

227 York Street Portland, Maine
NEW RESIDENCE
ARCHITECTURAL SPECIFICATIONS
10 May 2013

Note: Structural/Civil/MEP/Sprinkler Specifications
are included on drawings

Architect:

Reiter Architecture & Design

PO Box 275 -- Brooklin, ME 04616
Tel. 207.359.2300

Structural & Civil Engineer:

Casco Bay Engineering

424 Fore Street -- Portland, ME 04101
Tel. 207.842.2800

MEP & Sprinkler Engineer:

Bennett Engineering

PO Box 297 -- Freeport, ME 04032
Tel. 207.865.9475

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Division 0: GENERAL CONDITIONS

SECTION 00700 GENERAL CONDITIONS

1. General Conditions: AIA A201 - 2007, General Conditions of the Contract for Construction are included by reference as part of the contract documents. General Conditions Forms: General Conditions are available from the American Institute of Architects, Washington, D.C., 202-626-7300.
 2. These Product Specifications are complementary with the Project drawings. In the case of a conflict between documents, the Architect's interpretation shall prevail.
 3. All materials and products to be furnished as specified, unless request for substitutions are submitted with full documentation and substitutions have been approved.
 4. All products are to be installed per manufacturer's recommendations, including but not limited to, method of anchoring or attachment, adhesives, preparation of substrates.
 5. All aspects of the project are to be constructed in a good workmanlike manner, and in compliance with any and all relevant governing standards and requirements.
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SECTION 00800 PROJECT NARRATIVE

The project includes demolition of an existing house and the creation of a new house, using the same footprint. Excavation is called for at the rear of the building, since the original basement (known as the "Ground Floor") does not currently extend to the full length of the house above; however, if subsurface rock is encountered, the extent of the basement area may be modified.

The Contractor is required to furnish a narrative of how the work will be accomplished, given the restrictive site conditions of a narrow site and construction adjacent to the lot line.

The Owner will purchase a number of the finish items; see Specification Section 01001 describing these items.

A Blower Door test is required to ensure integrity of the building envelope.

Since the building is located within approximately 4" of the lot line on one side, the lot line wall requires additional protection, including a one hour rating and additional sprinkler heads at windows located along the lot line. Additionally, the Ground Floor is zoned for commercial use, and as such, the floor/ceiling assembly between the commercial space and the residence above is also required to have a one-hour rating.

Gas, electrical, and water service to the building shall be separately metered for the residential and commercial units. Much of the ground floor interior work and storefront is to be installed by the commercial tenant under separate contract. See Specification Sections 01002 and 01003 detailing these items.

**SECTION 01001
OWNER PROVIDED / CONTRACTOR INSTALLED ITEMS**

Owner will provide the following items for Contractor's installation. Installation includes, but is not limited to, connections with plumbing, electrical, gas and/or other services; blocking at walls and/or ceilings; painting and/or other finishing components.

1. Kitchen upper and lower cabinets (Contractor to provide and install countertops and backsplashes).
2. Kitchen appliances and fixtures, including sink & faucet, garbage disposal, refrigerator, gas range, dishwasher, refrigerator with icemaker, exhaust hood.
3. Bathroom vanities, sinks and faucets, toilets.
4. Bathroom towel bars and mirrors.
5. Stackable clothes washer & gas dryer.
6. Surface-mounted lighting fixtures and overhead decorative ceiling fans.

**SECTION 01002
CONTRACTOR-INSTALLED ITEMS WITH SEPARATE PRICING**

The following items are noted in Drawings and/or Specifications and shall be included under Contractor's work; however, separate prices for each item, including materials and installation, must be provided.

1. Three openings in ground floor concrete walls for future ductwork.
2. One 60" wide window in ground floor.
3. Rigid insulation under ground floor slab.
4. Fire retardant wood siding at exterior for future ductwork.
5. Water, gas and electric meters for ground floor services.
6. New 2" water line to building from street.

**SECTION 01003
ITEMS SHOWN ON DRAWINGS BUT TO BE INSTALLED BY OTHERS**

The following items are noted in Drawings and/or Specifications but are to be done by others under separate contract. This work shall be excluded from Contractor scope and price.

1. Ground floor concrete slab.
2. Ground floor rigid insulation at concrete walls.
3. Ground floor storefront window and door and exterior lighting at ground floor.
4. Garbage storage shed along sidewalk.
5. Rated ceiling assembly at ground floor ceiling.
6. Finish walls and other fit-out of interior of ground floor, except that 5/8" Type X gyp bd. at lot line wood frame wall shall be in Contractor's basic scope.

**SECTION 01004
ADD ALTERNATES**

Contractor is required to provide pricing for the following materials and/or systems in lieu of those shown in Drawings and/or Specification. Cost shall include all related work, whether noted or not, required to install full and complete noted materials and/or systems.

1. Exterior Siding: In lieu of vinyl siding and trim, install HardiePlank lap siding with painted clear exterior grade pine corner boards and related trim.
2. Roofing: In lieu of asphalt roof shingles, install standing seam metal roofing and related trim.
3. Siding: In lieu of clapboard-style vinyl siding at walls facing terraces (off Living Room and Bedroom 1): provide vinyl shingle-style siding.
4. Provide hardwood strip flooring (same as elsewhere) in Bedrooms # 2 & 3.

DIVISION 5: METALS

SECTION 05520 METAL CABLE RAILINGS

1. GENERAL

- SUMMARY

- Provide stainless steel cable railings at wood posts.

- SUBMITTALS

- Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

- QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Handrail and Railing Structural Performance: In accordance with applicable Building Code.

2. PRODUCTS

- MATERIALS

- Metal Railings:
 1. Manufacturers, Railings: Ultra-Tec Cable Railing System, or approved equal.
 2. Application: Stainless steel 1/4" diameter cable railings
 3. Auxiliary Materials:
 1. Swaging and/or other tensioning hardware for cable rails.

3. EXECUTION

- Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines and angles. Provide light-tight, hairline joints.
- Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- Coordinate with work of other sections; provide inserts and templates as needed. Install work plumb and level with uniform appearance.
- Restore damaged finishes and protect work.

END OF SECTION

Division 6: WOOD & PLASTICS

SECTION 06100 ROUGH CARPENTRY

1. GENERAL

• QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Lumber Standards and Grade Stamps: DOC PS 20, American Softwood Lumber Standard and inspection agency grade stamps.
- Construction Panel Standards: DOC PS 1, U.S. Product Standard for Construction and Industrial Plywood; APA PRP-108.
- Wood Framing Standards: NFPA House Framing Manual.
 1. Interior Wall Framing: 2 inch by 4-inch studs, 16 inches on center, unless otherwise noted.
 2. Exterior Wall Framing: 2 inch by 6-inch studs, 24 inches on center, unless otherwise noted.
 3. LVL and other Framing: see Structural Drawings
- Preservative Treatment: AWPA C2 for lumber and AWPA C9 for plywood; waterborne pressure treatment. Provide for wood in contact with soil, concrete, masonry, roofing, flashing, dampproofing and waterproofing.

2. PRODUCTS

• MATERIALS

- Rough Carpentry Applications:
 1. Framing with dimension lumber.
 2. Framing with engineered wood products.
 3. Framing with pressure-treated lumber at exterior stairs and ramp.
 4. Wood grounds, nailers, and blocking.
 5. Wood furring.
 6. Backing panels.
 7. Dimension Lumber:
 1. Light Framing: Stud, No. 3 or Standard grade.
 2. Structural Framing: No. 1 grade.
 3. Species: Any species of grade indicated.
 8. Miscellaneous Lumber:
 1. Moisture Content: 19 percent.
 2. Grade: Standard grade light framing.
 9. Engineered Wood Products: See Structural Drawings.
 10. Framing Anchors and Fasteners:
 1. Material: Non-corrosive, suitable for load and exposure. Drywall screws are not acceptable.

3. EXECUTION

• INSTALLATION

- Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- Plywood: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial"
- Provide nailers, blocking and grounds where required. Set work plumb, level and accurately cut.

- Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with other work.
- Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.
- Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 06200 INTERIOR FINISH CARPENTRY

1. GENERAL

• SUMMARY

- Provide interior finish carpentry, railings, countertops and other items noted on Drawings.
- Install Owner-provided cabinets, towel bars, and other miscellaneous items.

• QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Standards: Architectural Woodwork Institute (AWI) 'Architectural Woodwork Standards.'
- Preservative Treatment: Nonpressure method, exterior type, AWPA N1
- Wood Products: Comply with the following:
 1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 5. Hardwood Plywood and Face Veneers: HPVA HP-1.

2. PRODUCTS

• MATERIALS

- Interior Plastic Laminate Clad Countertops:
 1. Laminate: High pressure decorative laminate, NEMA LD-3.
 2. Grade: Custom.
 3. Core: Plywood.
 4. Edge: Lumber.
- Interior Frames, Jambs and Baseboard:
 1. Species for Opaque Finish: Closed grain hardwood.
 2. Grade: Custom.
 3. Site Finish: Opaque finish.
- Interior Shelving:
 1. Shelving: Plywood with hardwood edgeband.
- Interior Auxiliary Materials:
 1. Nails: FS FF-N-105.
 2. Anchors: Type required for secure anchorage.

3. EXECUTION

• INSTALLATION

- Provide work to sizes, shapes, and profiles indicated. Install work to comply with quality standards referenced. Back prime work and install plumb, level and straight with tight joints; scribe work to fit.
- Provide backerboards and/or wood grounds as required behind all wall-hung components including but not limited to: wall-hung cabinets.
- Quality Standard: Install woodwork to comply with AWI standards for the same grade specified for type of woodwork involved.
- Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.
- Repair minor damage, clean and protect.

END OF SECTION

**SECTION 06201
EXTERIOR FINISH CARPENTRY**

1. GENERAL

• SUMMARY

- Provide exterior finish carpentry, including but not limited to:
 - Provide wood decking.
 - Provide wood soffits
 - Provide Wood handrails
 - Provide Exterior Wood Stairs and Landings
 - 1. Guardrails, posts, walls and other trim

• SUBMITTALS

- Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

• QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Preservative Treatment: Nonpressure method, exterior type, AWPA N1

1. PRODUCTS

• MATERIALS

- Solid Wood Decking, Stairs, railing supports and Landings:
 - 1. Application: Solid wood floor decking, stairs, railing supports and landings.

