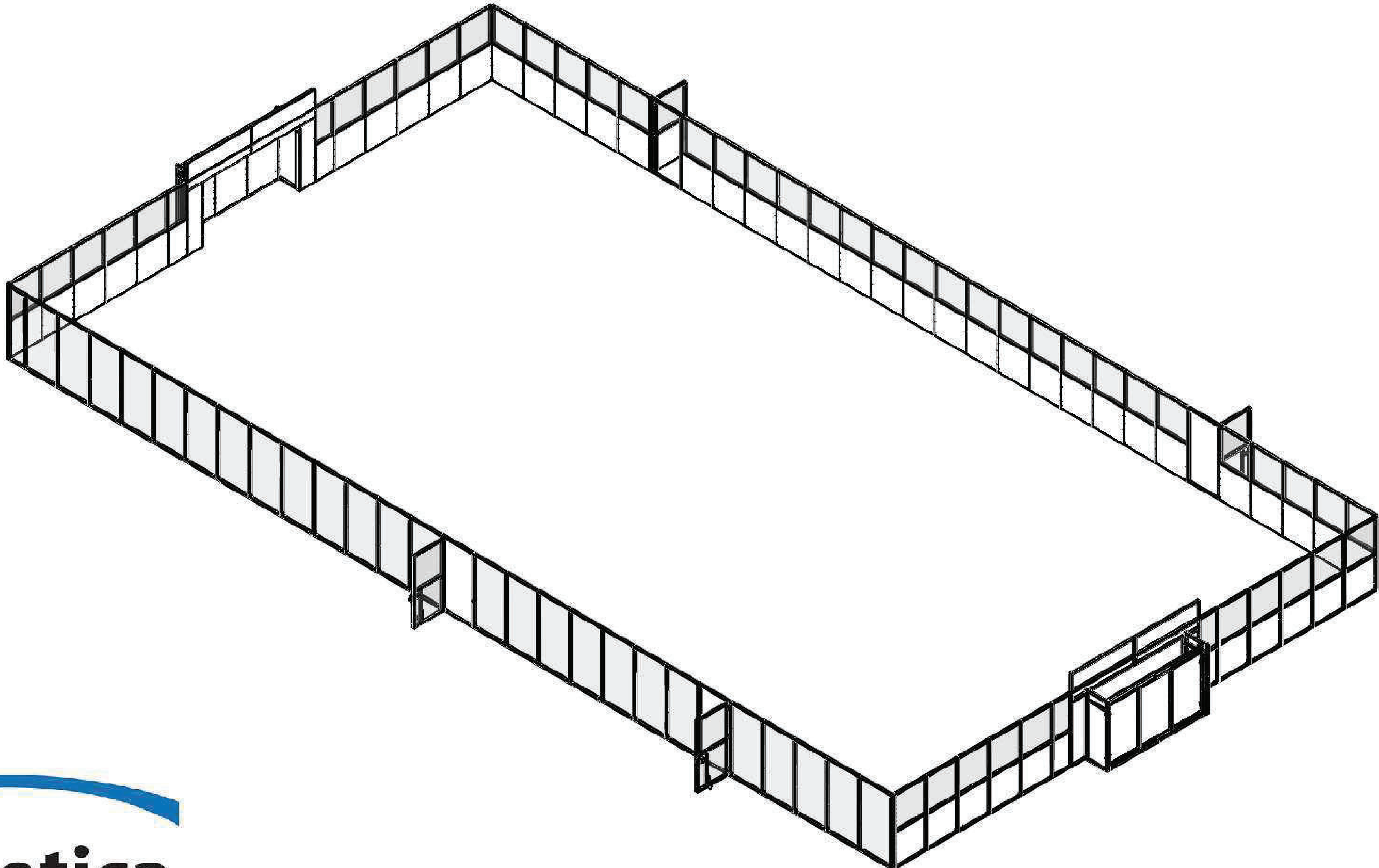
BY: 

DATE: 7-2-18

CC:

Signed: _____
Sepehr Soleimani

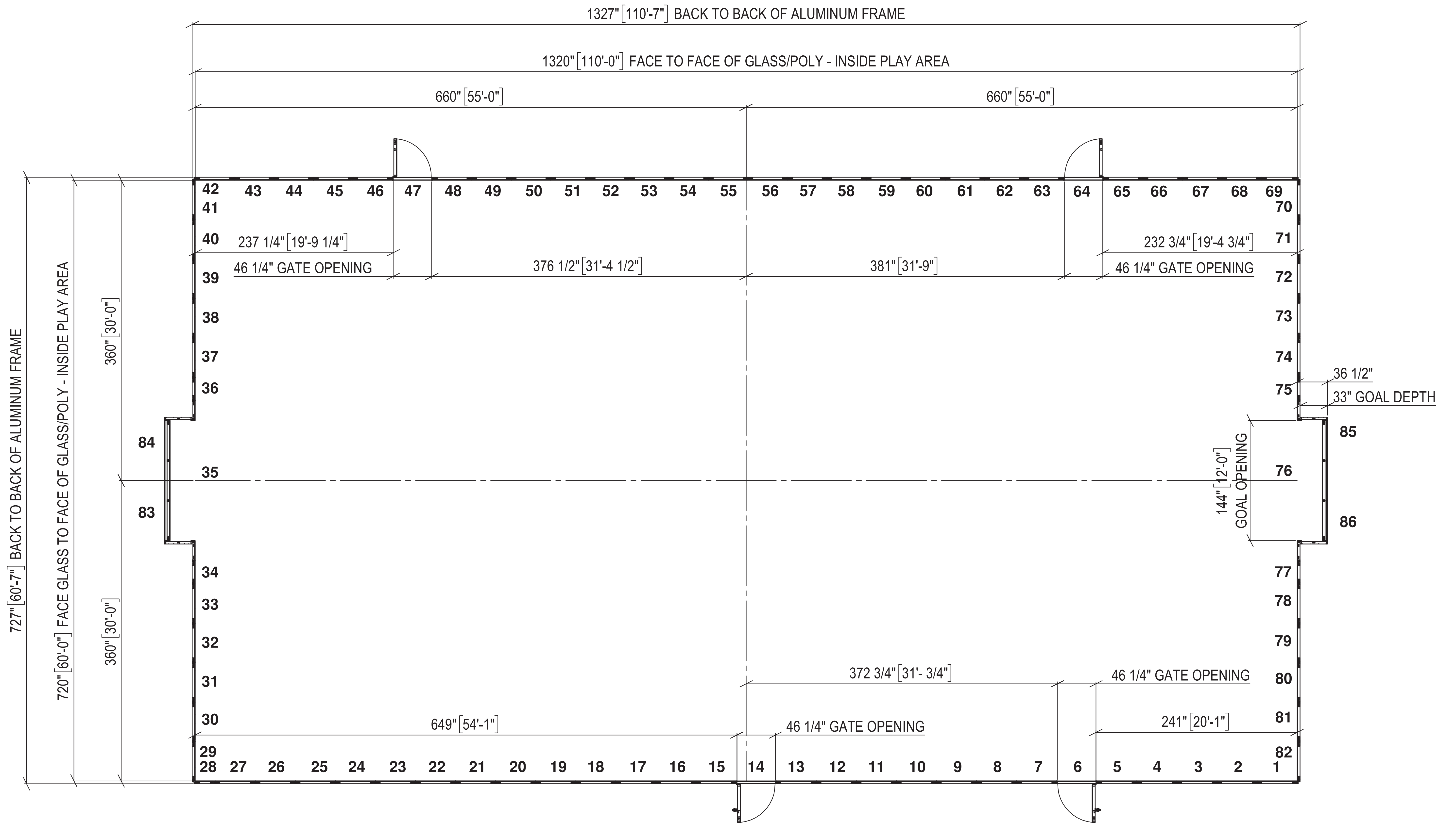
Project: Gunstone Bubble



Athletica Sport Systems
554 Parkside Drive, Waterloo, Ontario, Canada N2L 5Z4
Toll Free Phone: (877) 778-5911 Phone: (519) 747-1856 Fax (519) 747-3659

