SECTION 02 41 19 - 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 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 013591 "Historic Treatment Procedures" for historic removal and dismantling.
3. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner in re-usable condition.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. These items shall be preserved and protected in-place.

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly turn over to Owner.

1.5 PREINSTALLATION MEETINGS

A. Pre-demolition 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. 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.

C. 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. Ensure Owner's on-site operations and activities are uninterrupted.
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.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Pre-demolition Photographs or Video: 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 indicated 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.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, consult with Owner to identify items to be removed.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. 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.

D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection.

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.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE 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 ANSI/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 record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and videotapes.

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 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Arrange to shut off indicated utilities with utility companies.

2. 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.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated 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.
    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.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. 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.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: 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."

C. Temporary Shoring: 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.

3.4 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, to minimize disturbance of adjacent surfaces. 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 fire watch, if necessary, and 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.

B. 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 off-site.
5. Protect items from damage during transport and storage.

C. 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.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw; then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.

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.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 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.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items to Be Removed:

B. Existing Items to Be Removed and Salvaged:

C. Existing Items to Be Removed and Reinstalled:

D. Existing Items to Remain:

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Footings.
2. Slabs-on-grade.

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

1.3 DEFINITIONS

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

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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.

E. Samples: For waterstops and vapor retarder .

F. Welding certificates.

G. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

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

I. Field quality-control reports.

J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/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, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

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

C. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

D. Deformed-Steel Wire: ASTM A 496/A 496M.

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

F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

G. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

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

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

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

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.

b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
c. Euclid Chemical Company (The), an RPM company.
d. Grace Construction Products, W. R. Grace & Co.; DCI.
e. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
b. Cortec Corporation.
c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
d. Sika Corporation; FerroGard 901.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, non-fading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirement, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters
b. Davis Colors
c. Dayton Superior Corporation
d. Hoover Color Corporation
e. Lambert Corporation
f. QC Construction Products
g. Rockwood Pigments NA, Inc.
h. Scofield, L. M. Company
i. Solomon Colors, Inc.

2. Color: As selected by Architect from manufacturer’s full range

2.5 VAPOR RETARDERS

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

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
b. BASF Construction Chemicals - Building Systems; Confilm.
c. ChemMasters; SprayFilm.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.
d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler. Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

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

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50 .
3. Slump Limit: 4 inches (100 mm) , plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery..
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

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

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.2 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.3 STEEL REINFORCEMENT

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

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

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

1. Weld reinforcing bars according to AWS D1.4/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.

3.4 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

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

3.5 CONCRETE PLACEMENT

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

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by 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 will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

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

3.6 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. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated to receive mortar setting beds for bonded cementitious floor finishes.

C. 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.

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

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
    b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. 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.

3.7 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

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

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE PROTECTING AND CURING

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

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

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

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

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 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 joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.10 CONCRETE SURFACE REPAIRS

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

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

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, 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.
6. 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.

7. 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.

8. 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.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
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 Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

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.

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

END OF SECTION 03 30 00

SECTION 04 20 00 - UNIT MASONRY

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. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.
8. Cavity-wall insulation.

B. Related Sections:

1. Division 07 Section “Water Repellents” for water repellents applied to unit masonry.
2. Division 07 Section “Sheet Metal Flashing and Trim” for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement.” Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes and vents.
4. Accessories embedded in masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

F. Qualification Data: For testing agency.

G. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

I. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

J. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

1. Build sample panels for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: Provide CMUs that have been manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi .
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Face Brick product to match existing
      1) Glen Gery
      2) Belden Brick Co.
      3) Reland Brick Co.
      4) Cushura

2. Grade: SW
3. Type: Match Existing
4. Unit Compressive Strength: Match Existing
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's Area.
8. Size (Actual Dimensions): Match Existing
9. Application: Use where brick is exposed unless otherwise indicated.
10. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Mortar Cement: ASTM C 1329.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Lafarge North America Inc.

F. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Colored Portland Cement-Lime Mix:

        1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
        2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
        3) Lafarge North America Inc.; Eaglebond Portland & Lime.
        4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent by weight.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Company (The); Accelguard 80.
    b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
    c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

J. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
4. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
5. Wire Size for Veneer Ties 0.187-inch (4.76-mm) diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

D. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
3) Hohmann & Barnard, Inc.; DW-10, DW-10HS or DW-10-X.
4) Wire-Bond; 1004, Type III, RJ-711 or SureTie.

2.7 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat

washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

B. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. (2-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Advanced Building Products Inc.; Copper Fabric Flashing
2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
6) York Manufacturing, Inc.; Multi-Flash 500.

2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing
2) Firestone Specialty Products; FlashGuard.
3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.
4) Hohmann & Barnard, Inc.; Epra-Max EPDM Thru-Wall Flashing.
5) Sandell Manufacturing Co., Inc.; EPDM Flashing.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge
4. Where flashing is fully concealed, use flexible flashing.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head join and depth 1/8" (3 mm) less than depth of outer wythe, in color selected from manufacture's standard.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work included, but are not limited to, the following:

1) Advanced Building Projects Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents
4) Heckmann Building Products Inc.: No. 85 Cell Vent
5) Hohmann & Barnard, Inc.; Quadro-Vent
6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Building Products Inc.; Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

2. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.
d. Sheets or strips not less than 1 inch (25 mm) thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-

mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M or Type S.
2. For reinforced masonry, use Type M or Type S.
3. For mortar parge coats, use Type S or Type N.
4. For non-load-bearing walls use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).

3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 16 inches o.c. horizontally. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
1. Build flanges of factory-fabricated, expansion-joint units into masonry.
2. Build in compressible joint fillers where indicated.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch (13 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
6. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
8. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
9. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall.

Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
4. Space weep holes formed from plastic tubing 16 inches (400 mm) o.c.
5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
6. Trim wicking material flush with outside face of wall after mortar has set.

F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches (600 mm) above top of pea gravel.

G. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

H. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

END OF SECTION 04 20 00

SECTION 04 86 00 - STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following applications of stone masonry:

1. Anchored to concrete masonry back up.

B. Related Sections:

1. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.

C. Products installed, but not furnished, in this Section include:

1. Lintels and/or shelf angles for stone masonry, specified in Division 5 Section "Metal Fabrications."

1.3 SUBMITTALS

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

1. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties required by referenced ASTM standards.

B. Samples for Initial Selection: For colored mortar and other items involving color selection.

C. Samples for Verification:

1. For each stone type indicated. Include at least five samples, exhibiting extremes of the full range of color and other visual characteristics expected in completed Work. Samples will establish the standard by which stone provided will be judged.
2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Source Limitations for Stone: Obtain stone from one quarry, with resources to provide sufficient materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings in size of approximately 60 long by 48 inches high by full thickness, including face and backup wythes and accessories.

a. Include stone coping (as applicable to project) at top of mockup.
b. Include a sealant-filled joint at least 16 inches long in mockup.
c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 24 inches down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit stone masonry above half of flashing).
d. Include wood studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities Architect specifically approves in writing.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on

elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.7 COORDINATION

A. Advise installers of other work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 STONE

A. Varieties and Sources: Subject to compliance with requirements, provide stone of varieties and from sources as indicated below:

2.2 STONE VENEER

A. Provide sound natural stone as follows:

A. Products: Match existing building stone and mortar joints for color, finish, and other stone characteristics relating to aesthetic effects. Contractor may clean and re-use existing sunroom stone at Contractor's decision.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Essroc, Italcementi Group; Capitol PCL Blend or Saylor's Plus.
b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
c. Lafarge North America; Eaglebond.
d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

D. Mortar Cement: ASTM C 1329.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Lafarge North America; Lafarge Mortar Cement Magnolia Superbond Mortar Cement.

E. Colored Cement Product: Packaged blend made from portland cement and lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Pigments shall not exceed 10 percent of portland cement by weight.
3. Pigments shall not exceed 5 percent of mortar cement by weight.
4. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Colored Portland Cement-Lime Mix:

1) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
2) Lafarge North America; Eaglebond.
3) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

b. Colored Mortar Cement:

1) Lafarge North America; Magnolia Superbond Mortar Cement.

F. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

a. Match Architect's sample.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn, Div. of Degussa Building Systems; Trimix-NCA.

H. Water: Potable.

2.4 VENEER ANCHORS

A. Materials:

1. Hot-Dip Galvanized-Steel Wire: ASTM A 82, with ASTM A 153/A 153M, Class B-2.

I. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least 5/8-inch (16-mm) cover on outside face.

J. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inchdiameter, hot-dip galvanized-steel wire.

1. Ties are bent in the form of loops with legs not less than 15 inches (381 mm) in length and with last 2 inches (50 mm) bent at 90 degrees.
2. Ties are bent in the form of rectangular loops with ends bent downward for inserting into eyes projecting from masonry joint reinforcement specified in Division 4 Section "Unit Masonry Assemblies."
3. Ties are bent in the form of triangular loops designed to be attached to masonry joint reinforcement specified in Division 4 Section "Unit Masonry Assemblies" with vertical wires passing through ties and through eyes projecting from masonry joint reinforcement.

K. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dur-O-Wal, a Dayton Superior Company
b. Heckmann Building Products Inc.
c. Hohmann & Barnard, Inc.
d. Wire-Bond

2. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2.3 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: For flashing not exposed to the exterior, use[one of] the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Advanced Building Products Inc.; Copper Fabric Flashing.
2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
3) Phoenix Building Products; Type FCC-Fabric Covered Copper.
4) Polytite Manufacturing Corporation; Copper Fabric Flashing.
5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
6) York Manufacturing, Inc.; York Copper Fabric Flashing.

B. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness required; formulated from neoprene, urethane or PVC.

B. Cementitious Dampproofing: Cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.

C. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479, Type I or asphalt emulsion complying with ASTM D 1227, Type III or IV.

D. Weep Hole/Vent Products: Use the following unless otherwise indicated:
1. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch (10-mm) OD by thickness of stone masonry.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.

2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Advanced Building Products Inc.; Mortar Break.
b. CavClear/Archovations, Inc.; CavClear Masonry Mat.
c. Dur-O-Wal, a Dayton Superior Company; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

2.5 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

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

a. Diedrich Technologies, Inc.
b. Dominion Restoration Products.
c. EaCo Chem, Inc.
d. Hydrochemical Techniques, Inc.
e. Prosoco, Inc.

2.6 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Stone Masonry: Comply with ASTM C 270.

1. Mortar for Setting Stone: Type S Type N.
2. Mortar for Pointing Stone: Type N Type O.

D. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

E. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.

1. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.

F. Pigmented Mortar: Use colored cement product[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
3. Mix to match Architect's sample.

G. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.

2.7 FABRICATION

A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

C. Cut and drill sinkages and holes in stone for anchors and supports.

D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

E. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 4 inches (interior application) and 6 inches (exterior application) plus or minus 1/2 inch

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

C. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

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

3.2 PREPARATION

A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.

B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.
   1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in uncoursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 1 inch at widest points.

G. Provide sealant joints of widths and at locations indicated.

   1. Keep sealant joints free of mortar and other rigid materials.
   2. Sealing joints is specified in Division 7 Section "Joint Sealants."

H. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap

each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

I. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. At stud-framed walls, extend flashing through stone masonry, up the face of sheathing at least 12 inches, and behind weather-resistant sheathing paper.
2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
3. At sills, extend flashing not less than 4 inches at ends.
4. At ends of head and sill flashing turn up not less than 2 inches to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 7 Section "Joint Sealants" for application indicated.
6. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 7 Section "Joint Sealants" for application indicated.
7. Extend sheet metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.
8. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
9. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
10. Cut flexible flashing flush with face of wall after masonry wall construction is completed.

J. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.

1. Use plastic tubing to form weep holes.
2. Space weep holes 16 inches o.c.
3. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

B. Variation from Level: For[bed joints and] lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.

D. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to metal stud framing with wire anchors unless otherwise indicated. Tie anchors to studs.

B. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least 5/8-inch cover on outside face.

C. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

D. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.

E. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.

1. Place mortar spots in cavity at veneer anchors to maintain spacing.
2. Slope beds toward cavity to minimize mortar protrusions into cavity.
3. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.6 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Concave face slightly below edges of stone.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in greatest dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 04860

SECTION 06 10 00 - ROUGH CARPENTRY

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. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking, cants, and nailers.
4. Wood furring and grounds.

B. Related Requirements:
1. Section 061600 "Sheathing."

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include

physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

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

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

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

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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

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

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDENT-TREATED MATERIALS

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

B. Fire-Retardant-Treated Lumber or Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 M) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be texted according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all rough carpentry unless otherwise indicated. Items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Framing for stages.
3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. Plywood backing panels.

2.4 DIMMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: Interior partitions not indicated as load-bearing.

2. Species:

a. Hem-fir (north); NLGA.
b. Spruce-pine-fir; NLGA.
c. Hem-fir; WCLIB, or WWPA.
d. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

B. Load-Bearing Partitions: No. 2 grade.

1. Application: Exterior walls and interior load-bearing partitions.
2. Species:
a. Spruce-pine-fir; NLGA.

C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.

1. Species:
a. Spruce-pine-fir; NLGA.

D. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Application: Exposed exterior and interior framing.
2. Species and Grade: Douglas fir-larch; No. 1 grade.

2.5 ENGINEERED WOOD PRODUCTS

A. Engineered Wood Products, General: Products shall contain no urea formaldehyde.

B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Weyerhaeuser Company.
b. Boise Cascade
c. Louisiana Pacific

2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20 MPa) for 12-inch nominal-(286-mm actual-) depth members.
3. Modulus of Elasticity, Edgewise: 2,200,000 psi (15 100 MPa).

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

3. Cants.
4. Furring.
5. Grounds.
6. Utility shelving.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

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

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

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

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.8 METAL FRAMING ANCHORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

F. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives 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. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

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

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

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

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

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

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

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

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with indicated fastener patterns where applicable.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

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

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally or vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.5 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:

1. Where supported on wood members, by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).

C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches (50 mm) from top or bottom.

D. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at ends of joists unless nailed to header or band.

E. Provide solid blocking between joists under jamb studs for openings.

F. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

G. Provide bridging of type indicated below, at intervals of 96 inches (2438 mm) o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- (19-by-64-mm actual-) size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 STAIR FRAMING INSTALLATION

A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:

1. Size: 2-by-12-inch nominal- (38-by-286-mm actual-) size, minimum.
2. Material: solid lumber.
3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches (89 mm) of effective depth.
4. Spacing: At least three framing members for each 36-inch (914-mm) clear width of stair.

B. Provide stair framing with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.

3.7 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

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

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

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. Wall sheathing.
2. Roof sheathing.
3. Subflooring.
4. Underlayment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

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

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.".

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet 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."

B. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

C. Oriented Strand Board: DOC PS 2.

D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

E. Factory mark panels to indicate compliance with applicable standard.

2.3 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch (13 mm).

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch (13 mm).

C. Cementitious Backer Units: ASTM C 1325, Type A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. C-Cure; C-Cure Board 990.
b. Custom Building Products; Wonderboard.
c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch (15.9 mm).

D. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv, Inc.

2. Thickness: 1 inch (25 mm).

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 3/4 inch (11.9 mm).

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Subflooring: Exposure 1, Structural I single-floor panels or sheathing.

1. Span Rating: Not less than 24 o.c..
2. Nominal Thickness: Not less than 23/32 inch (18.3 mm).
3. Edge Detail: Tongue and groove.

B. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

C. Hardboard Underlayment: ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

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

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

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

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

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

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

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring:

   a. Glue and nail to wood framing.
   b. Space panels 1/8 inch (3 mm) apart at edges and ends.

2. Wall Sheathing:

   a. Nail to wood framing.
   b. Space panels 1/8 inch (3 mm) apart at edges and ends.

3. Underlayment:

   a. Nail to subflooring.
   b. Space panels 1/32 inch (0.8 mm) apart at edges and ends.
   c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 HARDBOARD UNDERLAYMENT INSTALLATION

A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.

1. Fastening Method: Nail underlayment to subflooring.

END OF SECTION 06 16 00

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wood trim, eaves and soffits.
2. Lumber siding.
3. Exterior stairs and railings.
4. Exterior porch flooring and steps.

B. Related Requirements:

1. Section 061063 "Exterior Rough Carpentry" for elevated decks including stairs and railings.

1.2 ACTION SUBMITTALS

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

B. Samples: For each type of product involving selection of colors, profiles, or textures.

1.3 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

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

1. Wood-preservative-treated wood.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

a. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. Application: Where indicated.

2.3 EXTERIOR TRIM

A. Lumber Trim:

1. Species and Grade: Spanish Cedar; premium grade.
2. Maximum Moisture Content:19 percent.
3. Face Surface:Surfaced smooth

B. Moldings: WMMPA WM 4, P-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in WMMPA WM 12.

1. Species: Spanish Cedar.

C. MDO Trim: Exterior Grade B-B, MDO plywood for wide area surfaces where lumber cannot be utilized.

2.4 LUMBER SIDING

A. Provide kiln-dried lumber siding complying with DOC PS 20.

B. Species and Grade: Spanish Cedar; premium grade.

2.5 EXTERIOR PORCH DECKING, STAIRS AND RAILINGS

A. Stairs:

1. Treads: 1-1/4-inch (32-mm) thick, kiln-dried stepping with half-round or rounded edge nosing.

a. Species and Grade: Douglas fir, C & Btr VG (Vertical Grain) stepping.

2. Risers: 3/4-inch (19-mm) thick, kiln-dried finish boards.

a. Species and Grade: Douglas fir, C & Btr or Superior finish; NLGA, WCLIB, or WWPA.

3. Porch Flooring: Tongue and grove, Douglas Fir; vertical grain, C and Better or superior finish.

B. Railings, Posts and other miscellaneous components: Spanish Cedar; premium grade.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. For applications not otherwise indicated, provide stainless-steel fasteners.

B. Insect Screening for Soffit Vents: Aluminum, 18-by-16-inch (1.6-by-1.4-mm) mesh.

C. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 079200 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 099113 "Exterior Painting."

B. Back prime all lumber, siding and trim prior to installation. Prime all cut edges prior to installation.

3.2 INSTALLATION, GENERAL

A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install stairs with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and with no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with bark side exposed to weather.

B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water. Cope at returns and miter at corners.

3.4 SIDING INSTALLATION

A. Lumber Siding: Apply starter strip along bottom edge of sheathing or sill. Install first course of siding with lower edge at least 1/8 inch (3 mm) below starter strip and subsequent courses lapped 1 inch (25 mm) over course below. Nail at each stud. Do not allow nails to penetrate more than one thickness of siding. Back prime siding prior to installation.

END OF SECTION 06 20 13

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Plastic-laminate cabinets.
4. Plastic-laminate countertops.
6. Closet and utility shelving.
7. Shop finishing of interior woodwork

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, fire-retardant-treated materials, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

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

1. Show details full size.
2. Show locations and sizes of blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for other items installed in architectural woodwork.
4. Apply AWI-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes (on board and veneer panels).
2. Plastic laminates (PVC edgings not permitted for exposed surfaces).
3. Thermoset decorative panels (for cabinet interiors and other non-exposed surfaces).
4. Solid-surfacing materials.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. for each species and cut, finished on 1 side and 1 edge.
2. Veneer-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish[, with 1 sample applied to core material] [and specified edge material applied to 1 edge].
4. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.
5. Solid-surfacing materials, 6 inches square.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

G. Qualification Data: For fabricator/installer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products and certified participant in AWI's Quality Certification Program..

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and transparent-finished wood doors that are required to be of same species as woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or,

where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

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

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Match Existing.

C. Wood Species for Opaque Finish: Any closed-grain hardwood.

D. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1[, Medium Density Overlay].
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

E. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

a. Formica Corporation.
b. Nevamar Company, LLC; Decorative Products Div.
c. Pionite
d. Wilsonart International; Div. of Premark International, Inc.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening (unless otherwise impractical), self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Catches: as indicated.

F. Adjustable Shelf Standards and Supports: as indicated.

G. Shelf Rests: as indicated

H. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

   1. Product: Subject to compliance with requirements, provide by Doug Mockett & Company, Inc.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

   1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base, unless otherwise noted..

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

B. Handrail Brackets: As indicated, with wall flange drilled and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
   2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
   3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly[, finishing,] and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for

shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Premium.

B. Wood Species: Any closed-grain hardwood.

2.6 PLASTIC-LAMINATE CABINETS

A. Grade: Premium

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade [HGS] .
2. Postformed Surfaces: Grade [HGP].
3. Vertical Surfaces: Grade [HGS].
4. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS or Thermoset decorative panels.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade [VGS] .

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes:

1. As selected by Architect from manufacturer’s full range.

G. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Premium.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from manufacturer's full range

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

E. Core Material: Particleboard or medium-density fiberboard. Provide exterior-grade plywood at sink counters.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.9 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4-inch veneer-faced panel product with solid-lumber edge

C. Cleats: 3/4-inch solid lumber

2.10 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing opaque-finished architectural woodwork.

D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with [No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips] [No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish] [toggle bolts through metal backing or metal framing behind wall finish].

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes [to tops with concealed metal brackets at 16 inches o.c.] [and] [to walls with adhesive].
4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. Refer to Division 9 Sections for final finishing of installed architectural woodwork[not indicated to be shop finished].

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering modified bituminous sheet waterproofing.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Representative Product: Grace, W. R., & Co. - Conn.; Bituthene 4000.

B. Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film

reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Equal Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. American Hydrotech, Inc.; VM75.
   b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
   c. CETCO Building Materials Group, a subsidiary of AMCOL International Corp.; Envirosheet.
   d. Henry Company; Blueskin WP 100/200.
   e. Meadows, W. R., Inc.; SealTight Mel-Rol.
   f. Nervastral, Inc.; BITU-MEM.
   g. Polyguard Products, Inc.; Polyguard 650.
   h. Protecto Wrap Company; PW 100/60.
   i. Tamko Building Products, Inc.; TW-60.
   j. York Manufacturing, Inc.; HydroGard.

2. Physical Properties:

   a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
   e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
   f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
   g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
   h. Hydrostatic-Head Resistance**:** 200 feet (60 m) minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

C. Modified Bituminous Sheet, Fabric Reinforced: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of rubberized-asphalt membrane with embedded fabric reinforcement, and with release liner on adhesive side.

1. Physical Properties:

   a. Pliability: No cracks when bent 180 degrees over a 1-inch (25-mm) mandrel at minus 25 deg F (minus 32 deg C); ASTM D 146.
   b. Puncture Resistance: [**40 lbf (180 N)**] [**100 lbf (445 N)**] minimum; ASTM E 154.
   c. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.

2. Sheet Strips: Self-adhering, reinforced, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

G. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.

2.3 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

1. Representative product: Subject to compliance with requirements, provide Hydroduct 220 or Hydroduct 660 by Grace, W. R., & Co. – Conn.

2. Or an equal product by one of the following manufacturers:

a. American Hydrotech, Inc.; Hydrodrain 400 or Hydrodrain 420.
b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6000,CCW MiraDRAIN 6000XL, CCW MiraDRAIN 6200 or CCW MiraDRAIN 6200XL.
c. Protecto Wrap Company; Protecto Drain 2000-V.

2.4 PROTECTION BOARD

A. Extruded Polystyrene Protection Board: 1” Thick.

PART 3 - EXECUTION

3.1 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Prepare surfaces and install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet-waterproofing terminations with mastic.

G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

I. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.2 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.3 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 07 21 00 - THERMAL INSULATION

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. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket acoustic insulation.
4. Air and Vapor barriers.

B. Related Sections:

1. Section 042000 "Unit Masonry" for insulation installed in cavity walls.
2. Section 071326 "Self-Adhering Sheet Waterproofing" for insulated drainage panels installed with waterproofing.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

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

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

2. Type IV, 25 psi (173 kPa).

B. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.
a. Owens Corning
b. Dow Chemical Company
c. Johns Manville

C. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Rmax, Inc.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is NOT a vapor barrier). Use where in all typical 2x6 wood stud wall construction where insulation is completely encased in other construction as follows:
1. 5 ½" thick, R21.

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 MINERAL-WOOL BLANKET INSULATION

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

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.4 SPRAY-APPLIED CELLULOSIC INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type III (materials containing an adhesive mixed with water during application; intended for application on attic floors), chemically treated for flame-resistance, processing, and handling characteristics.

B. R Value: R38.

2.5 AIR AND VAPOR BARRIERS

A. Air Barriers:
1. For use over exterior sheathing.
2. Product: DuPont™ Tyvek® CommercialWrap®
3. Manufacturer: DuPont Building Innovations; 1-800-44-Tyvek; www.Weatherization.Tyvek.com.
4. Accessories: X-Seal® Membrane Self-Sealing, Self-Adhering Air/Vapor Barrier tape to be installed over Tyvek under all veneer anchors.

B. Vapor Barriers:
   1. 10 mil polyethylene to be installed over typical 2x6 wood framing construction and under drywall interior finish. Tape all joints. Install with s.sheathing.
   2. Accessories: X-Seal® Membrane Self-Sealing, Self-Adhering Air/Vapor Barrier tape to be installed over polyethylene vapor barrier at locations of wood studs to seal all penetrations such as screws and nails.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

   1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of

insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
   a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

   a. Exterior Walls: Set units with facing placed toward interior of construction.

D. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where insulation blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated.

3.7 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 32 00 – SIMULATED SLATE ROOF TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Simulated slate roofing tiles (to match other adjacent Campus Building).

2. Underlayment.

1.2 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and blend specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

C. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fire-Resistance Characteristics: Where indicated, provide tiles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
   2. Class 4 Impact Resistance – UL 2218 Test Standard
   3. Wind Driven Rain – PA100-95 Test Standard.
   4. Wind uplift – UL 1897 Test Standard

B. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace simulated slate roof tiles that fail in materials or workmanship within specified warranty period.
   1. Material Warranty Period: 40 years from date of Substantial Completion, prorated, with first 12 years non-prorated.
   2. Algae-Discoloration Warranty Period: Simulated slate roof tiles will not discolor 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SIMULATED SLATE TILES

A. Simulated slate tiles made of a thermoplastic polyolefin compound with colorants and UV stabilizers
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following to match the existing adjacent Campus Buildings: Empire Slate™ Ecostar Gold Star Roof System. Eco Star LLC, 42 Edgewood Drive Holland, NY 14080 www.ecostarllc.com. Local Rep: Ed Taylor: 301-748-2409.
   2. Butt Edge: Straight cut to match existing.
   3. Tile size: 10'' or 12" widths by 18" long to match existing, and with a tapered nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures: = 300 - 320 lbs per square
   4. Color: As selected from manufacture's full range of colors to match existing roof tiles.

B. Hip, Ridge and Starter Tiles: Manufacturer's standard units to match simulated slate roof tiles. Trim each side of lapped portion of unit to taper approximately 1 inch.

2.2 UNDERLAYMENT MATERIALS

A. Underlayment:
   1. AquaGuard – a roofing underlayment recognized for use as an alternative to Type 30 roofing underlayment, consisting of spun bonded polyolefin coated with a layer of U.V. stabilized polyolefin on both sides, meeting requirements of ASTM D2626, referred to as 30 lb and without perforations.

A. Ice and Water Underlayment:
   1. Glacier Guard ice & water underlayment – Granular Surface 100 (55-mil), or Smooth Surface High Temperature 300 (40-mil) or Smooth Surface 400 (40-mil) a composite membrane consisting of fiberglass-reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface & Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).
   2. ELK VersaShield® - ELK VersaShield underlayment must be installed over the entire deck surface including over the Glacier Guard in conjunction with EcoStar UL Class A Empire Slate Tiles for those roof applications requiring UL Class A fire rating. ELK VersaShield should be installed per manufacturer's specifications.

2.3 ACCESSORIES

A. Roofing Cement: ASTM D 4586, Type II, asbestos free.
B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
   1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
D. "Starter Strip" tiles.
E. "Ridge Cap" tiles.

2.4 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 07620 "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (150 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
   1. Apply a continuous layer of simulated slate roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof.
   2. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
   3. Terminate felt underlayment extended up not less than 4 inches (100 mm) against sidewalls, curbs, chimneys, and other roof projections.
   4. Install fasteners at no more than 36 inch (900 mm)o.c.

C. Ice and Water Shield:
   1. 50 ft long by 3 ft wide rolled product. Apply to the top of plywood roof sheathing at the hips, valleys and eaves of the roof (underlayment shall extend 2 feet inside the exterior wall). Apply to the top of plywood roof sheathing at penetrations through the roof. Apply to the top of plywood roof sheathing at the entire roof where roof slopes are less than 4/12.
   2. Manufacturer: Grace Construction Products. Tel: 866-333-3726.Website: www.graceconstruction.com

3.2 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07620 "Sheet Metal Flashing and Trim."
   1. Install metal flashings according to recommendations in ARMA's "Residential Slate Roofing Manual" and simulated slate roof shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.3 SIMULATED SLATE ROOF TILE INSTALLATION

A. General: Install simulated slate roof tiles according to manufacturer's written instructions, recommendations in ARMA's "Residential Simulated slate roof Roofing Manual," and simulated slate roof shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an simulated slate roof shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
   1. Extend simulated slate roof tiles 3/4 inch over fasciae at eaves and rakes.
   2. Install starter strip along rake edge.

C. Install first and remaining courses of simulated slate roof tiles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install first and remaining courses of simulated slate roof tiles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

E. Install simulated slate roof tiles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.

F. Fasten simulated slate roof shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.
   1. Where roof slope is less than 4:12, seal simulated slate roof tiles with simulated slate roof roofing cement spots.
   2. When ambient temperature during installation is below 50 deg F, seal simulated slate roof tiles with simulated slate roof roofing cement spots.

G. Woven Valleys: Extend succeeding simulated slate roof shingle courses from both sides of valley 12 inches beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.

H. Closed-Cut Valleys: Extend simulated slate roofle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install simulated slate roof shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

I. Open Valleys: Cut and fit simulated slate roof tiles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

J. Ridge and Hip Cap Tiles: Maintain same exposure of cap tiles as roofing shingle exposure. Lap cap tiles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
   1. Fasten ridge cap simulated slate roof tiles to cover ridge vent without obstructing airflow.

END OF SECTION 07311

SECTION 07 61 00 - SHEET METAL ROOFING

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 custom-fabricated, standing and soldered flat lock seam sheet metal roofing.