2. Species: Pressure Treated 5" Wood Decking and Posts, sizes as noted on drawings.
3. Preservative Treatment: AWPA C31 with inorganic boron (SBX) and redry wood.
4. Floor Decking Appearance Grade: Architect Clear.
5. Finish: Clear exterior grade sealer.
6. Fasteners: stainless steel.

o Wood exterior soffits

1. Application: Soffits under terraces or roofing.
2. Species: T-111 Plywood.
3. Preservative Treatment: exterior grade.
4. Finish: Clear exterior grade sealer
5. Fasteners: stainless steel

o Wood Top Rails

1. Application: Top rails at terraces and exterior
2. Species: Solid Cedar.
3. Preservative Treatment: AWPA C31 with inorganic boron (SBX) and redry wood.
4. Finish: Clear exterior grade sealer
5. Fasteners: stainless steel

2. EXECUTION

• INSTALLATION

- o Provide work to sizes, shapes, and profiles indicated. Install work to comply with quality standards referenced. Back prime work and install plumb, level and straight with tight joints; scribe work to fit.
- o Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Use non-corrosive fasteners for exterior work. Coordinate with work of other sections.
- o Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.
- o Install all wood decking complying with recommendations of AITC 112.
- o Apply minimum 3 coats of sealer, following manufacturers' recommended application techniques.
- o Restore damaged components. Clean and protect work from damage.

END OF SECTION

SECTION 06273
EXTERIOR FIRE-RETARDANT TREATED WOOD

4. GENERAL

• SECTION INCLUDES

- o Fire-retardant treatment for the following exterior applications:
 1. Wood sheathing where noted on drawings behind future ductwork location.

• RELATED SECTIONS

- o Section 06100 - Rough Carpentry.
- o Section 06110 - Wood Framing.
- o Section 06112 - Wood Framing and Sheathing.

- Section 06114 - Wood Blocking and Curbing.

- REFERENCES

- ASTM D 2898 - Standard Test Method for Accelerated Weathering of Fire- Retardant-Treated Wood for Fire Testing.
- ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
- NFPA 703 - Standard for Fire-Retardant Treated Wood for Building Materials.
- UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- Department of Defense: Mil. Spec. L-19140E Lumber and Plywood, Fire-Retardant Treated.

- SUBMITTALS

- Submit under provisions of Section 01300.
- Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Product Specifications.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- Manufacturer's Certificates: Certify products meet or exceed specified requirements.

- DELIVERY, STORAGE, AND HANDLING

- Store products under shelter, off the ground with proper ventilation allowing for air circulation and protect from construction traffic, and damage.

- SEQUENCING

- Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

5. PRODUCTS

- MANUFACTURERS

- Acceptable Manufacturer: Hoover Treated Wood Products, Inc., which is located at: 154 Wire Rd. ; Thomson, GA 30824; Toll Free Tel: 800-TEC-WOOD; Tel: 706-595-5058; Fax: 706-595-6600; Email: marketing@frtw.com; Web: www.frtw.com
- Requests for substitutions will be considered in accordance with provisions of Section 01600 and subject to submission of product literature verifying equal or better performance.

- APPLICATIONS/SCOPE

- All lumber and plywood designated to be exterior fire retardant treated shall be pressure impregnated with Exterior Fire-X. Exterior Fire-X is provided in conformance with the following:
 1. International Building Code - Section 2303.2 , Fire retardant, Exterior Type.
 2. International Residential Code - Section R802.1.3, Fire retardant, Exterior Type.
 3. Mil. Spec. L-19140E Lumber and Plywood, Fire-Retardant Treated.
 4. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 5. UL Listing, Treated Lumber (BPVV).
 6. UL Listing, Treated Plywood (BUGV).
 7. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 8. NFPA 703 - Standard for Fire-Retardant Treated Wood for Building Materials.
 9. Mil. Spec. L-19140E Lumber and Plywood, Fire-Retardant Treated.

- After consideration of design value adjustments provide lumber of the appropriate grade and species as specified by the design criteria of the intended application
- After consideration of span rating adjustments provide plywood of the appropriate size, grade and species as specified by the design criteria of the intended application.
- FIRE RETARDANT TREATMENT
 - Lumber and Plywood: Pressure impregnated with Exterior Fire-X in accordance with the Follow-Up Procedures of Underwriters Laboratories Inc. Fire-retardant treatment shall contain no halogens, sulfates, chlorides, or ammonium phosphate.
 1. Species and Grade as specified in:
 1. Section 06100 - Rough Carpentry.
 2. Section 06110 - Wood Framing.
 2. Surface Burning Characteristics: Flame spread index of 25 or less and flame spread not more than 10.5 feet (3.2 m) beyond centerline of burners with no evidence of significant progressive combustion when tested in accordance with ASTM E 84 for 30 minutes.
 3. No increase in flame spread after testing per ASTM D 2898 Standard Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
 4. Moisture Content:
 1. Kiln dry lumber to 19 percent or less moisture content after treatment.
 2. Kiln dry plywood to 15 percent or less moisture content after treatment.
 5. Labeling: Each piece of lumber and plywood shall be labeled with a permanent ink mark.
 1. Each piece of lumber shall bear the UL Classification Mark certifying specified flame spread rating.
 2. Each piece of plywood shall be marked on both sides.
 3. Production and kiln drying after treatment monitored by Timber Products Inspection, Inc., with each piece labeled KDAT.
 4. The mark shall state there shall be no increase in the listed classification when subjected to the Standard Rain test.
- FABRICATION
 - Milling: Lumber shall be ripped or run to pattern, as required, prior to treatment.
 - Surface milling or planning is not allowed after treatment.
- 6. EXECUTION
- EXAMINATION
 - Discard pieces with defects that might impair quality or work.
- PREPARATION
 - Clean surfaces thoroughly prior to installation.
 - Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- FIELD CUTTING
 - Lumber:
 1. Do not rip or mill lumber after fire-retardant treatment; end cuts and joining cuts are permitted.
 2. Drilling of holes and notching permitted in accordance with American Forest and Paper Association Wood Construction Data #1.
 - Plywood: Fire-retardant-treated plywood may be cut in any direction.
- APPLICATION

- Install in accordance with manufacturer's instructions.
- Provide adequate airflow across at least one surface in wood roof systems to control moisture and reduce temperature.
- Cover roof sheathing with felt or roofing immediately after installation. If wetted during construction, allow to dry before enclosure or covering with roofing material.
- Fasteners: Use the following fastener types:
 1. Locations exposed to the weather or wet or damp locations: Use hot dip galvanized or stainless steel fasteners for all types of treated wood .
 2. Other locations: Use corrosion resistant fasteners for all types of treated wood. Acceptable for use with galvanized nails, truss plates, ductwork, plumbing, conduit and copper.
- Coordinate surface preparation and applied finishes with the requirements of Section 09900.
- PROTECTION
 - Protect installed products until completion of project.
 - Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Division 7: THERMAL & MOISTURE PROTECTION

SECTION 07210 BUILDING INSULATION

1. GENERAL

- SUMMARY

- Provide thermal insulation and vapor retarders.
- Provide acoustical insulation at underside of first floor framing

- SUBMITTALS

- Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

- QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

2. PRODUCTS

- MATERIALS

- Board Insulation:
 1. Manufacturer: CertainTeed Corp; Knauf Insulation or approved equal.
 2. Application: Under-slab insulation.
 3. Type: Extruded polystyrene, rigid.
 1. Standard: ASTM C 578.
- Spray-Applied Closed Cell Polyurethane Insulation:
 1. Manufacturer: [3M](#); [CertainTeed Corp.](#), [Insulation Group](#); or approved equal
 2. Application: Roof and under Terraces framing.
 3. Standard: ASTM C 1029.
 4. Minimum R-value: 7 per inch
- Spray-Applied Dense Pack Cellulose Self-supporting Insulation:
 1. Manufacturer: Submit manufacturer and product literature for approval
 2. Application: Exterior walls, Roof and above hung Ceiling at Second Floor.
 3. Standard: ASTM C739-08 and ASTM C1149.
 4. Minimum R-value: 3.5 per inch
- Acoustical Insulation:
 1. Manufacturer: Owens Corning or approved equal
 2. Application: In cavity of interior portion of First Floor framing.
 3. Standard: ASTM E 90.
 4. Minimum value: not less than STC 50 for air-borne noise.
- Vapor Retarder (Not Integral with Insulation):
 1. Application: Exterior walls and under Slab.
 2. Type: Reinforced 2-ply polyethylene, 6 to 10 mils.
 1. Accessories: Seam tapes.

3. EXECUTION

- INSTALLATION

- Install materials and systems in accordance with manufacturer's instructions and approved submittals.

Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections. Provide full thickness in one layer over entire area, tightly fitting around penetrations.

- Check building cavity walls for air leakage and moisture control. It is paramount that moisture and air leaks are eliminated at building cavities before installing spray-in.
- Spray insulation into cavities indicated; provide uniform coverage at correct density and thickness. Install blow-in insulation to the depth and width allowable within the existing wall cavities to attain the maximum possible R-value within existing wall cavity.
- In the case of materials installed with added moisture, provide natural ventilation to properly cure the insulation during and subsequent to its application. Allow damp spray-in methods time to dry before walls are closed.
- Install vapor retarder over entire area of inside face of exterior walls and elsewhere as indicated. Seal all seams and around perimeter and penetrations with duct tape to form a continuous vapor retarder free of holes.
- Protect installed insulation and vapor retarder.

END OF SECTION

SECTION 07313 ASPHALT SHINGLE ROOFING SYSTEMS

7. GENERAL

1.1 SECTION INCLUDES

- A. Granule surfaced asphalt shingle roofing.
- B. Moisture shedding underlayment, eaves, valley and ridge protection
- C. Associated metal flashing

1.2 RELATED SECTIONS

- A. Section 061000 – Rough Carpentry: Plywood Roof Sheathing
- B. Section 061500 – Wood Decking
- C. Section 072600 – Vapor Retarders
- D. Section 071354 – Sheet Waterproofing.
- E. Section 076000 – Flashing and Sheet Metal.

1.3 REFERENCES

- A. ASTM A 653/A 653M – Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM B 370 – Standard Specification for Copper Sheet and Strip for Building Construction.
- D. ASTM D 225 – Standard Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules.
- E. ASTM D 226 – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

1.4 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Provide manufacturer's printed product information indicating material characteristics, performance criteria and product limitations.
- C. Manufacturer's Installation Instructions: Provide published instructions that indicate

preparation required and installation procedures.