Project: Gunstone Bubble
Location: Virginia U.S.A.
Project Number: 18041

Second Submittal For Approval
Date: June 22, 2018
Revision: 1



Layout Drawing
 Top Plate Colour - 1/2" WHITE HDPE

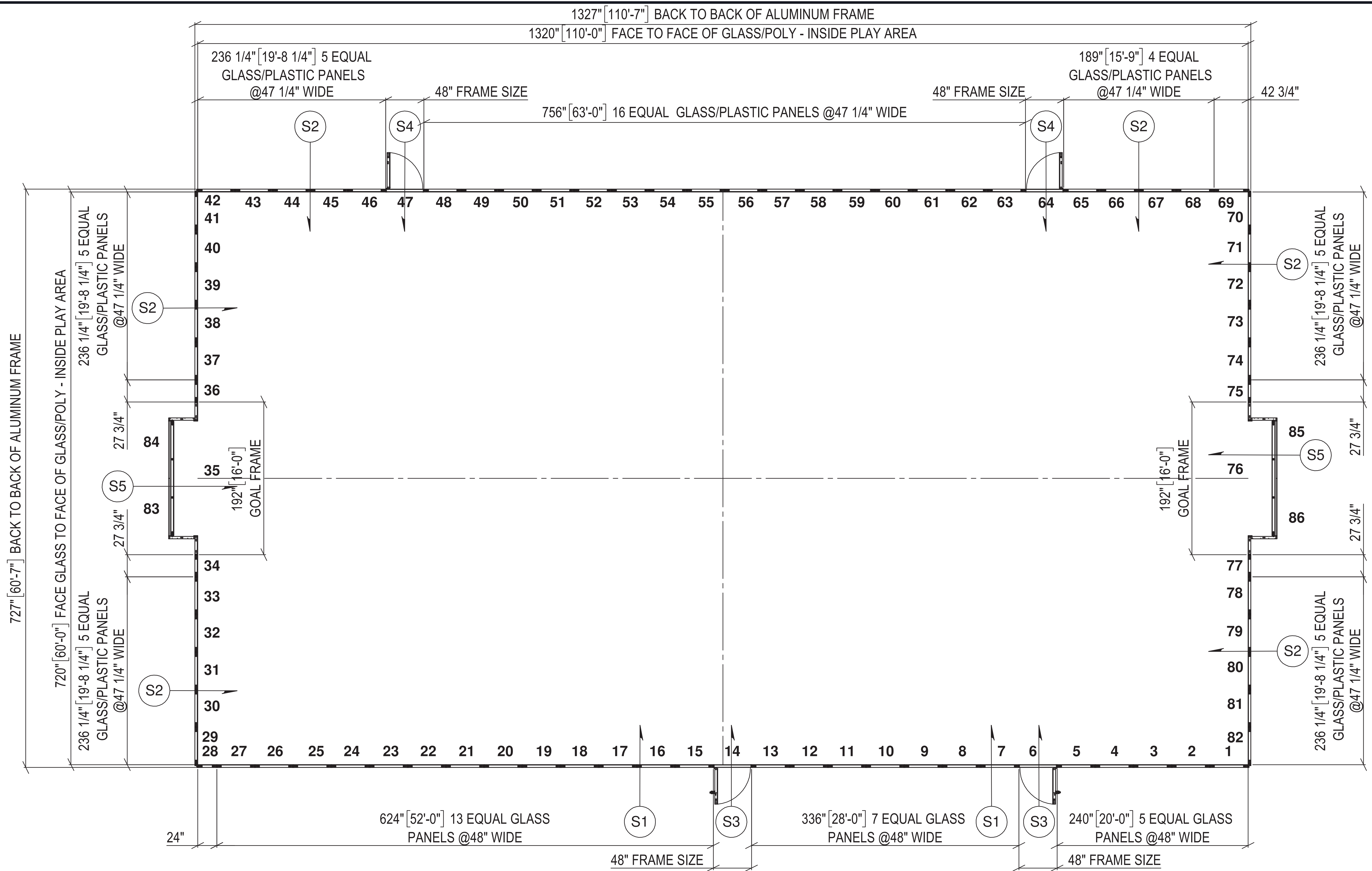
| No. | Revision/Issue | Date |
|-----|-------------------------------|------------|
| 1 | Second Submittal for Approval | June 22/18 |
| 0 | First Submittal for Approval | June 12/18 |

Athletica Sport Systems.
 554 Parkside Drive.
 Waterloo, Ontario
 Canada N2L 5Z4
 Toll Free 1-877-778-5911
 www.sportssystemscorp.com



Project Name:
Gunstone Bubble
 Address:
Virginia U.S.A.
 Project Number:
18041
 Project / Construction Manager:

Project Mgr:
 Voicu Goga
 Drawn By:
 Steve C.
 Drawn Date:
 6/22/2018
 Scale:
 NTS