1.3 COORDINATION

A. Coordinate sheet metal roofing layout and seams with sizes and locations of roof curbs, equipment supports, equipment provided, and roof penetrations.

B. Coordinate sheet metal roofing installation with rain drainage work, flashing, trim, and construction of roofing substrate**,** parapets, walls, and other adjoining work to provide leak proof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review structural loading limitations of substrates during and after roofing installation.
3. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affect sheet metal roofing.
4. Review requirements for insurance and certificates if applicable.
5. Review roof observation and repair procedures after sheet metal roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal roofing.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion joint locations, fixed points, and keyed details. Distinguish between shop- and field-assembled work.
3. Include details for forming, including seams and dimensions.

4. Include details for joining and securing, including layout and spacing of fasteners, cleats, and other attachments. Include pattern of seams.
5. Include details of termination points and assemblies.
6. Include details of expansion joints, including showing direction of expansion and contraction from fixed points.
7. Include details of roof penetrations.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail the following accessory items, at scale of not less than 1-1/2 inches per 12 inches (1:10) and/or 3 inches per 12 inches (1:5):

    a. Flashing and trim.
    b. Gutters and downspouts as they relate to adjacent sheet metal roofing.
    c. Roof curbs.

C. Samples for Initial Selection: For each type of sheet metal with factory-applied finishes.

1. Include Samples of trim and accessories involving finish or color selection.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Roofing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, and other attachments.
2. Trim and Metal Closures: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Other Accessories: 12-inch- (300-mm-) long Samples for each type of other accessory.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Sheet metal roofing, seam locations, and attachments.
2. Details for penetrations.

B. Qualification Data: For Installer and Fabricator.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Sheet Metal Roofing Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical roof area and eave as shown on Drawings, including underlayment, attachments, and accessories.

a. Size: Approximately 48 inches (1200 mm) square.
b. Include each type of exposed seam and seam termination, fascia, and gable end and rake.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.10 WARRANTY

A. Special Warranty: Warranty form at end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, rupturing, cracking, or puncturing.
b. Wrinkling or buckling.
c. Loose parts.
d. Failure to remain weather tight, including uncontrolled water leakage.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
f. Galvanic action between sheet metal roofing and dissimilar materials.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories, shall comply with requirements without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing shall remain watertight.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.

C. Copper Roofing Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOFING SHEET METALS

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

B. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. VM Zinc – Basis of Design
    b. Hussey Copper Ltd.
    c. PMX Industries
    d. Luvata Buffalo, Inc.

2. Weight (Thickness): 16-oz. /sq. ft. (0.55-mm) uncoated weight (thickness), with 0.787-mil (0.020-mm) coating thickness applied to each side.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Products: Subject to compliance with requirements and panel manufacturer requirements for a warranted installation, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; [Grace Ice and Water Shield HT].
c. Henry Company; Blueskin PE200 HT.
d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
e. Metal-Fab Manufacturing, LLC; MetShield.
f. Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
g. Polyguard Products, Inc.; Deck Guard HT.
h. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
i. SDP Advanced Polymer Products Inc; Palisade SA-HT.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.

B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. General:

a. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of roofing.
b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Tin Alloy-Coated Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.

C. Solder:
1. For Zinc-Tin Alloy-Coated Copper: ASTM B 32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 ACCESSORIES

A. Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.

1. Cleats: Intermittent and continuous attachment devices for mechanically seaming into joints and formed from the following materials and thicknesses unless otherwise indicated:

   a. Zinc-Tin Alloy-Coated Copper Roofing: 16-oz./sq. ft. (0.55-mm)

2. Expansion-Type Cleats: Cleats of a design that allows longitudinal movement of roof panels without stressing panel seams; of same material as other cleats.
3. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where necessary to ensure weather tight construction.
5. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch (0.46 mm).

2.6 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.

1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1 inch (25 mm).

B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

1. Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
2. Offset transverse seams from each other 12 inches (300 mm) minimum.
3. Fold and cleat eaves and transverse seams in shop.
4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leak proof construction.

E. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

F. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to SMACNA standards.

G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices of sizes recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Lay out panel arrangement and screw battens to wood sheathing before installation of sheet metal roofing.

1. Space fasteners not more than 18 inches (460 mm) o.c.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

1. Apply self-adhering sheet underlayment over entire roof.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal roofing and related flashing.

C. Install flashings to cover underlayment according to conditions.

3.4 INSTALLATION, GENERAL

A. General: Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings. Install fasteners**,** solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
3. Field cutting of sheet metal roofing by torch is not permitted.

4. Provide metal closures at peaks, rake edges, rake walls, eaves, and each side of ridge and hip caps.
5. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
6. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid four-panel lap splice condition. Install backing plates at roofing splices.
8. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.
9. Do not use graphite pencils to mark metal surfaces.

B. Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.

1. Point of Fixity: Fasten each panel along single line of fixing located as recommended by manufacturer.
2. Avoid attaching accessories through roof panels in manner that inhibits thermal movement.

C. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws and/or substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by sheet metal manufacturer or SMACNA.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with at least two fasteners to prevent rotation.
2. Space cleats not more than 12 inches (300 mm) o.c. Bend tabs over fastener head.
3. Provide expansion-type cleats for roof panels that exceed 30 feet (9.1 m) in length.

B. Seal joints as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to a width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel, aluminum, and titanium sheet.
2. Do not pre-tin zinc-tin alloy-coated copper.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
5. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
6. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
7. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.

D. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with double-fastened cleats spaced at 12 inches (300 mm) o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.

1. Lock each panel to panel below with soldered transverse seam.
2. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
3. Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (600 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12-inch (305-mm) o.c. spacing. Lock panels to edge flashing.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weather tight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and install units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

1. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual" and on Drawings.
3. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates, and to result in waterproof and weather-resistant performance.
4. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

    a. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep and filled with butyl sealant concealed within joints.
    b. Use lapped expansion joints only where indicated on Drawings.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal roofing within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in clean condition during construction.

E. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.9 ROOFING INSTALLER'S WARRANTY

A. WHEREAS of herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner:
2. Owner's Address:
3. Building Name/Type:

4. Building's Address:
5. Area of Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Peak gust wind speed exceeding 75 mph
    c. Fire;
    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. Vapor condensation on bottom of roofing; and
    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this day of

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION 07 61 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM, GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Exposed aluminum trim and fascia.
2. Aluminum Gutters and Downspouts
3. Metal flashing.

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

1. Division 7 Roofing Sections for flashing and roofing accessories installed integral with roofing membrane as part of roofing-system work.
2. Division 7 Section "Joint Sealants" for elastomeric sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:

1. Wind Zone 2

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.

1. 8-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project for a period of no less than five (5) years, with a record of successful in-service performance.

B. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Construct mockups for the following type of sheet metal flashing and trim:

    a. Exposed trim, gravel stops, and fasciae.
    b. Copings.

5. Obtain Architect's approval of mockups before start of final unit of Work.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Stainless-Steel Sheet: ASTM A 167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch (0.5 mm) thick, unless otherwise indicated.

B. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch (0.85 mm) thick, unless otherwise indicated. Use in conjunction with metal wall panels, and where trim is to match wall panel color.

C. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet, with a minimum thickness of 0.0625 inch (1.6 mm) except not less than 0.0937 inch (2.4 mm) thick for applications where burning (welding) is involved.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Berger Building Products, Inc.
2. Cheney Flashing Company.
3. Hickman Company, W. P.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m) with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate from the following exposed metal:

a. Formed Aluminum: 0.050 inch thick.

2. Gutter Profile: Half Round with round downspout
3. 6” gutter according to SMACNA's "Architectural Sheet Metal Manual."
4. Corners: Factory mitered and soldered or mechanically clinched and sealed watertight.
5. Gutter Supports: Manufacturer's standard adjustable supports as selected by Architect with finish matching the gutters.
6. Special Fabrications: Radiussed sections.
7. Gutter Accessories: Continuous snap-in leaf guard.

C. Support Bracket, retainer stem, and keeper bracket shall be manufactured from 0.125" x 1.00" extruded aluminum bar, helliarc welded construction, factory punched for fasteners.

D. Interior Straps shall be manufactured from 0.125" x 1.00" extruded aluminum.

E. Downspouts: Plain round complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Formed Aluminum: 0.063 inch thick.
2. Size: As indicated

F. Leaf Guards:

1. Leaf guard system by Englert: leaf protection screen made of high quality, heavy gauge 027 aluminum that fits over 6” gutter.

2.3 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counter-flashing pieces and compatible with flashing indicated.

B. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Counter-flashing Wind-Restraint Clips: Provide clips to be installed before counter-flashing to prevent wind uplift of the counter-flashing lower edge.

1. Material: Stainless steel, 0.0187 inch (0.5 mm) thick.

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

1. Fry Reglet Corporation.
2. Hickman: W.P. Hickman Co. 3. Keystone Flashing Company.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Burning Rod for Lead: Same composition as lead sheet.

B. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

C. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

E. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

F. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

G. Polyethylene Underlayment: ASTM D 4397, minimum 6¬mil- (0.15-mm-) thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching - or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.5 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in stainless steel sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.6 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Splash Pans: Fabricate from the following material: 1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

C. Roof-Drain Flashing: Fabricate from the following .-,material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

D. Scuppers: Fabricate from the following material: 1. Aluminum: 0.050 inch (1.2 mm) thick.

E. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:

1. Aluminum: 0.050 inch (1.2 mm) thick.

F. Copings: Fabricate from the following material: 1. Aluminum: 0.050 inch (1.2 mm) thick.

G. Counter-flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

H. Flashing Receivers: Fabricate from the following material:

I. Stainless Steel: 0.0156 inch (0.4 mm) thick. I. Drip Edges: Fabricate from the following material: 1. Aluminum: 0.0320 inch (0.8 mm) thick.

J. Equipment Support Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

K. Roof-Penetration Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

L. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Stainless Steel: 0.0250 inch (0.65 mm) thick.

2.7 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermo-cured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place, by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pre-tinned surface would show in finished Work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

E. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Separations: Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.

2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

G. Install reglets to receive counter-flashing according to the following requirements:

1. Where reglets are shown in concrete, furnish reglets for installation under Division 3 Section "Cast-in-Place Concrete."

2. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."

H. Counter-flashings: Coordinate installation of counter-flashings with installation of assemblies to be protected by counter-flashing. Install counter-lashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counter-flashing joints a minimum of 2 inches (50 mm) and bed with sealant.

I. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

J. Roof-Penetration Flashing: Coordinate roof¬penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.

2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

K. Splash Pans: Install where downspouts discharge on low-sloped roofs, unless otherwise shown. Set in roof cement or sealant compatible with roofing membrane.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07 62 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.3 SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
3) FM Global in its "Building Materials Approval Guide."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-

resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies].
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, 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: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.

3.5 FIELD QUALITY CONTROL

A. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

B. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and provisions of the Contract, including all Division 0 – Terms and Conditions Specification Sections and Division 1 – General Requirements Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants, fillers and adhesives for the following applications, including those specified by reference to this Section:

1. Interior joints in the following vertical surfaces and horizontal surfaces:

a. Control and expansion joints on exposed surfaces of masonry walls.
b. Joints where countertops abut vertical surfaces.
c. Perimeter joints between interior wall surfaces and frames of interior doors windows, elevator entrances and wood bases.
d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
e. Tile control and expansion joints.
f. Stone threshold setting.

B. Related Sections include the following:

1. Division 8 Section “Glazing” for butt glazing sealant.

2. Division 7 Section “ EPDM Membrane Roofing” for roof expansion joints.

3. Division 9 Section "Gypsum Board Assemblies" for locations of perimeter joints of gypsum board partitions to reduce sound transmission, with products specified in this section.

4. Division 8 Sections “Wood Doors and Frames” and Hollow Metal Doors and Frames for sealants applied to junction of door frames and partitions.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

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 type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Field Test Report Log: For each elastomeric sealant application.

E. Warranties: Special warranties specified in this Section.

PROJECT CONDITIONS

F. 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.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed.

2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.

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

C. Architectural Sealants:

1. Toxicity/IEQ:

a. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceed requirements South Coast Air Quality Management District (SCAQMD) #1168.

b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, and for all countertop sealants provide products that comply with 21 CFR 177.2600.

D. Single-Component Neutral-Curing Silicone Sealant [ES-1]:

1. Available Products:
   a. GE Silicones; SilPruf SCS2000.
   b. Pecora Corporation; 864.
   c. Pecora Corporation; 890.
   d. Polymeric Systems Inc.; PSI-641.
   e. Sonneborn, Division of ChemRex Inc.; Omniseal.
   f. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).

E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant [ES-4]:

1. Products:

a. Dow Corning; 786 Mildew Resistant.
b. Pecora Corporation; 898.
c. Tremco; Tremsil 600.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant [LS]: Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant [AS] for Exposed and Concealed Joints AS] Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Elastomeric Flexible Clear Sealants:
   a. Sound Specialties Coatings Corporation: Slickthane high solids polyurethane-acrylic blend, single component ambient or heat cure, zero to low VOC, waterborne.

B. Non-hardening fire-stop sealant:

1. Gun or trowel-applied intumescent sealant: 3M “CPW-25WB+” or approved equal.
2. Moldable intumescent putty: 3M “Fire Barrier Moldable Putty+” or approved equal.
3. Non-intumescent silicone sealant: 3M “Silicone Fire Stop”, USG “Smokeseal” or approved equal) may be used in lieu of the sealant on foam rod in noise sensitive walls that are also fire rated.

2.6 FOAM BACKER ROD

A. Closed cell polyethylene backer rod, ASTM C1193

B. Acceptable Manufacturers: ITP, Nomaco, or approved equal (available through Tom Brown, Inc. 800-446-2298)

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 Expansion Joint Filler: W.R. Meadows, Sealtight, multi-purpose expansion-contraction joint filler in recommended thickness for anticipated range of joint movement. Adhere to one plane surface.

2.9 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: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.10 ADHESIVES

A. Material recommended by adhesive manufacturer for application of material to substrate for intended application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions 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, blast cleaning, 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. Other porous substrates.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous 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. Porcelain enamel.
    b. Glazed surfaces of ceramic tile.
    c. Other porous substrates.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged.

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. Sealants for Stone Masonry: Provide non-staining sealant systems as certified by test data and as recommended by manufacturer for sealing interior and exterior stone facing joints.

D. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

1. Furnish and install acoustical sealant at the following locations:
   a. All penetrations of partition, wall, and floor construction by ductwork, conduit, piping, or structure
   b. All termination of partitions enclosing Noise Critical Spaces to abutting construction (e.g. partitions, structure, etc.)
   c. Both sides of door frames to abutting construction where doors are scheduled to have acoustical seals
   d. Both sides of window frames to adjacent construction at windows in partitions enclosing Noise Critical Spaces.
   e. Perimeter of penetrations through sound isolating ceilings, roof systems, and floor systems

2. Backer Rod shall be used in all joints greater than ¼ inch. Product to be constructed of closed cell foam, or appropriate resilient material for sealant. Dimension shall be minimum 30% greater than joint width, unless otherwise indicated on details.

E. Install sealant backings of type 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.

F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

G. 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.

H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
2. Inspect tested joints and report on the following:

    a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free of voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

3. 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 fill, sealant configuration, and sealant dimensions.
4. 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 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 Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 Sealant Schedule:

LOCATION	SYSTEM NO.	CUSTOM COLOR
Masonry/Masonry	ES-1	Yes
Masonry/Cast Stone	ES-1	Yes
Cast Stone /EIFS	ES-1	Yes
Masonry/Metal	ES-1	Yes
Metal/Metal	ES-1	Yes
Exterior Paving	ES-2	Yes
Tile/Fixtures	ES-4	Yes
Painter's Caulk	LS	No
Interior Acoustical Joints	AS	No

END OF SECTION 07 92 00

SECTION 08 14 33 - WOOD PANEL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide wood doors where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Section Includes:

1. Interior and exterior solid wood core stile and rail doors for painted finish.

C. Related Documents/Sections: Carefully examine the Contract Documents for requirements which affect work of this Section. Documents and specification sections containing requirements which relate to this Section include, but are not necessarily limited to:

1. General and Supplementary Conditions and sections in Division 1 of these Specifications.
2. Section 06 40 23 – Interior Architectural Woodwork

1.2 SUBMITTALS

A. General:

1. Identify proposed changes, differences, and discrepancies, including verbiage, terms, and definitions, between Contract Documents and submittals.

B. Product Data:

2. For each type of product indicated, submit manufacturer's specifications and other data needed to prove compliance with the specified requirements.

C. Shop Drawings:

1. Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction including details of stiles and rails, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.

2. For factory-premachined doors, indicate dimensions and locations of cutouts for locksets and other cutouts.

D. Samples:

1. Submit samples, 1'-0"" lengths for each material, type and finish required.

E. Quality Control Submittals:

1. Certificates:

a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

b. Manufacturer's Instructions:

1) Submit manufacturer's recommended installation procedures which, when reviewed by the Architect, may become the basis for accepting or rejecting actual installation procedures used on the work.

1.3 QUALITY ASSURANCE

A. Quality Standards: Comply with requirements of NWWDA I.S.1 Series and AWI "Architectural Woodwork Quality Standards".

1. AWI Quality Standard: "Architectural Woodwork Quality Standards"; including "Stile and Rail doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

A. NWWMA Quality Marking: Mark each wood door with NWWDA Wood Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series.

1. For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

B. Manufacturer: Obtain doors from a single manufacturer.

C. Product Delivery Storage and Handling

1. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

a. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

D. Project Conditions

1. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

i. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

1.4 WARRANTY

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during following period of time after date of Substantial Completion.
3. Interior stile and rail wood Doors: Life of installation.

    a. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Representative Manufacturer and Product:
1. Custom manufactured door to match existing solid wood stile and rail doors.

2.2 WOOD DOORS

A. General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces of each door, unless otherwise indicated.

B. General: Construct rated and non-rated doors to have the following attributes:

1. Style: Panel to match existing.
2. Bevel: 2 sides. 3/16” bevel.
3. Thickness: 1 ¾” thick.
4. Rails, stiles, shall be so constructed of wood reinforced if required to meet the following performance criteria:

    a. Direct screw withdrawal (ASTM D1037-78): 700 load pounds (315 load KG) minimum on average of ten test samples, using a No. 12 1-1/4 inch long steel, fully threaded wood screw.
    b. Modified cleavage (ASTM D143-83): 700 LB (315 KG) average minimum for ten test samples.
    c. Cycle/slam (ANSI A151.1, Section 2.5): 200,000 cycles with no loose hinge screws or other visible signs of failure.

5. Stiles and top and bottom rails shall match existing.
6. Construction of doors shall employ stile and rail components. Ensure stability and integrity while minimizing warping, cracking or bowing.

C. Interior Solid Core Stile and Rail Panel Doors for Painted Finish as follows:

1. Construction: Solid wood; custom stile and rail and panel profile to match existing.
    a. Species: Any hardwood
    b. Prime and paint

2.3 FABRICATION

A. Fabricate wood doors to produce doors complying with following requirements:

1. Factory premachine doors to fit frame opening sizes indicated and complying with AWI prefitting tolerances.

2. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.

2.4 FACTORY FINISHING

A. General: Factory-prime doors in compliance with AWI Quality Standard Section 1500. Priming should be with a low VOC water based primer. Minimum two coats are required.
B. Request finishing instructions from manufacturer before painting doors.
C. Final coat in field per Painting section 09 91 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames prior to hanging door:

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject door frames and doors with defects.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation see Section 08710 - Door Hardware.

B. Prefit Doors: Fit to frames for uniform clearance at each edge.

C. Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors which do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 081416

SECTION 08 21 20 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior stile and rail wood doors.

B. See Division 6 Section Interior Architectural Woodwork for wood door frames.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated.

B. Shop Drawings: Indicate location, size, and hand of each door; fire ratings; construction details for stiles, rails, panels, and moldings (sticking); mortises, holes, and cutouts; and other pertinent data.

C. Samples: For each face material and finish.

1.3 QUALITY ASSURANCE

A. NWWDA Quality Standard: NWWDA I.S.6, "Industry Standard for Stile and Rail Doors."

B. AWI Quality Standard: AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

C. WIC Quality Standard: WIC's "Manual of Millwork" for grade of door, core, construction, finish, and other requirements.

D. Safety Glass: Provide products complying with ANSI Z97.1 and testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

PART 2 - PRODUCTS

2.1 CUSTOM STILE AND RAIL DOORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Mitrewright, Inc.
2. Shavely Woodworking
3. ENJO Doors and Windows.

4. Maiman Company (The).
5. Pinecrest.

C. Stile and Rail Doors for Painted and Transparent Finishes:

1. Grade: Custom.
2. Wood Species and Cut:

a. Plain Sawn Birch or Poplar – Paint Grade.

3. Stile and Rail Construction: Solid lumber paint or stain grade where indicated.
4. Panel Construction: Solid wood to match existing.

5. Design and Layout:

a. NWWDA Design Group: 1-3/4 Thick Interior Panel Doors.

1) Panel Design: Match Existing.

D. Interior Doors:

1. Stile, Top and Intermediate Rail Widths: Match Existing wood panel doors.
2. Bottom Rail Widths: Match Existing wood panel doors.
3. Raised Panel Thickness: Match Existing wood panel doors.
4. Flat Panel Thickness: Match Existing wood panel doors.
5. Glass for Openings: Uncoated, clear, fully tempered float glass, ¼ inch thick.

E. Exterior Doors:

1. Stile, Top and Intermediate Rail Widths: Match Existing wood panel doors.
2. Bottom Rail Widths: Match Existing wood panel doors.
3. Raised Panel Thickness: Match Existing wood panel doors.
4. Flat Panel Thickness: Match Existing wood panel doors.
5. Glass for Openings: Uncoated, clear, fully tempered float glass, ¼ inch thick.

2.2 FABRICATION

A. Fabricate stile and rail wood doors for site fitting.

B. Fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

C. Machine doors for hardware that is not surface applied to match existing.

D. Factory-Glaze Openings: Comply with Division 8 Section "Glazing."

E. Field-Glazed Openings: Trim openings indicated for glazing with solid wood moldings of profile indicated, with one side removable.

F. Transom and Side Panels: Fabricate panels matching adjoining doors in materials, finish, and quality of construction.

G. Exterior Doors: Factory treat exterior doors after fabrication with water repellent to comply with NWWDA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.3 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime exposed portions of doors for paint finish with one coat of wood primer specified in Division 9 Section "Painting."

B. Transparent Finish: Factory Pre-Finish faces and edges of doors with stain (if required), other required pretreatments, and final finish to match existing wood paneling.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood doors to comply with referenced quality standard and manufacturer's written instructions.

1. Fire-Rated Doors: Install in corresponding fire-rated frames according to NFPA 80.

B. Shop-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels indicated; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances:

a. At Heads, Jambs and Between Pairs of Doors: 1/8 inch.
b. Bottom of Door to Top of Floor Finish or Covering: 1/8 inch.

END OF SECTION 08 21 20

SECTION 08 36 13 - SECTIONAL DOORS

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

1. Section includes electrically operated sectional doors including door and electrical operator, detailed to match the appearance of the existing wood overhead doors to be replaced.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated.

1. Wind code rated for Wind Zone: 2.

2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.

D. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283 or DASMA 105.

1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph.

1.4 SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Flat Door Sections: 6 inches (150 mm) square.
2. Frame for Paneled Door Sections: 6 inches (150 mm) long of each width of stile and rail required.
3. Panel for Raised-Panel Door Sections: 12 inches (300 mm) square at panel corner, but not smaller than required to show raised-panel profile.

E. Qualification Data: For qualified Installer.

F. Maintenance Data: For sectional doors to include in maintenance manuals.

G. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Wood Door Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

C. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

D. 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.

E. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
d. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years installation warranty from date of Substantial Completion. Lifetime Door Section Warranty.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SECTIONAL DOOR PRODUCT

A. Manufacturers:
1. Clopay Building Products, a Griffon Company.

2. Equal manufacturers:

a. Amarr Garage Doors.
b. Arm-R-Lite.
c. C.H.I. Overhead Doors.
d. Fimbel Architectural Door Specialties.
e. General American Door Company.
f. Haas Door; a Nofziger company.
g. Martin Door Manufacturing.
h. Overhead Door Corporation.
i. Raynor.
j. Rite-Hite Corporation.
k. Wayne-Dalton Corp.
l. Windsor Republic Doors.

B. Basis-of-Design Product:
1. Clopay residential style garage door.
a. Clopay Garage Doors, Cincinnati Ohio Office:
8585 Duke Boulevard Mason, OH 45040
b. Style: Classic Collection, Premium Series.
c. Custom Arch Top
d. Size: two sizes

1) X'xX' (existing opening - verify dimensions on site).
2) X'xX'(new double wide opening - verify dimensions on site).

e. Finish: Composite "White" overlay with "White" base.

2. or comparable product by one of the following:

a. Equal product.

2.2 STEEL DOOR SECTIONS

A. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.

1. Fabricate section faces from Four-layer insulated steel with custom white composite overlay construction with beveled coped edge and center groove.

B. Board Thermal Insulation:
1. Intellicore®insulated doors: 2" thick polystyrene with a thermal break and sandwiched between two layers of bonded steel.
2. R-value: 18.4 (calculated door section R-value is in accordance with DASMA TDS-163).

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.4 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

2.5 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
2. Keys: four for each cylinder.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.6 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Cables: Galvanized-steel lifting cables with cable safety factor of at least 5 to 1.

C. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.7 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit of type indicated, consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 110513 "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: [115] [208]
c. Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

E. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

K. Radio-Control System: Consisting of three-channel universal coaxial receiver to open, close, and stop door; two per operator.

2.8 DOOR ASSEMBLY

A. Steel and Composite Sectional Door: Sectional door formed with hinged sections.

B. R-Value: 18.4.

C. Track Configuration: Standard-lift track.

D. Weatherseals: Fitted to bottom and top and around entire perimete] of door. Provide combination bottom weatherseal and sensor edge.

E. Counterbalance Type: Torsion spring.

F. Manual Door Operator: Push-up operation.

G. Door Finish:

1. Aluminum Finish**:** Manufacturer’s standard White.

H. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

I. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Finish: Manufacturer's standard finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weathertight fit around entire perimeter.

D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.

E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 08 55 00 - ALUMINUM CLAD WOOD WINDOWS AND DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes fixed and operable wood-framed windows of the following type:

1. Aluminum clad - Fixed.
2. Aluminum clad – Double Hung.

B. Related Sections

1. Section 04200 Unit masonry Assemblies – Window flashing Systems

C. Replacement windows will be reviewed by the PA Museum and Historical Commission, and shall match existing profiles, configurations, dimensions, etc,… in-kind, and be approved by PAMC.

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

1. C: Commercial.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:

1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance.

2. Size indicated on Drawings.

B. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

a. Basic Wind Speed: 90 mph.
b. Exposure Category C.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

C. Certification: Windows shall be Hallmark certified to a rating of H-LC specifications in accordance with ANSI/AAMA/NWWDA I.S.2.

D. Window Unit Air Leakage: Per ASTM E 283, 7.5 psf (52 mph): 0.3 cfm per square foot of frame or less.

E. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 4.5 psf (42 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.
9. For installed products indicated to comply with design loads, include structural analysis data prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of wood windows and used to determine the following:

a. Structural test pressures and design pressures from basic wind speeds indicated.
b. Deflection limitations of glass framing systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.
   1. Include similar Samples of hardware and accessories involving color selection.

D. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below.

   1. Operable Window: Full-size unit with factory-applied finish.
   2. Hardware: Full-size units with factory-applied finish.
   3. Weather Stripping: 12-inch- (300-mm-) long sections.

E. Product Schedule: For wood windows. Use same designations indicated on Drawings.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of wood window. Test results based on use of downsized test units will not be accepted.

H. Maintenance Data: For operable window sash, operating hardware, weather stripping and finishes to include in maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

   1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of data for wood windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating wood windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain wood windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood windows and are based on the specific system indicated. Refer to Division 1 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. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass

Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide AAMA or WDMA-certified wood windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

G. 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 each window type.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to wood windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify wood window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:
   a. Window: Three years from date of Substantial Completion.
   b. Glazing: Ten years from date of Substantial Completion.
   c. Metal Finish: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. ALUMINUM CLAD WOOD WINDOWS AND DOOR MANUFACTURERS:

   a. Marvin Windows
      Marvin Windows and Doors
      P.O. Box 100. Warroad, MN 56763
   b. Pella Windows – equal products by Pella Windows
      Pella Corporation, 102 Main Street, Pella, Iowa 50219
   c. Kolbe-Kolbe
      1323 S. 11th Ave.
      Wausau, WI 54401-5998

2.2 ALUMINUM CLAD WOOD WINDOW TYPES:

A. Double Hung and Fixed Windows:

1. Aluminum clad wood ultimate—double hung, single hung, transom, picture—window complete with hardware, glazing, weather strip, insect screen, removable grille, Grille Between Glass, simulated divided lite, jamb extension, combination storm/screen, and standard or specified anchors, trim, attachments, and accessories.
2. System Description- Design and Performance Requirements:

   a. Window units shall be designed to comply with ANSI / AAMA / NWWDA 101 / I.S.2-97 and 101 / I.S. 2/ NAFS-02
   b. Double Hung / Single Hung: (H-LC40 rating up to CN 3036, CN 4026) (H-LC30 Rating up to CN4036)
   c. Transom: (TR-C40 rating up to CN 7420)
   d. Picture: (F-C40 rating up to CN 6878)
   e. Air leakage shall not exceed the following when tested at 1.57 according to ASTM E 283: .30 cfm per square foot of frame.
   f. No water penetration shall occur when units are tested at the following pressure according to ASTM E 547: (H-LC40 - 6.0) (H-LC30 - 4.5) (F-C40-6.0) (TR-C40-6.0) psf.
   g. Window assembly shall withstand the following positive or negative uniform static air pressure difference without damage when tested according to ASTM E 330: (H-LC40 – 60) (H-LC30 – 45) (F-C40-60) (TR-C40-60) psf.
   h. Simulated Divided Lites (SDL).
   i. Window-size as shown on the drawings.