1.5 QUALITY ASSURANCE

- A. Installer Minimum Qualifications: Installer shall be licensed or otherwise authorized by all federal, state and local authorities to install all products specified in this section. Installer shall perform work in accordance with NRCA Roofing and Waterproofing Manual Work shall be acceptable to the manufacturer.
- B. Maintain one copy of manufacturers application instructions on the project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store Products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials and materials used with solvent based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Deliver shingles to site in manufacturer's unopened labeled bundles. Promptly verify quantities and conditions. Immediately remove damaged products from site.

1.7 PROJECT CONDITIONS

- A. Anticipate and observe environmental conditions (temperature, humidity and moisture) within limits recommended by manufacturer for optimum results. Do not install products under environment conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Manufacturer's Warranty: Furnish shingle manufacturer's warranty for the product listed below:
 - 1. CertainTeed Landmark Lifetime limited warranty
- B. Warranty Supplement: Provide manufacturer's supplemental warranty (CertainTeed's Surestart or Surestart Plus) to cover labor and materials in the event of a material defect for the following period after completion of application of shingles:
 - 1. First Ten Years (All Lifetime Warranty products)
- C. Warranty Transferability Clause: Make available to Owner shingle manufacturer's standard option for transferring warranty to a new owner.
- D. Wind Warranty Upgrade to 130 mph for first 15 years provided all manufacturers' conditions and instructions are met by contractor.

8. PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Provide products manufactured by the CertainTeed Corporation. Contact Sales Support Group P.O. Box 860 Valley Forge, PA 19482 Toll Free 800-233-8990
 - o Substitutions: As approved by Architect

2.2 ASPHALT FIBERGLASS SHINGLES

- A. CertainTeed Landmark Shingle: Conforming to ASTM D 3018 Type I – Self-Sealing, UL Certification of ASTM D 3462, ASTM D 3161/UL997 70-mph Wind Resistance and UL Class A Fire Resistance, glass fiber mat base, ceramically colored/UV resistant mineral surface granules across entire face of shingle, two piece laminate shingle.
- B. Weight: 240-245 pounds per square (100 square feet) (12.0 kg/sq m).
- C. Color: As selected by Architect from manufacturer's standards.

2.3 SHEET MATERIALS

- A. Underlayment: CertainTeed "Roofers' Select", ASTM D 6757; asphalt-impregnated fiberglass-reinforced organic felt designed for use on roof decks as a water-resistant layer beneath roofing shingles

2.4 FLASHING MATERIALS

- A. Sheet Flashing: ASTM A 361/A361M; 26 Gauge (0.45 mm) steel with minimum G115/Z350

- galvanized coating
- B. Bituminous Paint: Acid and alkali resistant type; black color.
- C. Tinner's Paint: Color as selected by Architect to coordinate with shingle color.

2.5 ACCESSORIES

- A. Nails: Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, aluminum or chormated steel; minimum 3.8 inch (9.5mm) head diameter; minimum 11 or 12 gage (2.5mm) shank diameter; shank to be sufficient length to penetrate through the roof sheathing or ¾ inch (19mm) into solid wood, plywood or non-veneer wood decking.
- B. Asphalt Roofing Cement: ASTM D 4586, Type I or II

2.6 FLASHING FABRICATION

- A. Form flashing to profiles indicated on Drawings and to protect roofing materials from physical damage and shed water.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

9. EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions under provisions of Section 017000.
- B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surfaces.
- C. Verify deck surfaces are dry and free of ridges, warps or voids.

3.2 ROOF DECK PREPARATION

- A. Follow shingle manufacturer's recommendations for acceptable roof deck material
- B. Broom clean deck surfaces under eave protection and underlayment prior to their application

3.3 INSTALLATION – EAVE ICE DAM PROTECTION

- A. Place eave edge and gable metal edge flashing tight with fascia boards. Weather-lap joints 2 inches (50mm). Secure flange with nails spaced 8 inches (200 mm) on center.
- B. Apply CertainTeed "WinterGuard" Waterproofing Shingle Underlayment as eave protection in accordance with manufacturer's instructions.
- C. Extend eave protection membrane minimum 24 inches (640 mm) up slope beyond interior face of exterior wall.

3.4 INSTALLATION – PROTECTIVE UNDERLAYMENT

- A. Roof Slopes 4:12 or Greater: Install one layer of asphalt felt shingle underlayment perpendicular to slope of roof and lap minimum 4 inches (100 mm) over eave protection.
- B. Weather-lap and seal watertight with asphalt roofing cement items projecting through or mounted on roof. Avoid contact or solvent-based cements with WinterGuard and Diamond Deck

3.5 INSTALLATON – METAL FLASHING

- A. Weather-lap joints minimum 2 inches (50 mm).
- B. Seal work projecting through or mounted on roof with asphalt roofing cement and make weather tight.

3.6 INSTALLATION- ASPHALT SHINGLES

- A. Install shingles in accordance with manufacturer's instructions for product type and application specified.

3.7 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 014516.
- B. Visual inspection of the work will be provided by Owner. If conditions are unacceptable, Owner will notify the Architect.

3.8 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Section 017600.
- B. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07464
VINYL SIDING

I. GENERAL

1.1 SECTION INCLUDES

- A. Vinyl siding.
- B. Accessories and trim.

1.2 RELATED SECTIONS

- A. Section 06100 - Framing and Sheathing.
- B. Section 07260 - Vapor Retarders.
- C. Section 07900 - Joint Sealers.

1.3 REFERENCES

- A. ASTM D 3679 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding.
- B. ASTM D 5206 - Standard Windload Resistance Test.
- ASTM E 84 - Standard test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 DESIGN/PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Code compliance in accordance with the following:
 - IBC and IRC
- B. PVC Fire Resistance: Provide vinyl siding products that meet or exceed the following ratings:
 - Flame Spread Index < 25, smoke development rating <450, per ASTM E 84.
 - Fire endurance classification of 1 hour, per ASTM E 119 in a wall assembly.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- C. Verification Samples: For each finish product specified, two samples, minimum size 12 inches (300 mm) long, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Provide installer with not less than three years of experience with products specified or has obtained 5-Star Green Contractor (Preferred), 5-Star Contractor (preferred), or Master Craftsman credentials from CertainTeed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation. Refer to manufacturer's installation instructions for specific storage and handling requirements.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. Provide manufacturer's standard lifetime limited warranty on siding products, transferable to new owners.

II. PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corporation, Siding Products Group, P.O. Box 860, Valley Forge, Pennsylvania 19482. ASD. Tel: (800) 233-8990. Fax: (610) 341-7940; Email: ctsiding@certainteed.com; Web: www.certainteed.com.
- B. Substitutions: By approval of Architect

2.2 MATERIALS

- A. Vinyl Siding, Soffit and Components: Provide products made of extruded polyvinyl chloride as specified in this section and manufactured to comply with requirements of ASTM D 3679.
 - 1. Provide elongated nailing slots on nailing flanges to allow for movement.
 - 2. Factory-notch ends of horizontal panels to form overlapping joints.
 - 3. Provide products that meet weathering requirements of ASTM D 3679.
- B. Wolverine Restoration Smooth T3:
 - 1. Design: Triple 3 inch (76 mm) clapboard, restoration smooth finish with STUDfinder Installation System.
 - 2. Nail Hem: StormRoll Hem Roll Over
 - 3. Nail Hem.Lock: GripLock.
 - 4. Width: 9 inches (229 mm) plus or minus .062 inch (1.57 mm).
 - 5. Length: 12 feet 1 inch (3.68 m) plus or minus .025 inch (6 mm).
 - 6. Average Thickness: 0.044 inch (1.1 mm).
 - 7. Panel Projection: 5/8 inch (15.9 mm).
 - 8. Exposure: 3 inches (76 mm) with single nailing hem.
 - 9. Maximum Warp (per 2 panels): 0.250 inch (6 mm).
 - 10. Color: As selected by Architect from manufacturer's standards.

2.3 VINYL CARPENTRY ACCESSORIES

- A. Standard Accessories: As required for full and complete installation, and may include but not be limited to:
 - 1. Corner post: Standard width, 10 feet (3.05 m), 12 feet (3.66 m), and 20 feet (6.10 m) lengths.
 - 2. J-Channel: Standard width, 12 feet, 6 inches (3.81 m) length.
 - 3. Undersill trim: 3/4" face, 12 feet, 6 inch (3.81 m) length.
 - 4. 2-1/2 inch (64 mm) Metal Starter Strip. (No Color)
 - 5. 2-1/4 inch (57 mm) Vinyl Starter Strip. (No Color)
 - 6. Color: refer to CTS002 for color availability of accessories

2.4 FASTENERS

Provide galvanized or other corrosion-resistant nails as recommended by manufacturer of siding products.

III EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Examine, clean, and repair as necessary any substrate conditions which would be detrimental to proper installation.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION

- A. Install products in accordance with the latest printed instructions of the manufacturer.
- B. Installer should have current 5-Star Contractor (preferred) or Master Craftsman credentials.
- C. Install products with all components true and plumb.
- D. *For Vinyl Siding:* Nail horizontal panels by placing nail in center of slot. Nail vertical panels by placing first nail at top of top slot and remaining nails in center of slots. Drive nails straight, leaving 1/16 inch (1.6 mm) space between nail head and flange of panel. (NOTE: Refer to CTS205 Installation Manual for latest installation recommendations)
- E. Allow space between both ends of siding panels and trim for thermal movement. Overlap horizontal panel ends one-half the width of factory pre-cut notches.
- F. Stagger lap joints in horizontal siding in uniform pattern as successive courses of siding are installed.
- G. Install J-channel and flashing to accommodate successive courses of vertical siding. Install wood shims at building corners to bring cut edges of vertical siding out to correct plane.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 CLEANING

- A. At completion of work, remove debris caused by siding installation from project site.

END OF SECTION

SECTION 07530
THERMOSET (EPDM) MEMBRANE ROOFING

10. GENERAL

- SECTION INCLUDES

- Thermoset Membrane Roofing at terraces.
- Roof Cover Board

- RELATED SECTIONS

- Section 06100 - Rough Carpentry: Roof blocking installation and requirements.
- Section 07620 - Sheet Metal Flashing and Trim: Metal flashing and counter flashing installation and requirements.

