DOCUMENT 000101 – Vian 30 Housing Units

1.1 PROJECT MANUAL VOLUME 1

A. Vian 30 Housing Units

B. Cherokee Nation Property Management.

C. Vian, Oklahoma.

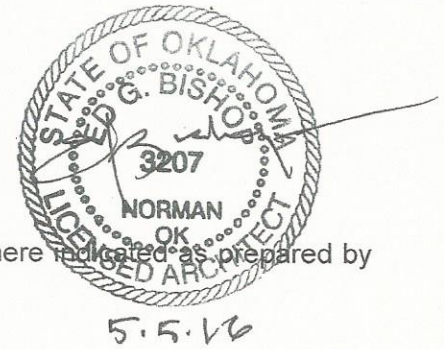
END OF DOCUMENT 000101

DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Ed G. Bishop.
2. Oklahoma Licensed Architect 3207.
3. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.



B. Civil Engineer:

1. Joe P. Kelley.
2. Oklahoma Registered Professional Engineer 21438.
3. Responsible for Divisions 3, 31, and 32.

C. HVAC/Plumbing Engineer:

1. Richard H. Godfrey III.
2. Oklahoma Licensed Professional Engineer 22350.
3. Responsible for Divisions 22 and 23.

D. Electrical Engineer:

1. Mark D. Tatarian.
2. Oklahoma Registered Professional Engineer 16838.
3. Responsible for Division 26.

5-5-2016

END OF DOCUMENT 000107

DOCUMENT 000110 – TABLE OF CONTENTS

1.1 LIST OF SPECIFICATIONS

B. Specifications: Specifications consist of the Contract Specifications listed in the Table of Contents section titled Comprehensive Housing Specifications dated 05/06/2016, as modified by subsequent Addenda and Contract modifications.

C. List of Specifications: Specifications consist of the following Contract Specifications and other specifications of type indicated:

1. Division 00 Procurement and Contracting Requirements
   - 000101 Project Title Page
   - 000107 Seals Page
   - 000110 Table of Contents

2. Division 01 General Requirements
   - 014000 Quality Requirements
   - 016000 Product Requirements

3. Division 03 Concrete
   - 033000 Cast-in Place Concrete

4. Division 04 Unit Masonry
   - 042000 Unit Masonry

5. Division 05 Metals
   - 055000 Metal Fabrications

6. Division 06 Carpentry
   - 061000 Rough Carpentry
   - 061600 Sheathing
   - 061753 Shop Fabricated Wood Trusses
   - 062000 Finish Carpentry
   - 064113 Wood-Veneer-Faced Architectural Cabinets

7. Division 07 Moisture Protection
   - 072100 Thermal Insulation
   - 072500 Weather Barriers
   - 073113 Asphalt Shingles
   - 076200 Sheet Metal Flashing and Trim
   - 077100 Roof Specialties
   - 079200 Joint Sealants

8. Division 08 Doors and Windows
   - 081113 Hollow Metal Doors and Frames
   - 081416 Flush Wood Doors
   - 081423 Clad Wood Doors

- 083113 Access Doors and Frames
- 085113 Aluminum Windows
- 087100 Door Hardware
- 088000 Glazing

9. Division 09 Finishes
   - 092613 Gypsum Veneer Plastering
   - 092900 Gypsum Board
   - 096516 Resilient Sheet Flooring
   - 096519 Resilient Tile Flooring
   - 096816 Sheet Carpeting
   - 099113 Exterior Painting
   - 099123 Interior Painting

10. Division 10 Specialties
    - 102800 Toilet, Bath, and Laundry Accessories

11. Division 11 Equipment
    - 113100 Residential Appliances

12. Division 22 Plumbing
    - 220000 General Plumbing
    - 220523 General-Duty Valves for Plumbing Piping
    - 220529 Hangers and Supports for Plumbing Piping and Equipment
    - 220533 Heat Tracing for Plumbing Piping
    - 220700 Plumbing Insulation
    - 221116 Domestic Water Piping
    - 221119 Domestic Water Piping Specialties
    - 221316 Sanitary Waste and Vent Piping
    - 221319 Sanitary Waste Piping Specialties
    - 223100 Domestic Water Softeners
    - 223300 Electric, Domestic-Water Heaters
    - 223400 Fuel-Fired, Domestic-Water Heaters
    - 224100 Residential Plumbing Fixtures

13. Division 23 Mechanical
    - 230000 General Mechanical
    - 230517 Sleeves and Sleeve Seals for HVAC Piping
    - 230593 Testing, Adjusting, and Balancing for HVAC
    - 230700 HVAC Insulation
    - 231123 Facility Natural-Gas Piping
    - 232300 Refrigerant Piping
    - 233100 HVAC Ducts and Casings
    - 233423 HVAC Power Ventilators
    - 233713 Diffusers, Registers, and Grilles
    - 235100 Breechings, Chimneys, and Stacks
    - 236313 Air-Cooled Refrigerant Condensers
    - 237339 Indoor, Direct-Fired Heating and Ventilating Units

14. Division 26 Electrical
    - 260519 Low-Voltage Electrical Power Conductors and Cables
    - 260526 Grounding and Bonding for Electrical Systems
    - 260529 Hangers and Supports for Electrical Systems
    - 260533 Raceway and Boxes for Electrical Systems
    - 262416 Panelboards
    - 262713 Electricity Metering
    - 262726 Wiring Devices
    - 262813 Fuses
    - 262816 Enclosed Switches and Circuit Breakers
    - 265100 Interior Lighting

15. Division 31 Earthwork
    - 311000 Site Clearing
    - 312000 Earth Moving

16. Division 32 Exterior Improvements
    - 321313 Concrete Paving

END OF DOCUMENT 000110

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Architect for a decision.

C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision.

D. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

E. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

G. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

H. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.

I. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

J. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor of irregularities or deficiencies in the Work observed during performance of its services.
2. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
3. Do not perform any duties of Contractor.

K. Associated Services: Cooperate with testing agencies and provide reasonable auxiliary services as requested. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Security and protection for samples and for testing and inspecting equipment.

L. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.

1. Show compliance with requirements for comparable product requests.
2. Architect will review the proposed product and notify Contractor of its acceptance or rejection.

C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.

D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.

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

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
4. Store materials in a manner that will not endanger Project structure.
5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
2. Where products are accompanied by the term "as selected," Architect will make selection.
3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:

1. Products:

a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.

2. Manufacturers:

a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.
b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.

3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.

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

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

2.2 COMPARABLE PRODUCTS

A. Architect will consider Contractor's request for comparable product when the following conditions are satisfied:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.
3. List of similar installations for completed projects, if requested.
4. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data concrete mix designs and submittals required by ACI 301.

B. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Comply with ACI 301, "Specification for Structural Concrete," and with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.2 MATERIALS

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

B. Plain Steel Wire: ASTM A 82/A 82M, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, as drawn, flat sheet.

D. Portland cement: ASTM C 150, Type I or II.

E. Fly Ash: ASTM C 618, Class C or F.

F. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

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

H. Aggregates: ASTM C 33, coarse aggregate or better, graded**,** with at least 10 years' satisfactory service in similar applications.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

I. Air-Entraining Admixture: ASTM C 260.

J. Chemical Admixtures: ASTM C 494, water reducing. Do not use calcium chloride or admixtures containing calcium chloride.

K. Vapor Retarder: Reinforced sheet, ASTM E 1745, Class A.

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. GCP Applied Technologies Inc. (formerly Grace Construction Products).
    b. Poly-America, L.P.
    c. W. R. Meadows, Inc.

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

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

N. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.3 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301.

B. Normal-Weight Concrete:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Limit: 4 inches for footings or 5 inches for concrete slabs with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.
5. 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.
6. For concrete exposed to deicing chemicals, limit use of fly ash to 25 percent replacement of Portland cement by weight and granulated blast-furnace slag to 40 percent of Portland cement by weight; silica fume to 10 percent of Portland cement by weight.

C. Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 CONCRETING

A. Construct formwork according to ACI 301 and maintain tolerances and surface irregularities within ACI 347R limits of Class A, 1/8 inch for concrete exposed to view and Class B, 1/4 inch for other concrete surfaces.

B. Place vapor retarder on prepared sub grade, with joints lapped 6 inches and sealed.

C. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

D. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.

E. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

F. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.

G. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.

H. Slab Finishes: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Provide the following finishes:

1. Scratch finish for surfaces to receive mortar setting beds.
2. Float finish for surfaces to receive waterproofing, roofing, or other direct-applied material.
   Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings.
3. Trowel and fine-broom finish for surfaces to receive thin-set tile.
4. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.

I. Cure formed surfaces by moisture curing for at least seven days.

J. Begin curing concrete slabs after finishing. Keep concrete continuously moist for at least seven days.

K. Owner will engage a testing agency to perform field tests and to submit test reports.

L. Protect concrete from damage. Repair and patch defective areas.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Allowances: Furnish face brick under the Face Brick Allowance specified in Section 012000 "Price and Payment Procedures."

B. See Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.

C. Submittals:

1. Samples for face brick and colored mortar.
2. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements.

D. Sample Panels: Construct a sample wall panel approximately 48 inches long by 48 inches high to demonstrate aesthetic effects and set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 UNIT MASONRY

A. Comply with TMS 602/ACI 530.1/ASCE 6.

2.2 MASONRY UNITS

A. Clay Face Brick: ASTM C 216, Grade SW, Type FBX or HBX, Type FBS or HBS, Type FBA or HBA.

1. Size (Actual Dimensions): 3” deep by 9” or 10” long
2. Solid brick with exposed surfaces finished for ends of sills and caps.
3. Special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
4. Special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

2.3 MORTAR AND GROUT

A. Mortar: ASTM C 270, proportion specification.

1. Use masonry cement mortar.
2. Do not use calcium chloride in mortar.
3. For masonry below grade or in contact with earth, use Type M.
4. For reinforced masonry, use Type M.
5. Colored Mortar: For face brick, use colored cement or cement-lime mix of color selected.

B. Grout: ASTM C 476 with a slump of 8 to 11 inches.

2.4 REINFORCEMENT, TIES, AND ANCHORS

A. Corrugated-Metal Veneer Anchors: 7/8 inch wide and made from 0.030-inch-thick steel sheet, galvanized after fabrication .

2.5 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: [Stainless steel, 0.0156 inch thick] or 0.0135 inch thick for fully concealed flashing, 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere].

B. Rubberized Asphalt Sheet Flashing: Pliable, adhesive rubberized-asphalt compound, bonded to a polyethylene film to produce an overall thickness of 0.040 inch. Use only where flashing is fully concealed.

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. Advanced Building Products Inc.
    b. Carlisle Coatings & Waterproofing Inc.
    c. W. R. Meadows, Inc.

C. Butyl Rubber Flashing: Pliable, butyl rubber compound, bonded to a polyethylene film, aluminum foil, or spun bonded polyolefin to produce an overall thickness of not less than 0.040 inch. Use only where flashing is fully concealed.

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. DuPont Building Innovations: E. I. du Pont de Nemours and Company.
    b. GCP Applied Technologies Inc. (formerly Grace Construction Products).
    c. Protecto Wrap Company.

D. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy, 0.025 inch thick, with a 0.015-inch-thick coating of adhesive. Use only where flashing is fully concealed.

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. DuPont Building Innovations: E. I. du Pont de Nemours and Company.
    b. Hohmann & Barnard, Inc.
    c. Hyload, Inc.
    d. Mortar Net Solutions.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded strips complying with ASTM D 1056, Grade 2A1.

B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; made from styrene-butadiene rubber or PVC.

C. Weep Holes: Cellular-plastic extrusion, full height and width of head joint][Round polyethylene tubing, 3/8-inch OD, 24 inches long or Free-draining polyethylene mesh, full height and width of head joint.

D. Cavity Drainage Material: Free-draining polymer mesh, full depth of cavity with dovetail-shaped notches that prevent mortar clogging.

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. Advanced Building Products Inc.
    b. CavClear/Archovations, Inc.
    c. Mortar Net Solutions.

E. Loose-Granular Perlite Insulation: ASTM C 549, Type II or IV.

F. Proprietary Acidic Masonry Cleaner: Product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

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.; a division of Sandell Construction Solutions.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cut masonry units with saw. Install with cut surfaces and, where possible, cut edges concealed.

B. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Stopping and Resuming Work: Step back units; do not tooth.

D. Tool exposed joints slightly concave when thumbprint hard unless otherwise indicated.

E. Keep cavities clean of mortar droppings and other materials during construction.

3.2 LINTELS

A. Install lintels where indicated.

B. Minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.3 FLASHING AND WEEP HOLES

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

B. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing before covering with mortar.

1. Extend flashing 4 inches into masonry at each end and turn up 2 inches to form a pan.

C. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections required by authorities having jurisdiction.

1. Inspections: Level B in TMS 402/ACI 530/ASCE 5.
2. Place grouts only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3.5 CLEANING

A. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly cured, clean exposed masonry.

1. Wet wall surfaces with water before applying acidic cleaner, then remove cleaner promptly by rinsing thoroughly with clear water.
2. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 042000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

PART 2 - PRODUCTS

2.1 METALS

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

B. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners at exterior walls. Select fasteners for type, grade, and class required.

2.3 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.4 FABRICATION

A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth, with contour of welded surface matching those adjacent.

C. Comply with AWS for recommended practices in shop brazing. Braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed brazed joints of flux, and dress exposed and contact surfaces.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

E. Fabricate steel pipe columns with 1/2-inch steel base plates and 1/4-inch steel top plates welded to pipe with continuous fillet weld same size as pipe wall thickness. Drill top plates for connection bolts and base plates for 5/8-inch anchor bolts.

F. Fabricate loose lintels from steel angles and shapes. Size to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches.

G. Fabricate pipe guards from 3/8-inch- thick by 12-inch- wide steel plate, bent to fit flat against the wall or column at ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.5 STEEL AND IRON FINISHES

A. Hot-dip galvanize steel fabrications at exterior locations.

B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3 and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide anchorage devices and fasteners where needed to secure items to in-place construction.

B. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack.

C. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers.

D. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for wood-preservative treated wood, fire-retardant treated wood, engineered wood products, shear wall panels and metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

B. 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: Engineered wood products shall have allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

C. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes Section 018113.36 - Sustainable Design Requirements - National Green Building Standard.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: 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. Use treatment containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Provide preservative-treated materials for items indicated on Drawings, and the following:

C. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   1. Wood sills, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   2. Wood framing members that are less than 18 inches above the ground.
   3. Wood floor plates that are installed over concrete slabs-on-grade.

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

   1. Use Exterior type for exterior locations and where indicated.
   2. Use Interior Type A unless otherwise indicated.
   3. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with design adjustment factors of not less than 0.85 for modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
   4. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
   5. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

E. Provide fire-retardant treated materials for all rough carpentry.

2.3 FRAMING

A. Dimension Lumber:

   1. Maximum Moisture Content: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness, no limit for more than 2-inch nominal thickness.
   2. Non-Load-Bearing Interior Partitions: Construction or No. 2, Any species Species groups in "Framing Other Than Non-Load-Bearing Interior Partitions" Subparagraph below are listed in order of decreasing strength (extreme fiber in bending).
   3. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2 [Hem-fir (north): NLGA; Retain "Exposed Framing" Subparagraph below for better appearance for exposed work.
   4. 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.

      a. Species: As specified for framing other than non-load-bearing interior partitions.
      b. Grade: Select Structural No. 1.

2.4 SHEAR WALL PANELS

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. Shear Transfer Systems.
2. Simpson Strong-Tie Co., Inc.
3. Weyerhaeuser Company.

B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.

C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized steel panel, steel top and bottom plates, and wood studs.

D. Allowable Design Loads: Shear wall panels shall have allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.5 MISCELLANEOUS LUMBER

A. Miscellaneous Dimension Lumber: Construction, or No. 2 grade with 15 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

B. Utility Shelving: Mixed southern pine, No. 1: SPIB; Hem-fir, Select Merchantable or No. 1 Common: NLGA, WCLIB, or WWPA; or Spruce-pine-fir, Select Merchantable or No. 1 Common: NeLMA, NLGA, WCLIB, or WWPA; with 15 percent maximum moisture content.

C. Concealed Boards: Mixed southern pine, No. 2: SPIB; or Western woods, Standard: WCLIB; or No. 3 Common: WWPA; with 15 percent maximum moisture content.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, Exterior, AC, fire-retardant treated, not less than 3/4-inch nominal thickness.

2.7 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

1. Power-Driven Fasteners: CABO NER-272.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Structural capacity, type, and size indicated.

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. KC Metals Products, Inc.
b. Simpson Strong-Tie Co., Inc.
c. USP Structural Connectors.

2. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 coating designation for interior locations where stainless steel is not indicated.

3. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

C. Sill Sealer: Closed-cell neoprene foam, 1/4 inch thick.

D. Flexible Flashing: Self-adhesive product consisting of a butyl rubber, or rubberized-asphalt compound, bonded to a backing sheet to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, 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. Do not splice structural members between supports unless otherwise indicated.

D. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2304.9.1, "Fastening Schedule," in the IBC 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.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for preservative-treated plywood, and fire-retardant-treated plywood.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

C. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes Section 018113.36 - Sustainable Design Requirements - National Green Building Standard Section 018113.43 - Sustainable Design Requirements - ASHRAE 189.1.

2.2 TREATED PLYWOOD

A. Preservative-Treated Plywood: AWPA U1; Use Category UC2.

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

B. Provide preservative-treated plywood for items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

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

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A unless otherwise indicated.
3. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Provide fire-retardant-treated plywood for items indicated on Drawings.

2.3 WALL SHEATHING

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

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

C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.

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. Georgia-Pacific Building Products.
b. Temple-Inland Building Products by Georgia-Pacific.
c. United States Gypsum Company.

D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

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

a. CertainTeed Corporation.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. United States Gypsum Company.

2.4 ROOF SHEATHING

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

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

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. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Johns Manville; a Berkshire Hathaway company.
d. Rmax, Inc.

2.5 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.

B. Sheathing Joint-and-Penetration Treatment Materials:

1. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant, recommended by tape and sheathing manufacturers for application indicated.
2. Sheathing Tape for Glass-Mat Gypsum Sheathing: Self-adhering, glass-fiber tape recommended by sheathing and tape manufacturers for application indicated.

C. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. 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.

B. Fastening Methods:

1. Wall and Roof Sheathing:

a. Nail to wood framing.

C. Glass-Mat Gypsum Sheathing Joint-and-Penetration Treatment: Seal sheathing joints and penetrations according to sheathing manufacturer's written instructions.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, and ICC-ES evaluation reports for metal plate connectors and metal truss accessories.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.

B. Comply with applicable requirements and recommendations of the following publications:

1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI BCSI, "Guide to Good Practice for Handling, Installing, Restraining & Bracing Metal Plate Connected Wood Trusses."

C. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 MATERIALS

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review, any species, graded visually or mechanically.

1. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Certified Wood: Sustainable Design Requirements - LEED 2008 for Homes Section 018113.36Retain "Minimum Chord Size for Roof Trusses" Paragraph below if requirement for minimum chord sizes is needed to provide stiffer members for nailing.

C. Minimum Chord Size for Roof: 2 by 6 inches nominal for both top and bottom chords.

D. Minimum Specific Gravity for Top Chords: 0.50.

E. Connector Plates: TPI 1, fabricated from hot-dip galvanized-steel sheet complying with 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); G60 coating designation; and not less than 0.036 inch thick.