2.4 GLAZING

A. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

B. Glazing:

1. Float Glass: ASTM C 1036, Quality 1.

2. Tempered Glass: ASTM C 1048.

a. Glazing System Type:

1) Silicone-glazed 11/16-inch dual-seal, insulating glass, clear argon-filled multi-layer, Low-E.

b. Simulated Divided Lites (SDL):

1) Type: Exterior aluminum grilles, divider band and interior wood grilles.

c. Exterior muntins: 1 1/8” profile extruded aluminum 0.055 inch (1.4 mm) thick.
d. Internal bar: 1 1/8” white contoured aluminum bar.
e. Interior muntins: Pine; SDL adhered to glass with closed-cell copolymer acrylic foam tape.
f. Pattern: Rectangular; Custom lite layout.
g. Finish: Match panel finish.

2.7 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material; designed to smoothly operate, tightly close, and securely lock wood windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

B. Counterbalancing Mechanism: Comply with AAMA 902.

C. Sash-Balance Type: Concealed, spring-loaded, block-and-tackle type, of size and capacity to hold sash stationary at any open position.

D. Sill Cap/Track: Extruded-aluminum track with natural anodized finish or Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

E. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks.

F. Roller Assemblies: Low-friction design.

2.8 HARDWARE FINISHES

A. Hardware Finishes: Provide oil rubbed bronze appearance.

2.10 INSECT SCREENS FOR CASEMENT WINDOWS

A. General: Provide manufacturer's insect screen.

B. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside of window and provide for each operable exterior sash or ventilator.

i. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Architectural C-24 class.

C. Aluminum Insect Screen Frames: (Casement Windows only) Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.

ii. Finish: Anodized aluminum in manufacturer's standard color.

2.11 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.

A. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

1. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.

B. Factory machine windows for openings and for hardware that is not surface applied.

C. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

D. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.

E. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.12 WOOD FINISHES

A. Factory-Finished Windows: Provide manufacturer's standard factory clear finish. Apply finish to exposed interior wood surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 55 00

SECTION 09 29 00 - GYPSUM BOARD

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. Interior gypsum board.

2. Tile backer panels.

B. Related Requirements:
1. Section 061000 "Rough Carpentry" for wood framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch
2. Long Edges: Tapered.

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

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.

c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound. Note: Do not use without authorization by Architect.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

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

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

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

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical & Horizontal surfaces unless otherwise indicated.
2. Type X: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 5: At panel surfaces that will be exposed to view and scheduled to receive semi-gloss or high gloss finishes.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions as applicable to concealed or exposed applications.

F. Glass-Mat Faced Tile Backer Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 31 00 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Porcelain Floor Tile.

B. Related Sections include the following:

   1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 9 Section "Gypsum Board Assemblies" for substrates for ceramic tile.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

   1. Level Surfaces: Minimum 0.6 Wet & Dry.

1.5 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
3. Full-size units of each type of trim and accessory[for each color and finish required].

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Joint sealants.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid latexes in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

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

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PRODUCTS, GENERAL

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

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Available Manufacturers:

1. Casa Dolce Casa
2. Crossville, Inc.
3. Daltile; Div.of Dal-Tile International Inc.
4. Ergon Engineered Stone
5. Garden State Tile
6. Marco Corona, Inc.
7. Royal Mosa

B. CT-1 Porcelain Stone Tile:

1. Crossville, Inc. (Basis of Design) Distributed by Garden State Tile
2. Style: Color Blox
3. Color: Sandbox
4. Number: A1101
5. Nominal Sizes: 6”x 6”
6. Actual Sizes: 5-13/16” x 5-13/16”
7. Thickness: 3/8”
8. Location: First Floor HDCP Toilet Room 104 Floor

C. CT-2 Porcelain Stone Tile:

1. Marca Corona, Inc., (Basis of Design) Distributed by Garden State Tile
2. Style: Natural Living
3. Color: Nal. Sand
4. Number: 4483
5. Nominal Module Sizes: 12” x 12”
6. Thickness: 10mm
7. Location: Second Floor Master Bath Room 217 Floor

D. CT-3 Porcelain Stone Tile:

1. Garden State Tile (Basis of Design) Distributed by Garden State Tile
2. Style: Travertini
3. Pattern: Mosaico Intreccio
4. Color: Beige Matte
5. Nominal Sizes: 2 x 2 & 1 x 1
6. Actual Sizes: 1-3/4” x 1-3/4” & 3/4” x 3/4”
7. Thickness: 3/8 inch.
8. Location: Second Floor Shared Bath Room 219 Floor

E. CT-4 Porcelain Stone Tile:

1. Garden State Tile (Basis of Design) Distributed by Garden State Tile
2. Style: Travertini

3. Pattern: Mosaico
4. Color: Beige Matte
5. Pattern: Modular Mosaic
6. Nominal Sizes: 3” x 3”
7. Actual Sizes: 2-7/8” x 2-7/8”
8. Thickness: 3/8 inch.
9. Location: Third Floor Guest Bath Room 306 Floor

2.4 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. Custom Building Products (Basis of Design).
2. Bonsal, W. R., Company.
3. Bostik.
4. DAP, Inc.
5. LATICRETE International Inc.
6. MAPEI Corporation.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix combined with styrene-butadiene-rubber liquid-latex additive.

a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Standard Unsanded Cement Grout: ANSI A118.6, color as selected by Architect from manufacturer's full range.

2.5 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Available Products:

a. Dow Corning Corporation; Dow Corning 786.

b. GE Silicones; Sanitary 1700.
c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
d. Tremco, Inc.; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, white zinc alloy exposed-edge material.

C. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with [adhesives] [or] [thin-set mortar] that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both

directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
3. For chemical-resistant furan grouts, comply with ANSI A108.8.

I. Joint Widths: Install tile on Walls with the following joint widths:
1. Porcelain Tile: 1/8 inch.

J. Install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:
1. Porcelain Tile: 1/8 inch.

C. Wood Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 31 00

SECTION 09 64 00 - WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. Field-finished wood flooring.

1.3 SUBMITTALS

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

B. Shop Drawings: Show installation details including location and layout of each type of wood flooring and accessory.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.

D. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.4 QUALITY ASSURANCE

A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.

   1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

D. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
   2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.

a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 FIELD-FINISHED WOOD FLOORING

A. Solid-Wood, Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled (kerfed) for stress relief.

B. Wood Species and Finish: Oak to match existing grain, size, etc…

1. Floor Sealer: Pliable, penetrating type.

2.2 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils thick.

B. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

C. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring.

D. Cork Expansion Strip: Composition cork strip.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."

1. Proceed with installation only after substrates pass testing.

C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:

1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring." Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring.".

B. Provide expansion space at walls and other obstructions and terminations of of not less than 3/4 inch.

C. Vapor Retarder:

1. Wood Flooring Installed over nom. ¾" pressure treated plywood sub-floor installed according to flooring manufacturer's written instructions.

D. Solid-Wood, Flooring: Blind nail or staple flooring to substrate.

E. Wood Trim: Nail baseboard to wall; do not nail to flooring.

3.4 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 64 00

SECTION 09 65 16 - SHEET FLOOR COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. Vinyl sheet floor coverings.
   2. Linoleum sheet floor coverings.

B. Related Sections include the following:
   1. Division 9 Section "Carpet Flooring" for Broadloom Carpet.
   2. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tile and sheet goods.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of floor covering indicated.

   1. Include similar Samples of installation accessories involving color selection.

C. Qualification Data: For Installer.

D. Maintenance Data: For floor coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project that are competent in heat-welding techniques required by manufacturer for floor covering installation.

   1. Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required.

B. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

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

1. Furnish not less than 5% or fraction thereof, in roll form and in full roll width for each color, and pattern and type of floor covering installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL SHEET FLOOR COVERING.

A. Meets or exceeds requirements for ASTM F1303 for Vinyl Sheet Flooring.

B. Products: Subject to compliance with requirements, provide the following, or an approved equal:

C. Sheet Vinyl (SV-1)

1. Manuf: Mannington, Basis of Design
2. Style: Premium Naturals
3. Number: 17371
4. Style: Bogota
5. Color: Ginger Root
6. Width: 12'-0"
7. Pattern Match: 36" x 36" – Do not Reverse
8. Application: Kitchen, Breakfast Nook, Rear Entry Floor Tile.

2.4 LINOLEUM SHEET FLOOR COVERING.

A. Meets or exceeds requirements for ASTM F2034 for Linoleum Sheet Flooring.

B. Products: Subject to compliance with requirements, provide the following, or an approved equal:

C. Linoleum (LIN-1)

1. Manuf: Forbo, Basis of Design.
2. Style: Marmoleum Real Authentic
3. Color: 3137 Slate Grey
4. Application: Caterer Kitchen.

D. Linoleum (LIN-2)

1. Manuf: Forbo, Basis of Design.
2. Style: Marmoleum Real Authentic
3. Color: 3141 Himalaya
4. Application: Laundry Room.

E. Linoleum Floor Covering With Backing:
1. Sheet Width: 79 inches (2 Meters).
2. Sheet Length: 105 Linear feet (32 Meters) or 89 Linear feet (27 Meters)
3. Gauge: 1/10" (2.5 mm)
4. Backing: Jute
5. Roll size: 77 Square yards (64 sq. meters) or 65 Square yards (55 sq. meters)
6. Seaming Method: Heat welded
7. Fire-Test Response Characteristics:
   a. ASTM E-662/NFPA 258 (Smoke Density) 450 or less.
   b. ASTM E-648/NFPA 253 (Critical Radiant Flux) Class I

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit sheet floor covering and substrate conditions indicated.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.

1. Color: Match floor covering. Architect to approve color before installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floor coverings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.

C. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing floor covering installation:

1. Remove adhesive and other blemishes from floor covering surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.

    a. Do not wash floor coverings until after time period recommended by manufacturer.

B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes, if recommended in writing by manufacturer.
2. Cover floor coverings with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 65 16

SECTION 09 68 00 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Tufted carpet.
2. Carpet Cushion.

B. Related Sections include the following:

1. Division 9 Section "Resilient Tile Flooring".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- (300-mm-) square Sample.
2. Carpet Cushion: 12-inch- (300-mm-) square Sample.
3. Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.
4. Carpet Seam: 6-inch (150-mm) Sample.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: 10 year wear warranty.

C. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.

1. Warranty includes consequent removal and replacement of carpet and accessories.
2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
3. Failure includes, but is not limited to, permanent indentation or compression.
4. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 CARPET

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

1. Manufacturer: Mohawk (CPT-1, Basis of Design).
   a. Pattern: 1V15 Gentle Essence
   b. Color: 524 Harvest Straw
   c. Source: John H. Myers
      York, PA 17404
   d. Contact: Jewel Crawford, 717-814-4428

      1) Fiber Type: 100% Smartstrand Silk Dupont Sorona Triexta
      2) Dye Method: Kuster
      3) Face Construction: Textured Cut Pile
      4) Pattern Repeat: None
      5) Tufted Yarn Weight: 58.80 oz. / sq. yd.
      6) Total Weight: 96.29 oz. per sq. yd.
      7) Gauge: 1/10 inch
      8) Primary Backing: Woven Polypropylene
      9) Secondary Backing: Woven Polypropylene
      10) Width: 12 feet
      11) Fiber Treatment: Smartstrand Sorona Silk
      12) GLP 1257

2. Manufacturer: Royal Dutch, a Division of Stanton Carpet Corporation (CPT-2, Basis of Design).
   a. Pattern: Verona Runner, Century Collection
   b. Color: Onyx 3786
   c. Width: 26”

      1) Fiber Type: Royaltron Polypropylene
      2) Dye Method: Solution Dyed
      3) Face Construction: Cut Loop
      4) Pattern Repeat: 6-15/16” l.
      5) Width: 26”
      6) Antistatic
      7) Antimicrobial

3. Performance Characteristics: As follows:

      1) Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm. Per ASTM E-648.
      2) Smoke Density: Not less than 450. Per ASTM E-662.
      3) Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
      4) Tuft Bind: Not less than 16 lbf (45N) per ASTM D 1335.
      5) Delamination: Not less than 4 lbf/in. (18 N/mm) per ASTM D 3936.
      6) Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
      7) Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC-16.
      8) Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria; not less than 1 mm halo of inhibition for gram negative bacteria; no fungal growth; per AATCC-174.
      9) Stain Resistance: Shall pass AATCC Red #40 stain scale from AATCC Test Method 175-1991, “Stain Resistance: Pile Floor Coverings” described in Performance Warranties 4.
      10) Fade Resistance: Shall pass AATCC lifetime color fade test failure as described in Performance Warranties 4.
      11) Anti-Static Requirements: Shall have a permanent static control system warranted by the fiber manufacturer and shall not exceed 3.5 kilovolts in accordance with AATCC test 134 for the life of the carpet.
      12) Indoor Air Quality: Shall pass CRI Indoor Air Quality program.

2.2 CARPET CUSHION

A. Basis-of-Design Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Mohawk Smart Cushion – Komen
   a. Traffic Classification: FHA Class II Heavy Traffic Rating
   b. Fiber Cushion: Synthetic ViscoElastic Memory Foam
   c. Thickness: 1/2 inches.
   d. Fiber Content: 90% Recycled
   e. Width: 6’-0”
   f. Length: 30’-0”
   g. Roll: 20 sq yards per Roll

h. Antimicrobial Additive
i. Spill Safe Moisture Guard
j. CRI Green Label

B. Performance Characteristics: As follows:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm. Per ASTM E-648.
2. Flammability Pill Test: DOC FF-1-70 Pill Test, passes.
3. Noise Reduction Coefficient (NRC): .66 per ASTM C 423-77.
4. Insulation “R” Factor: 2.19 per ASTM C518-76.
5. Emissions: Provide carpet cushion that complies with testing and product requirements of CRI's "Green Label" program.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:

1. Carpet manufacturer.
2. Carpet cushion manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following as applicable:

1. Carpet manufacturer.
2. Carpet cushion manufacturer.

C. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

a. Total VOCs: 10.00 mg/sq. m x h.
b. Formaldehyde: 0.05 mg/sq. m x h.
c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

D. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet and carpet cushion manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

F. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Division 6 Section "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following as applicable:

1. Carpet manufacturer.
2. Carpet cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installations."

B. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for stretch-in installation.

C. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Bevel adjoining border edges at seams with hand shears.
2. Level adjoining border edges.

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern per manufacturer’s instructions. For best side match and seam appearances, it is recommended to run seams perpendicular to external light sources.

I. Installer should allow additional time for installation of Patterned Carpet. Follow manufacturer’s instructions for pattern match procedures.

J. Install pattern based on building design and installation efficiencies. Architect to approve layout before installation.

K. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet and carpet cushion manufacturer.

END OF SECTION 09680

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall Paper.

B. Related Sections include the following:

1. Division 9 Section Painting for priming wall surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement**,** seams and termination points.

C. Samples for Initial Selection: For each type of wall covering indicated.

D. Samples for Verification: Full width by 36-inch long section of wall covering from lot to be used for each type of wall covering indicated for each color, texture, and pattern required.

1. With specified treatments applied.
2. Show complete pattern repeat.
3. Mark top and face of material.

E. Schedule: For wall coverings. Use same designations indicated on Drawings.

F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

1. Provide a mockup for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 fc is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Material: Full-size units equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the products listed in Part 2 "Wall-Covering Products" Article.

2.2 WALL-COVERING PRODUCTS

A. General: Provide rolls of each type of wall covering from the same run number or dye lot.

B. Wall Paper

1. Product – WC-1
    a. Manufacturer/Distributor: York Wall Coverings

b. Contact: 1-800-375-9675
c. Pattern: Claremont
d. Product Number: AE3009
e. Description: Straight / 25.25" Pattern Repeat
f. Double Roll: 27" x 27'-0" = 60.75 sq ft.
g. Location: Kitchen Wallcovering

2. Product – WC-2
   a. Manufacturer/Distributor: York Wall Coverings
   b. Contact: 1-800-375-9675
   c. Pattern: Lacey Circle Geo
   d. Product Number: AP7436
   e. Description: Straight / 1.75" Pattern Repeat
   f. Double Roll: 27" x 27'-0" = 60.75 sq ft.
   g. Location: First Floor HDCP Toilet Room Wallcovering Above Chair Rail

3. Product – WC-3
   a. Manufacturer/Distributor: York Wall Coverings
   b. Contact: 1-800-375-9675
   c. Pattern: Oriental Bonding Stripe
   d. Product Number: SA9210
   e. Color: To be determined by Architect – Full Range of Colors.
   f. Description: Straight / 3" Pattern Repeat
   g. Double Roll: 20.5" x 33'-0" = 56 sq ft.
   h. Location: First Floor HDCP Toilet Room Wallcovering Below Chair Rail

C. Wall-Covering Standard: Provide mildew-resistant, peelable, strippable, Washable wallpaper that complies with ASTM F 793 for Category I, Decorative Only products.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 9 Section "Painting 09 91 00 and recommended in writing by wall-covering manufacturer for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
3. Metals: If not factory primed, clean and apply metal primer.
4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install reversing every other strip.

E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

F. Match pattern 72 inches (1830 mm) above the finish floor.

G. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

I. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

D. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
4. Division 15 HVAC.
5. Division 15 Plumbing.
6. Division 16 Electrical.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall Surfaces: Provide samples on at least 100 sq. ft.
b. Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

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

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

1. Benjamin Moore & Co. (Benjamin Moore)
2. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
3. PPG Industries, Inc. (Pittsburgh Paints).
4. Sherwin-Williams Co. (Sherwin-Williams), basis-of-design products and colors.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range.

1. Anticipate up to 6 exterior colors and 20 interior colors for conventional paint products (refer to Finish Schedule). Ceilings to be flat finish, walls to be egg shell finish, and trim to be semi-gloss finish.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.

1. Sherwin-Williams; LEED Compliant - Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils., Basis of Design.

2.4 EXTERIOR PRIMERS

A. Exterior Wood Doors, Windows, Ceilings & Trim: Factory-formulated wood primer for exterior application.

1. Sherwin-Williams; Exterior Latex Wood Primer B42W8041: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

B. Exterior Hard Wood Surfaces: Factory-formulated oil based wood primer for exterior application.

1. Sherwin-Williams; Exterior Oil Based Wood Primer Y24W8020: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

C. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
1. Sherwin-Williams; LEED Compliant – Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

D. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
1. Sherwin-Williams; LEED Compliant - Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

2.5 INTERIOR PRIMERS

A. New Wood: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Premium Wall/Wood B28W8111. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

B. Old Wood: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Adhesion Primer B51W8050. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

C. Plaster: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Adhesion Primer B51W8050. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

D. Existing Plaster: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Loxon Concrete/Masonry A24W8300. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

E. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Sherwin-Williams; LEED Compliant – Loxon Concrete & Masonry Primer B28W8300: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

F. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Latex Wall Primer B28W600 Series: Applied at a dry film thickness of not less than 1.1 mils., Basis of Design.

G. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
1. Sherwin-Williams; LEED Compliant - Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

2.6 EXTERIOR FINISH COATS

A. Exterior Wood Doors, Windows, Ceilings & Trim: Factory-formulated satin waterborne latex for exterior application.

1. Sherwin-Williams; Exterior Super Paint A89 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

B. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.

1. Sherwin-Williams; LEED Compliant - Pro Industrial 0 VOC Acrylic Semi-Gloss Coating, B66-650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

2.7 INTERIOR FINISH COATS

A. Old & New Wood: Factory-formulated eggshell acrylic-latex interior enamel.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Interior Latex Eg-Shel, B20Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

B. Old & New Plaster: Factory-formulated eggshell acrylic-latex interior enamel.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Interior Latex Eg-Shel, B20Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

C. New Interior Gypsum Board Ceiling: Factory-formulated latex-based flat finish for interior application.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Interior Latex Flat, B30Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

D. New & Old Painted Wood Floors: Factory-formulated finish for interior application.

1. Sherwin-Williams; LEED Compliant – Armorseal Tread Plex B90 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

E. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Interior Latex Eg-Shel, B20W650 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

F. Interior Low-Luster Acrylic Enamel for Areas subject to Heavy Abrasion and Frequent Cleanings: Factory-formulated eggshell waterbased epoxy.

1. Sherwin-Williams; LEED Compliant - Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45W151 Series: Applied at a dry film thickness of not less than 1.5 mils., Basis of Design.

G. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Sherwin-Williams; LEED Compliant - ProGreen 200 Interior Latex Semi-Gloss, B31W650 Series: Applied at a dry film thickness of not less than 1.5 mils., Basis of Design.

H. Interior Semigloss Acrylic Enamel For Ferrous & Galvanized Metal: Factory-formulated semigloss acrylic-latex enamel for interior application.
1. Sherwin-Williams; LEED Compliant - Pro Industrial 0 VOC Acrylic Semi-Gloss Coating, B66-650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

2.8 INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Sher-Wood Fast-Dry Filler., Basis of Design.

B. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43, Basis of Design.

C. Stain: Factory-formulated stain applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Wood Classics 250 VOC Satin, Basis of Design.

D. Finish: Factory-formulated finish applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Wood Classics WB Poly A68F90 Satin, Basis of Design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
    c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    c. If transparent finish is required, backprime with spar varnish.
    d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
    e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
2. Provide finish coats that are compatible with primers used.
3. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical items to be painted are specified to be painted in Division 15.

F. Electrical items to be painted are specified to be painted in Division 16.

G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

a. Primer: Exterior ferrous-metal primer.
b. Finish Coats: Exterior semigloss acrylic enamel.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.

a. Primer: Exterior galvanized metal primer.
b. Finish Coats: Exterior semigloss acrylic enamel.

3.8 INTERIOR PAINT SCHEDULE

A. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Interior low-luster acrylic enamel.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.

b. Finish Coats: Interior low-luster acrylic enamel.

C. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior semigloss acrylic enamel.

D. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

E. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior flat acrylic paint.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

F. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

a. Finish Coats: Interior flat latex-emulsion size.

END OF SECTION 09 91 00

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Grab Bars
2. Underlavatory guards.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Construction Manager under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Names: Use of manufacturer's proprietary names to designate products is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

1. Toilet Accessories:

a. Products of Harney Hardware have been used as the basis of design and shall be used for all applications unless a substitution is approved by the architect.

2. Underlavatory Guards:

a. Brocar Products, Inc.
b. Truebro, Inc.
c. Approved equal

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Plastic: High-impact ABS grey plastic.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Frame less Glass-Mirror Units: Refer to Division 8 Section “Mirrors”.

F. 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 PUBLIC-USE WASHROOM ACCESSORY SCHEDULE

D. Grab Bar: Where indicated, provide Bronze grab bar complying with the following:

1. Stainless Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
2. Mounting: Concealed with manufacturer's standard flanges and anchors.
3. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
4. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.

E. Underlavatory Guard: Where indicated, provide underlavatory guard complying with the following:

1. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

END OF SECTION 10 28 13

SECTION 10 28 10 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Private-use bathroom accessories.

1.3 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 on Drawings.
2. Identify products using designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

D. 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.

E. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PRIVATE-USE BATHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on product indicated. Subject to compliance with requirements, provide the named product or a comparable product by the following:
   1. Harney, Alexandria, (Basis of Design).
      a. Surface Paper Holder: Harney, Alexandria, #15714, Venetian Bronze, or equal.
      b. Towel Bar: Harney, Alexandria 24” Towel Bar, #15715, Venetian Bronze, or equal.
      c. Towel Ring: Harney, Alexandria, #15716, Venetian Bronze, or equal.
      d. Robe Hook: Harney, Alexandria, #15712, Venetian Bronze, or equal.

2.3 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.

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.

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 10 28 10

SECTION 12 35 60 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wood Faced Vanity Cabinets.
2. Cabinet Hardware
3. Plastic-Laminate Countertops and Backsplashes.
4. Solid-Surface-Material Countertops and Backsplashes.
5. Cultured Marble Countertops and Backsplashes.

B. Related Sections include the following:
1. Division 7 Section “Sealants”.
2. Division 11 Section "Residential Appliances" for appliances.
3. Division 15 Section "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.3 DEFINITIONS

A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semi-exposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semi-exposed."

C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 SUBMITTALS

A. Product Data: For the following:
1. Bathroom Cabinets.
2. Cabinet Hardware.
3. Plastic-Laminate Countertops and Backsplashes.
4. Solid-surfacing-material countertops.
5. Cultured Marble Countertops and Backsplashes.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification:

1. Wood-veneered panels with transparent finish, 8 by 10 inches (200 by 250 mm), for each species.
2. Solid wood with transparent finish, 50 sq. in. (300 sq. cm), for each species.
3. Solid wood trim with transparent finish, 8 inches (200 mm) long, for each species.
4. Exposed hardware, for each type of item.
5. Countertop material, 6 inches (150 mm) square.

E. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Recycled Content Materials: Where recycled lumber materials are used for structural applications, include lumber certification and quality grading.

B. Engineered Wood Products:
1. Determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or E1333.
2. Determine Volatile Organic Compounds VOC), excluding formaldehyde, emitted from manufactured wood-based panels in accordance with ASTM D6330.

C. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

D. Product Options: Drawings indicate size, configurations, and finish material of cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' cabinets of similar sizes and door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Product Requirements."

E. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.

a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi-exposed location of each unit and showing compliance with the above standard.

1.6 PROJECT CONDITIONS

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

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual

dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. General:

1. Wood Materials: Provide cabinets made from wood and wood-based materials.
2. Adhesives: Do not use adhesives that contain urea formaldehyde.
3. Hardwood Lumber: Kiln dried to 7 percent moisture content.
4. Softwood Lumber: Kiln dried to 10 percent moisture content.
5. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.
6. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
7. Particleboard: Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.
8. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
9. Hardboard: AHA A135.4, Class 1 Tempered.

B. Exposed Materials:

1. Exposed Wood Species: Maple.

    a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
    b. Staining and Finish: As selected by Architect from manufacturer's full range.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color.

3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.

a. Edge band exposed edges with minimum 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.

C. Semi-exposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.2 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Surface-mounted decorative pulls.

C. Hinges: Concealed, adjustable self-closing hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

2.3 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one or more of the following:

a. Formica Corp.
b. Nevamar Company, LLC.
c. Panolam Industries International Incorporated (Pionite).
d. Wilsonart International.

3. Grade: HGS
4. Provide through-color plastic laminate.
5. Grade for Backer Sheet: BKL.
6. Colors, Textures, and Patterns: As selected by Architect from plastic-laminate manufacturer's full range.

B. Wood Materials:

1. Solid Wood Maple
2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue
3. Particleboard: Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.

4. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
5. Adhesives: Do not use adhesives that contain urea formaldehyde.

C. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Avonite, Inc.
b. E. I. du Pont de Nemours and Company.
c. Formica Corporation.
d. LG Chemical, Ltd.
e. Wilsonart International; Div. of Premark International, Inc.

2. Type: Standard type, unless Special Purpose type is indicated.
3. Colors and Patterns: Match Architect's samples.

D. Cultured Marble Tops: Homogeneous solid sheets of filled plastic resin.

1. Basis of Design Product: Full range of colors, by Custom Marble Products, or approved equal.
2. Product: Cultured marble vanity tops – Standard rim with integral bowls.

2.4 CABINETS

A. Basis of Design Product: The design for Laundry cabinets is based on:
a. Sierra Vista by Timberlake Cabinetry, Inc., or Equal.
b. Door Style: Raised Panel – Mitered Style / Full Overlay
c. Door Profile: Square
d. Finish: Painted Maple – Butterscotch glaze

B. Basis of Design Product: The design for Bathroom cabinets is based on:
a. Rushmore by Timberlake Cabinetry, Inc., or Equal.
b. Door Style: Solid Raised Center Panel – Mitered Style / Full Overlay
c. Door Profile: Square
d. Finish: Stained Maple – Full Range of Stains

C. Face Style: Flush overlay; door and drawer faces cover cabinet fronts with only enough space between faces for operating clearance.

D. Cabinet Style: Raised Panel.

E. Door Fronts: 3/4-inch- (19-mm-) thick, solid-wood flush overlay panels.

F. Cabinet End Construction: 5/8-inch- (16-mm-) thick particleboard or 1/2-inch- (12.7-mm) thick plywood.

G. Cabinet Tops and Bottoms: 5/8-inch- (16-mm-) thick particleboard or 1/2-inch- (12.7-mm-) thick plywood, fully supported by and secured in rabbets in end panels, front frame (if any), and back rail. (Vertical center support column present in all wall and base cabinets 39” or wider).

H. Drawers: 3/4-inch- (19-mm-) solid hardwood, 4 sided dovetail drawer box with 3/16” plywood floor, and natural finish.
   1. Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

I. Shelves: 3/4-inch- (19-mm-) thick particleboard or 5/8-inch- (16-mm-) thick plywood.

J. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

2.5 CABINET HARDWARE

A. Configuration: Provide the following Decorative Cabinet Hardware or approved equal:
   1. Manufacturer: Timberlake Standard Decorative Hardware.
   2. Finish & Style: To be determined by Architect, full Range.
   3. Size: Pull, ADA compliant

2.6 PLASTIC-LAMINATE COUNTERTOPS

A. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:

   1. Front: Self-edge.
   2. Backsplash: Square edge without scribe.
   3. Endsplash: Square edge without scribe.

B. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch (19 mm) thick.

   1. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood.
   2. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of particleboard laminated to top.

C. Backer Sheet: Provide plastic-laminate backer sheet on underside of countertop substrate.

D. Paper Backing: Provide paper backing on underside of countertop substrate.

2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

   1. Front: Straight, slightly eased at top.
   2. Backsplash: Straight, slightly eased at corner.
   3. Endsplash: N/A

B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate in accordance with approved details, with loose backsplashes for field assembly.

2. Sink bowls to be installed in field.

3. Colors and Patterns: To be selected by Architect, full range of colors.

2.8 CULTURED MARBLE COUNTER TOPS

A. Solid-Surfacing-Material Thickness: 3/4 inch.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. Full Range of Colors to be selected by Architect.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with edge configuration indicated.
2. Fabricate tops with loose backsplashes for field application.

D. Install integral sink bowls in countertops in shop.

E. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.

1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

F. Solid Surface and Cultured Marble Countertops: Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant per manufacturer’s written instructions in color to match countertop.
5. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
6. Seal edges of cutouts in particleboard subtops by saturating with varnish.

3.2 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

C. END OF SECTION 12 35 60

SECTION 20 00 00 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for work under Division 20.