- REFERENCES

- American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures, Current Revision.

- ASTM International (ASTM):
 1. ASTM D 4637 - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
 2. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- International Code Council (ICC):
 1. International Building Code (IBC).
- National Roofing Contractors Association (NRCA) - Low Slope Roofing and Waterproofing Manual, Current Edition.
- Underwriters Laboratories (UL):
 1. TGFU R1306 - "Roofing Systems and Materials Guide".
 2. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.
- DESIGN CRITERIA
 - Wind Uplift Performance: Carlisle offers a standard 55 MPH wind speed warranty.
 - Fire Resistance Performance:
 1. Roof system will achieve a UL Class A rating when tested in accordance with UL-790.
 - Drainage: Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.
 - Building Codes:
 1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.
- SUBMITTALS
 - Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- QUALITY ASSURANCE
 - Manufacturer Qualifications: All products specified in this section will be supplied by a single manufacturer with a minimum of twenty (20) years experience.
 - Installer Qualifications:
 1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
- DELIVERY, STORAGE, AND HANDLING
 - Store products in manufacturer's unopened packaging until ready for installation.
 - Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.
- PROJECT CONDITIONS
 - Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - Refer to Carlisle's Roofing System specification, Part II - Application, for General Job Site Considerations.
 - When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

- When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.
- Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- New roofing shall be complete and weathertight at the end of the work day.
- Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.
- WARRANTY
 - At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total-System warranty, outlining its terms, conditions, and exclusions from coverage.
 1. 15 years.

11. PRODUCTS

● MANUFACTURERS

- Acceptable Manufacturer: Carlisle SynTec , which is located at: P. O. Box 7000 ; Carlisle, PA 17013; Toll Free Tel: 800-4-SYNTEC; Tel: 717-245-7000; Fax: 717-245-7053; Email: [request info \(Amanda.Lodge@syntec.carlisle.com\)](mailto:request_info@amanda.lodge@syntec.carlisle.com); Web: www.carlisle-syntec.com
- Substitutions: per approval by Architect.

● SCOPE / APPLICATION

- Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in Design Criteria.
 1. Membrane Attachment: Fully Adhered.
- Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.
- Insulation: Provide a roof insulation system beneath the finish membrane.

● COVER BOARD

1. Gypsum Board: Dens-Deck Prime, 1/2" thick.

● ETHYLENE, PROPYLENE, DIENE TERPOLYMER (EPDM) MEMBRANE

- Sure-Seal Non-Reinforced Membrane: Cured, non-reinforced EPDM membrane meeting the requirements of ASTM D 4637 Type I.
 1. Color: Black.
 2. Membrane Thickness: 60 mil nominal.
 3. Sheet Dimensions:
 1. Width: 10 feet (3.05 m) maximum.
 2. Length: 100 feet (30.5 m) maximum.

4. Performance:
 1. Tensile Strength: 1550 psi (10.7 MPa) minimum.
 2. Tear Resistance: 200 lbf/in (35 kN/m) minimum.
 3. Elongation: 480 percent.

- CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

- Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed EPDM membrane prior to applying EPDM Primer.
- Sure-Seal SecurTAPE: 3 inch (76mm) or 6 inch (152mm) wide by 100 foot (30.5 M) long splice tape used for splicing adjoining sections of EPDM membrane.
- Sure-Seal HP-250 Primer: A solvent-based primer used to prepare the surface of EPDM membrane for application of Splice Tape or Pressure-Sensitive products.
- 90-8-30A Bonding Adhesive: A high-strength, yellow colored, synthetic rubber adhesive used for bonding Sure-Seal/Sure-White EPDM membranes to various surfaces.
- Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used as a compression sealing agent between EPDM membranes and applicable substrates.
- Universal Single-Ply Sealant: A 100 percent solids, solvent free, one-part, polyether sealant that provides a weather tight sealant to a variety of building substrates; used as a termination bar sealant. Available in white only.

- FASTENING COMPONENTS

- HP Fastener: Threaded, black epoxy electro-deposition coated (E-Coat) fastener for use with steel, wood plank or oriented strand board (OSB).
- Insulation Fastening Plate: Nominal 3 inch (76 mm) diameter FM approved metal plate used for insulation attachment.

- EDGINGS AND TERMINATIONS

- Sure-Seal Drip Edge: A 22 gauge pre-punched 90-degree angle cleat and 12 foot (3658mm) long fascia sections. .

12. EXECUTION

- EXAMINATION

- Do not begin installation until substrates have been properly prepared.
- If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- PREPARATION

- Clean surfaces thoroughly prior to installation.
- Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.
- A vapor retarder / temporary roof (Carlisle 725 TR Air & Vapor Barrier/Temporary Roof) may be applied to protect the inside of the structure prior to the roof system installation.

- MEMBRANE PLACEMENT AND ATTACHMENT (Fully Adhered)

- Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.
- Apply the Bonding Adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
- Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
- Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.
- Install adjoining membrane sheets in the same manner, overlapping edges appropriately to provide for the minimum splice width. It is recommended that all splices be shingled to avoid bucking of water.
- FLASHING
 - Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practicable.
 - Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
- CLEAN UP
 - Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
 - Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.
- PROTECTION
 - Protect installed products until completion of project.
 - Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Section 07900

Blower Door and Duct Blaster Testing for Duct & Envelope Tightness Verification

A Blower Door Test is required, with written report and follow-up measures if required.

Measuring house air leakage with a blower door

Air leakage can increase heating and cooling costs over 30% and contribute to comfort, health and safety problems. Finding hidden air leakage sites, called *bypasses*, can be difficult without the use of a blower door. This diagnostic equipment uses a fan to pressurize (force air into) or depressurize (force air out of) a building. When the fan operates, it is easy to feel the effects of *infiltration* – air leaking through cracks in the building envelope. Blower doors have gauges which can measure the relative leakiness of a building.

One measure of a home's leakage rate is air changes per hour (ACH), which estimates how many times in one hour the entire volume of air inside the building leaks to the outside. Leakier houses have higher ACH's, therefore higher heating and cooling costs, and greater potential for moisture, comfort, and health problems.

To determine ACH50, the blower door creates a pressure difference of 50 Pascals between inside and outside. Fifty Pascals is approximately equivalent to a 20 m.p.h. wind blowing against all surfaces of a building. The leakier the house, the harder the fan must work to maintain the pressure. The amount of air the fan blows, measured in cubic feet per minute (CFM), is used to determine ACH.

Measuring duct leakage with a duct blaster

A duct blaster combines a small fan and a pressure gauge to pressurize a house's duct system and accurately measure air leakage of the ductwork. This test is similar to a pressure test of a plumbing system. Duct leakage can increase heating and cooling costs over 30% and contribute to comfort, health and safety problems.

House set-up

Consistent test methods are used throughout and include: Not taping over the dryer vent hookup if no dryer is present, turning combustion appliances in conditioned space to "off" or "pilot", closing and locking all windows and exterior doors, including storms, turning off all fans or mechanical blowers and opening interior doors.

Blower door - untaped

The blower door measures the airflow (CFM50) required to de-pressurize the house to -50 Pascals (~0.2 inches w.c.). This test condition is known as *Untaped* and is the basis for the Air Changes per Hour calculation, $ACH50 = CFM50 \times 60 / \text{conditioned house volume}$.

Blower door - taped

After taping over all the supply and return duct grills, a second blower door test can be performed to determine the *Taped*CFM50 measurement. This number indicates how much air leakage is through the building envelope only, because any duct loss is blocked out.

Subtracting the *Taped* measurement test value from the *Untaped* value and adjusting the figure with the subtraction correction factor (SCF) gives a rough estimate of the total duct leakage. Several tests use this technique—the *modified blower door subtraction* (MBDS) and the more accurate *automated multi-point blower door* (AMBD) methods. While these tests are approved for duct tightness verification, the duct blaster is the preferred tool, as it provides a more direct measurement of leakage with a smaller margin of error.

Duct blaster - total leakage

The duct blaster is connected to the air handler to pressurize (or depressurize) the taped-over duct system to 25 Pascals. This is about the pressure that an HVAC system normally experiences. The blower door is not used for this test. The *Total* CFM25 amount of duct leakage is determined.

Duct blaster - leakage to outside

Since some duct leakage may occur within the conditioned space and is not necessarily bad from an energy standpoint, an additional duct test is performed to measure *Leakage To Outside*. For this test, the blower door is used to pressurize the house to 25 Pascals and the duct blaster pressurizes the ductwork to the same level. All duct leakage that is measured is lost to the outside, or unconditioned space, and represents heating or cooling energy that is directly wasted.

Blower door - pressure pan

The blower door can be a useful diagnostic tool in determining the relative amount of leakage in a particular duct run. For the *Pressure Pan* test, the duct system and blower door are set-up as in the *Untaped* test - no masking tape on any registers, house de-pressurized to -50 Pascals w.r.t. (with reference to) the outside. A highly accurate pressure gauge connected with a tube to a covering pan is placed over a single register and the pressure inside of that register is measured. If the particular duct run is fairly tight, the pressure inside the register will read close to the house pressure (say, -49 Pascals w.r.t. the outside, or -1 Pascal w.r.t. the house). If the duct run is excessively leaky or partially disconnected, the pressure inside the register will vary considerably from the rest of the house (say, -45 Pascals w.r.t. the outside, or -5 Pascals w.r.t. the house). A quick test of all registers will tell which have the leakiest duct runs. This method cannot be used to determine or quantify the duct leakage of a system.

Results and Procedures:

Blower door: Home should test at less than 7 ACH at 50 Pascals pressure (7 ACH 50). If house does not perform at this rate, additional sealing must take place and second testing done until results satisfy the minimum criteria.

END OF SECTION

Division 8: DOORS & WINDOWS

SECTION 08210 INTERIOR WOOD DOORS

11. GENERAL

- SUMMARY

- Provide solid core wood doors, paint grade.

- SUBMITTALS

- Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- Warranty: Submit manufacturers' standard warranty. Include labor and materials to repair or replace defective materials.
 1. Solid-Core Interior Doors: Life of installation.

- QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Quality Standards: [NWWDA I.S.1-A, 'Architectural Wood Flush Doors.'] [AWI's 'Architectural Wood-work Standards.'].]