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. Alpine Engineered Products, Inc.; a division of ITW Building Components Group, Inc.
b. CompuTrus, Inc.
c. Jager Building Systems, Inc.
d. Truswal Systems Corporation.

F. Fasteners: Where trusses are exposed to weather or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

G. Metal Framing Anchors: Provide framing anchors made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

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

a. Simpson Strong-Tie Co., Inc.

2.3 FABRICATION

A. Assemble trusses using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted. Fabricate wood trusses within manufacturing tolerances in TPI 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and brace trusses according to TPI recommendations and as indicated. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

B. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchor.

C. Securely connect each truss ply required for forming built-up girder trusses. Anchor trusses to girder trusses.

D. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."
2. Install and fasten strong-back bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

E. Install wood trusses within installation tolerances in TPI 1.

F. Do not alter trusses in field.

G. Remove wood trusses that are damaged or do not meet requirements and replace with trusses that do meet requirements.

END OF SECTION 061753

SECTION 062000 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Samples for moldings and trim.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes Section.

2.2 EXTERIOR FINISH CARPENTRY

A. Exterior Lumber Trim: Smooth-textured, Grade A, western red cedar.

1. Maximum Moisture Content: 15 percent.

B. Wood Moldings: WMMPA WM 4, N-grade wood moldings. Made from kiln-dried stock to patterns included in WMMPA WM 12.

1. Species: Western red cedar.

C. Cellular PVC Exterior Trim: Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.

D. Plywood Soffits: 3/8-inch- thick, Exterior-type, Grade A-C 303-30-S/W, cedar or fir faced, rough sawn, plain.

2.3 INTERIOR STANDING AND RUNNING TRIM

A. Interior Softwood Lumber Trim: C Select (Choice), eastern white, Idaho white, lodgepole, ponderosa, or sugar pine or C Select white woods.

1. Maximum Moisture Content: 15 percent.

B. Interior Hardwood Lumber Trim: Clear, kiln-dried, red oak.

C. Wood Moldings: WMMPA WM 4 made to patterns in WMMPA WM 12 from kiln-dried stock.

1. Softwood Moldings for Transparent Finish: Western red cedar Douglas fir.
2. Hardwood Moldings for Transparent Finish: Red oak.
3. Moldings for Painted Finish: P-Grade primed medium-density fiberboard.
4. Base: WM 713, ranch base.
5. Shoe Mold: WM 126, 1/2-by-3/4-inch quarter-round shoe.
6. Casing: WM 327, clamshell casing.
7. Stop: WM 856, ranch stop.

2.4 SHELVING AND CLOTHES RODS

A. Shelving: 3/4-inch finish boards as specified for interior softwood lumber trim.

B. Clothes Rods: 1-5/16-inch- diameter, chrome-plated-steel tubes.

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: hot-dip galvanized steel.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer.

1. Wood glue shall have a VOC content of 30 g/L or less.

2. Use waterproof resorcinol glue for exterior applications.

3. Adhesive shall have a VOC content of 50 g/L or less.

C. Insect Screening for Soffit Vents: Aluminum.

D. Continuous Soffit Vents: Aluminum hat channel shape with stamped louvers or perforations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condition interior finish carpentry in installation areas for 24 hours before installing.

B. Prime and backprime lumber for painted finish exposed on the exterior. Cut to length and prime ends.

C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

1. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

D. Install standing and running 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 long except where necessary. Stagger joints in adjacent and related trim. Cope at returns and inside corners and miter at outside corners.

END OF SECTION 062000

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings Samples showing the full range of colors available for each type of finish and AWI Quality Certification Program certificates.

B. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

C. Installer Qualifications: Fabricator of products.

D. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINETS

A. Quality Standard: AWI, AWMAC, and WI's "Architectural Woodwork Standards."

B. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes Section 018113.36 - Sustainable Design Requirements - National Green Building Standard Section 018113.43 - Sustainable Design Requirements - ASHRAE 189.1 Section 018113.53 - Sustainable Design Requirements - Green Globes.

C. Wood Cabinets for Transparent Finish: Custom grade.

1. Type of Construction: Frameless or Face frame.
2. Cabinet Door and Drawer Style: Flush overlay.
3. Wood Species for Exposed Surfaces: Red oak.
4. Cut: Plain sliced/plain sawn.
5. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
6. Matching of Veneer Leaves: Random match.
7. Veneer Matching within Panel Face: Running match.
8. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
9. Drawer Subfronts, Sides, and Backs: Solid-hardwood lumber.
10. Drawer Bottoms: Hardwood plywood.

2.2 MATERIALS

A. Wood Moisture Content: 4 to 9 percent.

B. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.3 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:

1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

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

D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: BHMA A156.9, B04013; metal.

G. Drawer Slides: BHMA A156.9, B05091.

1. Box Drawer Slides: Grade 1HD-100.
2. File Drawer Slides: Grade 1HD-100.
3. Trash Bin Slides: Grade 1HD-100.

H. Exposed Hardware Finishes: Comply with BHMA A156.18 for BHMA code number indicated.

1. Finish: Satin Stainless Steel: BHMA 630.

I. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated Softwood or hardwood lumber, kiln dried to 15 percent moisture content.

2.4 FABRICATION

A. Complete fabrication 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.

2.5 SHOP FINISHING OF WOOD CABINETS

A. Finishes: Same grades as items to be finished.

B. Finish cabinets at the fabrication shop; defer only final touchup until after installation.

1. Apply one coat of sealer or primer to concealed surfaces of cabinets. Apply two coats to end-grain surfaces.
2. Apply a wash coat sealer to woodwork made from closed-grain wood before staining and finishing.
3. After staining, if any, apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

C. Transparent Finish:

1. System - 4: Water-based latex acrylic.
2. System - 5: Conversion varnish.
3. System - 6: Synthetic penetrating oil.
4. System - 7: Catalyzed vinyl.
5. System - 8: Water-based cross linking acrylic.
6. System - 11: Catalyzed polyurethane.
7. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Install cabinets to comply with referenced quality standard for grade specified.

C. Install cabinets 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 cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built into or directly attached to substrates. Fasten with countersunk concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed nailing, countersunk and filled flush.

F. Cabinets: Install so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. 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.

END OF SECTION 064113

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Surface-Burning Characteristics: According to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

A. Glass-Fiber-Blanket Insulation: ASTM C 665, Type I, unfaced with flame-spread and smoke-developed indexes of 25 and 450, respectively.

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

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Owens Corning.

B. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type 1, pneumatic application, with flame-spread and smoke-developed indexes of 25 and 450, respectively.

2.2 ACCESSORIES

A. Vapor Retarder: Polyethylene, 6 mils thick.

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. Raven Industries, Inc.
b. Reef Industries, Inc.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed to fit between roof framing members and to provide cross-ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

C. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

D. Place loose-fill insulation to comply with ASTM C 1015.

E. Install sheet radiant barriers according to ASTM C 1158.

F. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items with tape.

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for water-resistive barrier.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIERS

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), un-perforated.

B. Building Paper: Kraft building paper with not less than 50 lbf/in. tensile strength, 1-hour water resistance, and 75 g/sq. m x 24 h water-vapor transmission.

2.2 ACCESSORIES

A. Flexible Flashing: Adhesive compound, bonded to plastic film or spunbonded polyolefin, with an overall thickness of 0.030 inch.

1. Butyl Rubber:

2. Rubberized Asphalt:

B. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.3 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Building Paper Installation:

1. Apply building paper immediately after sheathing is installed.
2. Apply horizontally with a 2-inch overlap and a 6-inch end lap.

3. Seal seams, edges, fasteners, and penetrations with tape.
4. Extend into jambs of openings and seal corners with flexible flashing tape.

B. Flexible Flashing Installation:

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 3 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

C. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Samples, and ICC-ES evaluation reports.

B. Warranties: Manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace asphalt shingles that fail in materials for a period of 30 years, prorated, with first 15 years nonprorated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A. Identify products with appropriate markings of testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Three-Tab-Strip, SBS-Modified Asphalt Shingles: ASTM D 3462/D 3462M, glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with tabs regularly spaced and complying with UL 2218, Class 4.

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

    a. Certainteed Roofing.
    b. Tamko.

2.3 ACCESSORIES

Felts: ASTM D 226/D 226M or ASTM D 4869/D 4869M, Type II, 30 lb. asphalt-saturated organic felts.

A. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970/D 1970M.

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. Atlas Roofing Corporation.
    b. Carlisle Residential; a division of Carlisle Construction Materials.
    c. GAF Materials Corporation.
    d. Grace Construction Products; W.R. Grace & Co. -- Conn.
    e. Owens Corning.
    f. Tamko Building Products, Inc.

B. Ridge Vent: Rigid UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.

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. Air Vent, Inc.; a Gibraltar Industries company.
    b. GAF Materials Corporation.
    c. Owens Corning.

C. Flexible Ridge Vent: Compression-resisting, three-dimensional, open-nylon or polyester-mat filter bonded to a nonwoven, nonwicking, geotextile fabric cover.

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. GAF Materials Corporation.
    b. Obdyke, Benjamin Incorporated.
    c. Tamko Building Products, Inc.

D. Asphalt Roofing Cement: ASTM D 4586/D 4586M, Type II, asbestos free.

E. Roofing Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel shingle nails, minimum 0.120-inch diameter, of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

F. Felt-Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

G. Sheet Metal Flashing and Trim: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Sheet Metal: Zinc-tin alloy-coated steel.
2. Drip Edge: Formed sheet metal with at least a 2-inch roof deck flange and a 1-1/2-inch fascia flange with a 3/8-inch drip at lower edge.

3. Open-Valley Flashing: Fabricate with 1-inch- high, inverted-V profile at center of valley and equal flange widths of 12 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with recommendations in ARMA's "Residential Asphalt Roofing Manual" and with asphalt shingle recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."

B. Apply self-adhering sheet underlayment at eaves and rakes from edges of roof to at least 36 inches inside exterior wall line.

C. Apply self-adhering sheet underlayment at valleys extending 18 inches on each side.

D. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment.

E. Install valleys complying with NRCA instructions. Construct woven valleys.

F. Install metal flashings to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

G. Install first and remaining courses of asphalt shingles, stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses and maintaining uniform exposure.

H. Install first and remaining courses of asphalt shingles, stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses and maintaining uniform exposure.

END OF SECTION 073113

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

B. Coordinate installation of sheet metal flashing and trim with adjoining roofing and wall materials, joints, and seams to provide a leakproof, secure, and noncorrosive installation.

C. Warranty on Finishes: Manufacturer agrees to repair or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standard: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" unless otherwise indicated. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. FM Approvals' Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-105. Identify materials with name of fabricator and design approved by FM Approvals.

2.2 SHEET METAL

A. Zinc-Tin Alloy-Coated Stainless Steel: ASTM A 240/A 240M, Type 304, fully annealed stainless-steel sheet, not less than 0.015 inch thick, with 0.787-mil thickness zinc-tin alloy coating applied to each side; with factory-applied gray preweathering.

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. Revere Copper Products, Inc.

2.3 ACCESSORIES

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

D. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.

1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
3. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.

E. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

F. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to the design, dimensions, geometry, metal thickness, and other characteristics of item indicated.

B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that are capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with cited sheet metal standards. Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.

B. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

C. Seams: Fabricate nonmoving seams with flat-lock seams.

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to a width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.
2. Do not pretin zinc-tin alloy-coated stainless steel.
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.

E. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating.

1. Coat concealed side of aluminum with bituminous coating where it contacts wood, ferrous metal, or cementitious construction.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

B. Warranties: Provide manufacturer's standard written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes for the period of 10 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting design pressures indicated on Drawings.

2.2 ROOF SPECIALTIES

A. Gutters and Downspouts:

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. Architectural Products Company.
    b. Castle Metal Products.
    c. Hickman Company, W. P.
    d. Metal-Fab Manufacturing, LLC.

2. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish expansion joints and expansion-joint covers.

    a. Gutter Style: Ogee.
    b. Aluminum: 0.050 inch thick.
    c. Prepainted, Zinc-Coated Steel: 0.034 inch thick.
    d. Gutter Supports: Gutter brackets Straps Spikes and ferrules Manufacturer's standard supports as selected by Architect with finish matching the gutters.

3. Downspouts: Corrugated rectangular with mitered elbows. Furnish wall brackets of same material and finish as downspouts, with anchors.

    a. Formed Aluminum: 0.050 inch thick.
    b. Prepainted, Zinc-Coated Steel: 0.034 inch thick.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces. Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
    1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped.
    1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper as recommended by manufacturer for use and finish indicated.

B. Aluminum Finish: Class I, color anodic finish; complying with AAMA 611.

C. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 coating designation. Prepare, pretreat, and apply coating to comply with ASTM A 755/A 755M.

D. Felt Underlayment: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felts.

E. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.

    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. Carlisle Residential; a division of Carlisle Construction Materials.
        b. Grace Construction Products; W.R. Grace & Co. -- Conn.
        c. Owens Corning.

F. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements.

    1. Exposed Penetrating Fasteners: Gasketed screws with heads matching color of metal.
    2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel.

G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant.

H. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement.

B. Coat back side of aluminum roof specialties with bituminous coating where they will contact wood, ferrous metal, or cementitious construction.

C. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

F. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

G. Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Low-Emitting Materials: Sealants shall comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes Section 018113.36 - Sustainable Design Requirements - National Green Building Standard Section 018113.43 - Sustainable Design Requirements - ASHRAE 189.1 Section 018113.53 - Sustainable Design Requirements - Green Globes.

B. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

C. Sealant for Use in Building Expansion Joints, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 50; for Use NT.

    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) Dow Corning Corporation.
        2) GE Construction Sealants; Momentive Performance Materials Inc.
        3) Sika Corporation; Joint Sealants.

2. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 100/50; for Use NT.

    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) GE Construction Sealants; Momentive Performance Materials Inc.

2) Sika Corporation; Joint Sealants.

D. Sealant for General Exterior Use Where Another Type Is Not Specified, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

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) Dow Corning Corporation.
2) GE Construction Sealants; Momentive Performance Materials Inc.
3) Sherwin-Williams Company (The).

2. Single-component, nonsag urethane sealant, ASTM C 920, Type S; Grade NS; Class 25; and for Use NT.

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) BASF Corporation; Construction Systems.
2) Bostik, Inc.
3) Sherwin-Williams Company (The).
4) Sika Corporation; Joint Sealants.

3. Single-component, nonsag polysulfide sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

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) W. R. Meadows, Inc.

E. Sealant for Exterior Traffic-Bearing Joints, Where Slope Precludes Use of Pourable Sealant:

1. Single-component, nonsag urethane sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use T.

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) BASF Corporation; Construction Systems.
2) LymTal International Inc.

F. Sealant for Exterior Traffic-Bearing Joints, Where Slope Allows Use of Pourable Sealant:

1. Single-component, pourable urethane sealant, ASTM C 920, Type S; Grade P; Class 25; for Use T.

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) BASF Corporation; Construction Systems.
2) Pecora Corporation.
3) Sherwin-Williams Company (The).

G. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and around Plumbing Fixtures:

1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.

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) Dow Corning Corporation.
2) GE Construction Sealants; Momentive Performance Materials Inc.
3) May National Associates, Inc.; a subsidiary of Sika Corporation.

H. Sealant for Interior Use at Perimeters of Door and Window Frames:

1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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) BASF Corporation; Construction Systems.
2) May National Associates, Inc.; a subsidiary of Sika Corporation.
3) Sherwin-Williams Company (The).

2.2 MISCELLANEOUS MATERIALS

A. Provide sealant backings of materials that are nonstaining; 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, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

D. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 1193.

B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS

GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

B. Furnish labor, materials and equipment to install all wood doors shown on drawings and / or specified herein.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS

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. Masonite.
2. Pioneer Industries.
3. Stanley.
4. Windsor Door.

B. Fire-Rated Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. At vertical exit enclosures and exit passageways, provide doors that that have a temperature rise rating of 450 deg F.

C. Doors: Complying with SDI A250.8 for level and model and SDI A250.4 for physical-endurance level indicated, 1-3/4 inches thick unless otherwise indicated.

1. Interior Doors: Level 1 and Physical Performance Level C (Standard Duty) or greater.
2. Exterior Doors: Level 2 and Physical Performance Level B (Heavy Duty) or greater, Model 2 (Seamless), metallic-coated steel sheet faces.

    a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Hardware Reinforcement: Fabricate according to SDI A250.6 with reinforcement plates from same material as door face sheets.

D. Glazing Stops: Non-removable stops on outside of exterior doors and on secure side of interior doors; screw-applied, removable, glazing stops on inside, fabricated from same material as door face sheet in which they are installed.

E. Grout Guards: Provide where mortar might obstruct hardware operation.

F. Prepare doors and frames to receive mortised and concealed hardware according to SDI A250.6 and BHMA A156.115.

G. Reinforce doors and frames to receive surface-applied hardware.

H. Prime Finish: Manufacturer's standard, factory-applied coat of lead- and chromate-free primer complying with SDI A250.10 acceptance criteria.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G60 or A60.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

D. Material for frames, stops, casings, etc., shall comply with the requirement of Division 6.

E. Finish hardware shall comply with Division 8.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pre-hung Doors: The contractor may, if he chooses, deliver wood doors to the job pre-hung and complete with frames and casings.

B. Install door frames plumb and true without springing and binding according to manufacturer’s recommendations.

C. Install doors to provide clearances between doors and frames as indicated in SDI A250.11.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer.

E. Sealant to be installed where door frame construction to make installation weather proof.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Samples for factory-finished doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

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

1. Graham Wood Doors; ASSA ABLOY Group company.
2. Marlite.
3. Mohawk Flush Doors, Inc.
4. Vancouver Door Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: WDMA I.S.1-A.

B. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes

C. Before retaining "Low-Emitting Materials" Paragraph below, verify availability with manufacturers.

D. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

E. WDMA I.S.1-A Performance Grade:

1. Heavy duty unless otherwise indicated.
2. Standard Duty: Closets (not including janitor's closets) Private toilets and where indicated.

F. Fire-Rated Wood Doors: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Where indicated, and or At vertical exit enclosures and exit passageways], provide doors that have a temperature rise rating of 450 deg F.

2. Provide core specified or mineral core as needed to provide fire-protection rating indicated.

2.3 FLUSH WOOD DOORS

A. Veneer-Faced Doors for Transparent Finish (where indicated within the construction documents):

1. Interior Hollow-Core Doors: Premium grade, seven-ply, standard hollow cores with lock blocks on both sides.

a. Faces: Grade A, As indicated within architect’s construction documents.
b. Veneer Matching: as indicated within the construction documents, as well pleasing in match. Visible veneer doors must be consistent throughout the home.
c. Pair matching.

B. Doors for Opaque Finish:

1. Interior Hollow-Core Doors: Standard hollow cores with lock blocks on both sides.

a. Faces: Medium-density overlay or any closed-grain hardwood.

C. Factory-fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

D. Factory-machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

E. Cut and trim openings to comply with referenced standards.

1. Trim light openings with moldings indicated.

F. Factory-finish doors indicated for transparent finish with stain and manufacturer's standard finish complying with WDMA TR-4, conversion varnish, and or WDMA TR-6, catalyzed polyurethane for grade specified for doors.