B. Coordinate the work of this Section with the requirements of the Project.

1.2 DEFINITIONS

A. Following are definitions of terms and expressions used in the Mechanical Sections in addition to definitions found in the Contract Conditions:

1. "Piping" includes pipe, fittings, valves, hangers, and other accessories that comprise a system.
2. "Ductwork" includes ducts, fittings, housings, dampers, hangers, and other accessories, which comprise a system.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. Work shall conform to the requirements of the codes, laws and ordinances of the Shippensburg University, National Fire Protection Association, American Society of Mechanical Engineers and other authorities having jurisdiction.
2. Comply with applicable codes, laws, standard practices.
3. Comply with the standards of good practice as outlined in the ASHRAE Guide, the Sheet Metal and Air Conditioning Contractor's Association's "Duct Manual", and the Apprentice Training Manual of the Steam Fitters Union.
4. The requirements of the authorities having jurisdiction shall take precedence over the Drawings and Specifications and changes required by the authorities shall be made after review by the Architect.

1.4 SUBMITTALS

A. Shop drawings are required for the following:

1. Plumbing
   a. Drains
   b. Plumbing Fixtures
   c. Circulating Pumps
   d. Sump Pumps
2. Heating and Air Conditioning
   a. Air Devices
   b. Insulation
   c. Exhaust Fans
   d. Heating and Air Conditioning Equipment

e. Temperature Controls
f. Testing, Adjustment and Balancing Reports and Qualifications

B. Review of shop drawings does not relieve the Contractor of responsibility for complying with the contract documents.

1.5 PROTECTION

A. Protect material and equipment from damage.

B. Post notices prohibiting the use of water closets.

C. Provide plastic protection inserts, specifically manufactured for the bathtubs and shower stalls.

D. Cap or plug openings in equipment, piping and ductwork with proper caps and plugs.

1.6 VARIANCES

A. Where conflicts exist within the contract documents, request clarification prior to the submission of a bid. If clarification is not requested, provide the work representing the higher cost and quality.

1.7 WARRANTY

A. During the warranty period, make the proper adjustments of systems, equipment and devices installed and perform work necessary to ensure the efficient and proper operation of the systems, equipment and devices.

B. Certain items of equipment shall be warranted for a longer time than the general warranty period. Provide for service or replacement required in connection with the warranty of these items.

PART 2 - PRODUCTS

2.1 PRODUCTS TO BE USED

A. Items are specified by designations such as trade name, manufacturer's name, catalog number and indicate the capacity and quality of the products or materials to be used on this project.

B. Only products indicated on Contract Documents by name and model number have been coordinated with other trades. Coordinate items of other manufacturer with other trades.

2.2 MATERIALS AND WORKMANSHIP

A. Items shown and not specifically called for, or items specified and not specifically indicated or detailed on the Drawings, or items neither specified nor shown, but

which are reasonably incidental to and commonly required to make a complete job, shall be provided.

2.3 FOUNDATIONS AND EQUIPMENT SUPPORTS

A. Provide foundations, supports, curbs and bases for equipment, as indicated or necessary for satisfactory installation and operation of equipment. Furnish and set anchor bolts.

B. Concrete pads shall be 4 inches thick minimum, thicker if necessary to accommodate a particular piece of equipment. Edges shall be beveled with outer edge extending 3 inches beyond equipment. Provide concrete pads for floor-mounted equipment. Exterior pads shall be reinforced and shall have edges turned down to below the frost line. Exterior pads shall extend eight inches beyond edges of equipment and shall be sloped for drainage.

C. Floor mounted stands, rods or legs, where required, shall be constructed of structural steel shapes (angles, channels) of Kindorf or Unistrut or steel pipe and fittings securely braced and fastened to flanges bolted to the floor. Minimum rod size shall be 3/8-inch diameter. Paint steel with rust inhibiting primer.

2.4 ROOF SUPPORTS AND CURBS

A. Provide equipment supports and curbs for the equipment and piping installed on or through the roof. Roof curbs shall be approved for use by the National Roofing Contractors National Association and shall be a minimum of 14 inches high. Curbs shall be sloping roof type suitable for pitch of the roof and shall set the equipment level. Curbs shall be double wall insulated type.

B. Provide wood blocking to raise the level of the bottom of the curb to be level with the top of the roof insulation.

C. Pipe curb assemblies, except for plumbing vent pipes shall be constructed of 18 gauge galvanized steel with base plate, raised cant, wood nailer strip and galvanized steel counter flashing. Top shall be provided with acrylic clad ABS plastic cover and graduated neoprene boots secured to cover and pipes by stainless steel band clamps. Pipe curbs shall be Pate Company PCA-5 or equivalent of Thy Curb.

D. Equipment supports shall be constructed of 18 gauge galvanized steel with base plate, raised cant, insulation, wood nailer strip and galvanized steel counter flashing. Equipment supports shall be Pate Company ES-5b or equivalent of Thy Curb.

2.5 HANGERS AND PIPE SUPPORTS

A. Provide pipe hangers and supports to maintain required slope and alignment for equipment and piping. Pipe hangers shall be as manufactured by Carpenter & Patterson, Fee & Mason, Modern Hanger or Grinnell.

B. Pipes may not be supported from other pipes. Trapeze hangers may be used for parallel runs of pipe with same slope.

C. Provide sway bracing at sufficient intervals to prevent lateral motion of horizontal or vertical piping and ductwork as required by the jurisdiction to meet the appropriate regional requirements.

D. For pipe and tubing, both horizontal and vertical, and regardless of the spacing of other supports, provide supports at or near changes in direction. Hangers shall be spaced at not over 6 feet apart for ½ inch pipe, not over 8 feet apart for 3/4 and 1-inch pipe and not over 10 feet for larger sizes.

E. For wood joist construction, hanger rods shall be supported from wood joists with hangers bolted through or attached with lag screws to the joists.

F. Hangers for pipe shall be similar to Carpenter & Paterson "Clevis" figure 100. Hangers for insulated lines with vapor barrier and carrying fluids with temperatures below 70 degrees shall be large enough to permit continuous insulation. Hangers on vapor barrier insulated piping shall be provided with rigid protector saddles with rigid core of insulation to thickness of adjacent insulation. Saddles shall be 16 gauge galvanized steel and shall cover one half of the circumference of the pipe covering. Saddle shall be secured to insulation with adhesive.

G. Pipes upon or within close distance of walls shall be carried by wall brackets, Carpenter & Paterson, Fig. 221, 139, or 227 as approved.

H. Support vertical lines at floor level with extension pipe clamps. Support lowest level of riser with pipe hanger as specified above on horizontal pipe as close to riser as possible.

I. Special supports required shall be provided to suit the conditions.

J. Expansion bolts or wood plugs will not be permitted in slag block walls. Equipment hung on such walls shall be supported by through bolts or approved anchor bolts set into masonry as the wall is laid up.

2.6 OPENINGS, CHASES, LINTELS AND SLEEVES

A. Determine the location and size of chases, lintels and openings necessary for the proper installation of the work and provide them during the erection of the work in which such chases and openings occur.

B. Provide sleeves through walls and floors for pipes. Sleeves through walls shall be of sufficient size to permit the insulation, where specified, to continue through the sleeve. Sleeves through walls shall be flush with the walls.

C. In case cutting of building construction is necessary, including cutting of structural members, such cutting shall be done and repaired to match original condition of the work.

D. Where non-combustible pipes pass through sleeves or around ductwork through openings in fire rated wall, floor-ceiling and ceiling-roof assemblies, seal openings with a Underwriters Laboratories classified firestop method. Firestop method shall be a one part, intumescent (expands with heat), latex elastomer capable of expanding a minimum of three times. Firestop materials shall be UL listed when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating.

E. If combustible piping materials are used, a UL listed firestop method shall be provided where the combustible materials penetrate fire rated wall, floor-ceiling and ceiling-roof assemblies. Firestop method shall be classified by UL as a through-penetration firestop device when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating. Plastic piping materials, including, but not limited to PVC, CPVC and ABS, are combustible. Firestop method shall be similar to Nelson Firestop Products.

F. Escutcheon plates shall be used to conceal sleeve opening on exposed uninsulated piping. Floor plates shall be split chrome plated cast brass similar to Ritter No. 36A.

2.7 VIBRATION ISOLATION

A. Provide vibration isolators manufactured by a firm specializing in this type of work for equipment and piping that is capable of transmitting noise and vibration to the building structures.

B. Isolators shall be designed to suit vibration frequency to be absorbed. Provide isolator units of area distribution to obtain proper resiliency under machinery load and impact. Where unequal distribution of weight occurs, design isolators for uniform deflection under imposed load.

C. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment. Conform to the requirements of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Chapter 47, "Sound and Vibration Control"

D. Isolators of the same type shall be the product of the same manufacturer, Mason, Vibration Eliminator or Korfund.

2.8 ACCESS PANELS

A. In general, valves, dampers, traps and equipment shall be accessible through the removable panels in the ceiling. Where ceilings are not removable and in walls where access is required for service, access panels shall be provided. Access panels shall be appropriate for the finish in which they are installed, with a fire rating to match the wall or ceiling in which they are installed.

B. Group valves, dampers and equipment together to keep the required number of access panels to a minimum.

2.9 ELECTRICAL WORK

A. Motors and heating elements for equipment specified under the mechanical Sections of the Specifications shall be provided with the equipment.

B. Starters, disconnect switches, and work pertaining to equipment power connections are specified under Division 26 unless specified with the equipment of this Division of the Specifications. Electrical devices provided under this Division shall meet requirements for similar equipment specified under Division 26.

C. Interlock wiring, and the provision of pilot devices such as push buttons, thermostats, flow switches and similar items and their related wiring associated with the Automatic Control System, shall be provided in accordance with the applicable requirements of Division 26. For ease of servicing, permanently identify both ends of conductors with W. H. Brady Co. self-sticking Perma-Code wire markers. Mark control diagrams accordingly.

D. Coordinate control device voltages.

E. Unless specifically noted otherwise, motors ½ HP and over shall be wound for 240 volts, 1 phase, 60 hertz current, and those under ½ HP for 120 volts, single phase, 60 hertz current. Motors shall be equipped with grease packed ball bearings. Motors shall be rated for continuous duty at 100 percent of rated capacity with an ambient temperature of 40 degrees C.

F. Design motors in accordance with NEMA standards and affix to each a nameplate accurately listing pertinent data. Motors shall have sufficient capacity to start and operate the machine they drive without exceeding the motor nameplate rating at the speed specified or at speeds or loads, which may be obtained, by the drive actually furnished. The motor HP or KW ratings are those estimated to be required by the driven equipment when operating at specified duties and efficiencies and are used to determine electrical feeder sizes. If the actual horsepower or KW required for the equipment to be furnished is greater than the indicated horsepower or KW, it shall be provided. Changes required in starter, feeder, branch circuit or other electrical items shall be made. Provide a shop drawing showing the mechanical/electrical coordination between trades. The shop drawing shall list all mechanical equipment with power demand, associated branch circuit feeder designation, conduit and wire size, breaker size and fused safety switch.

G. Unless otherwise indicated, polyphase motors shall be Class B, general purpose, squirrel cage, single speed, open induction type, stamped with NEMA Class B letter designation.

H. Single phase motors except as noted shall be open, capacitor start type. Motors 1/6 horsepower and under shall be permanent split capacitor type with built-in reset thermal overload protection, unless specifically noted otherwise. Motors 1/12

horsepower and smaller that start with no load may be shaded pole with built-in reset thermal overload protection.

I. Mechanical equipment with a factory wired control panel shall be wired in accordance with the National Electrical Code. Additionally, components within the panel shall bear the UL label.

J. Equipment shall be UL listed as a system or be tested by an independent electrical testing agency acceptable to the Architect to comply with requirements of the Authority having jurisdiction.

K. Do not install equipment, ductwork or piping in the dedicated spaces above switchgear, panels and transformers as identified in the National Electrical Code.

2.10 FLASHING

A. Sanitary vent pipes passing through the roof shall be provided with conical neoprene boots for any pitch roof with base extending minimum of eight inches from vertical portion of boot. Provide clamp for securing boot to pipe.

B. Flashing assemblies specified above shall be set in place as part of the work under this Division of this Specification, but will be finally installed as specified in another Division of this Specification.

C. Base flashing of roof drains, ducts, fans and other equipment, if required, is specified in another Division of this Specification. Cap flashings shall be provided to make a water tight seal.

2.11 IDENTIFICATION

A. After piping has been installed, tested and insulated, it shall be identified with adhesive type labels at least 2 inches high. Labels indicating direction of flow shall be applied adjacent to the name identification and shall point away from the name in the direction of flow.

B. Labels shall identify the piping system. Labels shall be located where pipe enters and leaves a space and at 30 foot centers on normal runs. Duct systems shall be similarly identified by noting the system and direction of flow.

C. Equipment shall be identified with engraved plastic laminate or anodized aluminum nameplates with pressure sensitive backing. Plates shall also be provided with drilled holes and fastened to equipment with moly-rivets. Letters shall be at least 3/8 inch high and larger in proportion to the size of the piece of equipment. Identification shall be the same as noted on schedules on the Drawings. Labels shall be provided for the following equipment.

1. Air Handling Units
2. Heat pumps
3. Exhaust Fans

D. On valves, except immediately adjacent to equipment, provide 1 inch diameter brass tag with embossed and painted black numbers to identify the valve. Tag numbers shall be coordinated between trades. Tags shall be attached to valve wheels with a brass link. Tags shall be manufactured by Brady, Seton Nameplate, or Wilmington Plastics.

E. Prepare a list showing the number and location of valves and a schematic piping diagram showing the location of numbered valves. The list and diagram shall be cross indexed so that the location and purpose of valves is identified. List and diagram shall be stored in a clear plastic envelope mounted on a wall where directed by the Architect.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Visit the site and become familiar with existing conditions. Modifications to work required to allow for existing conditions shall be provided. Submit proposed modifications to the Architect for approval prior to installation.

B. Relocate existing hangers and supports where necessary to install new work. Maximum spacing requirements shall apply for relocated supports.

C. Coordinate interruptions in service of existing systems with the Owner. Provide temporary connections to maintain operation of existing systems.

3.2 MANNER OF INSTALLATION

A. Piping and ductwork shall be installed to preserve access to valves, dampers and equipment. Valves, dampers and equipment which require frequent service, adjustment or control and which cannot be located in a readily accessible and safe place, shall be provided with extension devices and remote operators, as necessary and as accepted for use by the Architect.

B. Piping and ductwork shall be run to follow the lines of the building and to allow the maximum headroom consistent with proper pitch. Piping subject to thermal expansion shall be arranged to permit movement without damage to the piping, ductwork and equipment.

C. The Drawings are generally indicative of the work to be installed, but they do not show all offsets, fittings and similar details required, which shall be provided to meet the job conditions. In areas where work is installed in close proximity to work of other trades or within trades covered by this Division of the Specifications, prepare larger scale drawings consisting of plans and sections to show how work is to be installed in relation to work of other trades.

D. Equipment and systems shall be installed in accordance with the requirements and recommendations of the associated manufacturer.

3.3 EXCAVATION AND BACKFILL

A. Provide excavation and backfill necessary to install underground piping and other work included in this Division of the Specifications. Establish lines and grades required for the proper location of the work.

B. After the piping has been placed, the trenches shall be backfilled to the lines of present grades or finished grade as required. No backfill shall be placed, however, until water has been removed from the trenches and joints have been set and also after the tests have been made on piping as required.

3.4 RECORD DRAWINGS

A. Keep at the site two (2) sets of black and white prints for the express purpose of showing changes from the contract Drawings made during construction. Mark up the prints with red pencil during construction and deliver the prints, before final inspection, to the Architect as a final set of "Record Drawings". Refer to Division 1 for additional requirements.

3.5 TESTING

A. Before concealing piping and before insulating piping, test piping per the requirements listed below or as required by the authority having jurisdiction, whichever is more stringent, and prove tight.

B. Replace and retest to Architect's satisfaction pipe or fittings broken or damaged under test.

C. Before testing piping systems, remove or otherwise protect from damage, control devices, air vents, plumbing fixtures and other parts which are not designed to stand pressures used in testing piping.

D. New and existing sanitary and storm drain piping shall be tested by a standing water test so that the highest point of the system has no less than a 10 foot head of water. Fixtures shall be removed from system and piping capped or plugged. No drop in water level shall be allowed. Test systems for a period of four (4) hours.

E. New and existing domestic water systems and new and existing hydronic systems shall be tested hydrostatically, pumping the system to 150 psi test pressure and holding the system at the test pressure for two hours without additional pumping.

F. New and existing gas piping shall be air pressure tested at 50 psi test pressure for two hours without a drop in pressure during the test period.

3.6 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, strainers and other accessory items, clean systems. Remove burrs, cuttings and waste. Blow and flush piping until interiors are free of foreign matter.

B. Clean strainers and dirt pockets as often as required to guarantee no system stoppage by end of warranty period.

C. The heating water piping system including boiler shall be cleaned by filling the system with water with pumps in operation and boiler water set at 180 degrees F or higher with valves open and adding a sufficient quantity of tri-sodium phosphate to provide a solution of 3 pounds of tri-sodium phosphate per 100 gallons of water. Strainer baskets shall be maintained during this period to prevent clogging. At the end of the 48 hour cleaning period, the system shall be drained and flushed and then refilled for operation. The system shall again be brought up to operating temperature for 48 hours and the system shall be vented with the pumps running. At this time, temporary strainer baskets shall be removed, cleaned and reinstalled. Strainers shall be of sufficient fine mesh to protect the close tolerance of the pump, approximately 16 mesh. After one operating season, the temporary strainer baskets shall be removed and new baskets installed in the strainers.

D. Dust shall be removed from ductwork before Substantial Completion. Filter media shall be new at Substantial Completion.

E. If systems become stopped with refuse, remove the obstruction and replace and repair work disturbed.

F. Clean plumbing fixtures using non-scratching cleaners. Polish chromium plated work. Stilson type wrenches shall not be used on chrome plated work.

G. Remove rust and clean surfaces to be insulated or painted.

H. Leave systems in clean condition and running order.

3.7 STERILIZATION

A. The domestic water piping systems shall be sterilized with a chlorine water solution so that the piping system contains water with a chlorine concentration of 100 ppm at the end of a three hour retention period. Systems shall be flushed before sterilization. After the chlorine water solution has remained in the piping system for the specified period and at the specified concentration, the system shall be drained, flushed with clear water until the chlorine concentration is less than 1.0 ppm. Obtain representative samples of the systems water for analysis by a recognized bacteriological laboratory. If samples are not acceptable, the process shall be repeated until the samples are acceptable.

B. The domestic water piping system may be sterilized by other methods approved by local plumbing codes or the Health Department.

C. As a condition of acceptance of the system, furnish a certificate under seal to certify that the system has been sterilized to meet the requirements of the Health Department and that the system is satisfactory for human consumption.

D. Chemicals and materials used for sterilization of the systems shall meet the requirements of the authority having jurisdiction.

3.8 PAINTING

A. Remove rust, scale, grease, and dirt from equipment and material and leave ready for finish painting. Equipment specified with factory baked enamel finish shall be touched up as required to provide a surface visually free of scratches, nicks and blemishes.

B. Paint uninsulated ferrous piping, hangers and miscellaneous iron work in concealed spaces with one coat of Rust-O-Leum dampproof red primer.

C. Where metal duct is visible through a register or grille, paint the interior of the duct with flat black paint.

3.9 OPERATING AND MAINTENANCE MANUAL

A. Submit operating and maintenance instructions. The manual shall include the following:

1. A brief description of systems and their various components.
2. Full, definite and explicit instructions for starting, stopping, controlling and changing over systems from one season to another.
3. List of manufacturer's representatives with address and telephone numbers.
4. Manufacturer's printed operating and maintenance instructions, parts lists, illustrations and diagrams for pieces of equipment.
5. A complete schedule of periodic servicing and lubrication requirements for equipment.
6. One copy of each shop drawing and Contractor's drawings.
7. One copy of other items of equipment where not required as a shop drawing submittal.
8. One copy of each wiring diagram.
9. Motor manufacturer's certificate for motors exposed to the weather.
10. The field test data specified in Section 23 00 00 under Balancing and Adjusting.
11. Sterilization certificate for domestic water systems.

3.10 FIELD INSTRUCTION

A. Upon completion of work, furnish services of a competent representative to instruct Owner's representative in the proper operation and maintenance of elements of the mechanical systems. Submit instructor's name and credentials to the Architect for approval.

B. Spend not less than 40 hours in such formal instruction to prepare Owner to operate and maintain the systems.

C. At least 20 hours of the specified 40 hours of instruction shall occur after thirty days operation by Owner's representative and may be divided into periods of 4 hours at different seasons of the year.

3.11 PERFORMANCE TEST

A. Should the performance or capacity of the systems, equipment or devices furnished be questioned by written notice from the Architect after installation, provide necessary test equipment and complete a satisfactory test of the items in question. The test shall be run when and as directed by the Architect and in the presence of his representative. Should the items furnished not pass such a test, they shall be removed and replaced by systems, equipment or devices satisfactory to the Architect.

END OF SECTION

SECTION 22 00 00 - GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 22 00 00 apply to work performed under this Section.

1.2 SCOPE

A. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete plumbing systems, including interior sanitary soil, waste and vent piping; storm, interior domestic hot and cold water piping, plumbing fixtures and appliances to provide continuous and satisfactory service.

1.3 CONNECTIONS TO EQUIPMENT

A. Provide labor and materials to connect equipment furnished under this Section of the Specification.

B. Provide labor and materials to connect equipment furnished under other Sections of the Specification and requiring plumbing connections as if the equipment was furnished under this Section of the Specification. Provide traps, water stop valves, etc., for equipment requiring such connections to provide functioning systems.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cleanouts shall be provided at ends of runs, at changes of direction and near the base of each vertical soil, waste, or drain pipe. Cleanouts shall be placed on horizontal lines every 50 feet unless the conditions require them at closer intervals. Cleanouts at the base of vertical pipes shall be placed in a fitting just above the floor. Cleanouts shall consist of Y branches or 1/4 bends the full size of the line for piping 4 inches and smaller, and 4 inches for larger pipes. Cleanouts in horizontal lines shall be extended to floor level or grade as necessary. Cleanouts shall be series as listed below:

1. Below concrete floors with no finish or ceramic tile finish.
   a. Zurn - ZN-1400-3
   b. J. R. Smith - 4041
   c. Josam - 56020-15
   d. Ancon - CO-200-S

2. Below carpeted floors (flush with concrete with identification screw through carpet).
   a. Zurn - ZN-1400-15
   b. J. R. Smith - 4020-Y
   c. Josam - 56020-2-14-15
   d. Ancon - CO-200-RC
3. Below resilient tile floors.
   a. Zurn - ZN-1400-7
   b. J. R. Smith - 4160
   c. Josam - 56020-12-15
   d. Ancon - CO-200-TS
4. Exposed horizontal piping.
   a. Zurn - Z-1440A
   b. J. R. Smith - 4400
   c. Josam - 58500-20
   d. Ancon - CO-200
5. Concealed in finished wall-prime coat.
   a. Zurn - Z-1440-1
   b. J. R. Smith - 4402
   c. Josam - 58710-15
   d. Ancon - CO-450-RD
6. Base of exposed vertical pipes.
   a. Zurn - Z-1445
   b. J. R. Smith - 4510
   c. Josam - 58510
   d. Ancon - CO-460
7. Base of concealed vertical pipes.
   a. Zurn - Z-1445-1
   b. J. R. Smith - 4530
   c. Josam - 58790-15
   d. Ancon - CO-460-RD

B. Cleanouts shall consist of cast iron ferrules and shall seat against a lead seal. Access covers shall be polished nickel bronze in finished areas, brass below carpeting. Access covers will be secured by non-ferrous tamperproof screws.

2.2 DRAINS

A. Provide roof, floor and area drains shown on Drawings and/or described below. Drains shall be Zurn, J. R. Smith, Josam or Ancon.

B. Provide flapper type backwater valves on drains connected directly to the storm sewer where the line serving the floor drains does not have a backwater valve.

C. Floor drains and open site drains shall be served by trap primers. Install trap primer in a local cold water line of appropriate size. Trap primers shall be bronze bodied “Flow – Through” type. Trap primers shall come with built-in air gap, trap primers shall meet the requirements of ASSE Standard 1018. Trap primers shall be set above the floor level of the drains they serve. Trap primer valves located

behind walls shall be provided with access doors. Access doors to be coordinated with the Architect. Extend water line from trap primer to floor drain trap.

1. Watts Series – A200
2. Zurn
3. J. R. Smith
4. Josam
5. Ancon

2.3 PLUMBING FIXTURES

A. Provide plumbing fixtures as shown on the Drawings or as described herein. Exposed metal parts of fixtures, including faucets, waste fittings, waste plugs, strainers, flush valves, traps, supply and waste pipes and escutcheons shall be brass, chromium plated.

B. Hot and cold water connections to fixtures shall be provided with a stop valve. Stop valves, risers, etc. shall be residential/light commercial grade as manufactured by Brass Craft, Central Brass or Engineered Brass Co.

C. Provide metal supports necessary to adequately and substantially hang and set fixtures. Supports shall be Zurn, Josam or J. R. Smith and suitable for the wall thickness and piping arrangements shown.

D. Plumbing fixtures shall be caulked at wall and floor with silicone caulking material of same color as the fixture.

E. Locate countertop sinks furnished under this Division. Furnish templates to the countertop fabricator for cutting of required holes. For existing sinks, make a template from the existing countertop before the countertop is removed.

F. For sinks and fixtures specified under other Divisions, sinks which are removed and replaced into a new countertop, or furnished under other contracts, provide new necessary fittings (tailpieces, traps, and stop valves) and completely connect the sinks and fixtures.

G. Fixtures shall be as follows:

1. P-1A Water Closet - elongated syphon jet bowl with close coupled gravity flow tank, left hand flush, vitreous china bowl (color to be selected by architect) with 16-1/2" rim and floor outlet for 12" rough-in, fitted with bolt caps, wheel handle stop valve, supply pipe and flexible riser. Closet shall flush on 1.28 gallons.
   a. Model
      i. Kohler – K-3817: Stately
      ii. American Standard
      iii. Crane
      iv. Eljer
   b. Seat - white solid plastic closed front seat with cover.

i. Church - 380TL
ii. Olsonite
iii. Beneke

2. P-2A Lavatory – the bowl will be integral to the countertop furnished under a separate but related contract. Install countertop and coordinate the faucet hole spacing. Provide with residential weight wheel handle stop valves, flexible risers, and adjustable 1-1/4" x 1-1/2" 17 gauge tubing P trap with cleanout, trap nipple, and escutcheon.
   a. Faucet (First Floor Powder Room) – dual handle low lead brass stationary spout faucet with metal lift rod and pop up drain, aerator and 1.5 gpm flow restrictor.
      i. Kohler – K-72760-2BZ
      ii. American Standard
      iii. Crane
      iv. Eljer
   b. Faucet (Shared and Master Bathrooms) – dual handle low lead brass stationary bell spout faucet with metal lift rod and pop up drain, aerator and 1.5 gpm flow restrictor.
      i. Kohler – K-72759-2BZ
      ii. American Standard
      iii. Crane
      iv. Eljer
   c. Handles – lever handles for separate hot and cold water operation, ceramic disc valves.
      i. Kohler – K-98068-2BZ
      ii. American Standard
      iii. Crane
      iv. Eljer
3. P-3A – Not Used.
4. P-4A Shower – Shower stall wall tile will be provided under a separate but related contract.
   a. Base – Shower base shall be 36”x36” acrylic low threshold base and have center covered drain with removable cover.
      i. Kohler – Archer K-9396
      ii. American Standard
      iii. Crane
      iv. Eljer
   b. Shower Head/Valve - lever handle, single control, pressure balancing, four-port valve with integral stops attached. Faceplate, drop ell shall be chrome plated. Wall mounted showerhead shall be limited to 2.5 GPM.
      i. Kohler – K-72773/K-T72767-4
      ii. Moen
      iii. Delta
      iv. American Standard

5. P-5 Kitchen Sink – remove existing sink/faucet set and reinstall. Provide template of existing sink to aid in preparing the new countertop. Provide new chrome plated cast brass P trap and stop valves in the supply pipes and connect to existing rough-ins. Mount sink in counter furnished under another division.
6. P-6 Not Used.
7. P-7 Countertop Hand Sink - single compartment 18 gauge, type 302 stainless steel, self-rimming sink punched with one faucet hole. Sink bowl shall be 12 x 12 x 7-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Mount sink in counter furnished under another division.
    a. Model
        i. Elkay - LR-1517
        ii. Just
    b. Faucet - dual handle gooseneck bar faucet with swivel spout and chrome finish.
        i. Elkay - LKC-2223
        ii. Just
    c. Drain - 1-1/2" stainless steel strainer with cup strainer/stopper.
        i. Elkay - LK-36
        ii. Just
8. P-8 Coffee Maker Rough-in Box - self-contained 4”x5”x3-3/8” recessed box, ¼ turn brass ball supply valve, ½” female sweat connection, water hammer arrester and an adjustable faceplate.
    a. Model
        i. Ox Box
        ii. Watts
9. P-9 Ice Maker Rough-in Box - self-contained 4”x5”x3-3/8” recessed box, ¼ turn brass ball supply valve, ½” female sweat connection, water hammer arrester and an adjustable faceplate.
    a. Model
        i. Ox Box
        ii. Watts
10. P-10 Washing Machine Rough-in Box - self-contained 6”x7”x3-3/8” recessed box, single lever ¼ turn to control both (hot and cold) brass ball supply valves, 2” drain standpipe connection, and an adjustable faceplate.
    a. Model
        i. Watts Duo Cloz
11. P-11 Countertop Laundry Sink - single compartment 18 gauge, type 302 stainless steel sink punched with three faucet holes. Sink bowl shall be 25 x 22 x 12 inches deep. Provide cast brass P trap and water stop valves.
    a. Model
        i. Elkay - PLA-252212
        ii. Just
    b. Faucet - single lever faucet with 8 inch swivel spout and aerator.
        i. Elkay - LK-4100
        ii. Just

c. Drain - stainless steel body with crumb strainer and tailpiece.
   i. Elkay - LKJ-35
   ii. Just

2.4 SHOCK ABSORBERS

A. Provide shock absorbers in the water piping in horizontal runs serving water closets and dishwasher. Install near the end of runs or where shown on drawing and elsewhere as required to prevent noise or injury to the piping system resulting from water hammer.

B. Shock absorbers shall be J. R. Smith Hydrotrol or Zurn Z-1700 Shocktrol. Unit shall consist of stainless steel casing and air charged bellows. Shock absorbers shall be sized as recommended in the Plumbing Drainage Institute Standard WH-201.