12. PRODUCTS

- Interior Flush Wood Doors:
 1. Manufacturers: Brosco or approved equal, all doors 6'-8" high x widths as noted on drawings
 2. Type: Solid core.
 3. Thickness: 1-3/4 inches thick.
 4. Grade: Custom.
 5. Frames: Wood.
 6. Finish: Opaque.
 7. Finish Application: Site finished.

13. EXECUTION

- INSTALLATION

- Comply with NWMA I.S. 1A and specified quality standard.
- Prefit doors to frames. Premachine doors for hardware listed on final schedules. Factory bevel doors.
- Install doors with not more than 1/8 inch clearance at top and sides, 1/4 inch at bottom. Comply with NFPA 80 for rated assemblies.
- Adjust, clean, and protect.

END OF SECTION

SECTION 08600
POLYVINYL CHLORIDE (PVC) WINDOWS
Paradigm Windows: 8352 Awning Window, 8361 Fixed Casement Window, 8351 Casement Window

PART 1 – GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in text by basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

L-S-125B Screening, Non-metallic, Insect
DD-G-45-1D Glass, Float or Plate, Sheet

1.1.2 American Architectural Manufacturers Association (AAMA);

AAMA 101 IS2/A440-05 Voluntary Specification for Aluminum, PVC, and Wood Windows and Glass Doors Test method for rate of Air Leakage through Exterior windows, Curtain walls and doors (ASTM E283)

Test method for Structural Performance of Exterior Windows, Curtain walls and doors (ASTM E330)

Test method for Water Penetration of Exterior windows, Curtain walls and doors by Uniform Static Air Pressure Difference (ASTM E547)

Specifications for Sealed Insulating Glass Units (ASTM E774)

AAMA 1503-98 Voluntary test method for Condensation Resistance of Windows, Doors, and Glazed wall sections

AAMA 615-02 Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Plastic Profiles

NFRC 100-2004 Procedure for Determining Fenestration Product U-factors
NFRC 200-2004 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients
NFRC 400-2004 Procedure for Determining Fenestration Product Air Leakage

1.1.3 AAMA Certification Program for Vinyl Window Manufacturers

SUBMITTALS:

1.2.1 Certified Test Reports: Submit for air infiltration, water resistance, and uniform loading in accordance with the above referenced specification.

1.2.2 Catalog Data: Shall describe each type of window, hardware, fastener, accessory, operator, screen, and finish. (as applicable)

1.2.3 Certification of Compliance: Submit certificates that equivalent windows have been successfully tested and meet the requirements specified herein for air infiltration and water penetration.

1.3 DELIVERY AND STORAGE: Deliver windows to project site in an undamaged condition. Use care in handling and hoisting during transportation and at the job site. Store windows and components out of contact with the ground, under cover, protected from the weather, so as to prevent damage to the windows. Damaged windows shall be repaired to an "as new" condition or replaced as approved.

1.4 PROTECTION: Finished surfaces shall be protected during shipping and handling using manufacturers standard method.

1.5 CERTIFICATION: Window units shall be tested and certified for performance with the above referenced test methods. All window units shall be labeled certifying conformance with AAMA 101 I.S.2-05 , NFRC 100-04, and Energy Star.

1.6 CERTIFIED FABRICATOR: Windows shall be fabricated by an AAMA Certified Fabricator.

1.7 WARRANTIES:

1.7.1 Windows shall be fully warranted against any defects in material or workmanship under normal use and service for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.

1.7.2 Optional factory-applied exterior paint finish shall be warranted to the original purchaser against adhesive failure, peeling, cracking, or blistering for a period of 10 years when exposed to normal weather conditions. Color retention shall be warranted for the same period to be less than 5 Delta E per ASTM D2244. Change in gloss is not considered a defect.

1.7.3 Insulated Glass Units shall be fully warranted against visual obstruction resulting from film formation or moisture collection between the interior glass surface, excluding breakage, for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.

1.7.4 Contractor shall provide a written service warranty that clearly spells out how requests for service shall be handled, by whom, under whose responsibility and shall include the time frame for handling these service requests. A labor warranty providing service on the windows shall cover a period of not less than 10 years, and shall be provided in writing. A copy of the product and labor warranty must accompany other applicable warranties and be presented with bid.

1.8 PERFORMANCE REQUIREMENTS:

1.8.1 Glazing options: insulated glass, Low E glazing.

1.8.2 Test for air infiltration shall be in accordance with AAMA/NWWDA 101/I.S.2-05 and NFRC 400-04. Test results for different window sizes appear below. Test data subject to change without notice.

1.8.3 Test for water infiltration shall be in accordance with AAMA 101 I.S.2-05. Test results for different window sizes appear below. (AP = Operating, F = Fixed) Test data subject to change without notice.

1.8.4 Uniform Structural Load Test shall be in accordance with AAMA 101 I.S.2-05. Test results for different window types apply.

1.8.5 Test for Thermal Performance shall be in accordance with NFRC 100-04. Test data subject to change without notice.

1.8.6 Test for Condensation Resistance Factor (CRF) shall be in accordance with AAMA 1503-98. Test data subject to change without notice.

PART 2 – PRODUCTS

2.1 MANUFACTURER: Paradigm Awning Window as manufactured by **Paradigm Window Solutions**, 400 Riverside Industrial Parkway, Portland, ME 04103

2.2 MATERIALS: Windows shall conform to the requirements of specifications listed above. Provide windows of combinations, types and sizes indicated on drawings. Frame colors to be selected from Manufacturer's standard colors – allow for interior and exterior frames to be different colors.

2.2.1 Extruded PVC components produced from commercial quality virgin PVC (unplasticised polyvinyl chloride), conforms to AAMA 303 from sections in one piece, straight, true and smooth. Provide multi-chambered PVC extruded frames and sash in accordance with the manufacturers standard practice. Make fusion welded frame joints strong enough to develop full strength of members, with an external wall thickness of .070 “.

2.2.2 Operating Hardware: operating hardware shall be Roto X-Drive manufactured by Roto-Frank, Chester, CT. All operating handles shall be folding type.

2.2.3 Locking Device: Locking device shall be Roto X-Drive locking system manufactured by Roto-Frank, Chester, CT. Materials shall be high pressure zinc die-cast handle, case and sliders (liquid or powder coated painted finish).

2.2.4 Glass and Glazing: Glass shall conform to DD-G-451 and not less than “B” quality. Factory glazed ¾” insulating glass conforming to ASTM-E-774, with Truseal Duraseal seal spacer, manufactured by TruSeal Industries Inc., Cleveland, OH. Glazing shall be integral glazing type system with architectural back bedded glazing tape and designed to maintain a watertight seal between glass and sash frame. Non-standard glass options will have metal box-type spacer with dual seal system.

2.2.6 Weather-stripping: Three contact points of weather-stripping shall be provided on all four sides where the sash and frame make contact , and shall consist of an EPDM covered open cell foam weatherstrip on the sash, a Santoprene or equivalent TPR compression gasket on the frame and a co-extruded flexible PVC fin weatherstrip on the frame.

2.2.7 Insect Screening: Fed. Spec. L-S-125, Type II, Class 2 (plastic coated or impregnated fibrous glass yarn) of standard color as approved, mesh 18 X 16.

2.3 FABRICATION

2.3.1 Weathering Surfaces: All frame members shall be multi-chambered PVC extrusions utilizing double wall design without the need for reinforcement. Frame corners shall be fusion welded. Sash members shall be multi-chambered PVC extrusions utilizing double wall design at all glazing locations. Horizontal sash members shall be mitered and fusion welded to vertical sash members.

2.3.2 Drips and Weep Holes: Provided as required to return water to the outside.

2.3.3 Glazing Thickness: Design glazed windows and rabbets suitable for glass thickness specified above.

2.3.4 Fasteners: All fasteners are to be stainless steel type, corrosion resistance. Use flathead, cross-recessed type, exposed head screws with standard threads on windows, trim, and accessories. Screw heads shall finish flush with adjoining surfaces. Self-tapping sheet metal screws are not acceptable for material more than 1/16 inch in thickness. All sheetmetal screw fasteners shall penetrate into a screw boss consisting of at least three layers of PVC profile for secure fastening and reduce pull out.

2.3.5 Provisions for Glazing: Design sash for outside double-glazing and for securing glass with manufacturer's standard glazing systems. Provide glazing channels of adequate size and depth to receive and properly support the glass and glazing accessories.

2.3.7 Accessories: Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

2.3.10 Flat Casing: Co-extruded flex-fin' durometer weatherstrip to provide a seal between the casing and the window frame without the use of surface applied caulking. The extrusion shall consist of multiple chambers with a 1 7/8 “ extruded nailing fin and 1 ” by 1 ” integral J channel with an exterior wall thickness minimum of 0.075 “. All welded joints shall be aesthetically cleaned of weld flash material. The nominal overall dimension of the casing is 3 ½ “ by 1 3/8“. Optional exterior color finish may be applied to match or complement the exterior color of the window.

2.3.11 Sill Nose: Co-extruded flex-fin' durometer weatherstrip to provide a seal between the casing and the window frame without the use of surface applied caulking. The extrusion shall consist of multiple chambers with a 1

3/4 " extruded nailing fin and 1 " by 3/4 " integral J channel. Exterior wall thickness shall be a minimum of 0.075 ". A color-matched end cap shall be installed at both ends. Optional exterior color finish may be applied to match or complement the exterior color of the window. *NOTE TO SPECIFIER: Remove this section if not applicable.*

2.3.14 Weather-stripping: Provide for ventilating sections of all windows to insure a weathertight seal meeting the infiltration tests specified herein. Use easily replaceable factory applied weather-stripping of manufacturer's stock type, as specified above

2.3.15 Screens: Provide one insect screen for each operable ventilating unit. Design screens to fit closely around entire perimeter of each ventilator or opening, to be rewirable, easily removable from inside building, and interchangeable for same size ventilators of similar type windows. Provide all guides, stops, clips, bolts and screws as necessary, for a secure and insect tight attachment to window. Provide continuous aluminum screen frame for screen strength.

2.3.15.1 Screen Frames: Provide same quality and color finish as the window units. Frames shall have sections not less than .375" by .750" by 0.020" thick and shall have removable vinyl splines. Hardware, attachment devices, and accessories shall be manufacturer's standard and of same quality, material and finish as hardware of window unit.