1. Sheen: Satin.

G. Factory-finish doors indicated for opaque finish with manufacturer's standard finish complying with WDMA OP-4, conversion varnish, and or WDMA OP-6, catalyzed polyurethane for grade specified for doors.

1. Sheen: Satin, and or Semigloss.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors to comply with manufacturer's written instructions and WDMA I.S.1-A, and as indicated.

1. Install fire-rated doors to comply with NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

B. Align and fit doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

C. Clearances: As follows unless otherwise indicated:

1. 1/8 inch at heads, jambs, and between pairs of doors.
2. 1/8 inch from bottom of door to top of decorative floor finish or covering.
3. 1/4 inch from bottom of door to top of threshold.
4. Comply with NFPA 80 for fire-rated doors.

END OF SECTION 081416

SECTION 081423 - CLAD WOOD DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MOLDED-HARDBOARD-FACED DOORS

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

1. Jeld-Wen, Inc.
2. Masonite International Corporation.

B. Fire-Rated Wood Doors: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at positive pressure according to NFPA 252 or UL 10C.

C. Certified Wood: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes.

D. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

E. Faces: 1/8-inch- thick tempered hardboard, molded to panel configuration indicated, with smooth finish and or wood grain finish yet must be consistent throughout the home unit's construction.

1. Panel Configuration: as indicated per architectural/construction drawings. E.g., such as flush, 1-panel, 2-panel, 4-panel, or 6-panel. All must be consistent with a home units.

F. Hollow-Core Doors with Hardboard Faces: Three-ply or greater (yet must be consistent throughout a unit), hollow cores with lock blocks on both sides.

1. Core: Honeycomb or grid core routed to provide clearance for recessed areas of faces and provide full contact at remainder of faces.
2. Stiles and Rails: Softwood, 1-1/4-inch- wide stiles and 2-1/2-inch- wide rails.

G. Factory-fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

H. Factory-machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

I. Factory-finish doors with manufacturer's standard primer and opaque finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with WDMA's "How to Store, Handle, Finish, Install, and Maintain Wood Doors."

1. Install fire-rated doors to comply with NFPA 80.

B. Align and fit doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

END OF SECTION 081423

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing per the following:

1. Vertical Access Doors: NFPA 252 or UL 10B.
2. Horizontal Access Doors and Frames: NFPA 288.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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. Access Panel Solutions.
2. Acudor Products, Inc.

B. Flush Access Doors with Exposed Flanges: Prime-painted steel units.

C. Flush Access Doors with Concealed Flanges: Prime-painted steel units with gypsum board bead flange.

D. Recessed Access Doors: Prime-painted steel pan recessed [**1/2 inch**] [**5/8 inch**] with gypsum board bead for concealed flange installation.

E. Aluminum, Flush Access Doors (where applies): Clear anodic finish with exposed flanges.

F. Fire-Rated, Flush Access Doors with Exposed Flanges: Prime-painted steel, self-latching units with automatic closer.

G. Fire-Rated, Flush Access Doors with Concealed Flanges: Prime-painted steel, self-latching units with automatic closer.

H. Locks: Flush to finished surface, screwdriver operated.

2.3 MATERIALS

A. Steel Sheets: ASTM A 1008/A 1008M or ASTM A 591/A 591M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, with G60 or A60 coating.

C. Stainless-Steel Sheets: ASTM A 666, Type 304, with No. 4 directional satin finish.

D. Aluminum Sheet: ASTM B 209, Alloy 5005-H15.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors and panels accurately in position. Adjust hardware and door and panels for proper operation.

B. Install fire-rated access doors and panels according to NFPA 80.

END OF SECTION 083113

SECTION 085113 - ALUMINUM WINDOWS & STORM DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

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. Alenco.
2. Columbia.
3. EFCO Corporation.
4. Ideal.
5. Public Supply Company.
6. Thermal Windows, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Window Certification: AMMA certified with label attached to each window.
2. Performance Class: R.
3. Performance Grade: 30.

B. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F.

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

D. Windborne-Debris Resistance: Windows pass enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886.

2.3 ALUMINUM WINDOWS

A. Window Types: The following types, as indicated on Drawings:
1. Single hung.

B. Construction: Provide units with a concealed, thermal break.

C. Finish: Class II, bronze color anodic finish; complying with AAMA 611.

D. Trim: Provide indicated trim, matching material and finish of frame members.

E. Equip units with charcoal-gray, coated-aluminum mesh insect screens at operable sashes.

F. Glaze units with clear, low-E-coated, argon-filled, sealed insulating glass, complying with Section 088000 "Glazing."

2.4 ALUMINUM STORM DOORS

A. Self-storing aluminum storm door:
1. Equal to Columbia “Cobra”.
2. 2 light, 1 ¼” thick.
3. Pre-hung from “Z” bar sub-frame.
4. Kick panel .062 thick.
5. Sash unit 1/8” thick tempered glass in extruded aluminum frame.
6. Aluminum screen: 16 x 18 mesh.
7. Heavy-Duty pneumatic door closer, 2 pair hinges, latch with exterior handle and interior locking mechanism, Zinc plated wind chain, adjustable door bottom with vinyl sweep.
8. Baked enamel finish. Color as selected

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.

B. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

E. Clean glass and aluminum surfaces immediately after installing windows and storm doors. Remove nonpermanent labels from glass surfaces.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Hardware schedule.

PART 2 - PRODUCTS

2.1 HARDWARE

A. Hinges:

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. Baldwin Hardware Corporation.
    b. Ives; an Allegion brand.
    c. McKinney Products Company; an ASSA ABLOY Group company.
    d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2. Brass/bronze hinges with stainless-steel pins for exterior.
3. Two hinges for 1-3/8-inch- thick wood doors.
4. Three hinges for 1-3/4-inch- thick doors 90 inches or less in height.

B. Locksets and Latchsets:

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. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
    b. SARGENT Manufacturing Company; ASSA ABLOY.
    c. Schlage; an Allegion brand.
    d. Weiser Lock Corp.
    e. Yale Security Inc; an ASSA ABLOY Group company.

2. BHMA A156.2, Series 4000, Grade 2 for bored locks and latches.
3. Lever handles on locksets and latchsets,.

C. Key locks to Owner's new master-key system.

1. Cylinders with six-pin tumblers.
2. Provide cylinders for overhead doors, and other locking doors that do not require other hardware.

3. Provide construction keying.
4. Provide key control system, including cabinet.

D. Provide wall stops or floor stops for doors without closers.

E. Hardware Finishes:

1. Hinges: Matching finish of lockset/latchset.
2. Locksets, Latchsets, and Exit Devices: Oil-rubbed, oxidized bronze;.
3. Other Hardware: Matching finish of lockset/latchset.

F. Door Viewer:

1. Front Entrance Door: National Manufacturing “Eagle Eye”, wide angle, model V-805.
2. Mount 5’-0” above finish floor to center of view glass.

G. Electric Chimes:

1. Front Entrance Door Lighted Push Button: Nutone, Model PB-16L.

2. Hallway Chimes: Nutone, Model LB-14.

3. Attic Transformer: Nutone, Model 101-N.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware in locations required to comply with governing regulations and according to SDI A250.8 and DHI WDHS.3.

B. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet.

C. Deliver keys to Owner.

3.2 HARDWARE SCHEDULE

A. Hardware Set No.01: All Exterior Doors to Dwelling Units & Interior Door to Garage

1. Hinges.
2. Bored entry handleset (F94).
3. Bored auxiliary deadlock, key both sides.
4. Stop – Save-a-Wall Model M-10, Casey Enterprises.
5. Door viewer.
6. Threshold and weather stripping.

B. Hardware Set No.02: Doors to Bathrooms & Master Bedroom

1. Hinges.
2. Bored privacy, bedroom or bath lock (F76).
3. Stop – Save-a-Wall Model M-10, Casey Enterprises.

C. Hardware Set No.03: All Double Doors (Where Required)

1. Hinges.
2. (2) Dummy Knobs.
3. (2) Ball Catches.

D. Hardware Set No.04: All Other Bedroom & Closet Doors

1. Hinges.
2. Passage latchset
3. Stop – Save-a-Wall Model M-10, Casey Enterprises

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

PART 2 - PRODUCTS

2.1 GLASS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

E. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.

2.2 GLASS PRODUCTS

A. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS; Type I; Quality-Q3.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

2.3 GLAZING SEALANTS

A. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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. Bostik, Inc.
b. Dow Corning Corporation.
c. GE Construction Sealants; Momentive Performance Materials Inc.
d. Sika Corporation.
e. Tremco Incorporated.

B. Low-Emitting Materials: Sealants shall have a VOC content of not more than 250 g/L.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."

B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

3.2 INSULATING-GLASS TYPES

A. Glass Type : Low-E-coated, clear insulating glass.

1. Overall Unit Thickness: 5/8 inch (16 mm).
2. Thickness of Each Glass Lite: 4 mm.
3. Outdoor Lite: Annealed or Heat-strengthened float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Annealed float glass.
6. Visible Light Transmittance: 75 percent minimum.
7. Safety glazing where required.

END OF SECTION 088000

SECTION 092613 - GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 GYPSUM VENEER PLASTER

A. Gypsum Veneer Plaster: ASTM C 587, one and or two-component veneer plaster system.

1. One-Component Gypsum Veneer Plaster:

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) Georgia-Pacific Building Products.
2) National Gypsum Company.
3) United States Gypsum Company.

2. Two-Component Gypsum Veneer Plaster:

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) National Gypsum Company.
2) United States Gypsum Company.

2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Base for Veneer Plaster: ASTM C 1396/C 1396M, in thicknesses indicated. Regular type unless otherwise indicated, Foil backed where indicated, Type X where indicated, and or Type as required for specific fire-resistance-rated assemblies.

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

    a. CertainTeed Corporation.
    b. Georgia-Pacific Building Products.
    c. National Gypsum Company.
    d. United States Gypsum Company.

C. Backing Panels for Multilayer Application: ASTM C 1396/C 1396M, in thicknesses indicated. Same type as face layer unless otherwise indicated. Foil backed where indicated.

D. Cementitious Backer Units: ANSI A118.9 or ASTM C 1288, in thicknesses indicated.

2.4 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized-steel sheet, or aluminum-coated steel sheet; rolled zinc, plastic, or paper-faced, galvanized-steel sheet, galvanized-steel sheet, or aluminum-coated steel sheet, or rolled zinc plastic, paper-faced, galvanized-steel sheet.

1. Provide corner bead at outside corners unless otherwise indicated.
2. Provide LC-bead (J-bead) at exposed panel edges.
3. Provide control joints where indicated.

B. Aluminum Accessories: Extruded aluminum, in profile indicated, and with corrosion-resistant primer compatible with veneer plaster.

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. Fry Reglet Corporation.
    b. Gordon, Inc.

C. Joint-Reinforcing Materials: ASTM C 587.

1. Joint Tape: As recommended by gypsum veneer plaster manufacturer for applications indicated.
2. Embedding Material: As recommended by gypsum veneer plaster manufacturer.

D. Cementitious Backer Unit Joint-Treatment Materials: As recommended by cementitious backer unit manufacturer.

E. Bonding Agent: ASTM C 631, polyvinyl acetate.

F. Sound-Attenuation Blankets: ASTM C 665, Type I (un faced).

G. Acoustical Sealant for Exposed and Concealed Joints: Non sag, paintable, non staining latex sealant complying with ASTM C 834.

1. Sealants shall have a VOC content of 250 g/L or less.
2. Sealants 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."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panel products to comply with ASTM C 844 and as follows:

1. Isolate veneer plaster assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
3. Multilayer Fastening Methods: Fasten base layers with screws, and face layers to base layers with adhesive and supplementary fasteners.

B. STC-Rated Assemblies: Comply with ASTM C 919 for locating edge trim and closing off sound-flanking paths around or through assemblies.

C. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

D. Cementitious Backer Units: Comply with ANSI A108.11.

E. Apply bonding agent to dry concrete, masonry, and or cementitious backer units where finish is to cover.

F. Apply gypsum veneer plaster to comply with ASTM C 843 and manufacturer's written recommendations.

1. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch. Fill all voids and imperfections.
2. Two-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch. Fill all voids and imperfections. Trowel apply finish-coat plaster over base-coat plaster to uniform thickness of 1/16 to 3/32 inch.
3. Radiant-Heat, Two-Component Gypsum Veneer Plaster Ceilings: Apply plaster base coat to sufficiently cover electric heating cables. Trowel plaster parallel in direction of cables to uniform thickness of 3/16 inch. Completely cover cables.

After base coat has developed sufficient bond, apply finish coat. Trowel plaster to uniform thickness of 1/16 to 3/32 inch.

4. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
5. Provide finish as indicated.

END OF SECTION 092613

SECTION 092900 - GYPSUM BOARD

GENERAL

A.1 SECTION REQUIREMENTS

A. Submittals: Product data.

B. Related Work:

1. Joint Finish and Texture: Sheetrock joint finishing and texture is called for under Division 9A. This Sub-Contractor shall state in his proposal to General Contractor if joint finishing is included or excluded.

2. Division 6 – Finish Carpentry and Millwork.

    a. Note: Wood Framing: Check the spacing and alignment of wood framing members before installation. Carpenter shall correct members found out of line. The installation of any wallboard shall be considered in acceptance of framing system.

3. Division 9 - Painting

PRODUCTS

A.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

A.3 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints.

B. Gypsum Wall Board: Shall be ½” thick min. (exception 5/8” thick; where and if indicated and required by local codes; and shall not vary less than if local code requires 5/8”gyp bd. For General assembly of all walls; except walls between the living unit and the garage, of which shall be 5/8” fire-rated. Gypsum board ceilings shall be 5/8”. Moisture resistant wallboard shall be same as above and installed on all bathroom and laundry room walls and ceilings, as scheduled.

C. Drywall Accessories: Shall be galvanized steel and shall include Standard Corner Bead 1”x1 ¼”.

D. Tape and Bedding: Material shall be equal to U.S.G. Perf-A-Tape.

E. Interior Gypsum Board: ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges. Type X where indicated. Type as required for specific fire-resistance-rated assemblies Sag-resistant type for ceiling surfaces where indicated.

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. American Gypsum.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. United States Gypsum Company.

F. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges.

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. American Gypsum.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. United States Gypsum Company.

G. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, in thickness indicated. Regular type unless otherwise indicated. Type X where required for fire-resistance-rated assemblies and where indicated.

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. American Gypsum.
b. Georgia-Pacific Building Products.
c. Temple-Inland Building Products by Georgia-Pacific.
d. United States Gypsum Company.

H. Cementitious Backer Units: ANSI A118.9, ASTM C 1288, or ASTM C 1325.

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. C-Cure.
b. CertainTeed Corporation.
c. James Hardie Building Products, Inc.
d. United States Gypsum Company.

A.4 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet. For exterior trim, use accessories formed from hot-dip galvanized-steel sheet, plastic, or rolled zinc.

1. Provide cornerbead at outside corners unless otherwise indicated.
2. Provide LC-bead (J-bead) at exposed panel edges.
3. Provide control joints where indicated.

B. Joint-Treatment Materials: ASTM C 475/C 475M.

1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
2. Joint Compounds: Drying-type, ready-mixed, all-purpose compounds, or Setting-type taping compound and drying-type, ready-mixed, compounds for topping. Use setting-type compounds at exterior soffits.
3. Skim Coat: For final coat of Level 5 finish, use.

C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes.

D. Textured Finish where applies and or indicated: Polystyrene aggregate ceiling finish where indicated.

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. Georgia-Pacific Building Products.
b. National Gypsum Company.
c. United States Gypsum Company.

E. Textured Finish where applies and or indicated: Aggregate finish where indicated.

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

a. CertainTeed Corporation.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. United States Gypsum Company.

F. Textured Finish where applies and or indicated: Acoustical finish where indicated.

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. International Cellulose Corp.
b. United States Gypsum Company.

EXECUTION

A.5 INSTALLATION

A. Furnish all labor and material to install all drywall work shown on plans and described herein. All material stored on the job shall be be neatly stacked in a dry place.

B. Gypsum Board Application: Gyp. Board is installed over wood studs. Apply sheets to the studs and follow the printed instruction of manufacturer. Apply perpendicular to framing.

C. Boards shall extend to within ¼" of the floor, but shall not touch the floor and to the plate as shown.

D. Gypsum board shall be nailed to the studs with 1 ¼" GWB-54, ¼" head nail, spaced 8" o.c. on edges and 12"o.c. in field for ½" gyp, use 1 3/8" for 5/8" gyp. board.

E. Where fiberglass tub or fiberglass shower is on an exterior wall, insulated and install poly-film as specified elsewhere. Then install moisture resistance gyp. Board wall on exterior wall before tub is installed. After tub or shower is installed, apply second layer of moisture resistant gyp-board to cover edge tabs.

F. As work progress, waste material shall be removed from the job site, keeping the building and site cleared and orderly. Work in harmony with other trades that need to install bucks, supports, hangers, doors, windows and insulation.

G. Do not apply wallboard until all in-wall plumbing, electrical and mechanical lines and devices are installed, inspected and approved. Do all cutting of wallboard for Plumber and Electrician.

H. Special care shall be taken to "cut to fit" electrical boxes and plumbing pipes.

I. Install gypsum board to comply with ASTM C 840.

1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws; and or with screws, and face layers to base layers with adhesive and supplementary fasteners.

J. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

K. Finishing Gypsum Board: ASTM C 840.

1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.

2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

L. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

M. Joint Treatment and Textures Finish:
1. All joints in gypsum board shall be bedded and taped and all exposed surfaces finished in a texture. Install Perf-A-Tape (or equal industry product) in accordance with directions of manufacturer, taping all joints in gyp-board including vertical, horizontal and inside corners. All outside corners shall have standard metal corner.

2. This portion of the work shall be done by skilled trade mechanics. All joints must be brought to a true and uniform surface. The amount of joint work required will depend upon the framing and erection of gyp-board.

3. Use a steel trowel and extend mud as much as 12” from joint to provide a smooth uniform surface. The joint system shall be inspected under good light and approved before any texture is applied.

4. Surfaces to receive texture shall have one heavy coat of texture applied to surface, finishing in a light stipple. Texture may be roller applied or blown on.

5. Clean drywall and adjoining surfaces including the edges of casings, doors, floors, etc. and repair any damage from such case.

END OF SECTION 092900

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data and Samples. This contract includes all labor and material required for the installation of vinyl tile flooring as called within the Finish Schedule and as specified hereinafter. The Contractor shall submit actual samples of the floor covering to the Housing Authority for approval and to the project's Architectural manager. Include full color and or pattern selection.

B. Extra Materials: Deliver to Owner at least 10 linear feet larger patterns provide piece that shows pattern, in roll form and in full roll width, for each type and color of resilient sheet flooring installed.

C. The Housing Authority shall approve all colors. The materials hereinafter mentioned are intended to specify a quality of material.

D. Location of floor covering is designated on the Finish Schedule of the project documents. Unless referred elsewhere within the documents.

E. Indicate in drawing location of seams within room(s). Reduce seam occurences so to have as few as possible seams to the center of open rooms and walkways. Confer with Housing Authority and Architectural project manager any seam discrepancies or concerns. Determine and note compatibleness with other materials that come into contact and or adjacent surroundings.

PART 2 - PRODUCTS

2.1 UNBACKED VINYL SHEET FLOORING

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. Armstrong World Industries, Inc.
2. Forbo Flooring Systems.
3. Johnsonite; a Tarkett company.
4. Shaw Contract Group; a Berkshire Hathaway company.