Frame Drawing

Top Plate Colour - 1/2" WHITE HDPE

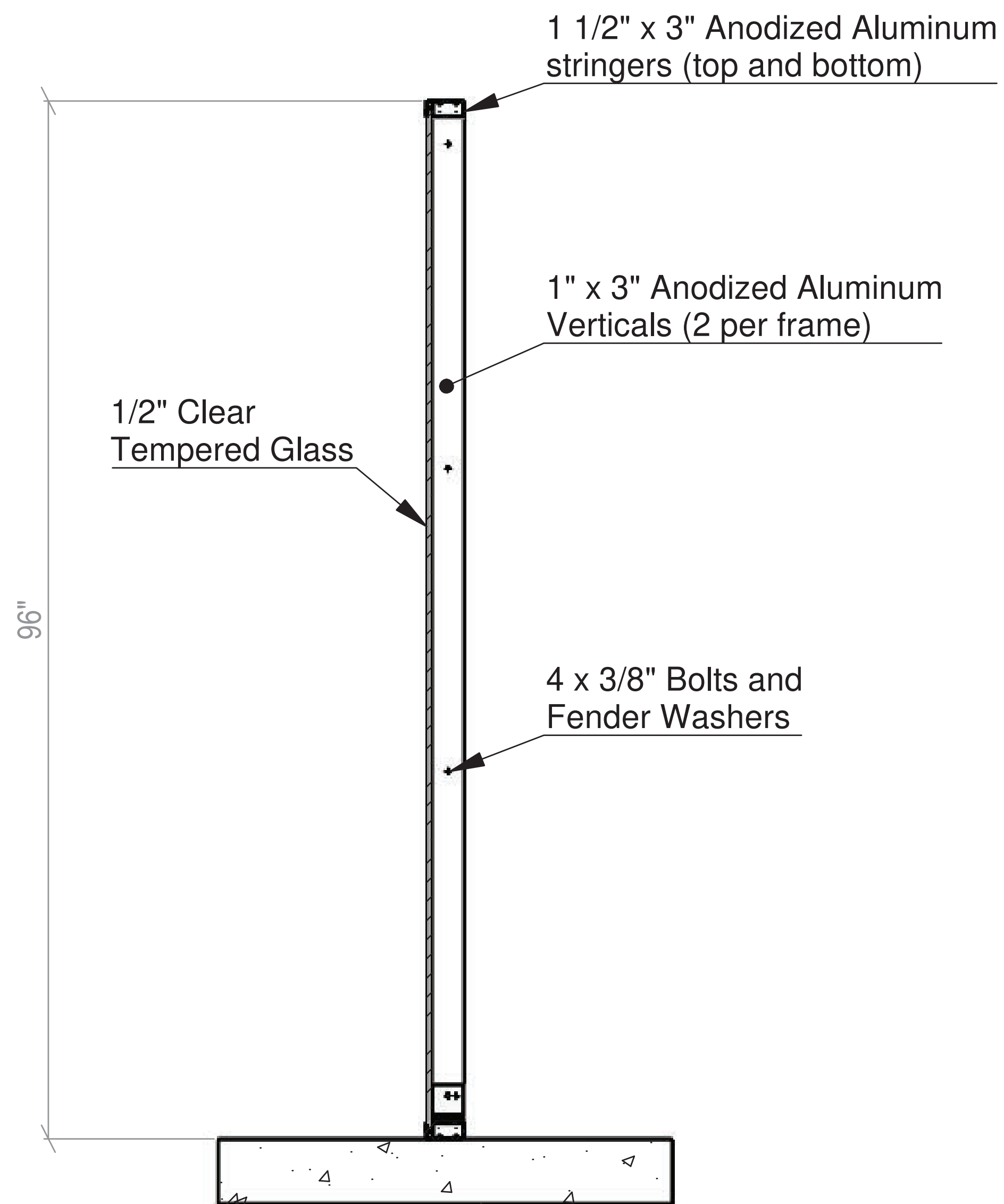
| No. | Revision/Issue | Date |
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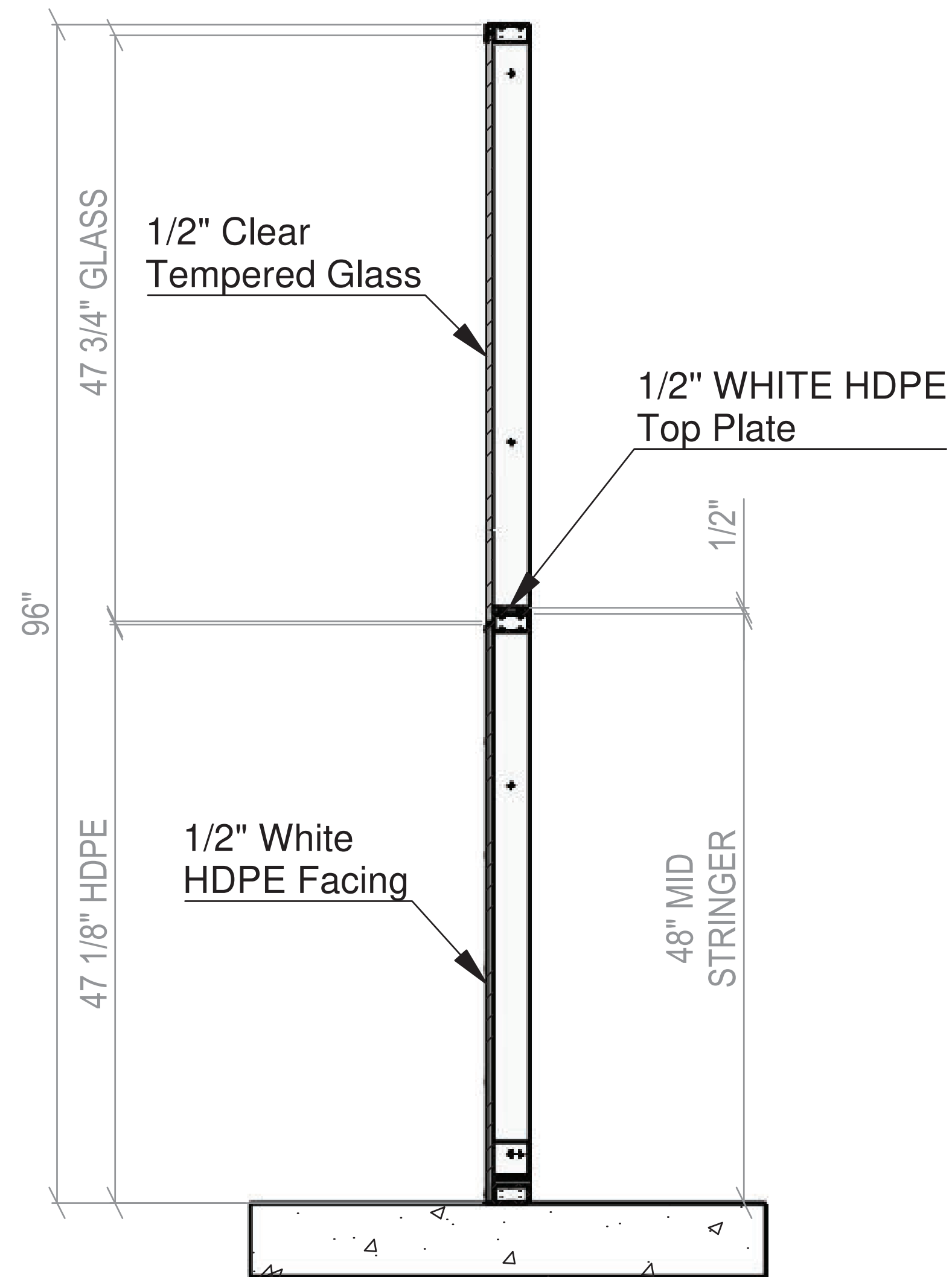
Project Name:
Gunstone Bubble
 Address:
Virginia U.S.A.
 Project Number:
18041
 Project / Construction Manager:

Project Mgr:
 Voicu Goga
 Drawn By:
 Steve C.
 Drawn Date:
 6/22/2018
 Scale:
 NTS



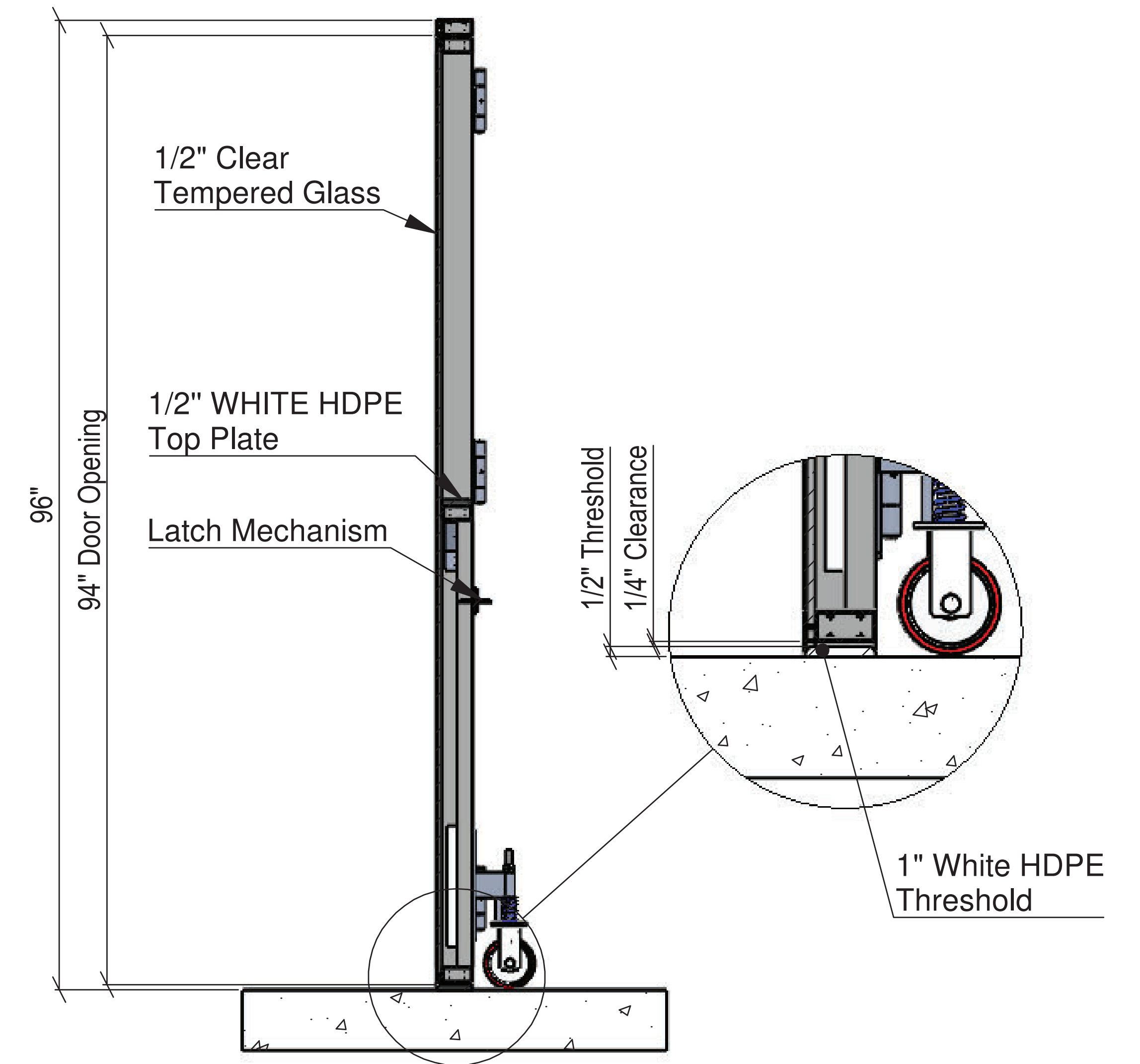
Typical section through 8' glass viewing panel