2.3.15.2 Screening: Install screening with weave parallel to frame and stretch sufficiently to present a smooth appearance. Conceal edges of screening in the spline channel.

2.3.15.3 Screen Finish: Exposed surfaces of aluminum extrusions shall be thoroughly cleaned, primed and given a finish in accordance with AAMA 603.8 with total dry thickness not less than 0.8mil. The finish color shall match the vinyl window.

PART 3 – EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation: Install in strict accordance with the window manufacturer's printed instructions and details, except as specified otherwise herein. Install windows without forcing into prepared window openings. Insulate perimeter of window frame with acceptable approved insulation material, as recommended by window manufacturer. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt, and building materials by keeping ventilators tightly closed and locked to frame. Bed screws in joints at mullions, contacts of windows with sills, built in fins, and sub-frames in approved sealant. Install windows in a manner that will prevent entrance of water. For replacement window installations, provide sill angle flashed in sealant at windowsills.

3.1.2 Anchors and Fasteners: Make ample provision for securing units to each other, and to adjoining construction.

3.1.3 Adjustments after Installation: After installation of windows adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.1.4 Protection: Where surfaces are in contact with, or fastened to wood, or dissimilar materials, the surface shall be protected from dissimilar materials as recommended by the manufacturer. Surfaces in contact with sealant after installation shall not be coated with any type of protective material.

3.2 CLEANING: Clean interior and exterior of window units of mortar, plaster, paint spattering spots, sealants, and other foreign matter to present a neat clean appearance and to prevent fouling of weather-stripping surfaces and weather-stripping, exterior finish, and to prevent interference with the operation of hardware. Replace with new windows all stained, discolored, or abraded windows that can not be restored to their original condition.

END OF SECTION

SECTION 08610
POLYVINYL CHLORIDE (PVC) DOORS
Paradigm Window: 8394 Patio Door

PART 1 – GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in text by basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

L-S-125B Screening, Non-metallic, Insect
DD-G-45-1D Glass, Float or Plate, Sheet

1.1.2 American Architectural Manufacturers Association (AAMA)
National Fenestration Rating Council (NFRC)
American Society for Testing and Materials (ASTM)

AAMA 101 I.S.2-97 Voluntary Specification for Aluminum, PVC, and Wood Windows and Glass Doors
Test method for rate of Air Leakage through Exterior windows, Curtain walls and doors (ASTM E283)

Test method for Structural Performance of Exterior Windows, Curtain walls and doors (ASTM E330)

Test method for Water Penetration of Exterior windows, Curtain walls and doors by Uniform Static Air Pressure Difference (ASTM E547)

Specifications for Sealed Insulating Glass Units (ASTM E774)

AAMA 1503-98 Voluntary test method for Condensation Resistance of Windows, Doors, and Glazed wall sections

AAMA 615-02 Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Plastic Profiles

NFRC 100-97 Procedure for Determining Fenestration Product U-Factors

NFRC 200-97 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients

NFRC 400-01 Procedure for Determining Fenestration Product Air Leakage

1.1.3 AAMA Certification Program for Vinyl Window Manufacturers

1.2 SUBMITTALS:

1.2.1 Certified Test Reports: Submit for air infiltration, water resistance, and uniform loading in accordance with the above referenced specification.

1.2.2 Catalog Data: Shall describe each type of window or door, hardware, fastener, accessory, operator, screen, and finish.

1.2.3 Certification of Compliance: Submit certificates that equivalent doors have been successfully tested and meet the requirements specified herein for air infiltration and water penetration.

1.3 DELIVERY AND STORAGE: Deliver patio doors to project site in an undamaged condition. Use care in handling and hoisting during transportation and at the job site. Store doors and components out of contact with the ground, under cover, protected from weather, so as to prevent damage to the windows. Damaged patio doors shall be repaired to an "as new" condition or replaced as approved.

1.4 PROTECTION: The entire door unit shall be protected during shipping and handling using manufacturers' standard method. This method of protection shall be a factory applied 1/2" plywood protective crate around the sides, top and bottom of the unit, with adequate corner bracing by structural wooden braces to ensure square-

ness. The screen shall be packaged in a separate cardboard protective box and shall be shipped inside of the plywood protective crate. The Sliding Patio Doors unit shall be shrink-wrapped at the factory.

1.5 CERTIFICATION: Patio door units shall be tested and certified for performance with the above referenced test methods. All units shall be labeled certifying conformance with AAMA 101/I.S.2-97, NFRC 100-97 and Energy Star.

1.6 CERTIFIED FABRICATOR: Patio doors shall be fabricated by an AAMA Certified Fabricator.

1.7 WARRANTIES:

1.7.1 Patio doors shall be fully warranted against any defects in material or workmanship under normal use and service for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.

1.7.2 Optional factory-applied exterior paint finish shall be warranted to the original purchaser against adhesive failure, peeling, cracking, or blistering for a period of 10 years when exposed to normal weather conditions. Color retention shall be warranted for the same period to be less than 5 Delta E per ASTM D2244. Change in gloss is not considered a defect.

1.7.3 Insulated Glass Units shall be fully warranted against visual obstruction resulting from film formation or moisture collection between the interior glass surface, excluding breakage, for a period of 20 years from date of acceptance on commercial projects and lifetime warranty to original homeowner on residential projects. 5 years factory labor included.

1.7.4 Contractor shall provide a written service warranty that clearly spells out how requests for service shall be handled, by whom, under whose responsibility and shall include the time frame for handling these service requests. A labor warranty providing service on the windows shall cover a period of not less than 10 years, and shall be provided in writing. A copy of the product and labor warranty must accompany other applicable warranties and be presented with bid.

1.8 PERFORMANCE REQUIREMENTS:

1.8.1 Glazing options shall include insulated glass units with Low E glazing.

1.8.2 Test for air infiltration shall be in accordance with AAMA 101/I.S.2-97. Test results for different patio door sizes appear below.

1.8.3 Test for water infiltration shall be in accordance with AAMA/NWWDA 101/I.S.2-97. Test results for different patio door sizes appear below.

1.8.4 Uniform Load Structural Test, with the window closed and locked, shall be in accordance with AAMA 101/I.S.2-97.

1.8.5 Test for Thermal Performance shall be in accordance with NFRC 100-97.

1.8.6 Test for Condensation Resistance Factor (CRF) shall be in accordance with AAMA 1503-98

PART 2 – PRODUCTS

2.1 MANUFACTURER: Paradigm Sliding Glass Door as manufactured by **Paradigm Window Solutions**, 400 Riverside Industrial Parkway, Portland, ME 04103.

2.2 MATERIALS: Patio door shall conform to the requirements of specifications listed above. Provide doors types and sizes indicated on drawings, including combination transom/patio doors as shown on drawings. Frame colors to be selected from Manufacturer's standard colors – allow for interior and exterior frames to be different colors.

2.2.1 Extruded PVC components, produced from commercial quality virgin PVC (unplasticised polyvinyl chloride), conforms to AAMA 303 from sections in one piece, straight, true and smooth. Provide multi-chambered PVC extruded frames and sash in accordance with the manufacturers standard practice. Make fusion welded frame

joints strong enough to develop full strength of members, with an exterior wall thickness of .090". Meeting rails between stationary and operating panels to have integral interlocks.

2.2.1.1 Locking Device: Provide each Sliding Patio Door with a 3 point stainless steel lock system which is engaged by rotating the lock handle located on the interior of the handle hardware. The handle hardware system provided with the sliding patio door shall be solid brass, with either a white powder coated finish, bright or antique brass, or brushed or polished chrome finish. A flush bolt is provided as standard on 4 panel doors to secure the passive sliding panel.

2.2.2 Glass and Glazing: Glass shall conform to DD-G-451 and not less than "B" quality. Sash shall be in factory glazed 1" insulating glass conforming to ASTM-E-774. Glazing shall be integral glazing type system with architectural back bedded glazing tape and designed to maintain a watertight seal between glass and sash frame.

2.2.3 Caulking and Sealing: As specified or recommended by door manufacturer.

2.2.4 Weather-stripping: All sliding panel units shall be double or triple weather-stripped using silicone treated pile to a rigid backing material which fits into a groove provided in the extruded door parts. Where the sliding panel meets the lock jamb an additional rubber gasket type compression weatherstrip shall be provided.

2.2.5 Insect Screening: Fed. Spec. L-S-125, Type II, Class 2 (plastic coated or impregnated fibrous glass yarn) of standard color as approved, mesh 18 X 16 in an extruded baked enamel frame with a dimension not less than 2" on the face and 1/2" in thickness. The screen frame shall roll on two rollers at the bottom and two rollers at the top, all with individual adjustment settings. There shall be a weatherstrip provided where the screen contacts the lock jamb to ensure that the screen frame will not rattle.

2.3 FABRICATION

2.3.1 Weathering Surfaces: All frame members shall be multi-chambered PVC extrusions utilizing double wall design without the need for reinforcement. Frame corners shall be fusion welded. Panel members shall be multi-chambered PVC extrusions utilizing double wall design at all glazing locations.

2.3.2 Sill: The sill shall be a thermally broken unit with anodized aluminum interior threshold, the thermal break shall be PVC with .090" perimeter wall thickness, and an anodized aluminum exterior sill nosing piece. The PVC thermal break shall have a stainless steel cap over the roller channel where the door panel rollers glide.

2.3.3 Adjustments: Two adjustments shall be provided to change the height of the door panels above the rollers to ensure squareness with the frame and four adjustments shall be provided, two at the top and two at the bottom to adjust the fit of the screen. Rollers for the sliding door panels shall be zinc dichromate plated tandem rollers.

2.3.4 Drips and Weep Holes: Provided as required to return water to the outside.

2.3.5 Glazing Thickness: Design glazed Sliding Patio Doors with rabbets suitable for glass thickness specified above.

2.3.6 Provisions for Glazing: Design sash for outside double-glazing and for securing glass with manufacturer's standard glazing systems. Provide glazing channels of adequate size and depth to receive and properly support the glass and glazing accessories.

2.3.7 Factory Mulls: Factory mulls to be assembled utilizing interior and exterior "U" channels and proprietary sealant application patterns.