2.5 WALL HYDRANTS AND HOSE BIBBS

A. Provide wall hydrants and hose bibbs as herein specified and indicated on the Drawings.

B. The exterior wall hydrants shall be frostproof hydrants Zurn 1310 with integral backflow preventor, J. R. Smith or Josam. The hydrant face shall be polished nickel bronze. The unit shall have bronze working parts and neoprene washers. Provide a loose key which will operate the hydrants.

C. Hose bibbs shall be Kohler K7871 Faucet, American Standard or Crane. The hose bibbs shall be chromium plated, loose key handle compression faucets with hose end and male IPS shoulder inlet fitted with Watts 8A backflow preventor.

2.6 VALVES

A. Provide valves as indicated on Drawings, as specified below and as required. Valves, where possible, shall be of one manufacturer, Stockham, Nibco or Jenkins, Jomar whose figure numbers are used below.

B. Valves 2 inches and smaller, which will be operated frequently, or will be used for throttling services, shall be ball or globe valves. Stop valves shall be ball valves.

C. Valves in the domestic hot water, cold water and hot water recirculating system shall be:

Description	For Copper Tube Nibco	Jenkins	Stockham
Gate-2-1/2” and smaller, bronze rising stem, solder end.	S-111	1242	B-108
Check Valves 2-1/2”and smaller, bronze, swing solder end	S-413-Y	1222	B-309

D. Non-lubricated plug valves, DeZurik 425 may be used for balancing and shut off valves in hot water circulating lines. Adjustable stop and tapping on the downstream side for pressure gauge connections shall be provided with balancing services. This valve may also be used in lieu of gate and globe valves where shown.

E. Ball valves may be used for shut off and balancing purposes except on gas piping where they shall not be used. Ball valves shall be NIBCO figure S-580-M, Jomar T-100 or Apollo. Provide memory stop on balancing valves.

F. Butterfly valves may be used for shut off or balancing purposes in lieu of gate or globe valves on piping 2-1/2 inches and larger. Valves shall be 200 pound and have EPDM liner, aluminum bronze disc and lever lock operator. NIBCO LD-2000-3, Jenkins 23ZE, Centerline, or DeZurik. On piping 8 inches and larger provide gear operator NIBCO LB-2000-5.

G. Non-slam check valves shall be installed on discharge of pumps, in vertical piping and elsewhere as shown and shall be 125 pound wafer style iron body, bronze fitted with renewable seat and disc and spring actuator, Miller 162, NIBCO W910, Hager or Smolensky.

PART 3 - EXECUTION

3.1 SANITARY AND STORM PIPING

A. Storm drainage shall be extended from clear water drains to discharge to the storm drainage system.

B. Sanitary piping shall be extended from fixtures, appliances, etc., to the existing sanitary sewer. Verify location, size and elevation of the existing line before performing work and notify the Architect if discrepancies are noted.

C. Sanitary and storm drain piping below the lowest finished floor to their connections to existing utilities shall be service weight cast iron pipe, CS-188-66, modified and made up with neoprene double seal gaskets of the same manufacturer as the pipe. Pipe and fittings shall bear the mark of the Cast Iron Soil Pipe Institute.

D. Sanitary and storm drain piping within the building, above ground shall be service weight cast iron "no hub" pipe with neoprene and stainless steel connectors.

E. Drain piping from air conditioning unit condensate pans above the ground shall be type "L" hard drawn copper water tube, ASTM B88 with solder type wrought copper fittings, ANSI A40.3.

F. Where lines pass under or through footings, encase them in concrete to uniform thickness as approved by the engineer.

G. In connection with underground piping, connections and turns, unless otherwise specified, shall be made with Y fittings and 1/8 bends.

3.2 WATER PIPING

A. Water piping inside the building shall be type "L" hard drawn copper water tube, ASTM B88 with solder type wrought copper fittings, ANSI A40.3. Brass solder joint valves shall be used with copper tubing. Solder shall be 95-5 tin antimony type. Protect piping from materials which may cause corrosion of copper.

B. Exposed piping at fixtures shall be IPS red brass, chromium plated.

C. Mains, branches and connections of the hot and cold water distribution piping systems shall be provided with valves placed at the points shown on drawings or directed by the Architect for proper isolation and control of the system. Equipment or appliances shall be separately valved so that service can be shut off and the piece of equipment or appliance removed without disturbing the piping system. Valves shall be located so as to be accessible to the operator. Separate valves for equipment and appliances are in addition to faucets supplied herein or in other Sections.

D. Provide for expansion of piping subject to temperature changes. This shall be accomplished by swings, bends or loops.

3.3 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be UL, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, PPG, Manville, Knauff Corporation, Certainteed, Armstrong, Eagle Picher, Insul Coustic or Benjamin Foster and shall be equal to those products that meet the Specifications below.

B. Insulate new cold water piping, hot water piping, tempered water piping, hot water circulating piping except chrome plated piping exposed at plumbing fixtures and insulate condensate drain lines. Insulation shall be heavy density long strand fiberglass, sectional insulation with all service vapor barrier jacket and double side adhesive self-sealing lap, Johns Manville Micro-Lok system or equal of Owens Corning. Insulation shall comply with ASTM E84 with a flame spread rating of 25 or less and smoke developed rating of 50 or less. Insulation thickness shall be in accordance with the Energy Code but shall not be less than

½ inch. Fittings, valve bodies, etc., shall be covered with Zeston type precut vinyl insulation jackets with pre-shaped fiberglass insert.

C. On exposed insulated piping in finished areas within seven feet of the floors, provide .010 inch thick galvanized steel insulation jackets. This does not include piping exposed in unfinished areas such as boiler rooms, storage rooms, etc.

D. At pipe hangers, for piping carrying fluids with temperatures below 70 degrees, provide a rigid core of insulation to support the pipe. Rigid insulation shall be the same thickness as the adjacent semi-rigid insulation and have the same flame spread and smoke developed ratings. Vapor barrier shall be continuous and integral between the rigid and semi-rigid sections of insulation. Rigid insulation shall be composed of hydrous calcium silicate. Rigid insulation shall be Johns Manville Thermo-12 Gold or equal of Owens Corning.

END OF SECTION

SECTION 23 00 00 - HEATING & AIR CONDITIONING

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 20 00 00 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 HEAT PUMPS - SPLIT SYSTEM

A. Provide direct expansion, split system heat pump systems consisting of exterior unit and interior fan coil unit. Equipment shall be of a single manufacturer. Systems shall be rated and catalogued to be compatible. Unit shall be ARI rated but shall operate at the conditions and capacities as noted on the drawings.

B. Outdoor Unit

1. Outdoor unit shall be air cooled with vertical air discharge provided with a hermetic compressor.
2. Compressor shall be welded steel hermetic provided with internal vibration isolation, crank case heater and motor winding over temperature and overcurrent safety devices.
3. Heater transfer coil shall be copper or aluminum tube with aluminum plate fins. Coil shall provide subcooling and shall be capable of storing refrigerant in system when 80 percent full or it shall be provided with an accumulator receiver. Heat rejection fan shall be deep pitched corrosion resistant propeller fan protected by a fan guard. Fan shall be direct driven by permanently lubricated motor with inherent overload protection and Class B insulation.
4. Provide outdoor unit with defrost controls, low ambient controls to 0 DegF, high and low pressure safety controls, time delay relay to prevent short cycling and automatic restart on resumption of electric service after a power failure. Controls shall be solid state. Where units are three phase, provide thermal overloads in power phases to provide single phase protection of motor.
5. Casing shall be suitable for exterior use and shall be provided with baked enamel finish over properly treated galvanized steel or other approved corrosion resistant finish. Unit shall be set on concrete pad.

C. Indoor Unit

1. Provide floor mounted, vertical fan coil unit with vertical discharge compatible for use with outdoor unit specified above.
2. Fan coil unit shall be complete with insulated casing with asphaltum treated drain pan, copper tube aluminum fin direct expansion refrigeration coil with suitable expansion valve, distributor and solenoid valve, fan section and filter section and auxiliary hydronic heat. Evaporator fan shall be vee belt drive or multi-speed of direct drive suitable for the installed field conditions and capacity.
3. Filter shall be standard throwaway type and shall be new and clean when building is accepted for use by the Owner.
4. Heat pump units shall be similar to model listed on drawing and manufactured by Carrier, York or Trane.

2.2 PUMPS - IN LINE

A. Provide in line, variable speed centrifugal pumps of the capacity as noted on the drawings. Pumps shall be complete with motor, integrated variable flow controls, flexible coupler with guard, mechanical seal and pump.

B. Pumps shall be iron body with bronze impeller and stainless steel sleeve bearings.

C. Provide support for pumps to prevent pipe strain.

D. In line pumps shall be Taco, Bell & Gossett or Armstrong.

2.3 HEATING COIL - HOT WATER

A. Provide hot water heating coil of the capacities noted and where shown on the drawing.

B. Coil shall consist of 5/8 inch copper tube with plate aluminum fins mechanically bonded to tube. Tubes shall be expanded into copper headers for coils up to 34 inches in height and threaded seamless copper headers over 35 inches in height. Coils shall be supported in galvanized steel frames of not less than 16 gauge and reinforced as necessary.

C. Coils shall be circuited as required to provide proper distribution and a water velocity of 4 feet per second minimum.

D. Coils shall be tested at 200 psi air under water and suitable for 125 psi working pressure.

E. Coils shall be Aaon, Carrier, McQuay, or York.

2.4 HOT WATER BASEBOARD

A. Provide copper tube-aluminum fin baseboard heaters for hot water use of the size, capacity and style as indicated on the drawings.

B. Elements shall be 1 inch O.D. seamless copper tubes with continuous aluminum plate fins. Copper tubes shall be brazed to steel headers and the unit tested at 350 psi hydrostatically.

Elements shall be encased in a steel frame and then supported on steel bracket in baseboard cabinet. Provide elements with air vent extended to face or cabinet for serviceability.

C. Cabinet enclosure shall be of style indicated by the Architect. Inlet and outlet grilles shall be stamped to be pencil proof. Recess units shall be provided with separate wall overlap frame to permanently protect wall opening. Cabinets shall be constructed of 20 gauge sides and rear and 18 gauge front and top. Enclosure shall have stamped front outlet grille and font base inlet opening. Enclosure cabinet shall be treated to be corrosion resistant and provided with baked enamel finish inside and out as selected by the Architect.

D. Convectors shall be Vulcan, Rittling or Sterling.

2.5 FANS – BATH EXHAUST

A. Provide exhaust fans for the bathroom of the capacities noted and where shown on the drawings.

B. Exhaust fans shall be complete with fan housing, ceiling grille, backdraft damper and direct drive fan. Provide disconnect means by cord and plug inside fan housing. Motor shall have inherent overload protection.

C. Exhaust fans shall be Nutone or Broan.

2.6 AIR DEVICES

A. Provide air devices to complete the heating, air conditioning and ventilating systems. Air devices in ceiling shall have flat white lacquered finish unless noted otherwise. Coordinate the appropriate border and mount for the specific application.

B. Air devices shall be as manufactured by Titus, Tuttle & Bailey, Price, Anemostat, Krueger, or Metalaire.

C. Supply air diffusers in the ceiling shall be square or rectangular pattern with removable directional multi-blade core. Pattern shall be four-way, unless noted otherwise on drawings. Construction shall be steel. Where diffuser is to be installed in a lay-in ceiling, diffuser shall have panels to fit into 24 x 24 modular lay-in ceiling. Provide diffusers with horizontal to vertical pattern, adjusting tabs and opposed blade damper. Where indicated on the Drawings to be connected to flexible ductwork, provide square to round adaptor.

1. Titus TDCA

D. Supply air registers in the ceiling with square or rectangular necks shall have steel adjustable curved vane face bars with opposed blade damper. Registers shall provide four-way distribution, unless indicated otherwise.

1. Titus 250

E. Sill supply grilles shall be horizontal fixed bar satin anodized extruded aluminum with bar spacing, deflection and quantities as indicated on the drawings with pencil-proof construction and debris screen. Provide grille with opposed blade damper.

1. Titus CT Series

F. Sidewall supply air registers shall be double deflection with vertical face bars and opposed blade damper. Construction shall be steel with white finish.

1. Titus 300RL

G. Sidewall return/exhaust registers (more than 7'-0" above floor) shall be horizontal fixed bar set at 35 degrees or fixed curved bar with opposed blade damper. Register shall be steel construction with white finish. Omit damper where indicated as grilles.

1. Titus 350RL

H. Sidewall return registers (below 7'-0" above floor) shall be heavy duty 14 gauge reinforced steel bars set at 1/2 inch centers on 40 degree angle. Provide with opposed blade damper (delete damper where noted as grilles). Finish shall be white enamel.

1. Titus 355RL-HD

2.7 DUCTWORK

A. Provide ductwork and plenums of the sizes shown on the Drawings and the materials, gauges and construction as listed below.

B. Ductwork shall not be fabricated or installed until clearances and dimensions have been verified in the field. Discrepancies between the duct sizes and configurations shown on the Contract Documents and those required to meet field conditions shall be brought to the attention of the Architect for his direction. Ductwork fabricated or installed prior to field verification that the ductwork will fit is done at the Contractor's risk and expense.

C. For details of duct construction not specified below refer to the latest editions of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Manuals. Duct systems shall be defined as follows with the applicable manual.

1. All systems "HVAC Duct Construction Standards" metal and flexible.

D. Ductwork shall be galvanized steel except as specified hereinafter of sizes indicated with sheets shaped and constructed as noted in the SMACNA Manual.

E. Flexible ductwork shall consist of a coated spring steel wire helix, polymeric liner, fiberglass insulation and fiberglass reinforced metallized film vapor barrier. Flexible ductwork shall be listed by Underwriters Laboratories under UL 181 standards as Class I flexible Air Duct Material and shall comply with NFPA Standards 90A and 90B. Flexible duct shall be rated for two inches positive and negative pressure and 2500 fpm maximum velocity. Flexible ducts shall be Thermoflex M-KE, Wiremold or General.

F. Where ducts are noted to be acoustically lined, they shall be lined with one half inch thickness of coated and edge sealed lining system. Liner and insulation shall meet

requirements of UL 181 and NFPA 90A/B. Liner shall meet bacteriological standards of ASTM C 1071. Seams and cut edges shall be sealed from airstream using metal brackets. Use of adhesive-backed tape is unacceptable. Insulation shall be 3 lb/cubic foot density with an R-Value of 4.0 per inch thickness. Duct sizes shown on drawings are the interior sizes of insulated duct. As a minimum, supply and return ducts from heating, ventilating and air conditioning units for a distance of fifteen feet from the units shall be acoustically lined. Duct lining shall be Owens Corning Aeroflex Plus or equal of Johns Manville, Certain Teed or Knauf.

G. Ductwork shall be galvanized steel except as specified hereinafter of sizes indicated with sheets shaped and constructed as noted in the SMACNA Manual.

Pressure Classification In Inches W.C.	System
1.0	Exhaust Systems (except as noted herein)
2.0	Return Air System
2.0	Supply Air System o Outlet Side of VAV Boxes and Mixing Boxes
4.0	Supply Air Systems on Inlet Side of VAV Boxes

H. Duct connections to air handling units and elsewhere as required to compensate for expansion and contraction and noise reduction shall be made with UL approved glass fabric such as Ventglas as manufactured by Vent Fabrics, Inc.

I. On low pressure systems duct details shall be as follows:

1. Square elbows Figure 2-2
2. Hangers Figure 4-4
3. Tee connections Figure 2-7
4. Register on trunk Figure 2-16
5. Volume dampers Figures 2-14 and 2-15

J. Provide manual volume dampers as shown on the Drawing and additionally as required to properly balance the air distribution systems as directed by the independent Test and Balance Agency.

K. Blank-off unused portions of louvers with an aluminum clad plywood panel. Aluminum shall have textured black finish and shall face outside. Inside shall have black painted plywood finish. Blank-off material shall be Weyerhauser Pre-finished Siding/Panel 15 with Ebony exterior finish and black painted plywood interior finish.

2.8 PIPING

A. Heating system hot water supply and return piping shall be provided as indicated below unless otherwise noted.

1. Piping - black steel, schedule 40
2. Fittings
   a. 2-1/2 inches and larger, black steel welded
   b. 2 inches and smaller, black cast iron banded

3. Unions
   a. 2-1/2 inches and larger, 150 pound slip on forged steel welding flanges with bolts, nuts and gasket
   b. 2 inches and smaller, black malleable iron, ground joint
4. Joints
   a. 2-1/2 inches and larger, welded
   b. 2 inches and smaller, threaded

B. Piping 2 inches and smaller may, at the Contractor's option, be type "L" hard drawn copper tubing ASTM B.88 made up with wrought copper sweat fittings ANSI A40.3 using 95-5 tin antimony solder.

C. Grooved pipe couplings as manufactured by Victaulic Company of America or Gustin Bacon may be installed on steel at connections to air conditioning units, pumps, throughout condenser water piping system and elsewhere where unions would be provided to provide flexibility in piping.

2.9 PIPING ACCESSORIES

A. Provide piping accessories including thermometers, pressure gauges, specialty items, etc., as specified below and/or indicated on the drawings.

B. Strainers shall be Walworth 3699-1/2, Sarco SB; bronze, smaller than 2-1/2 inches. Bailey 125 pound No. 100, Zurn 125 pound No. 540 FBS, or Crane No. 989-1/2, cast iron 2-1/2 inches and larger. Provide with small mesh basket during testing and cleaning period. Replace basket prior to air and water balance.

C. Unions shall be installed where required or detailed to permit removal of equipment, control valves, etc., from the piping systems without dismantling the system. Unions shall be malleable iron brass to iron seat, ground joint, same materials as pipe, Crane, Walworth or Jenkins. Provide di-electric fittings where pipe sections and fittings of dissimilar materials are joined.

D. Flexible connections of reinforced rubber or teflon construction shall be provided in suction lines and discharge line to pumps and chillers. Connections shall be arranged to correct minor misalignment, to facilitate disconnecting the piping and to reduce vibration transmission. Flexible connections shall be Resistoflex Corporation, complete with limit bolts and grommets, Mercer or Mason.

E. Combination temperature and pressure tappings shall be 1/4 inch fitting to receive either a temperature or pressure probe, 1/8 inch OD. Fitting shall be solid brass with two neoprene valve cores. Provide two pressure gauge adapters with 1/8 inch probe and two five inch stem pocket testing thermometers with 0 to 220 degree range. Fitting shall be Pete's plug. At Contractor's option, where thermometer well, pressure gauge tapping and/or flow indicator is required adjacent to a balancing valve, a combination device such as Autoflow FV series or flowset HB/U+ may be substituted.

F. Thermometers shall be 5 inch dial bi-metal with stainless steel case set into separable wells in the piping system. Range for hot water shall be 20-240. Thermometers to be Weksler Economy bottom side or rear mounted to be easily

visible from the floor.

G. Water pressure gauges shall be Weksler type P, phenol case 4-1/2 inch range P.S.I.G. dial, with bourdon tube, recalibrating type, black case. Gauges shall be installed on 1/2 inch pipe with gate valve in connection. Equivalent products of Weiss, Manning-Maxwell and Moore "Ashcroft", Trerice or Marsh will be acceptable.

H. Flow indicators of venturi type or orifice plate type shall be installed where noted on the drawings. Provide 2 reading devices and the necessary conversion charts. Indicators shall be as manufactured by Taco, Bell & Gossett or Sarco.

I. Provide automatic air vents at the high points of the piping systems in the mechanical room. Vents shall be piped to the nearest floor drain. Vents to be Fisher, Illinois or Taco. At the other locations where piping turns down in the direction of flow and at terminal devices, install key operated needle valve air vents.

PART 3 - EXECUTION

3.1 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be Underwriters Laboratory, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, Manville, Knauff Corporation, Armstrong, Certainteed, Miracle Adhesive, Moneco or Benjamin Foster and shall be similar to those products that meet the specifications below.

B. Ductwork

1. Exposed supply ductwork and return air ductwork except where ductwork located in the room supplied and exposed outside air ductwork shall be insulated with 1-1/2 inch thickness of 6 PCF fiberglass board with reinforced foil faced ASJ vapor barrier jacket secured to duct with Graham weld pins or perforated base stick clips set in Moneco M46420 adhesive. Pins shall be covered with finish cap to match insulation. Butt joints and seams and cover with vapor barrier mastic. Finish with a coat of lagging adhesive such as Benjamin Foster 30-35 or Moneco 55-10 embedding 8.5 glass cloth fabric over the adhesive. Use corner beads on edges of the duct
2. Concealed supply air duct, return air duct and outside air duct shall be covered with 1-1/2 inch thickness of 3/4 pcf flexible fiberglass duct covering with reinforced foil and kraft paper vapor barrier FRK jacket. Insulation shall be applied to duct over a 100 percent coverage of duct adhesive such as Benjamin Foster 85-20. Edges shall be butted together with a vapor barrier lap of 2 inch minimum. Seal joint and punctures with Benjamin Foster 30-35. Where ducts are over 24 inches in width, weld pins and caps shall be used to secure insulation to underside of duct. Secure laps with adhesive and flared staples on 4 inch center.
3. Ductwork that is internally lined is required to be insulated externally as indicated herein.
4. Ductwork exposed to outdoor elements shall be covered with 1-1/2 inch

thickness of 6 PCF rigid fiber board with vapor barrier jacket, applied to duct with stick pins and adhesive. Joints shall be lapped and sealed. Slope insulation to drain by providing insulation blocking underneath of insulation board. Finish with 2 coats of lagging weatherproof adhesive imbedded with glass cloth using corner beads on edges. Paint with weatherproof paint suitable for the installation. Top of duct and extending 2 inches down sides of duct shall additionally be covered with 22 gauge galvanized sheet metal cover which shall be sloped for positive drainage.

C. Piping

1. Hot water heating piping shall be as required by the energy code. As a minimum, the piping shall be covered with 1 inch thickness of long strand glass fiber insulation with all service vapor barrier jacket with self-sealing pressure sensitive lap, Manville AP-T, for piping up to 1-1/2 inches in size and with 2 inch thickness on piping 2 inches and over. Fittings shall be covered with 300 precut PVC fitting covers with fiberglass insulation insert. Cover shall be sealed to adjacent insulation with vapor retarder mastic and then covered with pressure sensitive tape.
2. Refrigeration suction piping and condensate drain piping above the ground shall be covered with 3/4 inch thickness of 6 PCF polyethylene foamed closed cell elastomeric pipe covering conforming to Mil Spec 15280, Armstrong Armaflex. Fittings shall be neatly mitered or continuous with piping. Covering on exterior of building shall be finished with 2 coats of Armaflex or other latex base finish to blend with adjacent finishes.
3. On exposed insulated piping in finished areas within seven feet of the floor, provide .016 aluminum insulation jackets. This does not include piping exposed in unfinished areas such as boiler rooms, storage rooms, etc.
4. At pipe hangers for piping carrying fluids with temperatures below 70 degrees, provide rigid core of insulation to support the pipe. Rigid insulation shall be the same thickness as the adjacent insulation and shall have the same flame spread and smoke developed ratings.

3.2 AUTOMATIC TEMPERATURE CONTROLS

A. Provide labor, materials, equipment, services, etc., to install a system of automatic temperature controls to perform the functions noted on the Drawings. Coordinate with unit supplied controls. Refer to the Drawings for explanation of Base Bid and Alternate prices.

B. System shall be as manufactured by Automated Logic and tied into the campus system. Provide an alternate price by the following manufacturers that is fully integrated to the campus Automated Logic system: Siemens, Johnson, or Honeywell.

C. Power source for the system shall be taken from a 120 volt source provided for this purpose. Under this Section, provide control power transformer and related wiring devices, etc., in accordance with the applicable requirements of the Electrical Division. Interlock wiring to fans, pumps, motors shall be provided as part of this work.

D. Automatic control valves and dampers shall be furnished by the temperature control manufacturer, but shall be installed by the trade normally installing such item; valves installed in the line by the heating contractor; dampers by the sheet metal contractor; under the supervision of the control manufacturer.

E. The temperature control system, as hereinafter specified and designated on the Drawings and plans, shall be guaranteed free of original defects in material and workmanship for a period of one year. After completion of the installation, thermostats, control valves, control motors, dampers shall be regulated and adjusted to perform the proper function.

F. Prepare schematic drawings of the temperature control system and submit them to the Architect for his review prior to starting work.

G. Upon completion of the work, revise the diagrammatic layouts to Record conditions and mount the revised layouts in clear plastic envelopes where directed.

H. Upon completion of work, furnish services of a competent representative to instruct Owner's representative in the proper operation and maintenance of the system. Instructor must be approved by the Architect. During the one year warranty period, provide telephone support for Owner's representative. Additionally during the one year warranty period, provide 80 hours, in 4 hour increments at the Owner's request, for formal training.

I. Wiring shall be run to a minimum of 24 inches from other wiring to avoid problems with electrical interference.

J. Equipment

1. Energy Management System
    a. Functions
        i. The system shall allow the creation of control sequences to operate the building and conserve energy and to establish TREND LOGS, DEMAND HISTORY, EQUIPMENT RUN TIME HISTORY, alarms and automatic call generation.
    b. Equipment
        i. The panels shall be enclosed in steel protective NEMA 1 enclosures. The doors shall be key locking and have viewing lenses to observe load status display LEDs. The door shall be removable.
        ii. The termination of field wiring shall be via screw terminals. The electronic logic assembly, including; processor, load boards and modem shall be removable as one unit without the need to determinate field wiring. This will allow separate installation of the enclosure and control wiring at the job site prior to installing the electronics.
        iii. The system shall operate from the commercial power mains and require only single phase power from 90 to 127 volts AC, 60 Hz, power consumption shall be less than 100 watts.
        iv. The operating temperature range shall be 32 degrees to 122

degrees F. 20 - 80 percent relative humidity non-condensing.

v. The system shall contain a clock and a calendar. The university shall be able to enter the time, day and year. The time, day and year shall be displayed on demand. The time shall automatically change to and from daylight savings time. The automatic change to and from daylight savings time shall be able to be inhibited by the user. When the system displays the time and day information it shall show the user if daylight savings is inhibited or not.

vi. The local system panels shall contain back-up battery that shall retain memory for customer entered controls, setpoints, clock, calendar and history information for a period of two years. This shall include DEMAND history, TREND LOG history and RUN TIME history. Nicad (Nickel cadmium) batteries shall not be acceptable for this application. No operator action shall be required to restore the system to operation when commercial power returns after a power outage.

c. Control

i. The software supplied with the system shall contain an operating system that will allow the user to enter commands, parameters and other values that will make up the control and monitoring program for their building. The software structure shall be such that it shall be impossible to enter values, conditions or procedures which will cause the processing of data to stop, to go into a "loop" or to cause the program to "crash".

ii. The product as delivered to the user will contain the capability to generate complete control programs. There shall be no need to return user entered data to the manufacturer for compiling or additional manipulation to generate a function program. There shall be no ongoing fee for the use of the program entered by the user. The system shall allow the user to add and delete points and controls.

iii. The system shall provide the capability to generate control strategy to accomplish the following basic functions.

a) Time Scheduling
b) Night Setup/Setback
c) Reset via Schedule
d) Seasonal Changeover
e) Run Time Logging
f) Automatic Status Reporting
g) Historical Data Gathering
h) Economizer Control
i) Reset via Setpoint
j) Deadband Control
k) Trend Logging
l) Proportional Control
m) Proportional Integral Control
n) Proportional Integral Derivative Control

3.3 TESTING AND BALANCING AIR & WATER SYSTEMS

A. The air and heating water distribution systems shall be balanced and adjusted to distribute the air quantities as noted on the drawings. Demonstrate to the Architect's satisfaction knowledgeability in this work and familiarity with the test instruments to be used. If the Architect does not approve of the Contractor's qualifications, the Contractor shall engage the services of an independent test organization specializing in this work and is a member of the Associated Air Balance Council or other nationally recognized air balancing organization. University authorized balancing contractors are : Eastern Air Balance, ABE, and Flood and Sterling.

B. Test equipment must be approved by the Architect and properly calibrated prior to starting work. Repairs, alterations, adjustments and readjustments necessary to meet the design conditions shall be made.

C. The balancing agency shall review the drawings before installation and advise the Contractor of additional dampers required in the ductwork, flow devices and balancing valves in the water piping, etc., to effectively and properly balance the systems. These devices shall be installed at no additional cost to the Owner.

D. At the completion of the balancing and adjusting and prior to the operating test, submit to the Architect three (3) certified typewritten reports to be retained by the Architect. Reports shall include:

1. Velocities and air quantities at supply returns and exhaust outlets installed under this contract.
2. Pressure and/or temperature difference across various pieces of equipment.
3. Air temperature delivered from heating and cooling equipment.
4. Water quantities at flow indicators.
5. Schedule of equipment.
6. Speed of belt driven equipment.
7. Nameplate data on motors installed under this contract.
8. Actual operating voltage and ampacity readings on motors.
9. Separate six hour operating tests shall be made during the cooling season and during the heating season in which an hourly record shall be made of the following:
   a. Settings of control equipment.
   b. Outside weather conditions.
   c. Thermostat readings.
   d. Dry and wet bulb temperatures in spaces.

   Outside temperatures shall be below 40 degrees Fahrenheit during the heating test and above 85 degrees Fahrenheit during the cooling test.

END OF SECTION

SECTION 26 00 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for work under Division 26

B. Coordinate the work of this Section with the requirements of the Project.

1.2 DEFINITIONS

A. Following are definitions of terms and expressions used in the Electrical Sections in addition to definitions found in the Contract Conditions:

1. "Wiring" includes wire, fittings, conduit, boxes and other accessories that comprise a system.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. Work shall conform to the requirements of the codes, laws and ordinances of Cumberland County, Pennsylvania, National Fire Protection Association, National Electrical Code (NEC), National Electrical Manufacturer's Association (NEMA) and other authorities having jurisdiction.
2. The requirements of the authorities having jurisdiction shall take precedence over the Drawings and Specifications and changes required by the authorities shall be made after review by the Architect.

1.4 SUBMITTALS

A. Shop drawings are required for the following:

1. Lighting Fixtures

B. Review of shop drawings does not relieve the Contractor of responsibility for complying with the Contract Documents.

C. Include in shop drawings equipment layout for Electric service equipment and electric rooms. Verify the physical dimensions of equipment provided comply with the layout shown within the contract documents. Any adjustments or modifications needed shall be provided at the contractor's expense.