S1



Typical section through glass/plastic panels

S2



Typical section through 8' glass gates

S3

Section Drawing I

- Notes:**
- Anodized Aluminum Frames
 - Stainless Steel Hardware
 - Boards must be installed on concrete prior to any other turf
 - Standard 5/8" stainless steel rod epoxy anchors

| No. | Revision/Issue | Date |
|-----|-------------------------------|------------|
| 1 | Second Submittal for Approval | June 22/18 |
| 0 | First Submittal for Approval | June 12/18 |

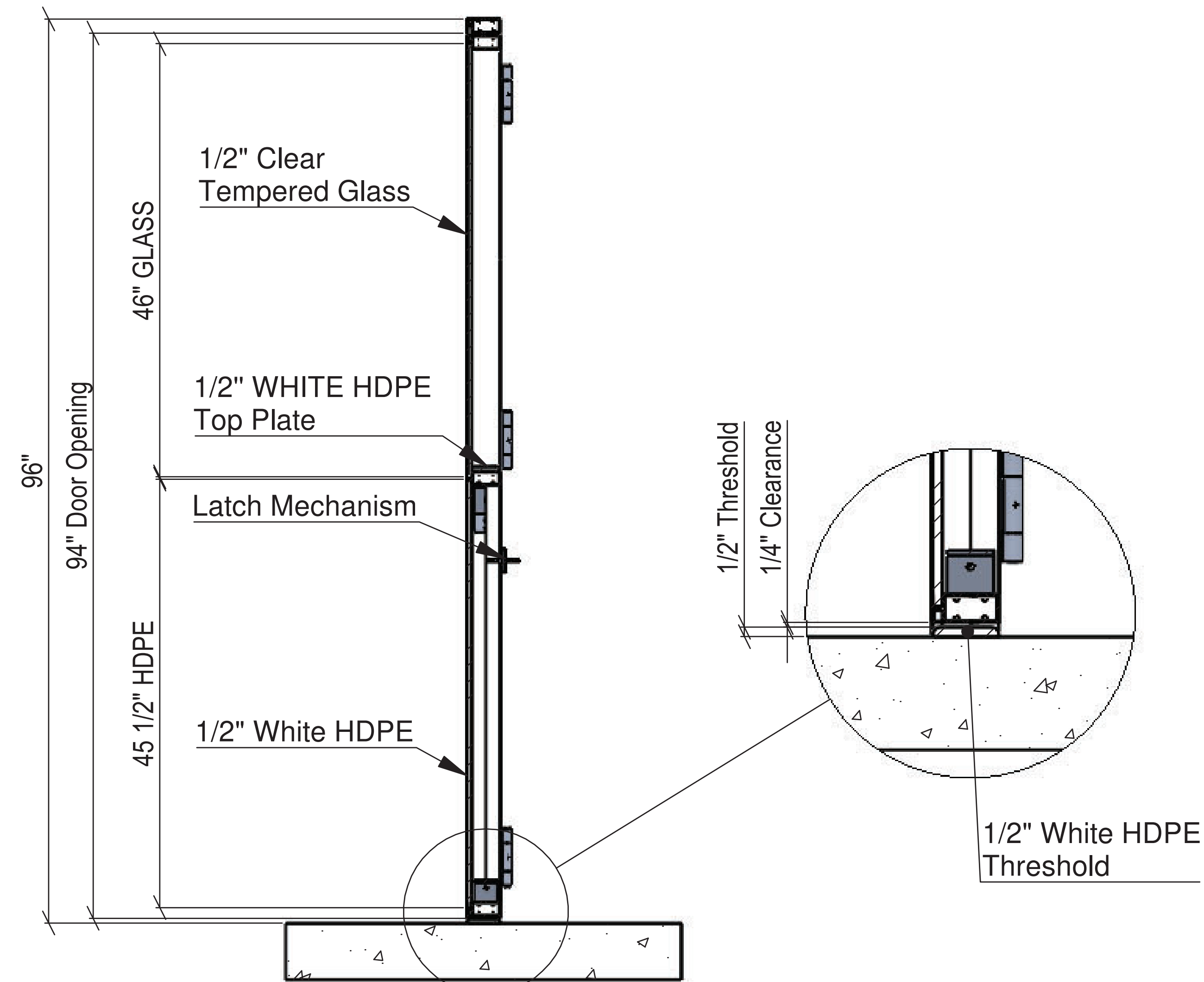
Athletica Sport Systems.
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Project Name:
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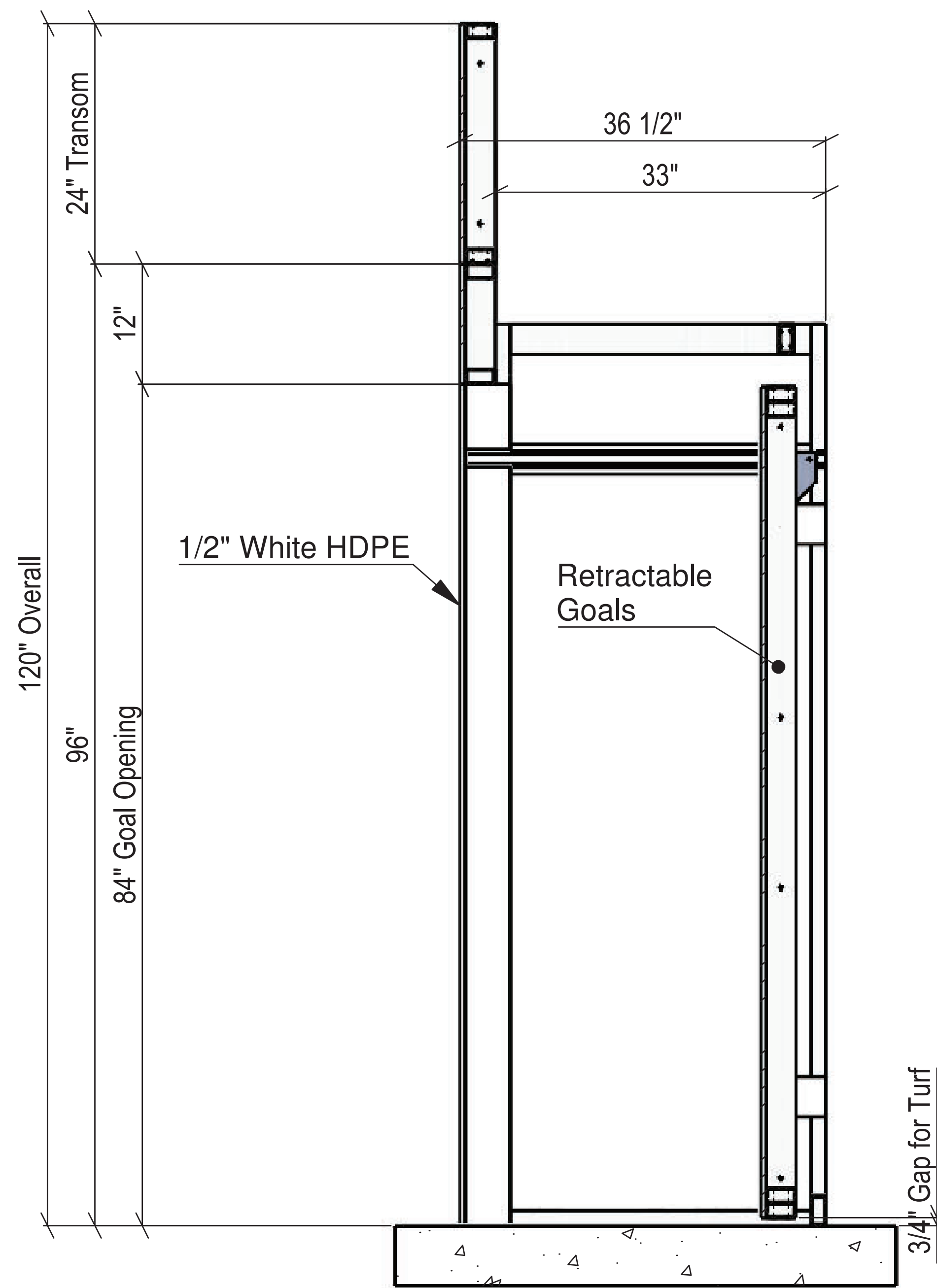
Project Mgr:
Voicu Goga
Drawn By:
Steve C.
Drawn Date:
6/22/2018
Scale:
NTS