2.3.8 Accessories: Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

2.3.11 Flat Casing: Co-extruded flex-fin' durometer weatherstrip to provide a seal between the casing and the window frame without the use of surface applied caulking. The extrusion shall consist of multiple chambers with a 1 7/8 " extruded nailing fin and 1 " by 1 " integral J channel with an exterior wall thickness minimum of 0.075 ". All

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welded joints shall be aesthetically cleaned of weld flash material. The nominal overall dimension of the casing is 3 ½ " by 1 3/8". Optional exterior color finish may be applied to match or complement the exterior color of the window.

2.3.14 Weather-stripping: Provide for ventilating sections of all sliding patio doors to insure a weather tight seal meeting the infiltration tests specified herein. Use easily replaceable factory applied weather-stripping of manufacturer's stock type, as specified above. For sliding surfaces, use silicone treated pile, bonded to a plastic-backing strip. Do not use neoprene or polyvinylchloride weather-stripping where they will be exposed to direct sunlight. Provide rubber compression type gasket where the sliding panel contacts the lock jamb and a mechanical and weather-stripped interlock where the sliding panel meets the stationary panel.

2.3.15 Screens: Provide one insect screen for each operable unit. Design screens to fit closely around entire perimeter of each opening, to be rewirable, easily removable, and interchangeable for same size patio doors with no exposed fasteners. Provide all guides, stops, clips, bolts and screws as necessary, for proper operation. Provide continuous extruded aluminum screen frame for screen strength. Aluminum screen wire shall be provided when stipulated.

2.3.15.1 Screen Frames: Provide same quality and color finish as the window units. Frames shall have aluminum sections not less than 2" by .500" thick and shall have removable vinyl splines. Hardware, attachment devices, and accessories shall be manufacturer's standard and of same quality, material and finish as hardware of patio door unit.

2.3.15.2 Screening: Install screening with weave parallel to frame and stretch sufficiently to present a smooth appearance. Conceal edges of screening in the spline channel.

2.3.16 Finish: Exposed surfaces of aluminum extrusions shall be thoroughly cleaned, primed and given a baked enamel finish in accordance with AAMA 603.8 with total dry thickness not less than 0.8mil. The finish color shall match the vinyl window.

PART 3 – EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation: Install in strict accordance with the window manufacturer's printed instructions and details, except as specified otherwise herein. Install patio doors without forcing into prepared rough openings. Insulate perimeter of door frame with acceptable approved insulation material, as recommended by window manufacturer. Set doors at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect and operating parts against accumulation of dirt, and building materials by keeping operating panel tightly closed and locked to frame. Bed screws in an approved sealant. Install windows in a manner that will prevent entrance of water. Provide sill pan flashing for weather tightness.

3.1.2 Anchors and Fasteners: Make ample provision for securing units to adjoining construction.

3.1.3 Adjustments after Installation: After installation of patio doors adjust all hardware to operate smoothly and to provide weathertight sealing when operating panels are closed and locked. Lubricate hardware and operating parts as necessary.

3.1.4 Protection: Where surfaces are in contact with, or fastened to wood, or dissimilar materials, the surface shall be protected from dissimilar materials as recommended by the manufacturer. Surfaces in contact with sealant after installation shall not be coated with any type of protective material.

3.2 CLEANING: Clean interior and exterior of units of mortar, plaster, paint spattering spots, sealants, and other foreign matter to present a neat clean appearance and to prevent fouling of weather-stripping surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace with new windows all stained, discolored, or abraded windows that can not be restored to their original condition.

END OF SECTION

**SECTION 08710
DOOR HARDWARE**

1. GENERAL

• SUMMARY

- Provide door hardware.

• SUBMITTALS

- Submit for approval hardware schedule proposed for use based on Owner's requirements.

• QUALITY ASSURANCE

- Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- Materials and Application: ANSI A156 series standards.

2. PRODUCTS

• MATERIALS

- Door Hardware:
 1. Manufacturers: Schlage, Mark, Ives, Grant, Stanley or approved equal.
 2. Quality Level: Residential.
 3. Locksets and Latchsets: Bored cylindrical type.
 4. Lock Cylinders: Integral.
 5. Hinges and Butts: Full-mortise type at interior, with nonremovable pins at exterior doors..
 6. Hardware Finishes: Satin chrome finish on exposed surfaces, stainless steel at all hardware exposed to weather.
 7. Auxiliary Materials:
 1. Weatherstripping and thresholds.

3. EXECUTION

• INSTALLATION

- Follow guidelines of DHI 'Recommended Locations for Builder's Hardware and hardware manufacturers' instructions.
- Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- Adjust operation, clean and protect.

• HARDWARE SCHEDULE

At all interior Doors:

- One (1) Latchset:
- Three (3) hinges: Stanley
- One (1) Dome Stop : Ives FS13

- At Exterior Door (existing door to be re-used with new hardware)

- One (1) Lockset:
- Three (3) hinges:

END OF SECTION

Division 9: FINISHES

SECTION 09260 GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of Work: Work of this section includes, but is not limited to, the following:
 1. Gypsum board and accessories
 2. Gypsum board finishing
 3. Trim and accessories

1.2 SYSTEM REQUIREMENTS

- A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
 1. Gypsum board partitions: Standard systems: Maximum deflection of $l/240$ of partition height.
 2. Interior suspended ceilings and soffits: Maximum deflection of $l/360$ of distance between supports.
 3. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board" except for more stringent requirements of manufacturer.
- B. Compliance with UL Assemblies: Where UL Assemblies are specified in project documents, refer to UL assembly requirements for all installation materials and components and assembly details.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage:
 1. Deliver material to site promptly without undue exposure to weather. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.
 2. Store above ground in dry, ventilated space. Protect materials from soiling, rusting and damage.
 3. Environmental Requirements: Do not install gypsum board when ambient temperature is below 40°F.
 4. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55°F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Gypsum Board and Accessories: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL or approved equal.

2.2 BOARD MATERIALS

- A. Gypsum Board: Water-Resistant, Standard, and Type X, interior and exterior grade, as noted on drawings, in thicknesses noted on drawings.

2.3 ACCESSORIES

- A. Metal Trim for Gypsum Board:
 1. Conform to profile and dimensions indicated.
 2. Material for interior work: Galvanized steel, 26 gauge minimum.
 3. Corner beads: Use Rounded Plastic corner beads at all outside corners and gypsum board openings.
- B. Adhesives and Joint Treatment Materials:
 1. Conform to requirements of ASTM C475.

2. Joint compounds: Drying-type (ready-mixed): Equivalent to SHEETROCK® brand taping joint compound and topping joint compound, or SHEETROCK® all purpose joint compound
 3. SHEETROCK® brand joint tape I
- C. Gypsum Board Screws: Self-drilling, self-tapping steel screws.
1. For steel framing less than 0.03 inch thick: Comply with ASTM C1002.
 2. For steel framing from 0.033 inch thick to 0.112 inch thick: Comply with ASTM C954.
 3. Provide Type S or Type S-12 screws.
- D. Miscellaneous Accessories: Provide as required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and adjoining construction and conditions under which work is to be installed. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with reference standards and manufacturer's instructions [and as required to comply with seismic requirements].
- B. Tolerances:
1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
 2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
 3. Shim as required to comply with specified tolerances.
- C. Install supplementary framing, blocking and bracing at terminations in gypsum board assemblies to support fixtures, equipment, heavy trim, bathroom accessories, furnishings or similar construction.

3.3 BOARD INSTALLATION

- A. Single Layer Gypsum Board on Metal Studs:
1. Loosely butt gypsum board joints together and neatly fit.
 2. Maximum allowable gap at end joints: 1/8 inch.
 4. Stagger joints on opposite sides of partitions.
 5. Apply ceiling boards first where gypsum board ceilings and wall occur.
 6. Cut openings in gypsum board to fit electrical outlets, plumbing, light fixtures and piping snugly and small enough to be covered by plates and escutcheons. Cut both face and back paper.
 7. Screw board in place securely with screws spaced according to manufacturer's recommendations.

3.4 FINISHING

- A. Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214, "Recommended Specification: Levels of Gypsum Board Finish".
- B. Interior Gypsum Board:
1. Three coats of taping and joint compound, following manufacturer's recommended procedure and methods.
 2. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

- C. Trim:

1. Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.
2. Install metal corner beads at external corners.
3. Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi-exposed, and where gypsum base terminates against dissimilar material.

3.5 ADJUSTING

- A. Correct damage and defects which may telegraph through finish work.
- B. Leave work smooth and uniform.

END OF SECTION

SECTION 09640 BAMBOO FLOORING and OAK TREADS & RISERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Prefinished solid bamboo strip flooring and matching accessories installed by the nail or staple down method.
- B. Section includes: Solid white oak treads and risers, sealed and finished on-site.

1.02 SUBMITTALS

- A. Submit the following items:
 1. Product Data:
 - a. Flooring Specification Sheet.
 - b. Finish data: finish type, composition and manufacturer (See summary in section 2.02).
 2. Accessory profiles (See specification in section 2.03).
 3. Warranty for Architect's review.
 4. Samples:
 - a. 4 inch (mm) or 12 inch long strip of flooring plank, with manufacturer identified.
 - b. One of each specified accessory, minimum 4 inches (100 mm) long.
- B. Closeout Submittals: Maintenance instructions

1.03 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer Qualifications:
 - a. Minimum three years experience in bamboo / hardwood flooring installation.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver flooring to project site in original boxes not less than 5 days prior to start of installation. Allow sufficient time for flooring to acclimate to site conditions.
- B. Store flooring materials in conditioned space at all times, and do not allow to freeze or get wet.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: All installation spaces, flooring and adhesive must be maintained at normal occupancy temperature and humidity levels for a minimum of 72 hours prior to and continuously following installation. HVAC systems must be operational and controlling site temperature and humidity.

1.06 WARRANTY

- A. Lifetime Structural Warranty: Lifetime against de-lamination, separation, buckling or cupping as a result of a manufacturing defect.
- B. Residential Finish Warranty: 25 years against wear through or separation from the flooring as a

result of a manufacturing defect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. White Oak Treads and Risers: Provide samples for Architect's approval.
 - 1. Tread and Riser dimensions as noted on drawings, minimum ¾" thick material.
 - 2. Finish and seal treads and risers, minimum three coats, to sheen matching bamboo flooring finish sheen.