1.5 PROTECTION

A. Protect material and equipment from damage.

B. Cap or plug openings in equipment and conduits with proper caps and plugs.

1.6 VARIANCES

A. Where conflicts exist within the contract documents, request clarification prior to the submission of a bid. If clarification is not requested, provide the work representing the higher cost and quality.

1.7 WARRANTY

A. During the warranty period, make the proper adjustments of systems, equipment and devices installed and perform work necessary to ensure the efficient and proper functioning of the systems, equipment and devices.

B. Certain items of equipment shall be warranted for a longer time than the general warranty period. Provide for service or replacement required in connection with the warranty of these items.

1.8 TEMPORARY POWER AND LIGHT

A. Temporary electric service and lighting is not covered under this Division of the Specifications.

PART 2 - PRODUCTS

2.1 PRODUCTS TO BE USED

A. Items are specified by designations such as trade name, manufacturer's name, catalog number and indicate the capacity and quality of the products or materials to be used on this project.

B. Only products indicated on Contract Documents by name, series and/or model number have been coordinated with other trades. Coordinate items of other manufacturer with other trades.

2.2 MATERIALS AND WORKMANSHIP

A. Items shown and not specifically called for, or items specified and not specifically indicated or detailed on the Drawings, or items neither specified nor shown, but which are reasonably incidental to and commonly required to make a complete job, shall be provided.

2.3 HANGERS AND CONDUIT SUPPORTS

A. Provide conduit hangers and supports to maintain required alignment for equipment and conduits.

B. Conduits may not be supported from other conduits. Trapeze hangers may be used for parallel runs of conduit.

C. Provide supports for equipment and materials under these Specifications. Supports shall be structural steel shapes (angles, channels) of Kindorf and Unistrut. Minimum rod size shall be 3/8 inch.

D. For wood joist construction, hanger rods shall be supported from wood joists with hangers bolted through or attached with lag crews to the joists.

E. Expansion bolts or wood plugs will not be permitted in slag block walls. Equipment hung on such walls shall be supported by through bolts or approved anchor bolts set into masonry as the wall is laid up.

2.4 OPENINGS, CHASES, LINTELS AND SLEEVES

A. Determine the location and size of chases, lintels and openings necessary for the proper installation of the work and provide them during the erection of the work in which such chases and openings occur.

B. Provide sleeves through walls and floors for conduit. Sleeves through walls shall be flush with the walls.

C. In case cutting of building construction is necessary, including cutting of structural members, such cutting shall be done and repaired to match original condition of the work.

D. Where non-combustible conduits pass through sleeves or openings in fire rated wall, floor-ceiling and ceiling-roof assemblies, seal openings with a Underwriters Laboratories classified firestop method. Firestop method shall be a one part, intumescent (expands with heat), latex elastomer capable of expanding a minimum of three times. Firestop materials shall be UL listed when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating.

E. If combustible conduit materials are used, a UL listed firestop method shall be provided where the combustible materials penetrate fire rated wall, floor-ceiling and ceiling-roof assemblies. Firestop method shall be classified by UL as a through-penetration firestop device when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating. Plastic conduit materials, including, but not limited to PVC, CPVC and ABS, are combustible. Firestop method shall be similar to Nelson Firestop Products.

F. Escutcheon plates shall be used to conceal sleeve opening on exposed conduit. Floor plates shall be split chrome plated cast brass similar to Ritter No. 36A.

2.5 ACCESS PANELS

A. In general, boxes, devices and equipment shall be accessible through the removable panels in the ceiling. Where ceilings are not removable and in walls where access is required for service, access panels shall be provided. Access panels shall be appropriate for the finish in which they are installed, with a fire rating to match the wall or ceiling in which they are installed.

B. Coordinate with other divisions and group boxes, devices and equipment together to keep the required number of access panels to a minimum.

2.6 IDENTIFICATION

A. Equipment shall be identified with engraved plastic laminate or anodized aluminum nameplates with pressure sensitive backing. Plates shall also be provided with drilled holes and fastened to equipment with moly-rivets. Letters shall be at least 3/8 inch high and larger in proportion to the size of the piece of equipment. Identification shall be the same as noted on schedules on the Drawings. Labels shall be provided for the following equipment.

1. Panelboards
2. Motor starting and control switches
3. Disconnects
4. Starters
5. Cabinets

B. Junction boxes and pull boxes, except those located at the fixture or equipment to which system is connected, shall be identified with permanent marker in large legible lettering to indicate system and circuiting on which installed. In exposed areas mark the inside of the cover.

C. Panels shall be provided with a typed directory listing circuits and associated breaker numbers.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Visit the site and become familiar with existing conditions. Modifications to work required to allow for existing conditions shall be provided. Submit proposed modifications to the Architect for approval prior to installation.

B. Where electrical systems pass through the renovated areas to serve other portions of the premises, they shall be suitably relocated and the systems restored to normal operation. Any outages in systems shall be coordinated with the Owner. Where duration of proposed outages cannot be tolerated by the Owner, provide temporary connection as required to maintain service.

C. Coordinate interruptions in service of existing systems with the Owner. Provide temporary connections to maintain operation of existing systems.

D. Relocate existing hangers and supports where necessary to install new work. Maximum spacing requirements shall apply for relocated supports.

E. Where new devices are added to existing walls and ceilings, new wiring shall be concealed by chasing existing walls as required. Devices shall be installed flush.

F. Where new finishes or treatments are added to existing walls and ceilings by the Architect, provide necessary outlet box extensions, plaster rings, etc., so that devices are installed in the same manner as existing, i.e., flush, concealed, surface, etc.

G. Coordinate with Architect for any required openings in existing finishes for the installation of branch circuit wiring and devices prior to any damage to existing finishes. Where possible route all branch circuit conductors through walls, floors, ceilings of areas of new construction or where areas are opened for installation from work of other trades.

3.2 DEMOLITION

A. Equipment removed that is salvageable and desired by the Owner to be retained, shall be stored on the site where directed by the Owner. Otherwise, other materials and equipment which are removed shall become the property of the contractor and shall be removed by him from the premises.

B. In each area to be renovated, remove the entire existing electrical installation except those portions indicated to be reused. When existing electrical work is removed, remove conduit, ducts, supports, etc. to a point below the finished floors or behind finished walls and cap. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material. Unused wiring and cable shall be removed back to source.

3.3 MANNER OF INSTALLATION

A. The Drawings showing the layout of the electrical systems indicate the approximate location of outlets and equipment. The runs of feeders and branch circuits as shown on the Drawings are schematic only and are not intended to show the routing and location of conduits. The final determination of routing and location shall be governed by structural conditions, obstructions and connection

locations on equipment. Detailed drawings showing major deviations shall be submitted to the Architect for acceptance and such changes shall be made.

B. The Drawings are generally indicative of the work to be installed, but they do not show all offsets, fittings and similar details required, which shall be provided to meet the job conditions. In areas where work is installed in close proximity to work of other trades or within trades covered by this Division of the Specifications, prepare larger scale drawings consisting of plans and sections to show how work is to be installed in relation to work of other trades.

C. The Architect reserves the right to a reasonable amount of shifting of outlet locations at no additional cost to the Owner until the time of roughing-in the work.

3.4 EXCAVATION AND BACKFILL

A. Provide excavation and backfill necessary to install underground conduits and other work included in this Division of the Specifications. Establish lines and grades required for the proper location of the Work.

B. After the conduit has been placed, the trenches shall be backfilled to the lines of present grades or finished grade as required. No backfill shall be placed, however, until water has been removed from the trenches and joints have been set.

3.5 RECORD DRAWINGS

A. Keep at the site two (2) sets of black and white prints for the express purpose of showing changes from the contract Drawings made during construction. Mark up the prints with red pencil during construction and deliver the prints, before final inspection, to the Architect as a final set of "Record Drawings". Refer to Division 1 for additional requirements.

3.6 TESTING

A. Provide labor, instruments and equipment required for the tests. Make necessary changes to the systems as required to produce the specified results. Retest to the Architect's satisfaction.

B. Tests shall be conducted before equipment is connected that would be subject to damage from the test.

C. Notify the Architect of the date and time of the test at least three days prior to that date.

D. The tests shall demonstrate to the satisfaction of the Architect the following:

1. That lighting, power and control circuits are continuous and free from short circuits.
2. That circuits are free from unspecified grounds, and grounded where specified.
3. That the resistance to ground of non-grounded circuits is at least one megohm.
4. That circuits are properly connected in accordance with the applicable wiring diagrams.
5. That circuits are operable, which demonstration shall include functioning of controls and continuous operation of lighting and power circuits for not less than 1/2 hour.

6. That the resistance of the ground field system does not exceed 5 ohms.

3.7 PAINTING

A. Remove rust, scale, grease, and dirt from equipment and material and leave ready for finish painting. Equipment specified with factory baked enamel finish shall be touched up as required to provide a surface visually free of scratches, nicks and blemishes.

3.8 OPERATING AND MAINTENANCE MANUAL

A. Submit operating and maintenance instructions. The manual shall include the following:

1. A brief description of systems and their various components.
2. List of manufacturer's representatives with address and telephone numbers.
3. Manufacturer's printed operating and maintenance instructions, parts lists, illustrations and diagrams for pieces of equipment.
4. One copy of each shop drawing and Contractor's drawings.
5. One copy of other items of equipment where not required as a shop drawing submittal.
6. One copy of each wiring diagram.
7. Manufacturer's data report from UL certifying code compliance for equipment specified.
8. Certificate of field test check by manufacturer's representation of the Fire Detection and Alarm System.
9. Certificate of approval from the code authority.

3.9 FIELD INSTRUCTION

A. Upon completion of work, furnish services of a competent representative to instruct Owner's representative in the proper operation and maintenance of elements of the electrical systems. Submit instructor's name and credentials to the Architect for approval.

B. Spend not less than 4 hours in such formal instruction to prepare Owner to operate and maintain the systems.

3.10 PERFORMANCE TEST

A. Should the performance or capacity of the systems, equipment or devices furnished be questioned by written notice from the Architect after installation, provide necessary test equipment and complete a satisfactory test of the items in question. The test shall be run when and as directed by the Architect and in the presence of his representative. Should the items furnished not pass such a test, they shall be removed and replaced by systems, equipment or devices satisfactory to the Architect.

3.11 SERVICE LOCATIONS

A. Determine from the Owner, Utility Company, Telephone Company, and City or County Departments or Governmental Agency the location of the services. Advise the Architect of discrepancies or possible interferences before work commences.

B. Arrange for services with the respective utility companies.

C. Initiate field coordination meeting with utility at project startup to review project requirements, project schedule and provide any final information requested by the utility to maintain proposed project schedule. Notify Engineer or Architect immediately of any items requiring their assistance.

D. It shall be the contractor's responsibility to coordinate with the utility and submit for approval prior to release, fabrication and installation for all proposed metering equipment and arrangements. Any discrepancies shall be brought to the immediate attention of the engineer or architect.

3.12 GROUNDING

A. Provide grounding system as shown on the Drawings and as required.

B. Grounds and connections shall be provided in accordance with the latest provisions of the National Electrical Code, and as indicated on the Drawings and specified.

C. Ground conductors shall be of copper sized as required by the National Electrical Code. Ground lugs and clamps shall be of the cast non-ferrous metal of the bolt on type. Main ground connections shall be provided with four bolts for connections. Bolts shall be brass. Taps to lugs shall be provided with two bolts.

D. Ground rod connectors shall be Burndy Type GAR or approved equal. Connectors shall be brazed to the ground conductor and ground rod.

E. Ground rods shall be copperweld 3/4 inch diameter, 10'- 0" long. Top of rods and ground conductors shall be 24 inches below finish grade. Rods shall be interconnected with copper cable, as indicated within the contract documents, creating a ground field.

F. Ground conductors shall be extended and connected to the main water service piping. Provide bonding jumpers on the main water service piping. Jumpers shall be installed at non-metallic couplings in the main water service piping to a point 10'-0" beyond the exterior of the building wall. In addition, ground conductors shall be extended and connected to the ground rods in the Ground Field.

G. Provide ground for service neutral and metallic structures, enclosures, devices, and utilization equipment permanently and effectively in accordance with requirements of the National Electrical Codes, and as shown and required. Grounding and bonding connections shall be solderless. Welding of conduit and fitting will not be allowed for bonding proposed.

H. The system neutral ground and the equipment ground system shall be connected to the common ground bus at the main disconnecting device. Service ground shall be extended to the main cold water pipe and the ground field as indicated on the Drawings. Also provide a continuous ground conductor around the walls of the transformer vault tied into the ground field.

I. The required equipment grounding conductors and straps shall be sized in compliance with N.E.C.. Equipment grounding conductors shall be provided with green insulation equivalent to the insulation on the associated phase conductors. The related feeder and the branch circuit grounding conductors shall be connected to the grounding bus with approved pressure connectors.

J. Bond the hot water system to the ground system in accordance with the National Electrical Code.

K. Provided a separate green insulated equipment grounding conductor for each feeder and branch circuit. The required grounding conductor shall be installed in the common raceway with the related phase and/or neutral conductors. Flexible metallic conduit equipment connections utilized in conjunction with the above shall be provided with suitable green insulated grounding conductors connected to approved grounding terminals at ends of the flexible conduit.

3.13 MOUNTING HEIGHTS

A. Mounting heights indicated on the drawings provide a general location of the outlets for bidding purposes only. Where mounting height information is not given, request the information from the architect. Field coordinate final location of outlets.

B. Prior to rough-in, coordinate and adjust the location and mounting height of power, data and telephone outlets with architectural casework, shelving, counters, millwork, furniture, or other appurtenance. Adjust locations as necessary to avoid conflicts without having to cutout portions of countertop backsplashes and the like.

END OF SECTION

SECTION 26 05 00 - METHODS AND MATERIALS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 26 00 00 apply to work performed under this Section.

B. The requirements of this Section of the Specifications apply to and form a part of the individual Electrical Sections of the Specifications.

1.2 SCOPE

A. The Work under this Section of the Specification includes the furnishing of labor, materials and equipment for the installation of a complete electrical system as shown and as specified herein.

PART 2 - PRODUCTS

2.1 LOAD CENTERS

A. Load centers shall be constructed in accordance with NEMA Standard PB1-1971 and shall bear the UL (service entrance) label.

B. Load centers shall be suitable for flush mounting.

1. Circuit breakers shall be provided with a designating number and a hand written circuit directory shall be provided on the inside of load center's door clearly describing loads being served by the breakers.
2. Load centers shall be provided with main breakers or main lugs, branch breakers and bussed spaces as indicated on the plans. Mains of load centers shall be aluminum. Lugs shall be U.L. listed for connection of both aluminum and copper conductors.
3. Provide a grounding bus in all load centers.
4. Load centers shall be rated for 208/120 volt service and be equipped with plug-on thermal-magnetic circuit breakers. Two or three-pole breakers shall be common trip type and shall not be composed of single pole units with a handle tie. Tandem breakers will not be permitted. Minimum ampere interrupting capacity of load centers shall be as indicated on the drawings. Maximum load center width shall be 14".
5. Circuit numbers indicated on branch wiring on the plans are to indicate grouping of loads on circuits and do not necessarily indicate actual circuit numbers in load centers. Circuits shall be so arranged that loads are balanced as closely as practical over the phases and that a branch circuit neutral conductor does not serve as a common for two or more single phase circuits connected to the same phase in the load center.
6. Provide Arc-Fault Circuit-Interrupter Protection for branch circuits that supply receptacles in dwelling units.
7. Load centers shall be by Eaton Cutler-Hammer or approved equal by General Electric, Siemens or Square D.

2.2 POWER SYSTEM ANALYSIS

A. Per the National Electrical Code, the maximum available fault current shall be field marked on all service equipment.

1. Submit a fault analysis prior to procurement of electrical equipment, performed by a company regularly engaged in power system analysis. The study shall be done utilizing one of the following software platforms: SKM Systems Analysis PTW, ETAP, or Easy Power.
2. Obtain the available fault current from the utility for use in the fault analysis. Do not use an inifinite bus for the utility contribution.
3. The fault analysis shall include motor contribution from downstream loads.
4. The fault analysis shall include all operating scenarios, including system on utility, system on generator, and any other switching scenario.
5. Provide a durable, printed label at the service equipment indicating the maximum available fault current and the date the calculation was performed.

2.3 TRANSIENT VOLTAGE SURGE SUPPRESSORS (TVSS)

A. Where indicated on the drawings, provide TVSS units integral to equipment, that provides both effective high energy surge current diversion as well as attenuation of electrical line noise. Units shall be suitable for applications in ANSI/IEEE C62.41, Location Categories B and C with high exposure levels.

B. TVSS units shall be designed for use in parallel connection applications. Series systems that are limited to system current will not be acceptable.

C. TVSS units shall conform to the following standards:

1. UL-1449, Second Edition
2. UL-1283
3. cUL
4. MIL Standard 220A
5. ANSI/IEEE C62.41 – 1991
6. ANSI/IEEE C62.45 – 1995
7. NEMA LS-1 – 1992

D. TVSS units shall conform to the following environmental and operating conditions:

1. Temperature: -40°C to +60°C
2. Humidity: 95% RH, non-condensing atmosphere
3. Operating Altitude: 0-12,000 ft.
4. Frequency: 50 or 60 Hz
5. Audible Noise: 35db maximum @ 3ft. from unit
6. Surface Temperature: less than 55°C

E. TVSS units shall utilize a single wafer (utility grade MOV) for each mode of operation. At a minimum, there shall be individual arrester wafers in each L-N mode and also a wafer in the N-G mode providing common mode protection.

F. The maximum surge current rating for each TVSS unit, based on an 8/20μs test waveform shall be 100KA per mode. This rating shall be based on the testing of a complete TVSS unit including fuses and all components that make up the TVSS system. TVSS units that derive a maximum surge current rating by adding test results of individual components shall not be acceptable.

G. The maximum continuous operating voltage for all voltage configurations shall be 115% of nominal.

H. The TVSS units shall have been repetitively surge-current-capacity-tested utilizing a 1.2x50s, 20KV open circuit voltage, 8x20s, 10KA short circuit Category C3 test waveform at one minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. At a minimum, TVSS units shall be capable of surviving 25,000 impulses without failure or performance degradation.

I. Suppression voltage rating values shall not exceed the following:

Nominal Voltage	L-N	N-G	L-G	L-L
208Y/120	400	400	700	700
480Y/277	800	800	1500	1500

J. Each phase of the TVSS unit shall be fused with fuse capability to allow the rated maximum surge current to pass through the unit without fuse operation. Fusing shall be capable of interrupting up to 200KA symmetrical fault current with 600V applied.

K. Each TVSS unit shall be equipped with a display panel giving visual system status indication. The display panel shall have 3 indicating lamps (1 per phase) that remain illuminated under normal operating conditions. Lamps shall extinguish in the event of fuse failure. In addition, an audible alarm shall be provided to indicate protection failure. A switch shall be provided to silence the audible alarm, thereby activating a red visible alarm light on the display panel.

L. Each TVSS unit shall include a transient voltage surge counter on the enclosure cover. The counter shall be provided with a battery backup capable of storing the number of events in memory when input power is unavailable.

M. Each TVSS unit shall be equipped with form C contacts in order to provide for remote monitoring when so desired.

N. TVSS units shall be equipped with a 3 pole breaker to serve as a maintenance disconnect.

O. TVSS units shall be housed in a NEMA 1 enclosure.

P. TVSS units shall be General Electric “Tranquell” series or approved equal.

2.4 SAFETY SWITCHES

A. General

1. Horsepower rated switches, of the appropriate size, where applicable.
2. 240 Volt
   a. 30-100 Amp - general duty
   b. 200 and greater - heavy duty
3. Fused

a. Heavy duty switches - rated 200,000 RMS symmetrical amperes at 480 volts.
b. General duty switches - rated 100,000 R.M.S. symmetrical amperes at 240 volts.

B. Enclosure

1. NEMA 1 for general interior work
2. NEMA 3R for exterior work and damp locations.
3. Cover interlock to prevent operation with cover open.
4. Visible blade
5. Externally operated with current carrying parts silver or tin plated.
6. Provisions two or more external padlocks
7. Capable of accepting copper or aluminum cables.

C. Safety switches shall be by Eaton Cutler-Hammer or approved equal by General Electric, Siemens or Square D.

2.5 FUSES

A. Fuses shall be rated 250V,

B. General Branch Circuit Devices

1. 1/10 to 600A Class T: Bussman JJS series (200k AIR)

C. Fuses shall not be installed until installation is complete. Fuses shall be installed on the job site; they shall not be installed in equipment at the factory and shipped in place in the equipment.

D. Fuses shall be of the same manufacturer, shall be of the sizes indicated. Where not indicated, fuses shall be of the proper size for the equipment protected.

E. Provide one (1) set of fuses in fuse spaces and leave one (1) replacement set in facility.

F. Fuse classes, types and ratings have been chosen on the basis of Cooper Bussmann Inc. fuses. Acceptable alternates: Ferraz-Shawmut, Cefco, Brush Fuses, Inc. and Littlefuse Inc. Requests for change in manufacturer or fuse types from that specified below shall be accompanied by a complete coordination study indicating the suitability of the proposed changes.

2.6 WIRING DEVICES

A. Wiring Devices shall be by Hubbell or approved equal by Bryant, General Electric, Pass & Seymour Arrow-Hart, Leviton, Gampere and Perfect-Line.

B. Lighting switches:

1. Toggle type
2. Side wired
3. Residential grade
4. 120 volts
5. 20 ampere
6. Handle color (Verify with Architect)

C. Receptacle outlets:

1. Polarized grounding
2. Side wired
3. Residential grade
4. 120 volts
5. 15 ampere
6. Finish color (Verify with Architect)

D. Tamper resistant Receptacle outlets:

1. Polarized grounding
2. Side wired
3. Residential grade
4. 120 volts
5. 15 ampere
6. Finish color (Verify with Architect)

E. GFI outlets:

1. Duplex
2. Residential grade
3. 125 volt
4. 15 ampere
5. finish color (Verify with Architect)

F. Wiring Device Coverplates:

1. Interior use
   a. standard sized
   b. sheetmetal
   c. finish color (Verify with Architect)
2. Exterior use or in damp or wet locations:
   a. Specification grade
   b. Weatherproof construction
   c. Gasketed plate & device covers
   d. U.L Listed for its intended use as follows:
      i. Type 1
         a) U.L. Listed & suitable for wet locations while in use (plug inserted at all times).
         b) Manufacturered by Tay Mac Corp. or approved equal.
      ii. Type 2
         c) U.L. Listed & suitable for wet locations for portable tools and/or equipment connected to an outlet only when attended. Cover to be closed and sealed when not in use.
         d) Manufacturered by Bell, BWF Manuf. Inc., Mulberry, Thepitt, or approved equal.

G. Provide appropriate DS covers on exposed FS boxes.

2.7 DIMMER SWITCHES

A. Captures type linear slide type. The slider shall be the captured type.

B. Dimmers shall meet U.L. 20 and U.L. 1472; limited short circuit test requirements for snap switches.

C. Dimmers shall meet ANSI/IEEE Std.C62.41-1980; tested to withstand certain voltages and current surges without damage.

D. Dimmers shall utilize an LC filtering network to minimize interference.

E. Dimmers shall be U.L. Listed for their intended use; incandescent, fluorescent, low-voltage and electronic low voltage.

F. Dimmers shall be provided with power failure memory; when power is interrupted and returned, the lights shall come back to the same light level.

G. At locations where multiple devices are necessary, multi-gang faceplates shall be provided.

H. The Contractor shall be responsible for the coordination of the proper back box size and the faceplate type.

I. Dimmer switches shall be by Lutron, "Nova" Series, or approved equal by Prescolite, Lightolier.

2.8 TELEVISION JACKS

A. Television jacks shall consist of a single tap F-connector with smooth face plate. Leviton #80781.

2.9 HEAT TRACE

A. Provide a complete UL listed system of heaters and components approved specifically for snow and ice melting of roofs, gutters and downspouts. The heat tracing system shall conform to ANSI/IEFE Standard 515-1997 and IECE Standard 515.1-2005.

B. The heating cable shall be of parallel resistance construction capable of being cut to length and terminated in the field. Series resistance cables shall not be allowed. The self regulating heater shall consist of two 16 AWG nickel-plated copper bus wires embedded in parallel in a radiation cross-linked self-regulating conductive polymer core specifically designed for snow and ice melting. The heater shall be capable of varying its heat output along its entire length. Power output of the heater shall be 11 watts per foot. The heater shall be covered by polyolefin dielectric jacket rated 300 Vac at 105ºC, a tinned copper braid (14 AWG equivalent wire size) and UV stabilized polyolelin outer jacket. The heater shall operate on a line voltage of 120-V without the use of transformers. Power connection shall be made in UL listed junction boxes. Heating cable core will be permanently marked with the manufacturer’s identification number for tracability. Acceptable products and manufacturer’s are SnoTrace RGS as manufactured by Thermon Manufacturing Company, Engineered Roof Deicing or equal of Qmark.

C. Power to the roof and gutter snow and ice melting circuits will be controlled by an ambient sensing thermostat designed to control the heating cable load or the coil of a contactor. The heat cable controller shall have a remote precipitation sensor.

D. Provide a remote control/display panel on the 1st floor at a location selected by the owner/architect.

E. Heating cable shall be installed per manufacturer's installation guide. Attachment shall be made with roof clips, downspouts cable hangers and/or aluminum tape as required to secure cable. Power connections shall be located in UL listed NEMA 4 or 4x junction boxes. Circuit breakers supplying power to the heat tracing must be equipped with 30 mA minimum ground-fault equipment protection.

F. Heating cable shall be tested with 2,500 Vdc megohmeter (megger) between the heating cable bus wires and the heating cable metallic braid. While a 2,500 Vdc megger test is recommended, the minimum acceptable level for testing is 1,000 Vdc. This test should be performed a minimum of two times: Prior to installation while the cable is still on reel(s) and after installation of heating cable and completion of circuit fabrication kits but prior to connection to power. The minimum acceptable level for the megger readings is 20 megohms regardless of the circuit length.

2.10 BOXES AND FITTINGS

A. Provide Metal boxes manufactured by one of the following:

1. Steel City
2. Raco
3. Thomas & Betts
4. Crouse-Hinds
5. Walker

B. Provide Non-metallic boxes as follows:

1. Constructed of:

   a. PVC
   b. Fiberglass
   c. Noryl compounds

2. UL listed to comply with the two (2) hour fire test done in accordance with ASTM E-119.
3. Suitable for use in electrical work.

C. Provide pressed steel galvanized boxes, #14 gauge minimum, for boxes less than 50 cubic inches installed:

1. flush in walls and concrete slabs
2. above removable ceilings and similar spaces
3. exposed at ceilings of unfinished spaces

D. Provide O-Z/Gedney type "FS" or "FD" cast aluminum device boxes, equipped with matching covers for boxes less than 50 cubic inches accommodating wiring devices installed:

1. flush in exterior locations

2. exposed on walls of unfinished interior spaces:

E. Provide boxes 50 cubic inches and larger and wire troughs as follows:

1. constructed of sheet steel
2. equipped with flat sheet steel covers held in place with round headed machine screws
3. weld and grind joints to remove burrs.
4. Provide hot dip galvanized boxes and covers.
5. Provide covers to flush boxes which overlap box approximately 3/4 inch on sides.

F. Provide pull boxes, junction boxes and wire troughs indicated in the construction documents, or required by field conditions or the National Electrical Code to facilitate wiring installation. Obtain approval prior to installing boxes in finished areas.

G. Provide a 4 inches square, 1-1/2 inches deep or larger box with appropriate raised covers or plaster rings for flush mounted switches and receptacles.

H. Locate boxes in face block, brick or tile walls at the course line and fit with square tile covers similar to Raco Series 782 or 792, or Steel City Series GW where walls are 6 inches or more in thickness.

I. Provide 4 inches octagonal boxes for ceiling and wall recessed outlets for lighting fixtures, except where required by fixture design.

J. Where switches and receptacles are indicated in close proximity to each other provide one multi-gang box with single plate. Install one device in each gang. Use solid gang boxes or sectional boxes for three or more devices.

K. Do not use, unless specifically indicated, through-wall boxes or boxes mounted back-to-back.

L. Mount flush boxes in or exposed on walls plumb. Install flush boxes such that the distance between the lip of the box and the wall is less than 1/8 inch. Mount receptacles vertically, unless noted otherwise.

M. Provide gasketed covers for boxes in exterior, damp, or wet locations.

N. Provide blank stainless steel device plates as covers for pressed steel pull and junction boxes installed flush in walls of finished areas. Provide flat galvanized steel covers for pressed steel pull and junction boxes in other locations.

O. Provide rigid wall plastic conduit and ENT fittings made by the same manufacturer and confirming to the same standards as their respective conduits.

P. Provide device specific cover plates for boxes used to accommodate wiring devices.

Q. Provide two point support for wall and ceiling mounted boxes whose largest surface is less than 200 square inches in area. Provide additional support where the conduit system in conjunction with these supports does not provide a rigid installation. Provide a minimum of four point support for boxes whose largest surface exceeds 200 square inches in area.

R. Provide 3/8 inch threaded steel rod studs, securely anchored to the building, which pass though the center knockout in the back of boxes for connection and support of lighting fixtures weighing 50 pounds or more.

S. Provide sheet steel pull and junction boxes and wire troughs with metal gauges as follows, the dimensions being those of the largest surface:

Maximum Dim. Inches	Maximum Square Inches	Box Gauge	Cover Gauge
26	600	16	14
40	1000	14	12
60	1500	12	12
over 60	over 1500	10	10

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

A. Conduit, outlets, wiring and other necessary fittings or accessories for power connections for heating equipment, fans and special furnishings shall be provided under this Section. Motor and equipment of different ratings shall be furnished and circuit components shall be adjusted accordingly.

B. Make final connections to electrical equipment specified under this Section and other Sections of these Specifications.

3.2 MOTORS, EQUIPMENT, CONTROLS AND CONTROL WIRING

A. Motors, air handling units, compressors, etc., and built-in control devices will be provided under other Sections unless noted otherwise.

B. Provide control connections for devices and equipment.

C. Provide power connections for equipment furnished under other Sections.

D. The installation, connections and operation of controls not noted will be done under other Sections, including provisions for conduits, wiring, outlet boxes, control components and connections.

E. Control wiring shall be in accordance with the drawings and/or manufacturer's certified and approved wiring diagrams.

F. Control wires shall be marked with "E-Z" tape markers at terminal points. Terminal blocks shall be marked to correspond to wire terminated.