3



Typical section through glass/plastic gate panels

S4



Typical section through retractable goals

S5

Section Drawing II

- Notes: - Anodized Aluminum Frames
 - Stainless Steel Hardware
 - Boards must be installed on concrete prior to any other turf
 - Standard 5/8" stainless steel rod epoxy anchors

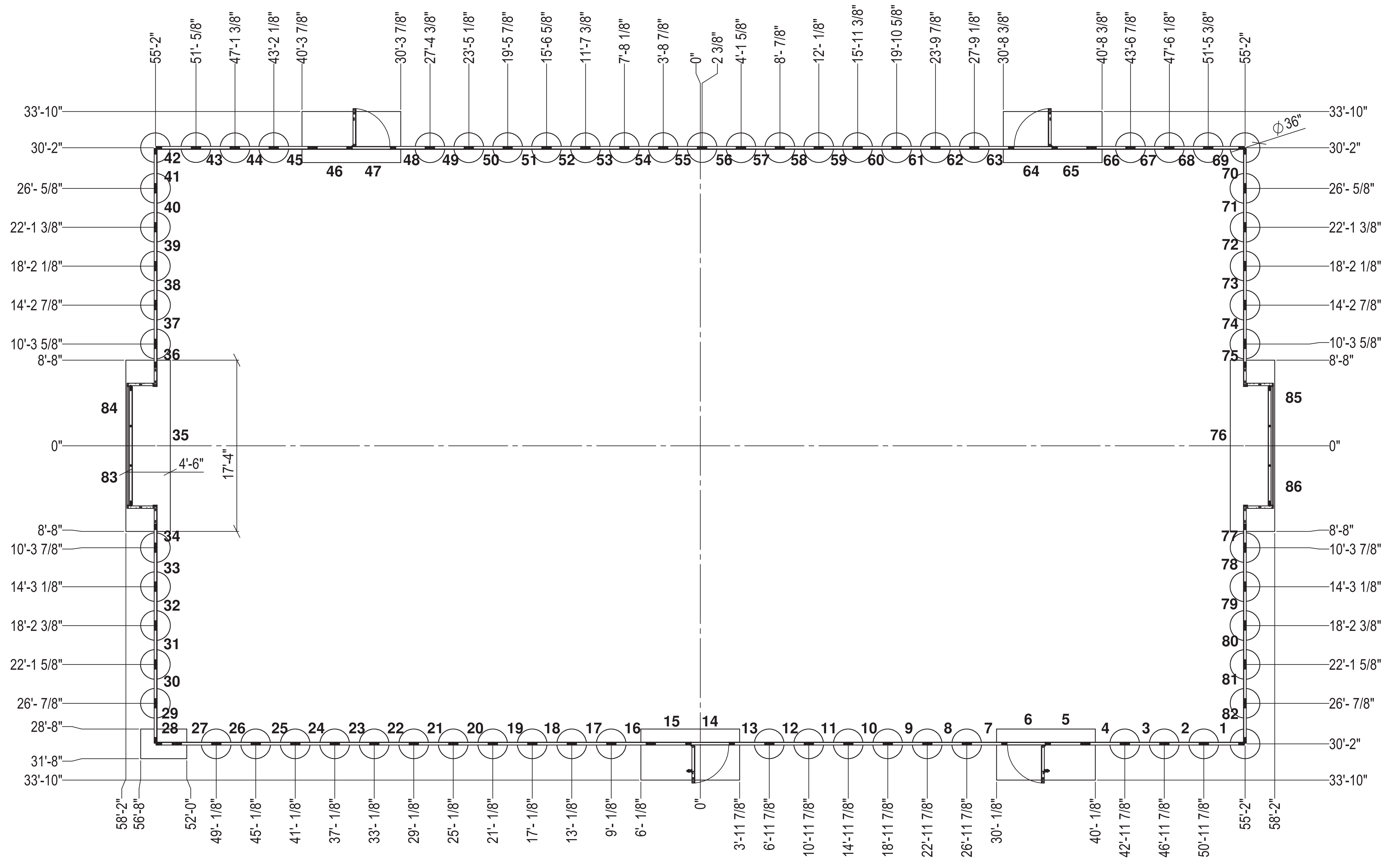
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|-----|-------------------------------|------------|
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 Voicu Goga
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 6/22/2018
 Scale:
 NTS



Anchor Layout Drawing

| No. | Revision/Issue | Date |
|-----|-------------------------------|------------|
| 1 | Second Submittal for Approval | June 22/18 |
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Project Mgr:
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 Steve C.
 Draw Date:
 6/22/2018
 Scale:
 NTS