B. Unbacked Sheet Vinyl Floor Covering: ASTM F 1913, 0.080 inch minimum thick.

C. Wearing Surface: Smooth and or Embossed. Highest wear layer possible. Wear layer surface .020in. (.05mm) min.

D. Sheet Width: 6.6 feet.

2.2 INSTALLATION ACCESSORIES

A. Trowel able Leveling and Patching Compounds: Latex-modified, portland-cement- or blended-hydraulic-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

1. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 For Homes.

C. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

1. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 For Homes.

A. Floor Polish: Protective liquid floor polish products as recommended by manufacturer. Polish shall be provided only if product manufacturer recommends for standard wear and usage of flooring within one day to one year of use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

B. Floor covering shall not be undertaken until after completion of all other work except moveable or detachable equipment.

C. Any floor too rough for direct application shall be machine sanded, or as otherwise directed for the removal of irregularities. Cracks and depressions shall be filled with latex underlayment.

D. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

E. Maintain uniformity of resilient sheet flooring direction, and match edges for color shading at seams.

F. Lay-in full bed of adhesive, with all joints straight and tight. Sheet vinyl shall be laid symmetrically about center of rooms.

G. Where there is no metal threshold and where covering does not extend into adjoining room, provide 2” vinyl edging strip under doors and openings. Heat twenty-four hours before laying floor and continue to heat.

H. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in substrates.

I. Cleaning: Remove surplus material from floors and adjoining surfaces. When building is otherwise complete, clean surfaces of any foreign matter and buff.

Floor Polish: Polish shall be provided only if product manufacturer recommends for standard wear and usage of flooring within one day to one year of use.

1. Remove soil, visible adhesive and surface blemishes from floor covering before applying liquid floor polish. Revise subparagraph below to suit products selected.

2. Apply as product and polish manufacturer’s recommended coat(s).

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING (including vinyl plank type products)

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data and Samples. This contract includes all labor and material required for the installation of vinyl-composition tile flooring as called for within the Finish Schedule and as specified hereinafter. The Contractor shall submit actual samples of the floor covering to the Housing Authority for approval and to the project's Architectural manager. Include full color and or pattern selection.

B. The Housing Authority shall approve all colors. The materials hereinafter mentioned are intended to specify a quality of material.

C. Location of floor covering is designated on the Finish Schedule of the project documents. Unless referred elsewhere within the documents.

D. Extra Materials: Deliver to Owner one box of each type and color of resilient floor tile installed.

PART 2 - PRODUCTS

2.1 SOLID VINYL TILE (and or vinyl Plank type dimensions).

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. Present 3 styles/manufacturers with full range presented for selection for IHA approval:

1. Armstrong World Industries, Inc.
2. Johnsonite; a Tarkett company.
3. Mannington Mills, Inc.

B. Tile Standard: ASTM F 1700; Class I, monolithic vinyl tile; Type A, smooth surface.

C. Thickness: 0.125 inch. Other thicknesses but no less than minimum must have approval thru the IHA. Include information regarding wear layer and provide highest wear layer appropriate for the homes use. Prefer minimum wear layer of 20mil/.55mm.

D. Size: 12 by 12 inches 18 by 18 inches 24 by 24 inches 36 by 36 inches 3 -7 by 36 - 48 inches. Sizes in planks may vary from manufacturer to manufacturer i.e., 6 by 36 inches. Unless called for specific size of plank and tile will be indicated within the construction documents and all other sizes, must be submitted with written explanation, product specification, and samples for IHA approval.

E. Warranty: Lifetime warranty for residential use and Minimum 5 years Limited warranty for light commercial use. No “seconds or “off-goods” grade products.

2.2 VINYL COMPOSITION FLOOR TILE

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. To be installed if and only indicated within construction documentation of the project, i.e., Room finish schedule.
   2. Submit 3 styles/manufacturers with full range color/pattern according to the finish type noted within the construction document set. Products for selection for IHA approval prior flooring installation:

B. Armstrong; Alterna.
   1. Armstrong World Industries, Inc;.
   2. Congoleum Corporation;.
   3. Earthwerks; Accu Clic Tile 4mm.
   4. Mannington Mills, Inc;.

C. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

D. Wearing Surface: Smooth or Embossed.

A. Thickness: 0.125 inch

B. Size: 12 by 12 inches

C. Any other sizes and thicknesses must be approved by the IHA.

2.3 INSTALLATION ACCESSORIES

A. Trowel able Leveling and Patching Compounds: Latex-modified, Portland-cement- or blended-hydraulic-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

   1. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes.

C. Floor Polish: Protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

B. Lay out tiles so tile widths at opposite edges of room are equal and are at least one-half of a tile.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged in patterns indicated within the construction documents.

D. Floor Polish: Remove soil, visible adhesive and surface blemishes from floor covering before applying liquid floor polish.

1. Apply two coat(s).

END OF SECTION 096519

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data and Samples.

B. Extra Materials: Deliver to Owner (Determine if IHA requires extra materials.) full-width carpet equal to 5 percent of each type and color installed, packaged with protective covering for storage.

PART 2 - PRODUCTS

2.1 **CARPET**, e.g., CPT-1

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. J&J Invision; J&J Industries, Inc.
2. Mannington Mills, Inc.
3. Masland Contract; Dixie Group, Inc. (The).
4. Milliken & Company.
5. Mohawk Group (The); Mohawk Carpet, LLC.
6. Shaw Contract Group; a Berkshire Hathaway company.
7. Shaw Inc.

B. Fiber Content: 100 percent nylon 6, 6, or 100 percent nylon 6, or unless otherwise indicated within the home unit's construction documents.

C. 10 year limited warranty, with 5 year stain warranty that provides stain protection against household food and beverage stains. Unless otherwise indicated by the construction documents.

D. Tested and approved in accordance with the carpet and rug institute of indoor air quality testing and labeling program, or equal comparable.

2.2 **Padding minimum 8# ½ with fiber mesh backing.**

A. Pile Characteristic as indicated: Cut, and or Frieze pile.

B. Face Weight: 24 oz./sq. yd. minimum excluding weight of backings.

C. Primary Backing: Nonwoven, polypropylene or polyester.

D. Secondary Backing: Nonwoven, polypropylene or polyester, and or Fiberglass.

E. Width: 12 feet.

F. Appearance Retention Rating: Moderate traffic, 2.5 minimum per ASTM D 7330.

G. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm per ASTM E 648.

H. Tuft Bind: Not less than 3 lbf for cut pile. Per ASTM D 1335. If construction documents of this home unit is to used for anything other than residence; e.g., minimum average recommended by CRI for school carpet with backing other than unitary backing. INVISTA recommends 5 lbf (22 N) for cut pile and 10 lbf (45 N) for loop pile. More than 5 lbf (22 N) for cut pile and 10 lbf (45 N) for loop pile may be required for high-frequency traffic locations. Where Approval by IHA in the later instance shall be required prior to ordering and or installing.

I. Delamination: Not less than 2.5 lbf/in. per ASTM D 3936.

J. Emissions: Preference to provide carpet that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.3 **CARPET CUSHION**, e.g., CPTC-1

A. Traffic Classification: CCC Class II, heavy or higher traffic.

B. Fiber Cushion: Synthetic and or (with preference to) Resinated recycled textile.
   1. Thickness: no less than 3/8”. plus 5 percent maximum.

C. Polyurethane Foam Cushion: Bonded foam.

   1. Compression Force Deflection at 64 Percent: per ASTM D 3574.
   2. Thickness: no less than 3/8”.

D. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm. Class 1

E. Emissions: Preferences to provide carpet cushion that complies with testing and product requirements of CRI's "Green Label" program for LEED for Homes Credit MR 2.2.

2.4 INSTALLATION ACCESSORIES

A. Carpet Adhesives: Product that complies with flammability requirements for installed carpet and is recommended by carpet and carpet cushion manufacturers for conditions indicated.

   1. Preferences to but not excluding other manufacturers. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes.

B. Tackless Carpet Stripping where applies: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with CRI 104.

B. Carpet Installation Method: Stretch. (An In-direct adhesion only to be used in only case of IHA approved of use of Carpet tile installation.)
   1. Maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position. Bind or seal cut edges as recommended by carpet manufacturer.
   2. Install pattern parallel to walls (and borders (where it applies)).

END OF SECTION 096816

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Include printout of MPI's "MPI Approved Products List" with product highlighted.
2. Samples.

B. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish-coat paint used on Project, in containers, properly labeled and sealed.

C. Before starting work the painter shall submit to the Housing Authority a complete list of the materials he/she intends to use and no material shall be delivered to the premises until such list has been approved.

D. Workmanship in General:

1. Work shall done by skilled mechanics in a workmanlike manner. Paint shall be of proper consistency and left free of brush marks, sages, or other defects.

2. Method of Application: Paint shall be applied with a roller or airless sprayer. All woodwork, metal and trim shall be brush painted, except as noted for pre-finish woodwork.

E. A minimum temperature of 50 degrees Fahrenheit. Shall be maintained where painting is to be being done or is drying. The General contractor shall guarantee all painting as called for in General Requirements.

F. The painter shall furnish all labor, materials, scaffolding, tools, etc., required for painting and wall covering described herein. He shall work in harmony with other trades and protect their work from damage.

G. Extra Materials: Deliver to Owner 1 gal.of each color and type of finish-coat paint used on Project, in containers, properly labeled and sealed.

H. Bathroom, Kitchen, and or laundry adjacent wall areas shall be painted withpaint that is made to be installed and is compatible for use within kitchens, bathrooms, and laundry rooms. Interior finish coat shall provide a washable finish.

I. Storage and Handling:

1. A space will be designated for the storage and mixing of paint, materials and tools. This space shall be adequately protected from damage to floors, walls, etc.

2. Paints shall be kept covered at all times. Take such precautions as needed to prevent fires.

J.

PART 2 - PRODUCTS

2.1 PAINT

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. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Kelly-Moore Paint Company Inc.
4. Pratt & Lambert.
5. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
6. Sherwin-Williams Company (The).
7. Zinsser; Rust-Oleum Corporation.

B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."
1. Primer, Alkali Resistant, Water Based: MPI #3.
2. Primer, Latex: MPI #6.
3. Primer, Alkyd: MPI #5.
4. Latex, Exterior Flat (Gloss Level 1): MPI #10.
5. Latex, Exterior Low Sheen (Gloss Level 3-4): MPI #15.
6. Latex, Exterior Semigloss (Gloss Level 5): MPI #11.
7. Latex, Exterior, Gloss (Gloss Level 6): MPI #119.
8. Alkyd, Exterior Flat (Gloss Level 1): MPI #8.
9. Alkyd, Exterior, Semigloss (Gloss Level 5): MPI #94.
10. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.
11. Alkyd, Quick Dry, Semigloss (Gloss Level 5): MPI #81.
12. Alkyd, Quick Dry, Gloss (Gloss Level 7): MPI #96.

C. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. Colors: As selected and as scheduled.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surfaces unless otherwise indicated.

1. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.

1. Use brushes only where the use of other applicators is not practical.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

3.3 EXTERIOR PAINT APPLICATION SCHEDULE

A. Galvanized Metal:

1. Flat or Low-Sheen Latex: [**Two coats**] over waterborne galvanized-metal primer: MPI EXT 5.3H.
2. Flat, or Low-Sheen Latex: Two coats over primer recommended by topcoat manufacturer for exterior use on galvanized-metal.
3. Flat, or Semigloss, Alkyd: Two coats over primer recommended by topcoat manufacturer for exterior use on galvanized-metal.

B. Aluminum:

1. Flat, or Low-Sheen Latex: Two coats over quick-drying primer for aluminum: MPI EXT 5.4H.

2. Flat, or Semigloss, Alkyd: Two coats over quick-drying primer for aluminum: MPI EXT 5.4F.

C. Wood: Including wood trim, architectural woodwork, doors, windows, wood siding, wood fences, and or wood-based panel products.

1. Flat, or Low-Sheen Latex: Two coats over latex primer: MPI EXT 6.3L.
2. Flat, or Low-Sheen Latex: Two coats over alkyd primer: MPI EXT 6.3A.

D. Plastic Trim:

1. Flat, or Low-Sheen Latex: Two coats over water-basedbonding primer: MPI EXT 6.8A.
2. Flat, or Semigloss Alkyd: Two coats over water-based bonding primer: MPI EXT 6.8B.

E. Exterior Gypsum Soffit Board:

1. Flat, or Low-Sheen Latex: Two, or Three coats: MPI EXT 9.2A.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Include printout of MPI's "MPI Approved Products List" with product highlighted.
2. Samples.

B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.

C. Before starting work the painter shall submit to the Housing Authority a complete list of the materials he/she intends to use and no material shall be delivered to the premises until such list has been approved.

D. Workmanship in General:

1. Work shall done by skilled mechanics in a workmanlike manner. Paint shall be of proper consistency and left free of brush marks, sages, or other defects.

2. Method of Application: Paint shall be applied with a roller or airless sprayer. All woodwork, metal and trim shall be brush painted, except as noted for pre-finish woodwork.

E. A minimum temperature of 50 degrees Fahrenheit. Shall be maintained where painting is to be being done or is drying. The General contractor shall guarantee all painting as called for in General Requirements.

F. The painter shall furnish all labor, materials, scaffolding, tools, etc., required for painting and wall covering described herein. He shall work in harmony with other trades and protect their work from damage.

G. Extra Materials: Deliver to Owner 1 gal.of each color and type of finish-coat paint used on Project, in containers, properly labeled and sealed.

H. Bathroom, Kitchen, and or laundry adjacent wall areas shall be painted withpaint that is made to be installed and is compatible for use within kitchens, bathrooms, and laundry rooms. Interior finish coat shall provide a washable finish.

I. Storage and Handling:

1. A space will be designated for the storage and mixing of paint, materials and tools. This space shall be adequately protected from damage to floors, walls, etc.

2. Paints shall be kept covered at all times. Take such precautions as needed to prevent fires.

J. Related Work:

1. Division 6 – Finish Carpentry and Millwork.

2. Joint Finish and Texture: Sheetrock joint finishing and texture is called for under Division 9A. This Sub-Contractor shall state in his proposal to General Contractor if joint finishing is included or excluded section.

PART 2 - PRODUCTS

2.1 PAINT

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. Benjamin Moore & Co.
2. Devoe.
3. Glidden Professional.
4. Kelly-Moore Paint Company Inc.
5. Pittsburg.
6. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
7. Sherwin-Williams Company (The).
8. Zinsser; Rust-Oleum Corporation.

B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."
1. Primer Sealer, Latex: MPI #50.
2. Primer, Alkali Resistant, Water Based: MPI #3.
3. Primer Sealer, Institutional Low Odor/VOC: MPI #149.
4. Primer, Latex, for Interior Wood: MPI #39.
5. Primer Sealer, Alkyd, Interior: MPI #45.

C. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. Low-Emitting Materials: Comply with Section 018113.26 - Sustainable Design Requirements - LEED 2008 for Homes.

E. Colors: As selected and or scheduled as approved by The Housing Authority. Colors selected and approved on site must be relayed to the project architect manager’s office for proper verification and documentation of project form.

1. Color Selections:
   a. Coordinate texture pattern and method of application with Housing Authority. Paint and stain colors as selected by Housing Authority.
   b. Contractor shall provide 4 color selections, submitted to Housing Authority, on each of the following items:
      1) Exterior Colors: Brick, Roof Shingles.
      2) Interior Colors: Floor Tile, (Carpet, if required), Wall/Ceiling Paint, Transparent Stain and Plastic Laminate Counter-tops.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paints shall be mixed and applied according to manufacturer's directions, using only such thinners as recommended. Materials shall be delivered in their original containers with labels intact and seals unbroken.

C. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

D. Protect floors, equipment and other work from damage during painting operation.

E. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

F. Surfaces shall be free from moisture, and properly prepared to receive finish. Sand between coats and remove all dust, dirt or foreign matter.

G. The finish of walls in kitchens, bathrooms, and laundry areas shall be smooth and be resistant to damage from grease, water, detergents and normal household chemicals.

H. Woodwork shall be cleaned and dusted before painting. Nails in woodwork shall be set by the Carpenter. Wood surfaces shall be sanded smooth before priming.

I. Woodwork, including cracks and nail holes, shall be filled after the first coat with spackling putty. Putty shall be tinted to suit the particular surface.

J. Note: items previously specified as pre-finished in Division 6 of this specification are not included herein.

3.2 APPLICATION

New construction, comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

A. Paint exposed surfaces, new and existing, unless otherwise indicated.

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint the back side of access panels.
4. Color-code mechanical piping in accessible ceiling spaces.
5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

B. Apply paints according to manufacturer's written instructions.

1. Use brushes only where the use of other applicators is not practical.
2. Use rollers for finish coat on interior walls and ceilings.
3. Do not paint in extremely cold weather, frost, or extremely damp weather.
4. Do not paint in dusty areas.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

2. Upon completion of painting operation, examine all painted surfaces and touch up any areas necessary.

3. Do all painting to complete hide of underlying surfaces. Finish coats should be the minimum mil thickness specified in B-935 upon completion.

3.3 INTERIOR PAINT APPLICATION SCHEDULE

A. The following list covers the type of material and the number of coats required.

B. Mil thickness for interior and exterior painting to be as follows:
1. Preparation Coat: 1.5 Mils
2. Finish Coats 3.0 Mils
3. Total Average Thickness 4.5 Mils

C. Wood: Including wood trim, architectural woodwork doors windows, wood-based panel products.

1. Semi gloss Latex: two coats over latex primer for wood: MPI INT 6.3T. Where Latex paint is call for within the construction documents and approved by the IHA.
2. Semi gloss and or Gloss (Only where specifically indicated to have gloss finish surface.) Latex: Two coats over alkyd primer: MPI INT 6.3U. Where Alkyd paint and sheen type is called for within the construction documents and approved by the IHA.
3. Flat Gloss Level 2, and or Semi gloss Institutional Low-Odor/VOC Latex: Two coats over latex primer for wood: MPI INT 6.3V. Where Institutional Low-Odor/VOC Latex is called for within the construction documents and approved by the IHA.
4. Gloss Level 2, and or Semi gloss High-Performance Architectural Latex: Two coats over latex primer for wood: MPI INT 6.3A. Where High-Performance Architectural Latex is called for within the construction documents and approved by the IHA.
5. Semi gloss, and or Gloss (Only where specifically indicated to have gloss finish surface.) Alkyd: Two coats over alkyd primer: MPI INT 6.3B. Where alkyd paint is called for within the construction documents and approved by the IHA.

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D. Gypsum Board
   1. General Areas:
      a. Texture (As Selected by IHA)
      b. Flat Latex: One coat over latex primer/sealer: MPI INT 9.2A.
      c. Flat Low-Odor/VOC Latex: One coat over low-odor/VOC primer/sealer: MPI INT 9.2M.
      d. Semi gloss High-Performance Architectural Latex: one coat over latex primer/sealer: MPI INT 9.2B.

   2. Kitchens and Utility/Laundry Areas:
      a. Texture with knock down trowel applied texture (smooth (As Selected by IHA))
      b. Flat Latex: One coat over texture: MPI INT 9.2A.
      c. Flat (Egg-Shell) Institutional Low-Odor/VOC Latex: Two coats over low-odor VOC primer/sealer: MPI INT 9.2M.
      d. Semi gloss High Performance Architectural Latex: One coat over latex primer/sealer: MPI INT 9.2B.