G. Provide conduit and wires, install and connect control equipment (starters, push buttons, etc.) and connect motors, air handling units, air conditioning equipment, and

built-in control devices, in accordance with wiring diagrams furnished under other Sections.

3.3 CONDUCTORS

A. Provide soft drawn copper 98 percent conductivity copper conductors with 600 volt insulation, and manufactured in accordance with the requirements of the National Electrical Code, the Board of Fire Underwriters, A.S.A., N.E.M.A. and I.C.E.A.

B. Provide conductors with "THHN-THWN" insulation.

C. Sizes are AWG or MCM. Minimum size for power and lighting circuits is #12. Minimum size for 120 volt control circuits is #14. Minimum insulation rating of conductors is 600 volts.

D. Aluminum wire is not permitted unless requested by the Contractor in writing prior to bid and approved for use by the Architect.

E. Provide stranded wire for No. 8 and larger. Make conductors continuous from outlet with no splices made except within outlet or junction boxes.

F. Provide UL approved "Y-ER-Ease", Buchanan, or Ideal pulling compound. Soap, grease or substances other than specified will not be permitted.

G. Utilize conduit and wire for circuits in exposed areas, feeders, and where other wiring methods are not specifically allowed by the National Electric Code, the Authority having jurisdiction, or elsewhere in these specifications.

H. Provide wiring manufactured by Pirelli, General Electrical Company, Phelps Dodge, American Insulated Wire Corps or AFC.

I. Wire and cable shall be delivered to the job site in full coils or reels, each bearing a tag containing the Underwriter's approval stamp, name of manufacturer, trade name, code, type of wire, and month and year manufactured.

3.4 CABLE

A. Flexible Non-metallic cable

1. Provide type "NM" cable with 60^{o}C, 600 volt, insulated copper conductors, bare ground wire, and PVC jacket.
2. Utilize flexible non-metallic cable for branch circuit wiring in concealed areas, unless noted otherwise.

3.5 RACEWAYS AND WIRING METHODS

A. Electrical Metallic Tubing (EMT)

1. Provide galvanized EMT which conforms to Federal Specification WW-C-563, as amended, ANSI Standard C80.3 and shall bears the UL label.
2. Provide EMT except where other conduit types are required by the NEC, the Authority having jurisdiction, or elsewhere in these contract documents.

3. EMT Couplings and box connectors (In concrete or masonry walls):
   a. concrete-tight
   b. steel
   c. compression ring type
   d. employ O-Z/Gedney type "A" bushings.
4. EMT Couplings and box connectors (elsewhere):
   a. steel
   b. set-screw type
   c. with insulated throat
   d. manufactured by
      i. Thomas & Betts
      ii. Raco
      iii. Steel City
5. EMT not terminating in a metal enclosure shall terminate with an O-Z/Gedney type "SBT" bushing.

B. Polyvinyl Chloride Conduit (PVC)

1. Provide PVC Schedule 40 conduit which conforms to NEMA TC-2 and WC-1094 specifications.
2. Provide PVC conduit when runs are below grade or below slab.
3. Provide PVC conduit, up to and including 1-1/4 inch size, in concrete floor slabs with the following limitations :
   a. Minimum concrete cover - 3/4 inch.
   b. Spacing - 3 diameters apart.
   c. Installed between the bottom and top reinforcing.
   d. Conduit outside diameter no more than 1/3 the slab thickness.
   e. Conduits are wired to reinforcing in reinforced slabs secured at regular intervals to the structural slab system.
   f. Integrity of the slab waterproofing is not disturbed.

C. Flexible metal conduit

1. Provide flexible metal conduit which conforms to Federal Specification, WW-C-566, as amended. The minimum size is 3/4". Provide Appleton liquid tight gasket assembly and "Sealtite" flexible conduit for flexible connections subject to weather, at liquid tight equipment, and as noted.
2. Utilize Flexible metal conduit under the following conditions:
   a. In short lengths for connection to motor terminal boxes, dry transformers, engine generators, etc. Where such equipment is exposed to weather or in damp or wet locations, "Sealtite" or "Liquidtite" flexible conduit shall be employed.
   b. In lengths as allowed by the National Electrical Code between outlet boxes and recessed lighting fixtures.
   c. Flexible metal conduit may be used in sizes up to 1-1/4 inches in suspended ceilings, in hollow spaces of precast concrete plank floor systems, and dry wall interior partitions except where prohibited by the NEC.
   d. Provide 2-screw clamp type or "Tite-Bite" box connectors with insulated throats as manufactured by Thomas & Betts, Raco, Steel City.

D. Electrical non-metallic tubing (ENT)

1. Provide ENT which meets the following requirements:

a. Complies with NEMA TC-13
b. Listed by UL as suitable for its intended purpose
c. Suitable for use in two (2) hour fire rated construction
d. Manufactured by Carlon or Condux International

3.6 WIRING METHODS

A. Conduit and cable methods shall conform to the National Electrical Code requirements and these Specifications and shall produce a complete, safe, well-built electrical system.

B. Conduit sizes shall be in accordance with the National Electrical Code except as follows:

1. None smaller than 3/4 inch, except that 1/2 inch may be used for control and signal wiring and where noted.
2. Where indicated conduits are larger than the National Electrical Code requirements.
3. Conduits and cables shall be installed concealed in walls, floors and above ceilings throughout, except as follows:
   a. Where suspended ceilings are not provided and the restrictions below prohibit conduit installation in concrete slab.
   b. In vertical shafts, electrical closets, mechanical and electrical equipment spaces where concealment is not practical, etc.
   c. At surface-mounted panelboards in otherwise finished spaces, limited to vertical runs above and below panel.
   d. Where required for equipment connections.
4. Surface raceways shall not be installed in any habitable rooms of the House.

C. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces and cold section plenums of air conditioning units shall be suitably sealed by means of sealing fittings to prevent accumulation of condensation.

D. Conduit nipples connecting outlets in adjoining rooms shall be packed with Johns-Manville "Duxseal" after wires are in place to prevent transmission of noise between rooms unless nipples are 12 inches or more in length.

E. Conduit fittings similar to Crouse-Hinds "Condulets" may be installed in exposed work to facilitate wiring installation and as indicated. They shall not be used for conduits which are to contain high voltage, telephone, data, television, or like wiring which cannot tolerate a sharp bend. They shall not be used where space permits the use of an adequately sized sheet steel pull box. Service entrance condulets may be used only on control wiring installations.

F. Provide 1/8 inch polypropylene pull cord in empty conduit systems.

G. Provide blank cover plates for unused data outlet assemblies.

H. Provide wallplate blanks for unused data termination ports.

3.7 SPLICES AND TERMINATIONS

A. Splices in branch circuits and control wiring shall be made with 3-M Company "Scotchlocks", Ideal "Wirenuts" or equivalent. Splices shall be insulation rated for 90ºC at 600 volts.

B. Splices, taps and terminations for feeder and motor wiring shall be made with approved set screw mechanical taps, sleeves or lugs. Provide terminations with a minimum 75º minimum rating at 600 volts.

C. Vinyl electrical tape shall be 90ºC, 600 volt insulation rated for use whenever added insulation is required. Rubber and friction tape shall not be used.

END OF SECTION

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 NOTE

A. Section includes lighting fixtures, lamps, and ballasts.

1.2 SCOPE

A. Provide a lighting fixture for each lighting fixture symbol shown on the Drawings, of the type and quality described herein and on the drawings. Fixtures shall be installed complete with lamps of the wattage indicated, sockets, housing, ballast, shades, diffusers and supports, and wired for operation.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Provide fixtures according to the designation indicated on the plans. Fixtures designations are explained and specified in the Lighting Fixture Schedule.

B. Where a letter designating fixture type is adjacent to a row of fluorescent fixtures, it shall be understood that fixtures in the row shall be of the same type and shall consist of the total lengths indicated. Although the descriptions of the fluorescent fixtures described may refer to 4 foot units, 2 foot, 3 foot, and 8 foot units may be used where applicable to obtain the fixture length necessary.

C. Construction Features

1. General Requirements
   a. Provide galvanized support hangers, channels and bolts.
   b. Provide rustproof exterior hardware such as screws, nuts, washers and anchor bolts.
   c. Provide stem suspended fixtures with self-aligning type semi-rigid ball joints so that fixtures hang level with vertical stems.
   d. Fixtures shall be wired for polarized system with one wire in each fixture to be distinctly marked for its entire length. Wire shall bear the label of approval of the Underwriter's Laboratory, Inc.
   e. Verify fixture finishes with Architect prior to ordering.
2. Fluorescent Fixtures:
   a. Die formed steel housing of 22 gauge, minimum.
   b. Post fabrication painting with baked white enamel, unless otherwise indicated.
   c. Minimum reflectance of 87%.
   d. Diffusers: 1/8" acrylic, unless noted.
3. Exterior Fixtures:
   a. Cast aluminum housing, unless noted.
   b. UL Listed for Damp or Wet Location, as required.
   c. Weatherproof gasketing.
   d. Corrosion resistant hardware and materials.

2.2 BALLAST

A. Manufacturers

1. General Electric
2. Advance
3. MagneTek Triad.
4. Motorolla
5. Approved Equal

B. General Requirements

1. Verify ballast voltage with fixture and circuiting voltage prior to ordering.
2. Provide ballasts suitable for lamp wattage and type specified.
3. Provide ballast that provide lamp starting conditions and operating parameters consistent with lamp manufacturers recommendations.
4. Ballast size and mounting configuration shall be compatible with existing ballasts for the same application.
5. Ballast must not contain PCB's.
6. Ballast shall be encapsulated (potted) to ensure maximum thermal and structural integrity.
7. Regulatory Requirements:
   a. UL listed, Class P, Type 1, CSA certified.
   b. FCC standard for EMI/RFI ensuring suitability for both commercial and industrial installations.
   c. ANSI and IEEE standards for harmonic distortion and line voltage transient, and immune to electrical interference.
   d. Audible noise rating of Class A, unless noted otherwise.
   e. Color-coded to ANSI Standard C82.11.
8. Characteristics
   a. Supply frequency: 57.5 to 62.5 Hz.
   b. Supply voltage variation: ± 10% with ± 5% light output
   c. Operating frequency: above 20KHz
   d. Maximum enclosure temperature rating: 70° C.
   e. Minimum lamp starting temperature
      1) in unheated or exterior spaces.: -20°F
      2) otherwise: 50° F.
9. 5 year manufacturer's warranty to cover parts & labor.

C. T8 Fluorescent Electronic Ballasts (FO17, FO25, FO40, FBO16, FBO24, FO32, FBO32, FBO31, type lamps)

1. Operate 1-4 lamps from single ballast, unless otherwise required.
2. Provide multiple ballasts where multi-level switching, or inverter ballasts are indicated (per drawings and/or schedule).
3. Operation: Instant Start/Parallel
4. Power factor: > 97%
5. Ballast factor: >88%
6. Total Harmonic Distortion (THD): <10%
7. Remote/Tandem wiring capability: 18 feet

D. T5 Fluorescent Electronic Ballasts (F14W, F21W, F24W, F28W, F35W, F39W, F54W, FT55W, FT36W, and FT24W type lamps)

1. Operate 1-2 lamps from single ballast, unless otherwise required.
2. Provide multiple ballasts where multi-level switching, or inverter ballasts are indicated (per drawings and/or schedule).
3. Operation: PROStart/Series
4. Power factor: > 98%
5. Ballast factor: 100%
6. Total Harmonic Distortion (THD): <10%
7. Dynamic end-of-life sensing to help protect against overheated bases and sockets.
8. Remote/Tandem wiring capability: 10 feet

E. T4 Compact Fluorescent Electronic Lamp Ballasts (CF18W, CF26, CF32W, CF42W type lamps)

1. Operates 1 or 2 lamps from single ballast.
2. Operation: Instant Start/Series Operation
3. High Power factor: >98%
4. Ballast factor: 100%
5. Total Harmonic Distortion (THD): T4: <10%
6. Dynamic end-of-life sensing to help protect against overheated bases and sockets.
7. Remote/Tandem wiring capability: 10 feet

2.3 LAMPS

A. Provide standard schedule lamps manufactured by:

1. General Electric Company
2. Phillips Lighting Company
3. Osram Sylvania
4. Ventura Lighting

B. Fluorescent

1. Color Temperature: 3500º K
2. Minimum CRI: 82
3. Minimum Average Lamp Life:
   a. T8 Fluorescent Lamps: 20,000 hours
   b. T5 Fluorescent Fixtures: 20,000 hours
   c. T4 Fluorescent Lamps: 10,000 hours

C. Incandescent

1. Inside frosted
2. Extended Life
3. 130 Volt

2.4 PHOTOCELLS

1. Provide integral photocells by the fixture manufacturer, installed at the factory. Integral twist-lock type photocells are acceptable if installed as a permanent part of the fixture.

PART 3 - EXECUTION

3.1 LOCATION

A. Coordinate the location of lighting fixtures with the Architect before final installation. Allow for a reasonable amount of shifting of fixture locations.

B. Consult the Architect's reflected ceiling plans and the installer of the ceilings to insure that fixtures are properly aligned, ventilated and located.

C. Coordinate actual fixture depths with piping, duct work, bulkheads, etc. prior to rough-in.

3.2 INSTALLATION

A. Provide "Earthquake” hold down clips on recessed fixtures.

B. Provide necessary accessories, as required, to support the fixtures independently of the ceiling suspension system. Securely fasten box and fixture supports to structural system main supports. Where fixtures are surface mounted, cut neat holes in the hung ceilings as required for the fixture supports.

C. Provide spring loaded sockets and acrylic tube guards on fluorescent lighting fixtures with exposed tubes.

D. Install fixtures so lamps are oriented in the same direction.

END OF SECTION

SECTION 28 30 00 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes product specifications and installation requirements for the Fire Detection and Alarm System.

1.2 GENERAL DESCRIPTION

A. The Fire Detection and Alarm System shall monitor addressable points.

B. Circuit Designations shall be as follows:

1. Class B
2. Initiating Device Circuits (IDC) Style B
3. Notification Appliance Circuits (NAC) Style Y.

C. Coordinate with the University and provide any required network interfaces with the campus system.

D. Components shall be U.L. listed for use as a system.

E. Provide 5% spare devices and capacity in system, including batteries, to support 10% spare devices.

1.3 QUALITY ASSURANCE

A. Provide a UL Certification that the system meets UL standards and local fire protection code. Provide the services and equipment of an alarm service company listed by Underwriters Laboratories Inc. in its Directory as being capable of furnishing the signaling systems specified herein. Alarm service company shall issue a certificate that all equipment, connected wiring and devices which form the specified system together with installation and maintenance service are in compliance with the requirements established by Underwriters Laboratories Inc. and the local Fire Prevention Code.

B. Equipment manufacturer shall supply proof of having produced similar equipment, now giving satisfactory service, for the past five years.

C. The system shall be manufactured from a single source, by Siemens.

1.4 SUBMITTALS

A. Provide a shop drawing submittal which includes the following:

1. Riser diagram
2. Scaled plan shop drawing showing equipment and device locations, wire sizes and conduits
3. Catalog cuts
4. Battery calculations
5. Voltage drop calculations
6. Fire alarm control panel detailed drawings
7. Fire alarm annunciator detailed drawings

B. Submit a copy of shop drawings to the authority having jurisdiction for their review and approval.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

A. The fire alarm control panel shall have the following features:

1. Siemens SLS-V panel.
2. Microprocessor based with built-in programmer.
3. Non-volatile memory for program storage.
4. Power Supply - 24Vdc
5. Zoned alarm verification
6. Programmable Alarm Silence/Reset Inhibit Timing
7. Programmable Alarm Silence Timer
8. Automatic Battery Charger with supervision and deep discharge protection
9. Lamp Test
10. Power Limited Initiating Device Circuit and Notification Appliance Circuit wiring

B. Provide number of Initiating Device Circuits and Notification Appliance Circuits required for proper operation of system.

C. Provide additional power supply panels (booster/extender panels) as required.

D. Provide digital alarm communicator transmitter (DACT) for transmission of alarm and supervisory signals to a UL listed Central Station. Alarm and supervisory signals to be transmitted shall be as designated by the Authority Having Jurisdiction. Appropriate power supplies, direct connect cords, phone lines, etc. shall be supplied for a functional system. Selection of a central monitoring station, its fees and fees for telephone lines and connections are the responsibility of the Owner or his representative. Coordinate with owner's representative as required.

E. Provide batteries for backup as required by Authority Having Jurisdiction.

2.2 FIRE ALARM ANNUNCIATOR PANEL

A. The fire alarm annunciator panel shall have the following features:

1. Alpha-Numeric type remote annunciator
2. Flush mounted
3. LEDs to indicate, normal, alarm, supervisory, and trouble conditions.
4. Lamp test, trouble silence, reset, and HVAC control key switch(es)

2.3 NAC POWER EXTENDER PANEL

A. Provide NAC Power Extender panels as required. Extender panel shall be standalone type capable of powering a minimum of 4 notification appliance circuits. Panel shall provide capability to be expanded to 8 notification appliance circuits.

B. Provide panel with internal power supply and battery charger as required.

C. The extender panel may be mounted close to the host control panel or can be remotely located, as required by field devices. The panel shall connect to the host panel via communications channel. Each output NAC shall be individually controllable for general alarm or selective area notification.

D. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel

2.4 INITIATING DEVICES

A. Initiating devices shall have the following general features, as well as those listed under the specific category:

1. Intelligent/Analog
2. Plug-in
3. Integrated base (where applicable)
4. Provide auxiliary alarm-operated relay contacts as required to provide supplementary alarm functions such as, fan shutdown etc.

B. Heat Detectors

1. Double Pole - Normally open contact
2. Combination Rate-of-Rise 15º per minute (self-restoring) and Fixed Temperature, 135ºF (57ºC) (self-restoring)
3. LED on unit

C. Smoke Detectors - Photoelectric

1. Infrared photo-optic type chamber
2. Nominal 1.8%± obscuration per foot sensitivity
3. Built-in test switch
4. LED on unit

D. Duct Detectors - Photoelectric

1. Infrared photo-optic type chamber
2. Provide air sampling tube - length as required
3. Nominal 1.8%± obscuration per foot sensitivity
4. Max air velocity rating of 3000 ft/min or greater
5. Remote alarm LED indicator/test station

2.5 NOTIFICATION DEVICES

A. Notification appliances shall have the following general features, as well as those listed under the specific category:

1. ADA Compliant
2. White housing
3. Weatherproof when installed in damp or wet locations.

B. Visual Devices - Strobes

1. Provide strobes with adjustable candela level, set to candela level indicated on plans.
2. Self-synchronizing flash

C. Audible/Visual Combination Devices - Horns & Strobes

1. Provide strobes with adjustable candela level, set to candela level indicated on plans.
2. Self-synchronizing flash
3. Self-synchronizing temporal audible output

4. Adjustable high or low dBA output with a maximum of 98 dBA @ ten feet

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide non-specified equipment required to make system fully functional.

B. Install fire alarm and detection system wiring in designated conduit raceway system.

C. Minimum wire size: No. 18 AWG solid copper for initiation and annunciator circuits; No.14 AWG solid copper for indicating circuits.

D. No wiring other than that directly associated with the fire alarm or auxiliary functions shall be permitted in the fire alarm conduits. Wiring splices shall be avoided. Transposing or changing color coding of wires shall not be permitted. Conductors in conduit containing more than one wire shall be color coded and labeled on each end with "E-Z Markers" or equivalent. Fire alarm junction boxes shall be painted red. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. Controls, switches, etc. shall be clearly labeled on equipment panels.

E. Location for ceiling-mounted equipment shall be coordinated with lights, air outlets and other ceiling fixtures and shall be acceptable to the Architect and to the authorities having jurisdiction.

F. Install required interconnect wiring for:

1. Fire emergency HVAC shut down
2. Tie-in to Central Station of fire department

G. Coordinate installation of new wiring or devices with the architect/owner. Notify the Architect/Owner of required cutting of any wall or ceiling finishes prior to installation. Where possible route wiring within wall or ceiling cavities made accessible by other construction work. Fish wiring within wall or ceilings spaces for installation.

H. Mount end-of-line device for each initiating and indicating circuit in a separate box located not more than 6 feet above the finished floor. Device shall be mounted on a terminal strip attached to the box cover with an engraved phenolic plate.

3.2 SEQUENCE OF OPERATION

A. The actuation of a duct detector shall shut down the associated air handling unit or group of units serving a common area and place the fire alarm system into "Alarm" or "Supervisory" mode, according to the authority having jurisdiction.

B. Detectors used solely for the following systems/functions shall not activate the building evacuation alarm:

1. heating, ventilating, and air conditioning system shutdown

C. The fire alarm control panel shall be provided with the ability to provide bypass of automatic alarm functions, such as central station/fire department alarm

notification, during fire alarm system tests. Bypass of any automatic alarm control function shall initiate a system "trouble" condition.

D. ALARM MODE

1. Operation of a fire alarm initiation device shall automatically:
   a. Sound an audible alarm signal at the fire alarm control panel.
   b. Light the general alarm LED (red) at the fire alarm control panel.
   c. Indicate the device/zone in alarm on the fire alarm control panel and remote annunciator panels.
   d. Sound audible alarm signals throughout the building, or in appropriate zones. Operation of the alarm acknowledge switch at the fire alarm control panel shall permit the silencing of the audible alarm signals during the alarm condition. The silencing of alarm signals shall not prevent the re-activation of alarm signal devices should a subsequent alarm condition occur.
   e. Flash alarm lights throughout the building, or in appropriate zones. Operation of the alarm acknowledge switch at the fire alarm control panel shall permit the deactivation of the visual alarm signals during the alarm condition. The deactivation of alarm lights shall not prevent the re-activation of alarm lights should a subsequent alarm condition occur.
   f. Operate control relay contact to initiate the transmission of an "Alarm" indication to the central monitoring station.

E. TROUBLE MODE

1. The fire alarm system wiring (except control wiring from addressable control element relays to fans, dampers, door holders, etc.) shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm signaling wiring shall automatically:
   a. Sound an audible signal at the fire alarm control panel.
   b. Light the general trouble LED (yellow) at the fire alarm control panel.
   c. Indicate the device/zone in alarm on the fire alarm control panel and remote annunciator panels.
   d. Operate fire alarm control panel "trouble" relay contact to initiate the transmission of a trouble indication to the central station.
2. The visual indications shall remain on until the trouble condition is repaired.

3.3 TESTING AND ADJUSTING

A. The manufacturer’s representative shall adjust smoke detectors and verify the setting of devices. Verify that circuits are continuous and free from short circuits and from unspecified grounds, and that resistance to ground of non-grounded circuits is not less than one megohm.

B. Testing procedures for the acceptance of the alarm and detection system shall be conducted in accordance with provisions of Chapters 10 of NFPA 72.

END OF SECTION

DIVISION 31 – EARTHWORK

Section 31 10 00 – Site Clearing

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes the following:

a. Removal of vegetation.
b. Topsoil stripping.
c. Removing below-grade improvements.
d. Removing above-grade improvements.
e. Saw-cutting of edges of existing pavement, curbs and sidewalks.
f. Removal of items as noted on plan.
g. Disposal of materials.
h. Identification of utilities.

C. PROJECT CONDITIONS

1. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

2. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

a. Protect improvements on adjoining properties and on Owner's property.
b. Restore damaged improvements to their original condition, as acceptable to property owners.
c. Protect existing pavement, curbs and sidewalks to remain. Neatly saw cut edges at right angle to surface between existing structures to remain and structures to be removed.

3. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

4. Cease operations immediately if structure appears to be in danger and notify Owner and Engineer.

5. Extent of selective demolition is work required to complete the overall intent of the Project whether or not indicated on Drawings or specified.

6. The Owner shall be given the opportunity to retain ownership of all removed materials and equipment.

D. REGULATORY REQUIREMENTS

1. Conform to applicable codes for demolition work, dust control, products requiring electrical disconnection and re-connection, safety of adjacent construction and discovered hazards.

2. Obtain required permits from authorities having jurisdiction.

3. Conform to procedures applicable when hazardous or contaminated materials are discovered.

2. PRODUCTS

A. Not applicable to this Section.

3. EXECUTION

A. PREPARATION

1. Provide, erect, and maintain temporary barriers and security devices.

2. Protect existing materials and construction which are not to be demolished.

3. Prevent movement of adjacent materials; provide bracing and shoring to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.

4. Notify affected utility companies before starting work and comply with their requirements.

5. Mark location and termination of utilities.

B. SITE CLEARING

1. General: Remove grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises, or dispose as specifically indicated or as directed.

2. Topsoil: Topsoil is defined as friable clay loam surface soil with organic material found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

a. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material for an area 5' beyond limits of earthwork.

1) Remove heavy growths of grass and other vegetation from areas before stripping.
2) Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

b. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion. Comply with Erosion and Sedimentation

Control Plan.

c. Excess topsoil shall remain the property of the Owner.

C. REMOVAL

1. Remove debris, rock, and extracted plant life from site.

2. Partially remove paving as indicated or necessary. Neatly saw cut edges at right angle to surface.

3. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

D. VEGETATION

1. Protection: The Contractor shall provide protection of existing trees.

2. Disposal of Material: All refuse and other debris shall be disposed of by hauling from the site.

3. Material to be removed shall be removed daily and shall not be allowed to accumulate on the site.

E. DISPOSAL OF WASTE MATERIALS

1. Burning on Owner's Property: Burning is not permitted on Owner's property.

2. Removal from Owner's Property: Remove all unsuitable soil, construction waste materials and non-organic waste materials from Owner's property and disposed in an approved landfill.

F. DEMOLITION

1. Disconnect, by removal, indicated utilities or abandon as noted on the drawings and identify designated utilities to remain within demolition areas. Provide by-pass connections as necessary to maintain continuity of service where required. Provide minimum of 72 hours advance notice to Owner if shut-down of service is necessary during change-over.

2. Demolish in an orderly and careful manner. Protect existing supporting structural members.

3. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site. Dispose materials removed in a legal manner.

4. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

5. Remove temporary Work.

End of Section 31 10 00

DIVISION 31 - EARTHWORK

Section 31 20 00 – Earthmoving

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes the following:

a. Preparing of subgrade for building slabs, walks, and pavements.
b. Excavating and backfilling for buildings and structures
c. Drainage fill course for support of building slabs-on-grade.
d. Excavating and backfilling of trenches within building lines.
e. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.
f. Placement of structural fill in areas of unsuitable soils.
g. Placement of fill as required to reach subgrade elevations of slabs-on-grade.

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

a. Division 31 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
b. Division 32 Section "Landscape Work" for finish grading, including placing and preparing topsoil for lawns and planting.
c. Division 32 Section “Asphalt Paving” for subgrade, subbase and base courses for bituminous pavement work.

3. Final Grading, together with placement and preparation of topsoil for lawns and planting, is specified in Division 32 Section "Landscape Work."

C. DEFINITIONS

1. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

2. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be at Contractor's expense.

a. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the Owner.

b. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Owner.

3. Additional Excavation: When excavation has reached required subgrade elevations, notify the Owner, who will arrange for an inspection of conditions. If the Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by the Owner.

   a. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

4. Fill: Satisfactory soil materials used to raise existing grades.

5. Structural Fill: Fill placed within the boundaries of buildings or structures and extending ten feet beyond said boundary to replace unsuitable soils and/or to raise existing grades to the footing bearing elevation when unsuitable fill material does not achieve the specified compaction density.

6. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

7. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

8. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

9. Base Course: The layer placed between the subbase and surface pavement in a paving system.

10. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

11. Drainage Fill: Course of washed granular material (AASHTO No. 57 or equal) supporting slab-on-grade placed to cut off upward capillary flow of pore water.

12. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

13. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

14. Controlled Low-Strength Material: Cementitious material with or without foaming agent for filling trenches under footings and slabs.

15. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 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:

    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.

Bulk Excavation: Not anticipated

16. Unsuitable Material: Unsatisfactory soil material as defined in Section 2.1 or subsurface material discovered during excavation which will negatively impact installed improvements, utilities or other aspects of the scope of work, as identified by the project geotechnical inspector.

D. SUBMITTALS

1. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

2. Product data for the following:

   a. Each type of utility line plastic warning tape.
   b. Filter fabric.
   c. Structural Fill.

3. Samples: Provide samples of proposed borrow materials for analysis by Owner's geotechnical engineer.

4. Material Test Reports: Unless samples are provided for analysis by the Owner's geotechnical engineer, provide material test reports from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

   a. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
   b. Laboratory compaction curve according to ASTM D 1557 for each borrow soil material proposed for fill and backfill.

5. Photographs of construction site and existing adjacent structures and site improvements.

E. QUALITY ASSURANCE

1. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

2. Testing and Inspection Service: Contractor will employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations.

3. Pre-installation Conference: Conduct conference at Project.

   a. Before commencing earthwork, meet with representatives of the governing authorities, Conservation District, Owner, Consultants, independent testing agency, utilities and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

F. PROJECT CONDITIONS

1. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

   a. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

      1) Pennsylvania Act 287 (2008): Contractor shall comply with Pennsylvania Act 287 (2008) regarding existing utilities. Provide three (3) working days notice prior to starting earthwork operations. For information call "Pennsylvania One Call System" at 8-1-1. Calls placed to PA One Call must also be communicated directly to University Facilities.

   b. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

      1) Provide minimum of 72-hour notice to the Owner, and receive written notice to proceed before interrupting any utility.

   c. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

2. Use of Explosives: Not Permitted.

3. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

   a. Operate warning lights as recommended by authorities having jurisdiction.
   b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   c. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

4. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site. Provide dust control measures (watering) on gravel access road during dry conditions as necessary.

G. UNIT PRICES

1. Unit prices for rock removal are not used as project is to be bid with soil unclassified, No changes in the Contract Sum or the Contract time will be authorized for rock excavation or the removal of obstructions.

2. PRODUCTS

A. SOIL MATERIALS

1. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

2. Satisfactory Soil Materials: On-site overburden and borrow materials meeting the requirements of ASTM D 2487 soil classification groups GC, GW, GP, GM, SP, SC and SM; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. ASTM D 2487 soil classification group ML and CL may be used if properly conditioned in the presence of the on-site geotechnical engineer.

3. Unsatisfactory Soil Materials: All materials not meeting the requirements outlined above.

4. Backfill and Fill Materials: Satisfactory soil materials.

5. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve including Pennsylvania Department of Transportation 2A Aggregate meeting the requirements of Specification 408, Section 703.

6. Structural Fill: Crushed aggregate meeting the requirements of PA DOT #2A.

7. Bedding Material: Subbase or base materials with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

8. Drainage Fill: Washed, evenly 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 not more than 5 percent passing a No. 8 sieve.

9. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 50 sieve.

10. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

11. Controlled Low Strength Fill: Controlled Low-Strength Material: Normal or low-density, self-compacting, flowable concrete material as follows:

    a. Portland Cement: ASTM C 150, Type I.
    b. Fly Ash: ASTM C 618, Class C or F.
    c. Normal-Weight Aggregate: ASTM C 33, 1 inch nominal maximum aggregate size.
    d. Foaming Agent: ASTM C 869 (Contractor's option).
    e. Water: ASTM C 94/C 94M.
    f. Air-Entraining Admixture: ASTM C 260 (omit if foaming agent used).

    Producing low-density, controlled low-strength material with the following physical properties:

    1) As-Cast Unit Weight: 65 to 75 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
    2) Compressive Strength: 140 psi, when tested according to ASTM C 495.

    Producing conventional-weight, controlled low-strength material with 140 psi compressive strength when tested according to ASTM C 495.

B. ACCESSORIES

1. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying non-metallic underground utilities, 6 inches wide and 4 mils thick minimum, 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 2'-6" deep.

   a. Tape Colors: Provide tape colors to utilities 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.

2. Filter Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.

   a. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:

      1) Grab Tensile Strength (ASTM D 4632): 100 lb.
      2) Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.
      3) Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

3. EXECUTION

A. PREPARATION

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

2. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

3. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. DEWATERING

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

   a. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
   b. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to

collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

C. EXCAVATION - BACKFILL

1. Proper placement of erosion control facilities shall occur prior to any earthwork activity.

2. Puddling will not be permitted.

3. Classified Excavation:

   a. All excavation shall be classified with additional compensation granted for rock and unsuitable material removal only.
   b. Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered.

4. General: All excavation shall be to the lines and grades as shown.

   a. Six inches below finish grades in seeded areas.
   b. Grades indicated at paved areas minus thickness of base course and surface materials.
   c. All backfill must be mechanically tamped, in layers not to exceed 6 inches in depth, and thoroughly compacted to prevent settlement.
   d. Where new work meets existing, grades shall be adjusted to allow new work to meet and match existing finished grades at paved areas. Notify Owner for approval of elevations and contours if not noted on contract drawings.

5. Excavation shall provide sufficient clearance for bracing, shoring, formwork, Inspection and installation, as required by OSHA.

6. The bottoms of all excavations shall be trimmed, by hand if necessary, to grades indicated or required.

D. STABILITY OF EXCAVATIONS

1. General: Comply with local, state and federal codes, ordinances, and requirements of agencies having jurisdiction to maintain stable excavations.

E. STORAGE OF EXCAVATED MATERIALS

1. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage. Provide temporary vegetative cover to prevent erosion.

   a. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
   b. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

F. EXCAVATION FOR STRUCTURES

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing

and removal of concrete formwork, installation of services, and other construction and for inspection.

a. Excavations for footings and foundations: Subsequent to reaching foundation bearing elevation, all footing subgrades shall be thoroughly compacted in order to densify the limited depth of the material loosened by the excavation process. Hand-operated vibratory compactors should be used for this purpose as long as the thickness of material loosened does not exceed four inches. All soft or weak areas disclosed by pumping, weaving, rutting, cracking, etc. of the subgrade should be over excavated to a firm base and and backfilled with structural fill. In the event a footing subgrade is excavated too deep, plan bearing should be re-established with structural fill following the recommendations described hereinafter. Alternately, fill with lean concrete or lower the bottom of the footing.

b. Excavation for Underground Utility Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

G. EXCAVATION FOR WALKS AND PAVEMENTS

1. Excavate surface under walks and pavements to comply with cross-sections, elevations and grades as indicated. Compact subgrade if necessary to provide proper bearing surface.

H. TRENCH EXCAVATION FOR PIPES AND CONDUIT

1. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit, unless otherwise indicated.

2. Excavate trenches and conduit to depth indicated or as required by the Owner or Utility to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, if applicable, otherwise follow the direction of the Owner or Utility.

a. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

b. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

c. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped bedding backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

I. COLD WEATHER PROTECTION

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

J. SUBGRADE INSPECTION

1. Notify Owner's geotechnical inspector when excavations have reached required subgrade.

2. If the inspector determines that unsatisfactory soil is present, continue excavation and replace with compacted structural fill as directed.

3. Proof-roll subgrade below the building slabs and pavements and at the base level of any structural fill with a smooth drum vibratory roller having a total static weight of at least 10,000 pounds. The vibratory roller should operate in a frequency range of 1,100 to 1,300 vibrations per minute (VPM). At 1,300 VPM, the dynamic force should be at least 20,000 pounds and the total applied force (static plus dynamic) should be at least 30,000 pounds. Do not proof-roll wet or saturated subgrades.

    a. Make at least 6 passes with the vibratory roller, alternating directions in order to completely proof-roll subgrade. Limit vehicle speed to 3 mph.
    b. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the inspector, and replace with structural fill as directed.

4. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

5. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

K. BACKFILL AND FILL

1. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section. Demolished blacktop and concrete may not be used for fill.

    a. Under grassed areas, walks, pavements, and steps satisfactory excavated or borrow material.
    b. Under proposed building footprint and extending 10 feet beyond, use satisfactory excavated or structural fill material.
    c. Under piping and conduit and equipment, use bedding materials. Shape excavation bottom to fit bottom 90 degrees of cylinder.
    d. Backfill trenches with controlled low strength material where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings or where masonry is supported directly on slab-on-grade. Place concrete to level of bottom of adjacent footing or slab drainage fill.

        1) Concrete is specified in Division 3.
        2) Do not backfill trenches until tests and inspections have been made and backfilling is authorized by the Owner. Use care in backfilling to avoid damage or displacement of pipe systems.

    e. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

    a. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, foundation drainage system and perimeter insulation.
    b. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
    c. Removal of concrete formwork.
    d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
    e. Removal of trash and debris from excavation.
    f. Achievement of design strength of masonry (including grout) or concrete of foundation walls.
    g. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

L. PLACEMENT AND COMPACTION

1. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

    a. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

2. Place backfill, fill and structural fill materials in layers not more than 8 inches in loose depth for material compacted by the aforementioned smooth drum vibratory roller, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

3. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

4. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

5. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the geotechnical engineer if soil density tests indicate inadequate compaction.

    a. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:

1) Under and ten feet beyond the building footprint, steps, walkways and pavements, compact top 12 inches of subgrade and each layer of structural fill or fill material at 95-97 percent maximum dry density.
2) Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 92 percent maximum density.

b. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

1) Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
2) Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

M. GRADING

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

2. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

a. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
b. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
c. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

3. Grading Surface of Structural Fill and Fill within and ten feet beyond the building footprint: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

4. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

N. PAVEMENT SUBBASE COURSE

1. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

2. Grade Control: During construction, maintain lines and grades including cross-slope of subbase course.

3. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

   a. When a compacted subbase course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

O. BUILDING SLAB DRAINAGE COURSE

1. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.

2. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

   a. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

P. FIELD QUALITY CONTROL

1. Quality Control Testing during Construction: The Contractor will employ and pay for a qualified independant testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed. Do not proceed until test results for previously completed work verify compliance with requirements.

   a. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.

      1) Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
      2) If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Owner.

   b. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Owner.

   c. Paved and Building Slab Areas: Perform at least one field density test of subgrade for every 1,000 sq. ft. of paved area or building slab, but in no case less than 33 feet in each cardinal direction nor fewer than three tests per day. In each compacted fill layer, perform one field density test for every 1,000 sq. ft.

of overlaying building slab or paved area, but in no case less than 33 feet in each cardinal direction nor fewer than three tests per day.

d. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face per day.

e. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.

2. When testing agency reports that, subgrades, fills or backfills are below specified density, scarify and moisten or aerate, or remove and replace material to the depth required, and perform additional compaction and testing until specified density is obtained.

3. Contractor to employ and pay for any testing required.

Q. EROSION CONTROL

1. Provide erosion control methods in accordance with the Plan and with the requirements of authorities having jurisdiction.

R. MAINTENANCE

1. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

4. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

S. DISPOSAL OF EXCESS AND WASTE MATERIALS

1. Removal from Owner's Property: Remove unacceptable or excess excavated material, trash, and debris, and legally dispose of it off Owner's property.

End of Section 31 20 00

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 12 16 – Asphalt Paving

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes the following:

a. Hot-mix asphalt paving
b. Pavement-marking paint

2. Related Sections include the following:

a. Division 31 Section "Earthmoving" for aggregate subbase and base courses.
b. Saw-cutting of edges of existing pavement is specified in site-clearing section.

C. SYSTEM DESCRIPTION

1. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the Pennsylvania Department of Transportation, Publication 408, Specifications, latest edition (Pub. 408), unless otherwise specified.

a. Standard Specification: PennDOT Publication 408, latest edition.
b. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. SUBMITTALS

1. Product Data: For each product specified. Include technical data and tested physical and performance properties.

2. Job-Mix Designs: Certification of supplier for each job mix proposed for the Work.

3. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

E. QUALITY ASSURANCE

1. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

2. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

a. Firm shall be a PennDOT registered and approved paving mix manufacturer.

3. Regulatory Requirements: Conform to applicable standards of authorities having

jurisdiction for asphalt paving work on public property.

F. DELIVERY, STORAGE, AND HANDLING

1. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

2. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

G. PROJECT CONDITIONS

1. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

   a. Tack Coat: Minimum surface temperature of 40 deg F
   b. Asphalt Base Course: Minimum surface temperature of 35 deg F and rising at time of placement.
   c. Asphalt Surface Course: Minimum surface temperature of 40 deg F and rising at time of placement.

2. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F (10 deg C) for water-based materials and not exceeding 95 deg F (35 deg C), or recommended by specific manufacturer.

2. PRODUCTS

A. MATERIALS

1. Asphalt Cement: PennDOT Publication 408, Section 702 - Bituminous Material.

2. Asphalt Wearing Course Mix (Superpave Asphalt Mixture Design): PennDOT Publication 408, Section 409.

3. Fine Aggregate: PennDOT Publication 408, Section 703 - Aggregate.

4. Tack Coat: PennDOT Publication 408, Section 460 - Bituminous Tack Coat.

B. AUXILIARY MATERIALS

1. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.

   a. Color: As indicated.

3. EXECUTION

A. EXAMINATION

1. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

2. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

3. Notify the Owner in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

B. SURFACE PREPARATION

1. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

   a. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

2. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

   a. Allow tack coat to cure undisturbed before paving.
   b. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

C. HOT-MIX ASPHALT PLACING

1. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

   a. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   b. Place hot-mix asphalt surface course in single lift.
   c. Spread mix at minimum temperature of 250 deg F (121 deg C).
   d. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
   e. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

2. Place paving in consecutive strips not less than 8 feet (2.44 m) wide, except where infill edge strips of a lesser width are required.

   a. Complete asphalt base course for a section before placing asphalt surface course.

3. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

D. JOINTS

1. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

   a. Clean contact surfaces and apply tack coat.
   b. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
   c. Offset transverse joints in successive courses a minimum of 24 inches (600

mm).

d. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."

e. Construct longitudinal joints by stringline method as described in AI's "The Asphalt Handbook".

f. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

g. Compact asphalt at joints to a density within 2 percent of specified course density.

E. COMPACTION

1. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

   a. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

2. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

1. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

   a. Average Density: 94 percent of theoretical maximum density according to ASTM D 2014, but not less than 92 percent nor greater than 97 percent.

4. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

5. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

6. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

7. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

8. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

F. INSTALLATION TOLERANCES

1. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

   a. Base Course: Plus or minus 1/4 inch (6 mm).
   b Surface Course: Plus 1/4 inch (6 mm), no minus.

2. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

a. Base Course: 1/4 inch (6 mm).
b. Surface Course: 1/8 inch (3 mm).

G. PAVEMENT MARKING

1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

2. Sweep and clean surface to eliminate loose material and dust.

3. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges.

H. FIELD QUALITY CONTROL

1. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

   a. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

4. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

5. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

   a. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.
   b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

      1) One core sample will be taken for every 500 sq. yd. (836 sq. m) or less of installed pavement, but in no case will fewer than 3 cores be taken.
      2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

6. Remove and replace hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

End of Section 32 12 16

DIVISION 32 – EXTERIOR IMPROVMENTS

Section 32 13 13 – Cement Concrete Paving

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes exterior cement concrete for the following:

2. Related Sections include the following:

a. Division 31 Section "Earth Moving" for grading.

C. DEFINITIONS

1. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast- furnace slag.

D. REFERENCES

1. The “PennDOT sections” noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition. The references pertain only to materials, construction, equipment, methods and labor. The payment provisions do not apply to work to be performed under this Contract. All costs associated with this work are part of the base bid. Where conflicts exist between referenced PennDOT specifications and any additional specifications found within this section, the more stringent specification shall apply.

2. ASTM C 1688 “Standard Test Method for Debsity and Void Content of Freshly Mixed Pervious Concrete.”

E. SUBMITTALS

1. Product Data: For each type of manufactured material and product indicated.

2. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

3. Qualification Data: For manufacturer and testing agency.

4. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based

on comprehensive testing of current materials:

a. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

5. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

a. Steel reinforcement and reinforcement accessories.
b. Admixtures.
c. Curing compounds.
d. Applied finish materials.
e. Bonding agent or epoxy adhesive.
f. Joint fillers.

6. Certificates: Contractor shall submit manufacturer's certification and PennDOT form CS-4171 for aggregate and for CS 4220 for Portland cement concrete certifying that the materials meet or exceed specification requirements.

7. Field quality-control test reports.

F. QUALITY ASSURANCE

1. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

2. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

3. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," and ACI 522 "Pervious Concrete" unless modified by requirements in the Contract Documents.

4. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

5. Test Panels: Cast one full-size section of the concrete sidewalk, concrete walkway with decorative brick banding and pervious concrete pavement in a permanent location to demonstrate typical joints, surface finish, thickness, void structure, texture, color, and standard of workmanship for Owner's approval.

2. PRODUCTS

A. MANUFACTURERS

1. In other Part 2 articles where titles below introduce lists, the following

requirements apply to product selection:

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
b. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. FORMS

1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

a. Use flexible or curved forms for curves with a radius as required.

2. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. STEEL REINFORCEMENT

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

D. RELATED MATERIALS

1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2. Antispalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

E. CONCRETE MIXTURES

1. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

a. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

2. Proportion mixtures to provide normal-weight concrete with the following properties:

a. Compressive Strength (28 Days):

1) Pavement, Sidewalks and Slabs: 4,000 psi

b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
c. Slump Limit: 4 inches plus or minus 1 inch.

3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal- weight concrete at point of placement having an air content as follows:

a. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.

3. EXECUTION

A. EXAMINATION

1. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

2. Proof-roll prepared subbase surface below concrete pavements with small steel roller equipment to identify soft pockets and areas of excess yielding. Existing subgrade under pervious pavement shall not be compacted or subject to excessive construction equipment traffic prior to stone bed placement.

3. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. PREPARATION

1. Remove loose material from compacted subbase surface immediately before placing concrete.

C. EDGE FORMS AND SCREED CONSTRUCTION

1. 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.

2. Check completed form work for grade and alignment to following tolerances:

a. Top of forms not more than 1/8 inch in 10 feet.
b. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

3. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

D. STEEL REINFORCEMENT

1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. JOINTS

1. General: Form construction, isolation, and contraction, expansion joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

    a. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

2. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

    a. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
    b. Extend joint fillers full width and depth of joint.
    c. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
    d. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
    e. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
    f. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

3. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

    a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

4. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

5. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

6. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

7. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

8. Fillers and Sealants: Comply with requirements of PennDOT for preparation of joints, materials, installation, and performance. Seal sidewalk joints with

SilcaFlex –ICLSL or equivalent.

F. CONCRETE PLACEMENT

1. General: Comply with the requirements of PennDOT for mixing and placing concrete, and as herein specified, specifically Publication 408, Sections 630 and 676.

2. Inspection: Before placing concrete, inspect and complete formwork installation, and steel reinforcement. Notify other trades to permit installation of their work.

3. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

4. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

5. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

6. Do not add water to concrete during delivery or at Project site.

7. Do not add water to fresh concrete after testing.

8. 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.

9. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

    a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

10. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

11. Screed pavement surfaces with a straightedge and strike off.

12. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

13. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction

joint.

14. 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.

15. In lawn areas, provide topsoil to top of sidewalk after final grade and compaction. Contractor is responsible for settlement next to walks resulting in greater than 1" drop.

F. CONCRETE PROTECTION AND CURING

1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

2. Comply with ACI 306.1 for cold-weather protection.

3. 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, screeding, and bull floating or darbying concrete, but before float finishing.

4. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

5. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

   a. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

      1) Water.

      2) Continuous water-fog spray.

      3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

   b. 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   c. Curing Compound: Apply Tamms Luster Seal 350 or equal 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.

6. Antispalling Treatment: Apply treatment to concrete surfaces no sooner than 28 days after placement, to clean, dry concrete free of oil, dirt, and other foreign material. Apply curing and sealing compound at a maximum coverage rate of 300 sq. ft. per gallon. Apply antispalling compound in 2 sprayed

applications. First application at rate of 40 sq. yds. per gal.; second application, 60 sq. yds. per gal. Allow complete drying between applications.

H. PAVEMENT TOLERANCES

1. Comply with tolerances of ACI 117 and as follows:

   a. Elevation: 1/4 inch.
   b. Thickness: Plus 3/8 inch, minus 1/4 inch.
   c. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
   d. Joint Spacing: 3 inches.
   e. Contraction Joint Depth: Plus 1/4 inch, no minus.
   f. Joint Width: Plus 1/8 inch, no minus.
   g. Void Structure: 15% minimum; 23% maximum for pervious concrete.
   h. Unit Weight: plus or minus 5 pcf of the design unit weight for pervious concrete.

I. FIELD QUALITY CONTROL

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

2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

   a. Testing Frequency: Obtain at least 1 composite sample for each 10 cu. yd. or 500 sq. ft. or fraction thereof of each concrete mix placed each day.

      1) When frequency of testing will provide fewer than five compressive- strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

   b. 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 mix. Perform additional tests when concrete consistency appears to change.
   c. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   d. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   e. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   f. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

      1) A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

3. Strength of each concrete mix will be satisfactory if average of any 3 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.

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

5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

7. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

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

J. REPAIRS AND PROTECTION

1. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

2. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

3. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

4. Maintain concrete pavement and sidewalks free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

K. WARRANTY

1. Contractor shall warrant all work for a period of one year from date of substantial completion. Contractor shall remove and replace work determined to be unsatisfactory by the Owner as required. This warranty shall cover surface delamination, cracking and settling, and imperfections in Contractor’s work.

End of Section 32 13 13

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 14 00 - Unit Paving

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. Clay pavers set in mortar setting beds.

B. Related Sections:

1. Section 321313 "Concrete Paving" for concrete base under unit pavers

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pavers.
2. Mortar and grout materials.

B. Samples for Initial Selection: For the following:

1. Each type of unit paver indicated.
2. Joint materials involving color selection.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store liquids in tightly closed containers protected from freezing.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. Regional Materials: Provide brick pavers that have been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

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

a. Glen Gery

b. Hanover

c. EP Henry

2. Thickness: 2-5/8 inches (67 mm).
3. Face Size: 3-5/8 by 7-5/8 inches (92 by 194 mm).
4. Color: As selected by Architect.

C. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

D. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

2.2 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.3 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.

C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

D. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.

E. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

E. Joint Pattern: As noted on Drawings

F. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints. Install joint filler before setting pavers.

H. Provide steps made of pavers as indicated on the Architectural drawings. Install paver steps before installing adjacent pavers.

1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

E. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths: Provide 3/8-inch (10-mm) nominal joint width with variations not exceeding plus or minus 1/16 inch (1.5 mm).

I. Grouted Joints: Grout paver joints complying with ANSI A108.10.

J. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

K. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 32 14 00

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 92 00 – Landscape Work

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes provisions for the following items:

a. Lawns.
b. Topsoil and soil amendments.
c. Initial maintenance and warranty of landscape materials.

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

a. Excavation, filling, and rough grading required to establish elevations shown on drawings are specified in Division 31 Section, "Earthmoving."

C. QUALITY ASSURANCE

1. Subcontract landscape work to a single licensed firm specializing in landscape work with at least five years' experience in lawn establishment.

2. Source Quality Control:

a. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.
b. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Owner, together with proposal for use of equivalent material.
c. Analysis and Standards: Package standard products with manufacturers certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
d. Topsoil: Before delivery of topsoil, furnish Owner with written statement giving location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown during past 2 years.

D. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

2. Material Certifications:

a. Certificates of inspection as required by governmental authorities.
b. Manufacturer's or vendor's certified analysis for soil amendments and fertilizer

materials.

c. Label data substantiating that planting materials comply with specified requirements.

d. Seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each grass seed species.

3. Planting Soil Mixture Schedule: Submit proposed planting soil mixture schedule for planting beds to Owner for approval.

E. DELIVERY, STORAGE AND HANDLING

1. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

2. Limestone shall be dry and not lumpy.

3. Fertilizers and seed shall be delivered and stored in original unopened packages, kept dry and not opened until need for use. Damaged or faulty packages shall not be used.

F. JOB CONDITIONS

1. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

2. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

3. Grading and Seeding: This work shall not be performed until all underground water and electrical lines, sanitary and sewers, drains, paving, walks, curbs, steps, drainage structures, catch basins, and similar items or new work in or adjacent to areas to be seeded have been installed, tested, inspected, and accepted by the Owner. Grass seeding shall be applied to all disturbed areas as the result of this Project.

4. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner before planting.

5. Care of Site: The proper care of the lawns, planting areas, adjacent pavement, and existing plants shall rest with the Contractor during the progress of all Work. The Contractor shall confine topsoil, materials, and equipment to such limits that will not interfere with normal pedestrian and vehicular traffic, and all walks and pavement shall be kept clean at all times except when unavoidable in the actual performance of the Work.

G. SEQUENCING AND SCHEDULING

1. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available.

2. Pre-installation Conference: Contractor shall conduct a per-installation conference involving the Owner prior to the installation of any soils for lawn areas. Nay finish landscaping prior to this meeting is cause for rejection of the installed work.

H. PROJECT WARRANTY

1. Lawn Guarantee: Contractor shall guarantee the lawn, areas developed under this Contract to be in a vigorous and thriving condition by the end of the maintenance period, free from objectionable quantities of weeds and other undesirable growth. Rejected work shall be replaced by the Contractor at no additional cost.

2. Warranty lawn areas for a period no less than 6 months from final acceptance subject to the provisions above.

2. PRODUCTS

A. TOPSOIL

1. Topsoil: Topsoil is defined as natural or cultivated surface-soil layer that is fertile, friable, natural loam, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps and other extraneous or toxic matter harmful to plant growth and maintenance operations.

2. The Contractor shall remove all topsoil to a depth of not less than 4 inches and stockpiled on site for re-use in landscape work. All topsoil is the property of the Owner. Excess topsoil removed and not required for finish grading shall be removed by the Contractor and stockpiled as directed by the Owner. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete landscape work. Test topsoil to determine lime and starter fertilizer rates/requirements.

3. Imported Topsoil: Provide screened imported topsoil as required that is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than ¾ inches in any dimension, and other extraneous or toxic matter harmful to plant growth or be a hindrance to planting and maintenance operations.

   a. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches. Do not obtain from bogs or marshes. Topsoil shall not be delivered in frozen or muddy condition. Source of topsoil shall be approved in advance by the Owner before delivering topsoil to the site.
   b. Imported topsoil is to have a pH between 6 and 7; and contain not less than 3% and not more than 10% of organic matter, as determined in accordance with AASHTO-T194.

B. SOIL AMENDMENTS

1. Lime: lime shall be high magnesium ground limestone containing not less that 85 percent total carbonates, 95 percent passing a 20-mesh sieve, 40 percent passing a 60-mesh sieve and a minimum of 30 percent passing a 100-mesh sieve.

2. Aluminum Sulfate: Commercial grade.

3. Peat Humus: Finely divided peat, so completely decomposed and free of fibers that its biological identity is lost. Provide in granular form, free of hard lumps and with pH range suitable for intended use.

4. Bonemeal: Commercial, raw, finely ground; 4 percent nitrogen and 20 percent

phosphoric acid.

5. Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

6. Sand: Clean, washed sand, free of toxic materials.

7. Perlite: Conforming to National Bureau of Standards PS 23.

8. Vermiculite: Horticultural grade, free of toxic substances.

9. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil, or toxic substances and with 7.5 pounds of nitrogen uniformly mixed into each cubic yard of sawdust.

10. Manure: Well rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.

11. Mulch: Brown shredded hardwood mulch free from deleterious materials and suitable for top dressing of trees and planting beds.

12. Commercial Fertilizer: In accordance with the soil test recommendations, fertilizer shall be in bags showing weight, analysis, and manufacturer's name.

14. Organic Matter: If required by the soil test, shall be polymer dewatered recycled composted leaf mulch, reed sedge peat and/or peat moss.

D. GRASS MATERIALS

1. Grass Seed: Shall be clean and fresh, packed in sealed bags showing net weight, composition of mix, date of germination tests, and supplier's name. Germination test must be done within a nine month period prior to sale of the seed. Seed shall be tall fescue 70-100% at 0-30% (20% turf type perennial rye, and or 10% blue grass.

E. MISCELLANEOUS LANDSCAPE MATERIALS

1. Anti-Erosion Mulch: Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats, or barley.

2. Wood Cellulose Fiber Mulch: Shall consist of especially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. The fiber mulch, including dye, shall contain no germination or growth inhibiting factors. The mulch material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with other additives to form homogeneous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.

   The mulch material shall contain no elements or compounds at concentration levels that will be phyto-toxic. Wood cellulose fiber must conform to the following physical requirements: fiber length to approximately 10 mm., diameter to approximately 1 mm., pH range of 4.0 to 8.5, ash content of 1.6% maximum and water holding capacity of

90% minimum.

2. EXECUTION

A. PREPARATION FOR PLANTING LAWNS

1. Subgrade Preparation: Loosen subgrade of lawn areas to a minimum depth of 8 inches prior to topsoil installation and grading to permit interface of soils. At laydown areas and temporary roadways, loosen subgrade to a depth of 18”-24”. Use of a harley rake or rock hound alone will not be acceptable if it does not reach the full depth of the topsoil. Completely remove sticks, roots, rubbish, and other extraneous matter from the loosened subgrade. Limit preparation to areas which will be planted promptly after preparation.

2. Topsoil Placement

a. Spread topsoil to minimum depth of 8” and work as required meeting lines, grades, and elevations shown, after light rolling and natural settlement.
b. Place total amount of topsoil required in two lifts. Work first lift (4” of topsoil) into the top 4” of loosened subgrade. Place second lift of 4” of topsoil. Add specified soil amendments and mix thoroughly into upper 2 inches of topsoil. Rock rake surface of finished grade to remove stones larger than 2” in any dimension and sticks, roots, trash, and other extraneous matter.
c. Topsoil shall not be placed when the subgrade is frozen, excessively wet, or extremely dry, and no topsoil shall be handled when in a frozen or muddy condition. During all operations following topsoil spreading, the surface shall be kept 100% free from stones over 2 inch in diameter or any rubbish, debris, or other materials which would be detrimental to seeding or to maintenance of the turf.
d. Work the topsoil as required meeting lines, grades, and elevations shown, after light rolling and natural settlement.
e. After completion and approval of finish grading, remove any excess topsoil from site, unless otherwise directed, and leave finish grade area clean and well raked, ready for lawn work.
f. Do not cover manhole lids or valve boxes. These shall be brought up to level grade.
g. Tire track soil compaction to grade at all walks and pavement edges. If subsequent settlement at edges exceeds 1”, apply additional soil and re-plant.
h. Till and rough grade prior to fertilizer or lime applications.
i. Keep all non-lawn working equipment off of topsoil once it has been placed. Soil compaction due to construction contact after soil placement must be re-tilled.

3. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

4. Restore lawn areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

B. SEEDING NEW LAWNS

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

2. As soon as ground has been properly prepared, sow grass seed at the rate of 8 lbs. per 1,000 sq. ft., total, (minimum) in two operations at right angles to each other, using a suitable mechanical seeder or sowing by hand for smaller areas.

3. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with a fine spray..

4. Do no seeding in adverse weather or on wet or frozen ground.

5. Protect seeded slopes and areas adjacent to all concentrated stormwater outfalls against erosion with erosion netting or other methods acceptable to the Owner.

6. After seed application, wood cellulose fiber mulch shall be applied at a net dry weight of 1,500 lbs. per acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 lbs. of wood cellulose fiber per 100 gallons of water. In areas where erosion is a problem, use an organic tackifier such as CON-TACK™ or approved equal in accordance with manufacture's recommendations. Do not use straw.

C. RECONDITIONING EXISTING LAWNS

1. Recondition existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor re-grading is required.

2. See Preparation for Planting Lawns section for subgrade preparation and topsoil placement.

3. Provide fertilizer, seed, and soil amendments as specified for new lawns, and as required, to provide a satisfactorily reconditioned lawn.

4. Provide new topsoil, as required, to fill low spots and meet new finish grades.

5. Cultivate bare and compacted areas thoroughly to provide a satisfactory planting bed.

6. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.

7. Where substantial lawn remains, but is thin, mow, rake, aerate if compacted, fill low spots, remove humps, and cultivate soil, fertilize, and seed. Remove weeds before seeding, or if extensive, apply selective chemical weed killers as required. Apply seedbed mulch, if required, to maintain moist condition.

8. Water newly planted lawn areas and keep moist until new grass is established and warranty period expires.

D. CLEANUP AND PROTECTION

1. During landscape work, keep pavements clean and work area in an orderly condition.

2. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers.

E. INSPECTION AND FINAL ACCEPTANCE

1. When landscape work is completed, the Owners Representative will, upon request,

make an inspection to determine acceptability.

2. When inspected landscape work does not comply with requirements, replace rejected work. Remove rejected plants and materials promptly from project site.

F. MAINTENANCE PERIOD

1. Owner Provides all mowing. Contractor is responsible for all other services (to include watering, weeding, fertilizing, over-seeding and re-planting) until a healthy, uniform, close stand of grass is established free of weeds, bare spots exceeding 5 by 5 inches and surface irregularities.

End of Section 32 92 00