   3. Full Baths, ¾ baths, and ½ bathrooms.
      a. Texture (smooth (As Selected by IHA))
      b. Flat primer/sealer Low-Odor/VOC Latex: One coat over texture finish.
      c. (Egg-Shell) or Semi gloss (As approved by Housing Authority for project.) enamel Low-Odor/VOC: One coat over low-odor VOC primer/sealer.
      d. (Egg-Shell) or Semi gloss (As approved by Housing Authority for project.) Low-Odor/VOC: One coat over low-odor/VOC.

   4. Spray-Textured Ceilings:
      a. Ceiling in general throughout (including the garage areas).

1) Blown plaster textured ceiling throughout. Finished with sample approved trowel knocked down texture (smooth (As Selected by IHA)). (Garage included.)
2) Flat primer/sealer Low-Odor/VOC Latex: One coat over primer/sealer: MPI INT 9.1A
3) Flat Latex throughout: two coats over latex primer/sealer: MPI INT 9.1A.

b. Ceiling in Laundry rooms, all bathrooms, and enclosed kitchen ceilings (Vertical dry-wall at all 4 walls of a kitchen.).
   1) Blown plaster textured ceiling throughout. Finished with sample approved; trowel knocked down texture (smooth (As Selected by IHA)).
   2) Flat primer/sealer Low-Odor/VOC Latex: One coat over primer/sealer: MPI INT 9.1A
   3) Semi gloss Latex: One coat over alkyd primer/sealer: MPI INT 9.1B.

END OF SECTION 099123

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

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 Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

B. Toilet Tissue Dispenser:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Type: Single-roll dispenser.
3. Mounting: Surface mounted with concealed anchorage.
4. Material: Chrome-plated zinc alloy (zamac) or steel.
5. Operation: Noncontrol delivery with standard spindle.
6. Capacity: Designed for 4-1/2- or 5-inch- diameter-core tissue rolls.

C. Grab Bar:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Material: Stainless steel, 0.050 inch thick.
3. Mounting: Concealed.
4. Gripping Surfaces: Smooth, satin finish.
5. Outside Diameter: 1-1/2 inches for heavy-duty applications.
6. Mounting: Surface.
7. Material: Stainless steel, No. 4 finish (satin).

D. Shower Curtain Rod:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Outside Diameter: 1-1/4 inches.
3. Mounting: Flanges with exposed fasteners.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Medicine Cabinet:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Mounting: Recessed, for nominal 4-inch wall depth.
3. Size: 18 by 24 inches.
4. Door: Framed mirror door concealing storage cabinet equipped with continuous hinge and spring-buffered, rod-type stop and magnetic door catch.
5. Shelves: Three, adjustable.

F. Robe Hook:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Towel Bar:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Description: 3/4-inch- square tube with rectangular end brackets.
3. Mounting: Flanges with concealed fasteners.
4. Length: 18 inches 24 inches 30 inches.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Underlavatory Guard:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
2. Description: Insulating pipe coverings for supply and drain piping assemblies, which prevent direct contact with and burns from piping and allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

C. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

D. Mirrors: ASTM C 1503, mirror glazing quality, clear-glass mirrors, nominal 6.0 mm thick.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation, and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 102800

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

A. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC A117.1.

C. Electric or Gas Range: 30-inch- wide, freestanding range with 4 burners and manual-cleaning oven with broiler unit.

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. Amana; a division of Whirlpool Corporation.
b. General Electric Company (GE Appliances).
c. General Electric Company (Hotpoint).
d. Maytag; a division of Whirlpool Corporation.
e. Sears Brands LLC (Kenmore).
f. Whirlpool Corporation.

2. Color: White.

D. Exhaust Hood: 30-inch , wall-mounted ventilating exhaust hood with three-speed automatic fan.

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. General Electric Company (GE Appliances).
b. General Electric Company (Hotpoint).

c. Maytag; a division of Whirlpool Corporation.
d. Sears Brands LLC (Kenmore).
e. Whirlpool Corporation.

2. Color: White.
3. Fan Control: Hood-mounted switch, with separate light switch.
4. Weatherproof roof cap with back draft damper and rodent-proof screening.

E. Refrigerator/Freezer: Freestanding, frost-free, two-door refrigerator with top-mounted freezer, ABS thermoplastic-copolymer interior cabinet liners.

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. Amana; a division of Whirlpool Corporation.
b. General Electric Company (GE Appliances).
c. General Electric Company (Hotpoint).
d. Maytag; a division of Whirlpool Corporation.
e. Sears Brands LLC (Kenmore).
f. Whirlpool Corporation.

2. Color: White.

3. Fresh Food Compartment Volume: 15.6 cu. ft..
4. Freezer Compartment Volume: 5.13 cu. ft..
5. Shelf Area: Three adjustable glass shelves, 26 sq. ft..
6. Options: Ice maker.
7. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

F. Dishwasher: Built-in, under-counter, automatic dishwasher, sized to replace 24-inch-base cabinet, four wash cycles with hot-air and heat-off drying cycles, porcelain-enamel tub and door liner, nylon-coated sliding dish racks.

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. Amana; a division of Whirlpool Corporation.
b. General Electric Company (GE Appliances).
c. General Electric Company (Hotpoint).
d. Sears Brands LLC (Kenmore).
e. Whirlpool Corporation.

2. Color: White.
3. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

G. Clothes Washer: Freestanding, top-loading, automatic clothes washer with 3.2-cu. ft. capacity porcelain-enamel tub and four wash cycles including regular, delicate, and permanent press; 3/4-hp reversible motor.

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. Amana; a division of Whirlpool Corporation.
b. General Electric Company (GE Appliances).
c. General Electric Company (Hotpoint).
d. Maytag; a division of Whirlpool Corporation.
e. Sears Brands LLC (Kenmore).
f. Whirlpool Corporation.

2. Color: White.
3. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

H. Electric or Gas Clothes Dryer: Freestanding, front-loading clothes dryer, 6-cu. ft. capacity with porcelain-enamel-coated steel interior.

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. Amana; a division of Whirlpool Corporation.
b. General Electric Company (GE Appliances).
c. General Electric Company (Hotpoint).
d. Maytag; a division of Whirlpool Corporation.
e. Sears Brands LLC (Kenmore).
f. Whirlpool Corporation.

2. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

D. Verify that accessories required have been furnished and installed.

END OF SECTION 113100

SECTION 22000 – GENERAL PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. These specifications govern the furnishing of all materials and the installation of the same under the subject of plumbing work.

B. The plumbing contractor is directed to read Special Conditions Turnkey and shall be required to conform to any and all provisions therein.

C. The plumbing contractor is responsible for the work under all Division 22 headings and shall hereinafter in Division 22 of these specifications be referred to as the "Contractor". Plumbing plans, and by reference general and electrical plans, are a part of this specification.

D. The Plumbing plans indicated the extent and general arrangements of the various plumbing systems. Changes in locations or arrangement required by job conditions shall be made by approved Change Order.

1.2 MATERIALS AND EQUIPMENT

A. All work and materials specified are to be new and of the quality described and essentially the standard product of the manufacturer. The use of manufacturers' names in specifying equipment or material herein determines the material or equipment to be used.

B. Unless otherwise specified, where two or more units of the same class equipment or material are to be used for similar purposes, they shall be the products of the same manufacturer. All equipment shall be installed in accordance with the manufacturer's recommendations.

1.3 CLEANING

A. All dirt, rubbish, grease, or stains due to the operations of the Contractor shall be removed from all floors, walls, fixtures, etc., with the premises left in perfect condition. All plumbing equipment under this contract shall be set and connected, ready for operation.

1.4 PERMITS AND FEES

A. Contractor shall secure all necessary permits or licenses to carry work, and shall pay all lawful fees, taxes, etc., in connection with the work. Contractor shall arrange for all tests and inspections on any or all parts of work, required by authorities and organizations having jurisdiction, and shall pay all charges for the same.

1.5 LAW AND ORDINANCES

A. Work performed shall be in accordance with all local and state or national codes, laws and ordinances pertinent to such work. In case of any conflict wherein methods or standards on installation of materials specified do not equal or exceed requirements of laws of ordinances but not specified or shown on the drawings shall be furnished without extra charge as if shown or specified.

1.6 JOB FORMAN

A. The Contractor shall have a competent representative available at all times while the project is under construction who will be responsible for coordination of the trades and installation of the work according to plans and specifications.

1.7 WORK TO BE PERFORMED BY OTHER TRADES

A. Electrical Subcontractor is responsible for all wiring, including interconnecting wiring between controls and any electrical temperature control wiring.

B. The Developer will perform the following work in connection with the mechanical contract.
   1. Build into building construction all pipe sleeves, bolts and inserts necessary for supporting mechanical equipment. These items will be furnished by the Contractor and will be set in place by him.
   2. Provide all chases, shafts and recesses necessary for installation of all mechanical equipment and furring necessary to conceal piping, ductwork, etc. The Contractor shall provide all necessary information as to size, exact location of chases, recesses, furring, etc., required.
   3. Provide wall, floor, and roof openings necessary for the installation of the mechanical systems. Contractor shall provide exact size and location of such openings, and shall be responsible for completed installations being watertight and waterproof.
   4. Provide bases and supports for principle items of mechanical equipment. He Contractor shall provide exact size and location and shall be responsible for all bases and supports other than these specified above.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS (O&M)

A. The Developer shall furnish the Indian Housing Authority (IHA) two bound sets of operating and maintenance instructions covering all equipment furnished under specifications for each total contract. The instructions shall be assembled in an indexed brochure. Separate equipment brochures will not be acceptable. NOTE: These manuals must be delivered to the above before final payment.

B. A competent supervisor shall instruct the IHA representative in the care, operation, and maintenance of the equipment.

1.9 PROTECTION OF MATERIAL AND WORK

A. Protect and preserve all materials, supplies and equipment and all work performed.

1.10 FINAL AND GUARANTEE

A. Nothing herein contained may be construed to relieve the Developer and Contractor from making good and perfect work in all details of construction of installation, and they will be held responsible to provide and furnish necessary material, and to perform all necessary labor, and to bear all expenses incidental to the satisfactory completion of the work embraces herein.

B. At final inspection, prior to purchase by the Indian Housing Authority, the Developer and Contractor shall demonstrate completely the system and equipment performance. Developer and Contractor shall guarantee all labor, material, and equipment furnished under this contract against any defects developing from faulty or poor workmanship or material for a period of one (1) year from the date of final acceptance by the Indian Housing Authority. The Developer or Contractor shall remedy any defect appearing within that time without extra charge to the Indian Housing Authority within a reasonable time after notice. The term “defect” excludes occurrences, as would normally follow improper treatment, accident, or wear and tear of normal use.

C. Furnish written guarantees for each piece of equipment so covered by manufacturer’s warranties. These shall be furnished for each dwelling unit and shall be bound, indexed and labeled for the appropriate dwelling.

1.11 SINGULAR NUMBER

A. Where any device or part of equipment is herein referred to in the singular number (such as “the pump”), such reference shall be deemed to apply to as many devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCOPE

A. The work performed under this heading includes all labor, materials, and equipment to complete the various piping systems for plumbing, drainage and heating, including all pipe fittings, insulation, and valves as shown on the plans and specifications. Contractor shall keep a competent foreman on the premises while his work is in progress.

B. All piping shall be run substantially as shown on the plans and shall be run in the most direct manner, make the piping conform to the building construction and shall be made without extra charge. Each section of pipe and all fittings, valves, etc., shall be inspected and thoroughly cleaned inside before being installed. All piping and fittings shall have working pressure

ratings suitable for the operating pressures to which they will be subject. All defective pipe, fittings, valves, and other material installed shall be removed and replaced with new and good material. Pipe shall be cut accurately to measurements established at the site and worked into place without springing or forcing. Ream ends of all cut pipe.

C. The plumber shall furnish material, labor, and transportation required for performance of the work herein described. He shall keep a competent foreman on the premises while work is in progress.

D. Contractor shall obtain necessary permits and pay all fees therefore. He shall be responsible for damage to property caused by him or his employees. He shall protect his work from damage and work in harmony with other trades.

E. From time to time as the work progresses, he shall remove all rubbish and accumulation resulting from his work. Plumbing work shall comply with all laws having jurisdiction of the work including the Local Code, State Health Department and the BOCA Plumbing Code.

F. The Plumber shall examine the general plans and specifications, and make sure he understands the conditions under which he must work. He must visit the building site and secure firsthand information regarding the location and depth of water, gas and sewer lines.

G. Refer to foundation plan and notice the depth and location of grade beams. If necessary to run lines through concrete bean, provide sleeves in concrete.

H. Piping shall be installed in a manner to insure absence of vibration, rubbing or other objectionable noises. All necessary expansion requirements must be provided.

I. Pipe sizes shown on the plans are nominal, (not including insulation).

3.2 SITE VISIT

A. Contractor shall visit the site of the project and thoroughly familiarize himself with the existing conditions prior to submitting a proposal. Additional payment will not be authorized for extra work for reason of unforeseen conditions due to failure to make site visit.

3.3 FONDATIONS, BASES AND SUPPORTS

A. Contractor shall furnish all special foundations, bases, and supports required for the proper installation and operation of any equipment furnished under this Division. Equipment with moving parts shall have special cork or rubber-and-metal isolation bases for prevention of noise and vibration.

3.4 MOTORS AND CONTROL (S)

A. Contractor shall furnish all motors and integral motor starters for mechanical equipment.

B. Unless otherwise specified or noted, all motors less than ½ HP shall be wound for single phase, 6—cycle, 120-volt current.

C. Motors shall be constructed in accordance with NEMA standards, shall be applied to operate at not more than 100% of their rating, and shall have ball or roller bearings.

D. Where motor sizes are increased above those shown on plans, due to variations in manufacturer's equipment, the Developer and Subcontractor will ascertain the requirements and make due allowances for increased service thereto. Any additional cost in electrical work caused by variation in manufacturers' equipment shall be the responsibility of the Developer and Subcontractor.

3.5 WASTE, VENT PIPE AND FITTINGS

A. Refer to appropriate Division 22 specifications for allowable materials. All joints and connections in plastic pipe shall be made watertight with joint cement as recommended by manufacturer.

B. Cleanouts: Accessible cleanouts shall be installed in all waste lines and shall not be greater than 100 feet apart in horizontal lines and elsewhere as shown or required by Code. All cleanouts shall have removable plugs.

C. Roof Flashing: Vent through roof shall be flashed with 4 pound sheet lead with lead extending 8" away on all sides, turned-in at top and made watertight. The Contractor may use galvanized roof flashing with neoprene seal sized to fit vent stack.

D. Floor Drains: Shall be 2" discharge and located in showers and water heater closets, as shown on plan. Strainers shall be 4" diameter brass, with chrome finish, adjustable to the finished floor surface of shower or closet.

E. Standing Drains: The contractor will furnish and install 1-1/2" standing drains with trap and 1-1/2" drain lines for washer box as shown and located on the plans.

3.6 WATER PIPE AND FITTINGS

A. Refer to appropriate Division 22 specifications for allowable materials.
   1. Water pipe above grade within the building area shall be Type L hard copper. Under floor water pipe shall be Type K soft copper without joints and shall comply with ASTM C425-64.
   2. All fittings shall be seat joint type using 95-5 solder. The ends of the pipe shall be reamed to full diameter and cleaned with garnet paper. Water lines to 5'-0" outside of building shall be Type K soft copper with sweated terminal fittings. Beyond 5'-0" shall be PVC Schedule 40 pipe.
   3. Air Chambers: 12" copper pipe shall be installed in water supply of each fixture. The diameter of the air chamber shall be not less than the size of the supply.
   4. Plates: Exposed pipe passing through floors and walls shall be fitted with chromium plated split ring escutcheons.
   5. Fittings on water heater shall be brass (no galvanized). Provide electrically insulated non-metallic fittings for dielectric break in water lines at water heater. All water pipes shall be neatly arranged and securely anchored to avoid vibration.
   6. Solder: "Lead Free Solder" tin/copper/nickel/silver low melting temperature.

3.7 PIPE INSULATION AND SLEEVES

A. Refer to appropriate Division 22 specifications for allowable materials.

B. The full length of all hot water pipes and all cold water pipes shall be insulated per section 220700 Insulation.

C. Where piping penetrates the slab, insulation must be properly sized to fit pipe and cover all fittings. All water supply lines under slab shall be sleeved with 80 pound black poly pipe throughout, and extending through slab to connection with sweeps.

D. Where vents or other piping (except gas) penetrate tope plate, seal voids around piping with liquid polyurethane foam. DO NOT SEAL GAS LINE PENETRATIONS.

3.8 GAS SERVICE

A. Refer to appropriate Division 22 specifications for allowable materials.

B. The entire installation shall conform to the rules and regulations of the Local Gas Company. Verify location of existing gas service and install gas service of 1-1/4" diameter, with cut-off at each entrance into building. Cut-off to be cast iron body with brass working parts, as approved by Indian Housing Authority.

C. Distribution: Gas shall enter the building above the floor line and distribute overhead above ceilings and drop in partitions. There shall be no connections within the partitions. Top plate shall be vented to the attic space where gas lines penetrate them. Provide gas to each gas-burning device, provide cut-offs and connect.

D. Regardless of anything herein to the contrary, where L.P gas is used the entire installation and distribution shall be in strict accordance with the state requirements for liquid petroleum piping.

E. Furnish and install ¾" gas line, with cut-off, to each water heater, central furnace, range space, and clothes dryer space. (Cap end of lines that are optional use, in addition to cut-off, at range and dryer spaces.

F. *LP Gas (where applicable) – 250 gallon tank will be provided and filled to a minimum 70% capacity at time of acceptance by the Indian Housing Authority.

3.9 PLUMBING FIXTURES

A. Furnish and install plumbing fixtures where so indicated on plans. Protect fixtures from damage during construction and replace any damaged material without cost to the Indian Housing Authority (IHA).

B. Refer to appropriate Division 22 specifications for allowable materials.

C. NOTE: No plastic valves of stops shall be used. All fixture fittings shall be washer less valves. All exposed trim (not in cabinet work) shall be chromed.

D. Water Well Pump: Where required, furnish GOLD-JACUZZI submersible 1/3 to 1-1/2 HP per O.E.H. recommendation, complete with pump, pump ends, motor, tank and all accessories. Provide 5-year protection plan “Sub-Shield” or equal. The contractor shall furnish this warranty to IHA complete with serial number, name of participant and location of pump.

3.10 PROTECTION OF WORK

A. At all times, take precautions necessary to properly protect the plumbing equipment and accessories from damage. Protect work from possible damage from freezing and stoppage of the pipes, traps, floor drains, and waste lines by building materials. The Contractor shall repair any damage without additional charge. Protect all plumbing fixtures from use or damage until completion of building.

3.11 LEAK DAMAGE

A. The General Contractor shall be responsible for damages to the building, or its contents, etc., caused by leaks in any of the equipment installed by him or his Subcontractors, through equipment or material failures, disconnected pipes, and fittings or by overflows caused by improper installation and/or protection. The Contractor shall be responsible for all repairs to merchandise, fixtures and equipment damaged.

3.12 REMOVL OF RUBBISH

A. The Contractor shall keep the premises free from accumulations of waste material or rubbish caused by this work during construction period. At the completion of the work, remove all rubbish from the building site. Leave the building “Broom Clean”.

3.13 EXCAVATING AND BACKFILLING

A. Furnish all excavating and backfilling required, both inside and outside building, for the installation of all underground piping in connection with this contract.

B. The bottom of all trench excavation shall be firm, stable and of uniform density as nearly as practicable; and unless necessary, materials shall not be disturbed below grade. All soft, wet, disintegrated, or other unsuitable materials shall be removed and any rock materials shall be removed to a depth of a least 6” below grade. Such removed materials shall be replaced with suitable material thoroughly compacted in place to finish the grade elevation in a satisfactory manner. Bell holes shall be provided under all bells to a minimum depth of 3”. Water, gas and sewer lines in yard shall have a minimum coverage of 24”. Keep trenches dry and furnish necessary pumps and power.

C. After inspection and approval, backfill trenches with approved backfill material and solidly tamped about pipes. This material shall be carefully deposited and compacted in uniform layers as specified in Item “N”. Puddling or water flooding for consolidation of materials is approved for sand only.

D. Earth backfilling shall be hand placed alongside and 12" above the pipe, on both sides simultaneously, in layers not exceeding 4" depth, loose measurements. Each layer shall be thoroughly compacted. Compactions shall be not less than 90% Standard Proctor Density.

E. Submission of bid shall constitute acceptance by the Bidder of existing site conditions as a part of the requirements for this work.

F. General: Lay all pipes in open trench except when the Local Authority Having Jurisdiction gives written permission for tunneling. Open the trench sufficiently ahead of pipe laying to reveal obstructions. Maintain easy access to fire hydrants by firefighting apparatus. Provide trench crossings as necessary to accommodate public travel.

G. Width of Trench: Excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds 10 feet, keep the trench at the level of the top of pipe as narrow as practicable.

H. Sheeting and Bracing: As necessary to protect workmen and adjacent structures, comply with OSHA regulations. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. Cut off such sheet not to be removed at least 3 feet below finished grade.

I. Water Removal: Pump or bail water from trenches and bell holes to permit proper joining of pipes. Conduct the discharge from trench dewatering to drains or natural drainage channels.

J. Disposition of Utilities: Rules and regulations governing the respective utilities shall be observed in executing all work under this heading. Active utilities shall be protected. Relocation, if required, shall be in accordance with the written instructions of the Local Authority. Inactive and abandoned utilities encountered in trenching operations shall be removed, plugged or capped. In absence of specified requirements, plug or cap such utility lines at least 3 feet from utility line to be installed or as required by the local regulations.

K. Grading Trench Bottom: Carry machine excavation only to such depth that soil bearing for pipes will not be disturbed. Grade bottom of trenches evenly to insure uniform bearing for all pipes. Cut holes as necessary for joints and joint making.
   1. As an alternative method, optional with the Contractor, excavate trenches to insure uniform bearing for all pipes. Cut holes as necessary for joints and joint making.
   2. In rock, cemented gravel, old masonry or other hard material, excavate at least 4" below the pipe at all points and refill to grade with sand or gravel firmly compacted.

L. Special Supports: Wherever the soil, at or below the requisite pipe grade, is unsuitable for supporting sewer or other such piping and appurtenances specified in this Division, such special supports, in addition to those shown or specified , shall be provided as the Local Authority may direct.

M. Tree Protection: Protect the roots of trees to remain. Within the branch spread of such trees, perform all trenching by hand. Open the trench only with the utility can be installed immediately; prune injured roots cleanly; and backfill as soon as possible.

N. Backfilling: Backfill trenches only after piping has been inspected, tested and locations of pipelines and appurtenances have been recorded.

1. For a depth of at least 12” above the top of the pipe, backfill by hand with earth or granular material free from large stones, rock fragments, roots and sod; excluded cinders, junk, refuse, scrap iron, and unused portions of welding rods from trenches in which metal pipes are to be laid; tamp this backfill thoroughly in layers 4 inches in thickness, taking care not to disturb the pipe or injure the pipe coating.
2. For the remaining trench depth, backfill in 6” to 10” lifts with material as specified in the preceding subparagraph, except that the material may contain stones, rocks, concrete or masonry materials with a maximum dimension of 4 inches, providing he voids in such coarse material are completely filled with earth or granular material. IN the event that sufficient suitable material, as herein specified for the trench backfill, is not available from the trenching or other excavation for the project, supply and place the required additional material. Compact thoroughly to backfill to 90% Standard Proctor Density. If the granular material is sand, the top 6 inches of the trench must be soil similar to the existing finish material or soil.
3. NOTE: Where sand is used to fill trenches, 5’ entering of leaving a building shall be clay type soil, which will prohibit the flow of water.

3.14 SERVICES

A. Where an approved public water and/or sewer system is available to the house, this Contractor shall connect complete to the public systems. Where there is not public water or sewer system available, this Contractor shall provide a complete well and water system and septic system in accordance with the Indian Housing Authority Bidder’s Packet, the State Health Department, and the Indian Health Service.

B. Sewer Connection: Where applicable, make a proper connection to existing city sewer and pay all costs incident thereto. Verify sewer location and depth before installing waste lines and provide a uniform grade from all fixtures to the point of discharge.

3.15 TESTING AND ADJUSTING

A. Plumbing contractor shall test and adjust the various plumbing systems on this job to give the required performance.

B. Pipe work must be properly tested by the Plumbing Contractor and approved by the Indian Housing Authority before being covered up or enclosed by building construction. The Contractor will be held responsible, and be required to pay for any damage or expense due to leaks or broken connections that may prove to exist before and after such work is concealed.

C. Waste and Vent Piping: Plug all necessary openings to allow entire system to be filled with water to level of highest vent stack above roof. System shall hold water 30 minutes without a drop in level, 24 hours without leakages. Portion of systems may be tested as above, except that a vertical stack 10 feet above highest horizontal point to be tested may be installed and filled with water to maintain pressure. A pump may be used to attain pressure; pressure must hold for 30 minutes without pumping.

D. Hot and cold water lines shall be made tight without dope or caulking. Test by air to 125psi. System must hold pressure for twelve (12) hours without pumping. Test to be performed after rough-in has been completed.

E. Gas piping to be tested with 50 pounds air pressure; test to remain on piping for 24 hours without a drop in pressure. Final test on all piping connections to be made with soap solution.

F. A final test shall be made upon completion of all piping systems. The test pressure being the maximum operating pressure of the system, without leaking.

END OF SECTION 220000

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder-joint connections.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

2.2 GENERAL-DUTY VALVES

A. Valve Sizes: Same as upstream piping unless otherwise indicated.

B. Valves in Insulated Piping: With 2-inch stem extensions.

C. Class 125, NRS, Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: Bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use gate valves for shutoff duty.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves for each fixture and item of equipment.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in a position to allow full stem movement.

F. Provide interior cut-off 1” diameter gate valve in interior wall at exterior hose bibb location. Install valve minimum 12” into interior wall. Provide with 16”x18” “Cover Up” access panel by Diversified Plastics Industries, Sand Springs, OK, or equal.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

2.2 HANGERS AND SUPPORTS FOR PLUMBING PIPING EQUPMENT

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Miscellaneous Materials:

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

a. Properties: Nonstaining, noncorrosive, and nongaseous.
b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

3.2 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal movement of piping systems.

C. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 4.
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 4.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 4, if longer ends are required for riser clamps.

END OF SECTION 220529

SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

a. Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
b. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
c. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
d. Wiring Diagrams: Power, signal, and control wiring.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. Comply with IEEE 515.1.

2.2 PLASTIC-INSULATED, SERIES-RESISTANCE HEATING CABLES

A. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.

B. Electrical Insulating Jacket: Minimum 4.0-mil Kapton with silicone jacket or Tefzel.

C. Cable Cover: Aluminum braid and silicone or Hylar outer jacket.

D. Maximum Operating Temperature: 300 deg F.

E. Capacities and Characteristics:

1. Maximum Heat Output: 6 W/ft..

2.3 CONTROLS

A. Pipe-Mounting Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.4 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Electric Heating Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Section 220700 "Plumbing Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

B. Set field-adjustable switches and circuit-breaker trip ranges.

C. Protect installed heating cables, including nonheating leads, from damage.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Testing: Perform tests after cable installation but before application of coverings.

G. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

H. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 220533

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

2.3 ADHESIVES

A. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less.

2.4 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 PIPE INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 078413 "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Interior Piping System Applications: Insulate the following piping systems:

1. Domestic hot water.
2. Recirculated domestic hot water.
3. Domestic cold water.
4. Exposed water supplies and sanitary drains of fixtures for people with disabilities.

F. Do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Sanitary drainage and vent piping.
3. Drainage piping located in crawlspaces unless otherwise indicated.
4. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities.

5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.2 INDOOR PIPING INSULATION SCHEDULE

A. Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

B. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch thick.

C. Domestic Hot and Recirculated Hot Water:

1. NPS 1 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For transition fittings and dielectric fittings.
2. Product for solvent cements and adhesive primers, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 PREFORMANCE REQUIREMENTS

A. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Types L, water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, 95-5 lead-free-alloy solder.

B. Soft Copper Tubing: ASTM B 88, Types K, water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, 95-5 lead-free-alloy solder.

C. PEX Tube and Fittings: ASTM F 877, SDR 9 PEX tubing and ASTM F 1807, metal insert-type fittings with copper or stainless-steel crimp rings.

1. Manifold: ASTM F 877 plastic or corrosion-resistant-metal assembly, with a plastic or corrosion-resistant-metal valve for each outlet.

D. Special-Duty Valves:

1. Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

E. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install unions at final connection to each piece of equipment.

D. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

E. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.

F. Install shutoff valve, inside the building at each domestic water service entrance.

G. Install domestic water piping without pitch for horizontal piping and plumb for vertical piping.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

1. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

    a. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.
    b. Install hangers for vertical PEX piping every 48 inches (1200 mm).

3.2 INSPECTING AND CLEANING

A. Inspect and test piping systems as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

B. Clean and disinfect potable domestic water piping by filling system with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 PIPING SCHEDULE

A. Underground, Service Entrance Piping: Soft copper tubing.

B. Aboveground Distribution Piping: Type L, hard copper tubing or PEX piping.

3.4 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze gate valves for piping NPS 2 and smaller.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 MANUFACTURED UNITS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded, complying with ASME B1.20.7.
4. Finish: Chrome- or nickel-plated bronze.

C. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 (DN 50) and smaller.

5. End Connections: Threaded for NPS 2 (DN 50) and smaller.
6. Accessories:

    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

D. Water Regulators:

1. Standard: ASSE 1003.
2. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
3. Body: Bronze for NPS 2 (DN 50) and smaller.
4. End Connections: Threaded for NPS 2 (DN 50) and smaller.

E. Clothes Washer Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Plastic box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

F. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig (860 kPa).
3. Operation: hand wheel.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4.
6. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Nozzle and Wall-Plate Finish: Rough bronze.

G. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water-hammer arresters in water piping according to PDI-WH 201.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For solvent cements and adhesive primers, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components.

2.2 PIPES AND FITTINGS

A. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

1. Adhesive Primer: ASTM F 656.

a. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent Cement: ASTM D 2564.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install wall penetration system at each pipe penetration through foundation wall.

1. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

B. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

C. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

E. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

F. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

H. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

A. Aboveground Applications: PVC plastic, DWV pipe and fittings with solvent-cemented joints.

B. Belowground Applications: PVC plastic, DWV pipe and drainage-pattern fittings with cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Plastic Cleanouts:

1. Size: Same as connected branch.
2. Body: PVC.
3. Closure Plug: PVC.
4. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.
3. Body Material: Gray iron.
4. Seepage Flange: Required
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Coating on Interior and Exposed Exterior Surfaces: Not required.
8. Sediment Bucket: Not required.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 4.0-lb/sq. ft. thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.
b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings: ASME A112.1.2, chrome-plated brass cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor unless otherwise indicated.

1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

C. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

D. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

END OF SECTION 221319

SECTION 223100 - DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.

a. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Operation and Maintenance Data:

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within five years from date of Substantial Completion.

C. Maintenance: Submit manufacturer's "Agreement for Continued Service and Maintenance," before Substantial Completion, for Owner's acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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.

B. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

2.2 RESIDENTIAL WATER SOFTENERS

A. Description: Factory-assembled, fully automatic, pressure-type water softener with one mineral tank and one brine tank or cabinet-style, combination mineral and brine tank unit with equivalent characteristics.

1. Mineral Tank: Steel or FRP, with coating or liner suitable for potable-water service and 125-psig minimum pressure rating. Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects."
3. Controls: For fully automatic operation.
4. Brine Tank: Combination measuring and wet-salt storing system.

a. Tank and Cover Material: FRP or molded PE.

b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
c. Size: Large enough for at least two regenerations at full salting.

5. Factory-Installed Accessories:

a. Piping, valves, tubing, and drains.
b. Sampling cock.
c. Main-operating-valve position indicator.

2.3 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.

1. Form: Processed, food-grade salt pellets.

2.4 WATER TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water softener on 4-inch-thick concrete base.

B. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible.

C. Anchor water softener and brine tanks to substrate.

D. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure.

E. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

F. Install piping adjacent to equipment to allow service and maintenance.

G. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Provide shutoff valves on raw-water inlet and soft-water outlet piping.

H. Add water to brine tanks and fill with salt.

END OF SECTION 223100

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type and size of domestic-water heater.

B. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace water heaters that fail in materials or workmanship within three years from date of Substantial Completion. Failures include, but are not limited to, tanks and elements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

B. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

2.2 WATER HEATERS, GENERAL

A. Insulation: Suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.

B. Anode Rods: Factory installed, magnesium.

C. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

D. Drain Valve: Factory or field installed.

2.3 ELECTRIC WATER HEATERS

A. Residential, Small-Capacity, Electric, Domestic-Water Heaters:

B. Standard UL 174, 40-gal. capacity; steel with 150-psig working-pressure rating. Two electric, screw-in, immersion-type heating elements with adjustable thermostat for each element and wiring arrangement for nonsimultaneous operation with maximum 30-A circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature and pressure relief valves and extend to closest floor drain.

B. Install vacuum relief valves in cold-water-inlet piping.

C. Install shutoff valves and unions at hot- and cold-water piping connections.

D. Make piping connections with dielectric fittings where dissimilar piping materials are joined.

E. Electrically ground units according to authorities having jurisdiction.

END OF SECTION 223300

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type and size of domestic-water heater.
2. Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."
3. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
4. Operation and maintenance data.

B. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace water heaters that fail in materials or workmanship within five years from date of Substantial Completion. Failures include, but are not limited to, tanks and elements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

D. Gas-Fired Water Heaters: Bear AGA certification label.

E. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

F. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

2.2 WATER HEATERS, GENERAL

A. Insulation: Suitable for operating temperature and required insulating value. ASHRAE/IESNA 90.1. Surround entire tank except connections and controls.

B. Anode Rods: Factory installed, replaceable magnesium.

C. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

D. Drain Valve: ASSE 1005. Factory or field installed.

2.3 GAS-FIRED WATER HEATERS

A. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Standard ANSI Z21.10.1/CSA 4.1., 40-gal. capacity and 40 kBtu/h input burner; steel with 150-psig working-pressure rating; with adjustable thermostat; automatic gas-ignition system, draft hood; and power-vent system interlocked with burner. Energy Star rating and 40.4 GPH recovery.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install heaters on water-heater stand on floor.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.

B. Install temperature and pressure relief valves and extend to closest floor drain.

C. Install vacuum relief valves in cold-water-inlet piping.

D. Install shutoff valves and unions at hot- and cold-water piping connections.

E. Make piping connections with dielectric fittings where dissimilar piping materials are joined.

F. Connect gas water heaters according to NFPA 54. Connect gas vent and draft hoods and diverters where required. Extend to outside and terminate in vent cap.

G. Furnish and install 24 gauge galvanized metal pitch pan beneath water heaters installed over wood plenum framing and deck. Pan is to be same size as water heater closet. Sides are to extend up 2” with hemmed edge, abutting wall studs. Gypsum board wall to sit atop pan edge, in J-metal. Plumb and seal pitch pan into 2” floor drain, extending up through plenum base.

END OF SECTION 223400

SECTION 224100 - RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bathtubs.
2. Faucets.
3. Bidets.
4. Lavatories.
5. Showers.
6. Kitchen sinks.
7. Dishwasher air-gap fittings.
8. Water closets.
9. Toilet seats.
10. Supply fittings.
11. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 BATHTUBS

A. Bathtubs FRP, with shower.
   1. FRP Bathtubs:
   2. Fixture:
      a. Standard: ANSI Z124.1.2 for FRP bathtubs.
      b. Bathing Surface: Slip resistant according to ASTM F 462.
      c. Size: Refer to plans.
      d. Color: White.

e. Drain Location: Refer to plans.
f. Drain: NPS 1-1/2 (DN 40); chrome-plated-brass, pop-up waste and overflow.

3. Faucet: Pressure Balanced.
4. Supply Fittings: Included in faucet.
5. Tub Filler: Chrome-plated-brass diverter spout.
6. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B45.125.2.
b. Drain: Stainless steel or chrome-plated brass, removable strainer.
c. Overflow: Chrome-plated-brass escutcheon with toggle drain-plug device.
d. Drain Piping: NPS 1-1/2 cast-brass overflow, P-trap, and waste.

2.2 BATHTUB FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Bathtub Faucets: Single handle, pressure balance.

1. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
2. Faucet:

a. Body Material: Solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 3 gpm unless otherwise indicated.
d. Mounting: Concealed.
e. Operation: Single handle, twist or rotate control, with hot- and cold-water indicators.
f. Antiscald Device: Integral with mixing valve.
g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
h. Diverter: In-tub filler spout.
i. Supply Connections: NPS 1/2 (DN 15).

3. Shower Head:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Type: Ball joint with arm and flange.
c. Backflow-Prevention Device: ASSE 1014.
d. Shower Head Material: Metallic with chrome-plated finish.
e. Spray Pattern: Adjustable.
f. Integral Volume Control: Not required.
g. Shower-Arm, Flow-Control Fitting: Not required.

4. Bathtub Filler Spout: Chrome-plated brass.

2.3 LAVATORIES

A. Lavatories: Round, enameled cast iron or vitreous china, counter mounted.

1. Enameled Cast-Iron Lavatories:

    a. American Standard
    b. Kohler
    c. Eljer

2. Vitreous-China Lavatories:

    a. American Standard
    b. Kohler
    c. Eljer

3. Fixture:

    a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron lavatories.
    b. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.
    c. Type: Self-rimming.
    d. Round Nominal Size: 18 inches in diameter.
    e. Faucet-Hole Punching: Three holes, 4-inch centers.
    f. Color: White.

4. Faucet: Comply with requirements in “Lavatory Faucets” Article.
5. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
6. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.4 LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Single-control mixing valve.

1. General-Duty, Solid-Brass Faucets:

    a. Delta
    b. Moen
    c. Valley

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Body Material: General-duty, solid brass.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 2.2 gpm.
7. Centers: 4 inches.
8. Mounting: Deck, exposed.

9. Valve Handle(s): Lever.
10. Inlet(s): NPS 3/8 tubing, plain end.
11. Spout: Rigid.
12. Spout Outlet: Aerator.
13. Operation: Compression, manual.
14. Drain: Pop up.

2.5 SHOWERS

A. Showers: Standard FRP with base and faucet.

1. FRP Showers:

a. MUSTEE, INC

2. Standard: ANSI Z124.1.2.
3. Nominal Size: 36 by 36 inches.
4. Surround: One piece.
5. Bathing Surface: Slip resistant according to ASTM F 462.
6. Color: White.
7. Drain Location: Center.
8. Shower Base.

2.6 SHOWER FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Shower Faucets: Single handle, pressure-balance, mixing valve.

1. Single-Handle, Pressure-Balance Faucets:

a. Delta
b. Moen
c. Valley

2. Fixture:

a. Standard: ASME A112.18.1/CSA B125.1.
b. General: Include hot- and cold-water indicators; check stops; and fixed shower head, arm, and flange. Coordinate faucet inlets with supplies.
c. Body Material: Solid brass.
d. Finish: Polished chrome plate.
e. Maximum Flow Rate: 3 gpm unless otherwise indicated.
f. Mounting: Exposed.
g. Operation: Compression, manual.
h. Antiscald Device: Integral with mixing valve.
i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: NPS 1/2.
4. Shower Head:

    a. Type: Ball joint and head integral with mounting flange.
    b. Shower Head Material: Combined, metallic and nonmetallic with chrome-plated finish.
    c. Spray Pattern: Adjustable.
    d. Integral Volume Control: Not required.

2.7 KITCHEN SINKS

A. Kitchen Sinks: Two bowl, counter mounted, stainless steel.
    1. Stainless-Steel Kitchen Sinks:

        a. American Standard
        b. Kohler
        c. Elkay

    2. Fixture:
        a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
        b. Overall Dimensions: 32”x21”.
        c. Metal Thickness: 20 Gauge.
        d. Bowl:
            1) Drain: 3-1/2-inch, crumb cup.

                a) Location: Centered in bowl.

    3. Faucet: Comply with requirements in "Sink Faucets" Article.
    4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
    5. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

        a. Disposer: Not required.
        b. Dishwasher Air-Gap Fitting: Comply with requirements in "Dishwasher Air-Gap Fittings" Article.

2.8 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets: kitchen sink.

    1. General-Duty, Solid-Brass Faucets:

        a. Delta
        b. Moen
        c. Valley

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
7. Mixing Valve: Single control.
8. Backflow-Prevention Device for Hand Spray: Not required.
9. Centers: 4 inches.
10. Mounting: Deck.
11. Handle(s): Lever.
12. Spout Type: Swing, round tubular.
13. Spout Outlet: Aerator.
14. Drain: Stopper with chain.

2.9 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:
1. Standard: ASSE 1021.
2. Description: Device designed to prevent backflow of contaminated liquid into domestic dishwashers.
3. Material: Plastic body with chrome-plated-brass cover.
4. Hose Connections: 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet.
5. Capacity: At least 5 gpm (0.32 L/s); at inlet pressure of at least 5 psig (35 kPa) and at temperature of at least 140 deg F (60 deg C).
6. Mounting: Deck.
7. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).

2.10 WATER CLOSETS

A. Water Closets: Floor mounted, floor outlet, close coupled (gravity tank), vitreous china.

1. Accepted Manufacturers
   a. American Standard
   b. Kohler
   c. Eljer

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1, ASME A112.19.5, and ASSE 1037.
   b. Bowl Type: Siphon jet.
   c. Height: Refer to plans
   d. Rim Contour: Round.
   e. Water Consumption: Water saving.
   f. Color: White.

3. Toilet Seat: Comply with requirements in "Toilet Seats" Article.
4. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
c. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.

d. Riser:

1) Size: NPS 3/8.
2) Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.11 TOILET SEATS

A. Toilet Seats:

1. Acceptable Manufacturers
   a. Church
   b. Olsonite
   c. Beneke

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Residential.
5. Shape: Regular rim (Closed front).
6. Configuration: Closed front with cover.
7. Size: Regular.
8. Hinge Type: Check.
9. Hinge Material: Noncorroding metal.
10. Color: White.

2.12 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Lavatory and Kitchen Sink Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

   a. Operation: Wheel handle.

3. Risers:

    a. Size: NPS 3/8 (DN 10) for lavatories.
    b. Size: NPS 1/2 (DN 15) for kitchen sinks.
    c. Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.13 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset tailpiece for accessible lavatories.

C. Drain: Pop-up type with NPS 1-1/4 (DN 32) straight tailpiece as part of faucet for standard lavatories.

D. Drain: Grid type with NPS 1-1/2 (DN 40) offset tailpiece for accessible kitchen sinks.

E. Trap:

1. Size: NPS 1-1/4 (DN 32 for lavatories.
2. Size: NPS 1-1/2 (DN 40) for kitchen sinks.
3. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated-brass or -steel wall flange.

2.14 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install floor-mounted water closets on closet flange attachments to drainage piping.

C. Install counter-mounting fixtures in and attached to casework.

D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

E. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

F. Install toilet seats on water closets.

G. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

H. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

I. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.

J. Set bathtubs and shower receptors in leveling bed of cement grout.

K. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

L. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

M. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

SECTION 230000 – GENERAL MECHANICAL

PART 1 - GENERAL

1.1 SUMMARY

A. These specifications govern the furnishing of all materials and the installation of the same under the subject of mechanical work.

B. The mechanical contractor is directed to read Special Conditions Turnkey and shall be required to conform to any and all provisions therein.

C. The mechanical contractor is responsible for the work under all Division 23 headings and shall hereinafter in Division 23 of these specifications be referred to as the “Contractor”. Mechanical plans, and by reference general and electrical plans, are a part of this specification.

D. The mechanical plans indicated the extent and general arrangements of the various mechanical systems. Changes in locations or arrangement required by job conditions shall be made by approved Change Order.

1.2 MATERIALS AND EQUIPMENT

A. All work and materials specified are to be new and of the quality described and essentially the standard product of the manufacturer. The use of manufacturers’ names in specifying equipment or material herein determines the material or equipment to be used.

B. Unless otherwise specified, where two or more units of the same class equipment or material are to be used for similar purposes, they shall be the products of the same manufacturer. All equipment shall be installed in accordance with the manufacturer’s recommendations.

1.3 CLEANING

A. All dirt, rubbish, grease, or stains due to the operations of the Contractor shall be removed from all floors, walls, fixtures, etc., with the premises left in perfect condition. All mechanical equipment under this contract shall be set and connected, ready for operation.

1.4 PERMITS AND FEES

A. Contractor shall secure all necessary permits or licenses to carry work, and shall pay all lawful fees, taxes, etc., in connection with the work. Contractor shall arrange for all tests and inspections on any or all parts of work, required by authorities and organizations having jurisdiction, and shall pay all charges for the same.

1.5 LAW AND ORDINANCES

A. Work performed shall be in accordance with all local and state or national codes, laws and ordinances pertinent to such work. In case of any conflict wherein methods or standards on installation of materials specified do not equal or exceed requirements of laws of ordinances but not specified or shown on the drawings shall be furnished without extra charge as if shown or specified.

1.6 JOB FORMAN

A. The Contractor shall have a competent representative available at all times while the project is under construction who will be responsible for coordination of the trades and installation of the work according to plans and specifications.

1.7 WORK TO BE PERFORMED BY OTHER TRADES

A. Electrical Subcontractor is responsible for all wiring, including interconnecting wiring between controls and any electrical temperature control wiring.

B. The Developer will perform the following work in connection with the mechanical contract.

1. Build into building construction all pipe sleeves, bolts and inserts necessary for supporting mechanical equipment. These items will be furnished by the Contractor and will be set in place by him.
2. Provide all chases, shafts and recesses necessary for installation of all mechanical equipment and furring necessary to conceal piping, ductwork, etc. The Contractor shall provide all necessary information as to size, exact location of chases, recesses, furring, etc., required.
3. Provide wall, floor, and roof openings necessary for the installation of the mechanical systems. Contractor shall provide exact size and location of such openings, and shall be responsible for completed installations being watertight and waterproof.
4. Provide bases and supports for principle items of mechanical equipment. The Contractor shall provide exact size and location and shall be responsible for all bases and supports other than these specified above.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS (O&M)

A. The Developer shall furnish the Indian Housing Authority (IHA) two bound sets of operating and maintenance instructions covering all equipment furnished under specifications for each total contract. The instructions shall be assembled in an indexed brochure. Separate equipment brochures will not be acceptable. NOTE: These manuals must be delivered to the above before final payment.

B. A competent supervisor shall instruct the IHA representative in the care, operation, and maintenance of the equipment.

1.9 PROTECTION OF MATERIAL AND WORK

A. Protect and preserve all materials, supplies and equipment and all work performed.

1.10 FINAL AND GUARANTEE

A. Nothing herein contained may be construed to relieve the Developer and Contractor from making good and perfect work in all details of construction of installation, and they will be held responsible to provide and furnish necessary material, and to perform all necessary labor, and to bear all expenses incidental to the satisfactory completion of the work embraces herein.

B. At final inspection, prior to purchase by the Indian Housing Authority, the Developer and Contractor shall demonstrate completely the system and equipment performance. Developer and Contractor shall guarantee all labor, material, and equipment furnished under this contract against any defects developing from faulty or poor workmanship or material for a period of one (1) year from the date of final acceptance by the Indian Housing Authority. The Developer or Contractor shall remedy any defect appearing within that time without extra charge to the Indian Housing Authority within a reasonable time after notice. The term “defect” excludes occurrences, as would normally follow improper treatment, accident, or wear and tear of normal use.

C. Furnish written guarantees for each piece of equipment so covered by manufacturer’s warranties. These shall be furnished for each dwelling unit and shall be bound, indexed and labeled for the appropriate dwelling.

1.11 SINGULAR NUMBER

A. Where any device or part of equipment is herein referred to in the singular number (such as “the pump”), such reference shall be deemed to apply to as many devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCOPE

A. The work performed under this heading includes all labor, materials, equipment and services installation of all heating systems, in strict accordance with specification and the applicable drawings. Contractor shall keep a competent foreman on the premises while his work is in progress.

B. The following are furnished by others: Cutting and framing for ducts and grilles, gas services to furnaces. Electrical work as explained hereinafter and all headers and buck for ducts.

C. Except as above, the Mechanical Contractor shall furnish material, labor, equipment and transportation required for a complete system as shown.

D. Contractor shall obtain necessary permits and pay all fees therefore. He shall be responsible for damage to property caused by him or his employees. He shall protect his work from damage and work in harmony with other trades.

E. From time to time as the work progresses, he shall remove all rubbish and accumulation resulting from his work. Mechanical work shall comply with all laws having jurisdiction of the work including the Local Code, State Health Department and the BOCA Mechanical Code.

F. The mechanical contractor shall examine the general plans and specifications, and make sure he understands the conditions under which he must work.

G. Cooperation: Install roof vents, flashings, etc., before or during the application of the roof. If for any reason, roof repairs are necessary after the completion of the roof, this Subcontractor shall make the necessary arrangements with roofer to provide proper guarantee.

3.2 SITE VISIT

A. Contractor shall visit the site of the project and thoroughly familiarize himself with the existing conditions prior to submitting a proposal. Additional payment will not be authorized for extra work for reason of unforeseen conditions due to failure to make site visit.

3.3 FONDATIONS, BASES AND SUPPORTS

A. Contractor shall furnish all special foundations, bases, and supports required for the proper installation and operation of any equipment furnished under this Division. Equipment with moving parts shall have special cork or rubber-and-metal isolation bases for prevention of noise and vibration.

3.4 MOTORS AND CONTROL (S)

A. Contractor shall furnish all motors and integral motor starters for mechanical equipment.

B. Unless otherwise specified or noted, all motors less than ½ HP shall be wound for single phase, 6—cycle, 120-volt current.

C. Motors shall be constructed in accordance with NEMA standards, shall be applied to operate at not more than 100% of their rating, and shall have ball or roller bearings.

D. Where motor sizes are increased above those shown on plans, due to variations in manufacturer’s equipment, the Developer and Subcontractor will ascertain the requirements and make due allowances for increased service thereto. Any additional cost in electrical work caused by variation in manufacturers’ equipment shall be the responsibility of the Developer and Subcontractor.

3.5 VENTS

A. Refer to appropriate Division 23 specifications for allowable materials.

B. All Fuel Vents: Furnish and install where shown on plans all fuel, 8” jacketed flue, complete with escutcheon cover at ceiling, ceiling base support, stack, roof jack and roof cap. NOTE: Location of flue as determined by IHA.

C. Dryer Vent: Furnish and install jacketed dryer vent and flashing from dryer location to outside with rain-proof roof or wall cap as required, complete with rodent screen.

D. Combustion Air Supply: Required at each compartment containing a furnace and/or water heater; install to each such compartment two 6” round combustion air ducts into attic 4” above top of insulation. One duct shall extend 1” below ceiling line; one shall extend 12” above floor line. Secure ducts to prevent moving and provide bug screens over ducts in attic.

E. Vent Hood: Furnish, install, complete, and make all connections to (one-in-all) range hood, 30” wide, with 2 speed fan, light socket, rear wiring, 120V electrical service, permanent washable filter, and automatic damper. Hood shall vent through roof with 7” round duct and be provided with flashing and vent cap at roof. Hood shall be mounted as detailed above range.

F. Bathroom Vent with Heat Light: Furnish and install duct through roof with roof jack and vent cap. Coordinate work with electrical contractor.

3.6 INSTALLATION

A. Control Thermostat/Switch System: Furnish for installation by the Electrician, a wall mounted thermostat with heat/cool/fan/off settings. Thermostat shall be of type that will operate the fan without the activation of the furnace burner or the condensing unit, and shall be adjustable with a range of 55 to 85, low voltage type. Thermostat shall not be installed on wall of heater closet or exterior wall.

B. It shall be the responsibility of the Electrician to install wiring and make all connections for control. It will be the responsibility of the Mechanical contractor to direct such work and give proper notice of any change required.

C. Flue and Flue Connections: Furnish and install complete to all heating units, flue and flue connections. System shall be METALBESTOS double, metal wall, type, assembled with necessary fittings and couplings as directed by manufacturer. Provide roof flashing as required and waterproof flue cap.

D. Ductwork and Plenums: Refer to appropriate Division 23 section.

E. Grilles, Registers and Diffusers: Refer to appropriate Division 23 section.

F. Furnace: Refer to appropriate Division 23 section.

G. Condensing Unit: Refer to appropriate Division 23 section.

H. Run insulated refrigerant piping in attic, from heating and air conditioning closet to exterior soffit for installation of optional air conditioning equipment. Seal piping penetration in soffit and ceiling.

I. Duct Insulation: Refer to appropriate Division 23 section.

3.7 PROTECTION OF WORK

A. At all times, take precautions necessary to properly protect the mechanical equipment and accessories from damage. Protect work from possible damage from freezing and stoppage of the pipes, traps, floor drains, and waste lines by building materials. The Contractor shall repair any damage without additional charge.

3.8 LEAK DAMAGE

A. The General Contractor shall be responsible for damages to the building, or its contents, etc., caused by leaks in any of the equipment installed by him or his Subcontractors, through equipment or material failures, disconnected pipes, and fittings or by overflows caused by improper installation and/or protection. The Contractor shall be responsible for all repairs to merchandise, fixtures and equipment damaged.

3.9 REMOVL OF RUBBISH

A. The Contractor shall keep the premises free from accumulations of waste material or rubbish caused by this work during construction period. At the completion of the work, remove all rubbish from the building site. Leave the building “Broom Clean”.

3.10 TESTING AND ADJUSTING

A. Refer to appropriate Division 23 section.

3.11 GUARANTEE

A. This Contractor shall guarantee all materials, equipment and labor of this section as called for in Supplemental General Conditions. This guarantee shall include the performance of the component parts of the system in strict accordance with the intent of the specifications.

END OF SECTION 230000

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: ethylene-propylene-diene-monomer-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement nonshrink grout; recommended for interior and exterior applications.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

C. Fire-Barrier Penetrations: Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand, and make a watertight seal.

END OF SECTION 230517

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Certified TAB reports.

B. TAB Firm Qualifications: AABC or NEBB certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine automatic temperature system components to verify the following:

1. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
2. Sensors are located to sense only the intended conditions.

G. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check for airflow blockages.

E. Check condensate drains for proper connections and functioning.

F. Check for proper sealing of air-handling unit components.

G. Check for proper sealing of air duct system.

3.4 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.
2. For adhesives and sealants, documentation including printed statement of VOC content.

B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics:

1. Indoor Insulation and Related Materials: To be factory-labeled designating maximum flame-spread index of 25 or less and smoke-developed index of 50 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

C. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.

D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

G. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

H. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 078413 "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Mineral-Fiber Insulation Installation:
1. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
2. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
3. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
4. For ducts and plenums with surface temperatures below ambient, install a continuous, unbroken vapor barrier.

F. Plenums and Ducts Requiring Insulation:

1. Concealed and exposed supply and outdoor air.
2. Concealed and exposed return air located in nonconditioned space.
3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.

G. Plenums and Ducts Not Insulated:

1. Metal ducts with duct liner.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

H. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.2 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed duct insulation shall be the following:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density, R-8 minimum.

B. Exposed duct insulation shall be the following:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft nominal density, R-8 minimum.

3.3 HVAC PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:

1. Flexible Elastomeric: 1 inch thick.

END OF SECTION 230700

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Service Meter Minimum Operating Pressure: 5 psig.

B. Natural-Gas System Pressure within Building: One distribution pressure. 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and polyethylene (PE).

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1: Includes flame-retardant PE coating, copper-alloy threaded ends, and striker plates.

C. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11 and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

2.3 SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.

B. Strainers: ASTM A 126, Class B, cast-iron body, Y-pattern, full size of connecting piping, CWP rating of 125 psig (860 kPa). Include [40] [60]-mesh startup strainer and perforated stainless-steel basket.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

D. Service Meters: Comply with gas company requirements.

E. Detectable Warning Tape: PE-film warning tape 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection; colored yellow.

2.4 MANUAL GAS-SHUTOFF VALVES

A. General Requirements for Metallic, Manual Gas-Shutoff Valves: Comply with ASME B16.33.

1. CWP Rating: 125 psig.

B. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable stem-packing threaded ends.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.

5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded body packnut design with adjustable stem packing.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Operator: Square head or lug type with tamperproof feature where indicated.
4. Pressure Class: 125 psig (862 kPa).
5. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
6. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Valve Boxes: Cast iron, two sections, with base to fit over valve, barrel a minimum of 5 inches (125 mm) in diameter, and cover with "GAS" lettering.

2.5 PRESSURE REGULATORS

A. General Requirements: Single stage, steel jacketed, and corrosion resistant. Include elevation compensator.

B. Service-Pressure Regulators: ANSI Z21.80:

1. 100-psig maximum inlet pressure. Factory- or field-installed, stainless-steel screen in vent opening if not connected to vent piping.

C. Line Pressure Regulators: ANSI Z21.80:

1. 5-psig maximum inlet pressure. Factory- or field-installed, stainless-steel screen in vent opening if not connected to vent piping.

D. Appliance Pressure Regulators: ANSI Z21.18:

1. 1-psig maximum inlet pressure. Regulator may include vent-limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 SLEEVES AND SLEEVE SEALS

A. Galvanized-Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Modular rubber sealing-element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: Ethylene-propylene-diene-monomer-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.8 ESCUTCHEONS AND FLOOR PLATES

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install underground, natural-gas piping buried at least 36 inches below finished grade.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

D. Install underground, PE, natural-gas piping according to ASTM D 2774.

E. Install shutoff valve, downstream from gas meter, outside building at gas service entrance.

F. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

1. Sleeves:

a. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
b. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078446 "Penetration Firestopping."

2. Sleeve-Seal-System Installation:

a. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
b. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand, and make a watertight seal.

G. Install service meters to comply with gas company requirements.

3.2 INDOOR PIPING INSTALLATION

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install escutcheons at penetrations of interior walls, ceilings, and floors.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Section 078413 "Penetration Firestopping."

F. Install gas stops for shutoff to appliances with low-pressure gas supply.

G. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

I. Connect branch piping from top or side of horizontal piping.

J. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

K. Connect gas piping to equipment and appliances with shutoff valves and unions. Install gas valve upstream from and within 72 inches (1800 mm) of each appliance using gas. Install union or flanged connections downstream from valves.

L. Do not use natural-gas piping as grounding electrode.

3.3 PIPING JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads complying with ASME B1.20.1.

B. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators.

C. Joints in Steel Piping with Protective Coating: Apply joint-cover kits to pipe after joining to cover, seal, and protect joints.

D. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.4 VALVE INSTALLATION

A. Install manual gas-shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install anode for metallic valves in underground, PE piping.

3.5 OUTDOOR PIPING SCHEDULE

A. Underground, natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground, natural-gas piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.6 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping, if approved by authority having jurisdiction (AHJ).
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

C. Underground, below building, shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.7 UNDERGROUND, MANUAL GAS-SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves.
2. NPS 2 and Smaller: Bronze plug valves.

3.8 ABOVEGROUND, MANUAL GAS-SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 231123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIRMENTS

A. Line-Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

B. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

2.2 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings and Unions: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.3 VALVES AND SPECIALTIES

A. Thermostatic Expansion Valve: Comply with ARI 750.

1. Forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 40 deg F suction temperature; 700-psig working pressure, and 240 deg F (116 deg C) operating temperature.

B. Straight-Type Strainers:

1. Welded steel with corrosion-resistant coating and 100-mesh, stainless-steel screen with socket ends; 500-psig (3450-kPa) working pressure and 275 deg F (135 deg C) working temperature.

C. Permanent Filter Dryers: Comply with AHRI 730.

1. Steel shell with ductile-iron cover; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements in Section 230500 "Common Work Results for HVAC" for basic piping installation requirements.

B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Section 230500 "Common Work Results for HVAC" for wall penetration systems.

C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

D. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.

E. Insulate suction lines to comply with Section 230700 "HVAC Insulation."

F. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

G. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

H. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, Type K or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, Type K or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

END OF SECTION 232300

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.
2. For adhesives and sealants, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems" and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

D. Comply with UL 181 for ducts and closures.

2.2 DUCTS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.

B. Joint and Seam Tape, and Sealant: Comply with UL 181A.

C. Rectangular Metal Duct Fabrication: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 ACCESSORIES

A. Volume Dampers and Control Dampers: Single-blade and multiple opposed-blade dampers, standard leakage rating, and suitable for horizontal or vertical applications; factory fabricated and complete with required hardware and accessories.

B. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Flexible Ducts: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-inch-thick, glass-fiber insulation around a continuous inner liner complying with UL 181, Class 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
1. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg ((500 Pa)) and Lower: Seal Class B.
2. Unconditioned Space, Exhaust Ducts: Seal Class C.
3. Unconditioned Space, Return-Air Ducts: Seal Class B.
4. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg ((500 Pa)) and Lower: Seal Class C.
5. Conditioned Space, Exhaust Ducts: Seal Class B.
6. Conditioned Space, Return-Air Ducts: Seal Class C.

C. Conceal ducts from view in finished and occupied spaces.

D. Avoid passing through electrical equipment spaces and enclosures.

E. Support ducts to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Hangers and Supports."

F. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

G. Install volume and control dampers in lined duct with methods to avoid damage to liner and erosion of duct liner.

H. Ductwork and Plenums: Furnish and install all ducts, branches, etc., as necessary to make the complete system as shown on the drawings. All ducts shall be fabricated in accordance with SMACNA standards from galvanized sheet steel in accordance with the following:
1. Round Duct:
   a. Up to 8” duct, 28-gauge, 2” slip joints, 1” lock seams
   b. 9” to 16” duct, 26-gauge, 2” slip joints, 1” lock seams
2. Rectangular Duct:
   a. Up to 12” wide, 26-gauge, 1” S-drive joints, 1” lock seams.
   b. 23” to 30” wide, 24-gauge, 1” S-drive joints, 1” lock seams.
3. Shall be fabricated of galvanized steel, of gauge specified above, from plenum to room register boot. Metal supply plenum shall be built in absorption coefficient of not less than .70 at ta frequency of 500hz.
4. All joints shall be taped and made air tight before insulating, minimum three screws per joint. Strap anchor to rafters (trusses) at maximum 10’-0” o.c., and at corners and transition. Strap anchor size to be minim 1” wide by 16-gauge thickness.

3.2 TESTING, ADJUSTING, AND BALANCING

A. Balance airflow within distribution systems, including submains, branches, and terminals, to indicated quantities.

END OF SECTION 233100

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Products shall be licensed to use the AMCA-Certified Ratings Seal.

B. Power ventilators shall comply with UL 705.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CEILING-MOUNTED VENTILATORS

A. Housing: Steel, lined with acoustical insulation.

B. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

C. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

E. Accessories:

1. Manual Starter Switch: provide light switch for control.
2. Isolation: Rubber-in-shear vibration isolators.
3. Backdraft damper.

2.3 MOTORS

A. Motors to be totally enclosed, fan cooled, and minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

1. Comply with NEMA MG 1 unless otherwise indicated by authorities having jurisdiction. Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units with clearances for service and maintenance.

B. Ceiling-Mounted Units: Suspend units from structure using steel wire or metal straps.

C. Furnish and install duct through roof with roof jack and vent cap.

D. Ground power ventilators.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated, including color charts for factory finishes.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Grilles and registers shall be pressed steel, factory finished in “Off-white”, with fins ½” o.c.; similar to AIRMATE #140, #160 or #190, or as required for airflow direction. Grills by LIMA, BARBER-COLMAN, TITUS or AIRMATE.

B. Fixed-Face Register:

1. Material: Steel.
2. Finish: Baked enamel, white.
3. Mounting: Countersunk screw.

C. Fixed-Face Grille:

1. Material: Steel.
2. Finish: Baked enamel, white.
3. Mounting: Countersunk screw.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B or 550 deg F (288 deg C) continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211 and suitable for certified gas-fired appliances.

B. Construction: Inner shell and outer jacket separated by at least 1/4-inch (6-mm) airspace.

C. Inner Shell: Type 1100, aluminum.

D. Outer Jacket: Galvanized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude 90 percent of rainfall.
2. Termination: Round chimney top designed to exclude 98 percent of rainfall.

EXECUTION

2.2 INSTALLATION

A. Install vents according to stipulated minimum clearances from combustibles.

B. Seal between sections of positive-pressure vents using only sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

END OF SECTION 235100

SECTION 236313 - AIR-COOLED REFRIGERANT CONDENSERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Rate air-cooled refrigerant condensers according to ARI 460.

B. Factory-test sound-power-level ratings according to ARI 270.

C. 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.

D. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

2.2 AIR-COOLED REFRIGERANT CONDENSERS

A. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls for outdoor installation. R-410A refrigerant.

B. Condenser Coil: Copper tubing with aluminum or steel coil fins, factory tested at 425 psig (2930 kPa).

C. Condenser Fans and Drives: Propeller fans for vertical air discharge. Motors to comply with NEMA MG 1.

D. Operating and Safety Controls: Condenser fan motor thermal and overload cutouts; magnetic contactors for condenser fan motors and factory-mounted and -wired disconnect switch for single external electrical power connection.

1. Fan Cycling Control: Head pressure switches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain recommended clearances.

B. Equipment Mounting:

1. Install air-cooled condenser refrigerant condensers on cast-in-place concrete equipment bases.

C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

1. Install electrical devices according to NFPA 70.

D. Install piping adjacent to machine to allow service and maintenance.

E. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

END OF SECTION 236313

SECTION 237339 - INDOOR, DIRECT-FIRED HEATING AND VENTILATING UNITS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Include rated capacities, furnished specialties, and accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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.

B. Comply with NFPA 70.

2.2 INDOOR, DIRECT-FIRED HEATING AND VENTILATING UNITS

A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and direct-fired gas burner to be installed exterior to the building.

2.3 CABINET

A. Cabinet: Single-wall, galvanized-steel panels with lifting lugs. Lift-out access panels for furnace and fan motor assemblies on both sides of unit. Fibrous-glass duct lining 1 inch thick, complying with ASTM C 1071, Type II, applied on complete unit. Heat-resistant, baked-enamel finish. Horizontal or vertical-pattern, galvanized-steel discharge plenum with diffusers incorporating individually adjustable vanes.

1. Fabricate mounting base and attachment to air-handling-unit sections, accessories, and components.

B. Filters: Comply with NFPA 90A; 1 inch thick.

2.4 SUPPLY-AIR FAN

A. Fan: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft.

B. Fan Motor: Permanent-split capacitor, with silicone-controlled rectifier for speed adjustment, premium efficiency motor, with open, drip proof enclosure.

1. Comply with NEMA MG 1 unless otherwise indicated by authorities having jurisdiction. Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

    a. NEMA Design: <**Insert designation**>.
    b. Service Factor: <**Insert value**>.
    c. Motor Speed: [**Single speed**] [**Multispeed**].

C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, isolators.

2.5 DIRECT-FIRED GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z83.4, ANSI Z83.18, and NFPA 54. Cast-iron burner with stainless-steel mixing plates. Single-stage or Two-stage control valve. Electrically ignited by ceramic hot-surface.

1. Fuel: Natural or Propane gas, refer to plans.

B. Safety Controls: Airflow-proving switch; high-temperature limit; safety lockout; redundant, automatic, main gas valves; electric pilot valve; modulating temperature control valve; main and pilot gas regulators; main and pilot manual shutoff valves; main and pilot pressure taps; and high-low gas pressure switches to comply with ANSI standards.

2.6 CONTROLS

A. Factory-wired, fuse-protected control transformer, with connection for power supply and field-wired unit to remote control panel.

B. Control Panel: Recessed, with trim ring, remote panel, with engraved plastic cover. Include on-off-auto fan switch, supply-fan operation light, heating operation light, dirty-filter light operated by unit-mounted differential pressure switch, and safety-lockout light.

C. Control Devices: Seven-day programmed timer with minimum four periods per day.

D. Temperature Control: Operates gas valve to maintain supply-air or room temperature.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired units according to NFPA 54.

B. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service.

C. Drawings indicate the general arrangement of ducts. Connect supply and return ducts to indirect-fired H&V units with flexible duct connectors.

END OF SECTION 237339

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

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

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO.

C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC, nonmetallic-sheathed cable, Type NM.

2.2 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway, Metal-clad cable Type MC, or Nonmetallic-sheathed cable Type NM.

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: : Type THHN-THWN, single conductors in raceway, Metal-clad cable Type MC, or Nonmetallic-sheathed cable Type NM.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Class 1 Control Circuits: Type THHN-THWN, in raceway.

F. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

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

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch in diameter x 10 feet in length.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No.8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No.2/0 AWG minimum. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    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) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways and fittings.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. RNC: NEMA TC 2, Type EPC-40-PVC**,** unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit, RNC, Type EPC-40-PVC.
2. Concealed Conduit, Aboveground: Rigid steel conduit, EMT, RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: Rigid steel conduit.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, before rising above the floor.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility**,** compounded for direct-burial service.
2. Thickness: 4 mils.

3. Weight: 18.5 lb/1000 sq. ft.
4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

D. Tag: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility**,** compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft.
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch..

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits more than 30A, and 120V to ground: Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

a. Color shall be factory applied.
b. Colors for 120/240-V Circuits:

1) Phase A: Black.
2) Phase B: Red.

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels or Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

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

B. Panelboard schedules for installation in panelboards.

1.3 QUALITY ASSURANCE

A. 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.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As required.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories (where applicable):

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e. Communication Capability: Intregal communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes equipment for electricity metering by utility company.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.

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

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Siemens Energy & Automation, Inc.
d. Square D; a brand of Schneider Electric.

2. Comply with requirements of utility company for meter center.

3. Housing: NEMA 250, Type 3R enclosure.
4. Minimum Short-Circuit Rating: Equal to rating established at Panel MDP symmetrical amps at rated voltage.
5. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.
6. Surge Protection: For main disconnect device, comply with requirements indicated on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

D. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
1. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262713

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches and wall-box dimmers.
3. Communications outlets.

B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

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

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

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

   a. Cooper; 3560-6.
   b. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

2.7 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.8 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Ivory or as selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in enclosed switches and panelboards.

1.2 SUBMITTALS

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

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. 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.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L, fast acting.

B. Feeders: Class L, fast acting.

C. Motor Branch Circuits: Class RK1, time delay.

D. Other Branch Circuits: Class RK1, time delay.

E. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures.

B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers.

1.2 SUBMITTALS

A. Product Data: Include data on features, accessories, finishes.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility.

B. Electronic Drivers for LED Devices, Arrays, or Systems: SSL-1-2010

C. LED Fixtures:
1. Listings and Certifications
   a. UL/CUL Listed for safety (1598)
   b. UL/CUL dry/damp location listed
   c. CE
   d. RoHS compliant
   e. FCC Class B
   f. Lighting Facts (U.S. Department of Energy) certified
   g. DesignLights Consortium approved

D. Metal Parts: Free of burrs and sharp corners and edges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Adjust aimable lighting fixtures to provide required light intensities.

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
   1. Take precautions necessary to avoid damage to existing trees which are designated to remain.

C. Utility Locator Service: Notify OKIE One-Call for area where Project is located before site clearing.

D. Do not commence site-clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when topsoil is dry or slightly moist.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect site improvements to remain from damage. Restore damaged improvements to condition existing before start of site clearing.

D. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

E. Preparation of Sub-Grade for foundations:
   a. If there is a geotechnical report for the site, follow the recommendations in the geotechnical report.

   b. Topsoil in building area including all grass, trees, roots, etc., shall be removed. Good topsoil shall be stock-piled for top dressing.

c. Old drain lines, piping, and other foreign matter within the building area shall be removed. The sub-grade of all slabs shall be finished to a true and even grade, moisture-treated to within 2% of optimum density, and compacted to 95% ASTM D-698, unless specified otherwise in the geotechnical report, or by the project engineer.

d. Subgrade shall be proof-rolled, and any areas that are spongy and sink more than ¼" under the heavy wheel loads shall be removed and replaced with suitable fill material.

F. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

3.2 SITE CLEARING

A. Remove obstructions, trees, shrubs, grass, roots, and other vegetation to permit installation of new construction.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

C. Strip topsoil. Remove sod and grass before stripping topsoil. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade stockpiles to drain water.

1. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

D. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

E. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement.

F. Dispose of waste materials and excess topsoil, off Owner's property.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Unit prices for rock excavation are specified in Section 012000 "Price and Payment Procedures."

B. Unauthorized excavation consists of excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

C. Utility Locator Service: Notify OKIE One-Call for area where Project is located before beginning earthmoving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, or other deleterious matter.

B. Unsatisfactory Soil: ASTM D 2487 Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT.

C. Top Soil: Sand loam, free of clay, coarse sand, stones, plants roots or other organic material.

D. Backfill and Fill: Satisfactory soil materials. River sand, free of roots and other organic material.

E. Sub base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

I. NOTE: Where sand is used to backfill trenches, the five feet (5') entering or leaving a building shall be clay type soil, which will prohibit the flow of water under the building.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Do not start until fill material, fill areas and equipment to be used in performing the work have been approved by the Housing Authority, and until all foreign materials have been removed and all new construction over which filling or backfilling is required has been completed and approved, such as footings, drains, utility items and etc.

B. Place all fills and backfills in layers not more than 6 inches thick, with moisture content within 2% of optimum.

C. Compact fills and backfills to the following minimum densities, expressed as percentages of maximum densities as determined by ASTM D698. Fill and soil compaction control for all backfill areas under slabs, primary lawn areas, and streets or driveways, shall be engineered lifts not greater than 6" for each lift.

1. Fill under unpaved areas shall be compacted to 90 percent of maximum density.
2. Fills under paved areas shall be compacted to 95 percent of maximum density.

D. Backfill or fill around drain tile and other pipes shall be compacted with hand tools to a point 12 inches above pipe.

E. Protect and maintain erosion and sedimentation controls during earthmoving operations.

F. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

G. Backfill: Approved excavated material, free of stones, debris, roots and other organic material.

H. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

I. Explosives: Do not use explosives.

J. Excavate to sub grade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents.

K. Excavate for structures, building slabs, pavements, and walkways. Trim subgrade to required lines and grades.

L. Utility Trenches: Excavate trenches to indicated slopes, lines, depths, and invert elevations. Shape sub grade to provide continuous support.
   1. Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

   2. Place and compact initial backfill of satisfactory soil material or sub base material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final sub grade.

M. Proof-roll sub grade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub grades.

N. Plow, strip, or break up sloped surfaces steeper than 4 horizontal to 1 vertical prior to receiving fill.

O. Grading: Make sure all underground services are in place and the ditches tamped before any attempt is made at finished grading. The ground surface adjacent to the building shall be 6” or more below the floor elevation and sloped uniformly for a minimum distance of 15’ feet away from house at a 5% or greater slope. Grading shall then extend away from house pad to drain entire house lot, with no ponding.

P. Under pavements and walkways where indicated on the plans, place sub base course material on prepared subgrade and compact within 2% of optimum moisture content to required grades, lines, cross sections, and thicknesses.

Q. Allow testing agency to inspect and test each subgrade and each fill or backfill layer and to verify compliance with requirements.

R. All work shall be done in such a manner that damage to existing construction is avoided. All damaged areas shall be repaired in a timely manner, to the satisfaction of the Housing Authority.

S. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and dispose of them off Owner's property in an appropriate and environmentally-acceptable fashion.

END OF SECTION 312000

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and design mixtures for concrete from an approved testing lab.

PART 2 - PRODUCTS

2.1 CONCRETE PAVING

A. Comply with ACI 301 unless otherwise indicated.

2.2 MATERIALS

A. Welded Wire Reinforcement: ASTM A 185, flat sheets.

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

C. Portland Cement: ASTM C 150, Type I or II, supplemented with:
   1. Fly Ash: ASTM C 618, Type C or F.
   2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: ASTM C 494. Calcium chloride shall not be used.

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

H. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.3 CONCRETE MIXTURES

A. Proportion normal-weight concrete mixes to provide the following properties:
   1. Compressive Strength (28 Days): 3500 psi
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement shall be in accordance with the mix design.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Air Content in accordance with the mix design.

PART 3 - EXECUTION

3.1 PAVING

A. Accurately position and support reinforcement, and secure against displacement.

B. Locate and install contraction, construction, isolation, and expansion joints as indicated or required.

C. Place concrete in a continuous operation within planned joints or sections. Do not add water to adjust slump.

D. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet and light broom finish.

E. Tool edges and joints to a radius of 1/4 inch.

F. Begin curing after finishing concrete. Keep concrete continuously moist for at least seven days, or apply membrane-forming curing compound to concrete.

G. Owner will engage a qualified testing agency to perform tests and inspections.

H. Remove and replace concrete paving that is broken, damaged, or defective. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

I. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days.

END OF SECTION 321313