- B. Bamboo Flooring Strip Type:
 - 1. Vertical Grain: Bamboo strips laminated together with edges exposed to the wear surface to form a solid bamboo plank without internal voids.
 - a. Color: "Carbonized".
 - 2. Bamboo Harvest: Bamboo harvested between 5-1/2 to 6 years to ensure color clarity, hardness and stability of fiber.
 - 3. Size: 3-5/8 inches (92 mm) wide by 5/8 inch (15 mm) thick by 24, 36, 48, and 72 inch (620, 900, 1200, and 1840 mm) lengths.
 - 4. Edge: Tongue and groove with micro-bevel edge.
 - 5. Back: Channeled and sealed with factory-finish seal coat.
 - 6. Chemical Treatment: Natural borate solution and hydrogen peroxide to eliminate pests and mildew at time of manufacture
 - 7. Finish: Seven-coat, 100 percent solids, non off-gassing, water-based system with aluminum oxide and two top coats of scratch-resistant polyurethane.
 - 8. Physical Property Performance Requirements:
 - a. Hardness: ASTM D 1037, Janka Ball: Minimum 1747 Vertical Caramelized.
 - b. Dimensional Stability: ASTM D 1037: Dimensional change coefficient: 0.0004 parallel / 0.0027 perpendicular / 0.003 thickness
 - c. Flammability: ASTM E 648: Class I Interior Floor Finish rating per NFPA 101.
 - d. Abrasion Resistance: ASTM D 4060, CS-17 Taber abrasive wheels: Final wear-through: Minimum 27,500 cycles.
 - e. Slip Resistance: ASTM D2394, Coefficient of Friction Average; Static 0.592; Sliding 0.62.
 - f. Moisture Content: ASTM D 4442, Oven Dry Method: 6-8 percent average.
 - g. Formaldehyde Emissions: ASTM E 1333: 0.021 ppm.
 - h. ASTM C 518-04: R value of 0.6.

- B. Nails or Staples:
 - 1. 3/4 Inch (19 mm) Thick Subfloor: 1-1/2 inch (38 mm) nails or staples.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which flooring will be installed.
 - 1. Verify that subfloor is clean, dry, and free of contaminants or protruding fasteners.
 - 2. Test subfloor for moisture vapor emissions using a Calcium Chloride or equivalent test. Do not install flooring if vapor pressure exceeds 3 lbs per 1,000sf (15g per m²) within a 24 hour period.
 - a. In multiple story buildings, test each floor level scheduled to receive bamboo flooring.
- B. Verify that HVAC system is operating properly and maintaining proper occupancy level temperature and humidity conditions.
- D. Commencement of work by installer is an acceptance of suitable substrate conditions.
- E. Prior to installation, the installer shall examine all material and determine that it matches the work order.

3.02 PREPARATION

- A. Acclimatization: Open flooring boxes, remove shrink wrap and foam packing at a minimum of 3 days prior to start of installation.
- B. Grind and or fill subfloor using methods and materials appropriate to the subfloor construction to eliminate humps and depressions. For best results neither humps nor depressions shall exceed 1/8 of an inch (3 mm) within a 6 foot (1830 mm) radius or 3/16 of an inch (4.7 mm) within a 10ft (3048 mm) radius.

- B. Because bamboo is a natural fiber, variations in color naturally occur. Each box should be inspected for differences in color with color variance staggered throughout the floor.

3.03 INSTALLATION

- A. Bamboo Flooring: Install in accordance with manufacturer's installation guidelines.
- B. Install flooring planks by stapling, gluing, or nailing or stapling and gluing to substrate at Contractor's option].
- C. Run plank length to match longest room dimension.
- D. Accessories: Install using methods appropriate to the accessory and flooring system.
- E. Accommodate thermal expansion. Install transitions, trim and base molding, as identified in manufacturer's installation guidelines and as required to accommodate site conditions.

3.04 CLEANING

- A. Remove all debris left from flooring installation; vacuum and leave flooring in clean, debris-free condition.

3.05 PROTECTION

- A. Cover installed flooring with heavy Kraft-paper or other suitable covering. Do not use a non-breathable sheet or film that could cause condensation to form. Maintain covering throughout remainder of construction period.

END OF SECTION

SECTION 09910 PAINTS & SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior and Exterior Primer.
- B. Interior and Exterior Paint and Sealer.
- C. Wall Preparation.

1.2 SUBMITTALS

- A. Product Data: Provide a complete list of all products to be used, with Manufacturer's name, product name and/or catalog number, and general product category.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Disposal:
 - 1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use. Do not incinerate closed containers.
 - 2. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 EXTRA MATERIALS

- A. At project closeout, supply the Owner or owner's representative one gallon of each product for touch-up purposes. At project closeout, provide the color mixture name and code to the Owner or owner's representative for accurate future color matching.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore & Co., or approved equal.

2.4 MIXING AND TINTING

- A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.
- B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.
- C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

2.5 INTERIOR PRIMERS

- A. Wood & MDF:
 - 1. Latex: One (1) Coat - Eco Spec WB Interior Latex Primer #372.
- B. Ferrous Metal:
 - 1. Latex:
 - a. One (1) Coat - IronClad Latex Low Lustre Metal & Wood Enamel #363.

2.6 INTERIOR FINISH COATS

- A. Flat Finish (Ceilings):
 - 1. Latex: Two (2) Coats - Eco Spec Interior Latex Flat #219 (MPI Listed Product, Category 143).
- B. Eggshell Finish (Walls):
 - 1. Latex: Two (2) Coats - Eco Spec Interior Latex Eggshell Enamel #223 (MPI Listed Product, Category 144).
- C. Satin/Semi-Gloss Finish (Doors, trim, painted wood):
 - 1. Latex: Two (2) Coats - Eco SpecWB Interior Latex Semi - Gloss #376.

2.7 INTERIOR PAINT COLOR SCHEDULE (Eco-Spec to match noted BM colors)

- A. Walls: Colors to be selected. Allow for three colors at interior walls, with all walls within a single room to be same color.
- B. Ceilings: "Super White"
- C. Doors, Frames, Trim, Baseboard: Colors to be selected.

2.8 EXTERIOR SEALERS

- A. Provide exterior grade sealer to all exterior wood materials called to be sealed, including but not limited to exterior soffits, handrails, and decking. Submit proposed manufacturer and products for approval.

PART 3 EXECUTION

3.1 EXAMINATION & PREPARATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Ensure that surfaces to receive paint are dry immediately prior to application. Ensure that moisture-retaining substrates to receive paint have moisture content within tolerances allowed by coating manufacturer.
- C. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.
- D. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.
- E. Clean surfaces thoroughly prior to coating application. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
- C. Remove or protect adjacent hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, adjacent surfaces, and other items not indicated to receive coatings.
- D. Prepare surfaces in accordance with manufacturer's instructions for specified coatings and indicated materials, using only methods and materials recommended by coating manufacturer.
- E. Gypsum Board and Plaster: Repair cracks, holes and other surface defects with joint compound to produce surface flush with adjacent surfaces.

- F. Wood: Seal knots, pitch streaks, and sap areas with sealer recommended by coating manufacturer; fill nail recesses and cracks with filler recommended by coating manufacturer; sand surfaces smooth.

3.2 APPLICATION

- A. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface.
- B. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
- C. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet (1.5 m).
- D. Remove dust and other foreign materials from substrate immediately prior to applying each coat.
- E. Where paint application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.
- F. Where color changes occur between adjoining spaces, through framed openings that are of same color as adjoining surfaces, change color at outside stop corner nearest to face of closed door.
- G. Re-prepare and re-coat unsatisfactory finishes; refinish entire area to corners or other natural terminations.
- H. Repair to Architect's acceptance coatings damaged by subsequent construction activities. Where repairs cannot be made to Architect's acceptance, re-apply finish coating to nearest adjacent change of surface plane, in both horizontal and vertical directions.

END OF SECTION

Division 15: MECHANICAL

SECTION 211313 – AUTOMATIC FIRE PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design, install and test a pressurized, fully supervised, wet pipe fire protection system for full building protection in accordance with NFPA, IBC, and the Owner's insurance underwriter. Areas subject to freezing shall have a dry pipe system, dry pendent or sidewall heads, or glycol-and-water loop per NFPA.
- B. The sprinkler system design for the Residence shall be based on NFPA13R requirements. There shall be a separate sprinkler service capped for the future fit-up space (NFPA 13 system).
- C. The system shall be designed per the requirements of the Portland Fire Department as well as NFPA.
- D. Provide sprinkler heads at windows where required by NFPA for buildings located close to property lines, see drawings for additional information.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.3 QUALIFICATIONS

- A. The Fire Protection Work shall be performed by a qualified Contractor primarily engaged in the design and installation of Fire Protection Systems. The fire protection system design shall be performed under the direction of, and sealed by, a professional engineer registered in the State of Maine or NICET III certification.
- B. Welding qualifications of individuals installing welded piping shall be certified by the National Certified Welding Bureau for the type(s) of weld(s) proposed for use in piping assembly.

1.4 SUBMITTALS

- A. Items for which the submittal requirements of section 23 05 00 Common Work Results for HVAC, apply are as Follows:

1. Hydrant flow test.
2. System components and devices.
3. Hydraulic calculations.
4. Piping layout, details and control diagram.
5. Flushing and testing records.
6. Certificate of installation.
7. Copy of Fire Protection Contractors License.
8. Welding certificates of individual welding technicians.
9. Sprinkler heads.
10. Fire department connection(s).
11. Firestopping materials and methods.

Submit hydrant flow test, equipment descriptive data, hydraulic calculations and system layout for review by the Owner's Insurance Underwriter. Submit the system layout to the Architect for review. The Architect's review will be limited to checking for conformance with the design concept of the

project and general compliance with the contract documents and will in no way assume liability for review for compliance with codes, standards and laws.

1.5 SPRINKLER COVERAGE

- A. Sprinkler head coverage shall conform with NFPA requirements for the use of the building. Coverage shall be increased accordingly where required by the Authority having jurisdiction.
- B. If the requirements of the inspection agency or the Owner's insuring agent are more rigorous than those stated herein, then the more rigorous requirements shall govern.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS AND HARDWARE

- A. Pipe, Fittings, Joints, Hangers, Valves, Fire Department Connections, Alarms: Conform to NFPA-13R, Installation of Sprinkler Systems.
- B. Sprinkler Heads:
 - 1. Interior Heated Spaces: Conform to NFPA-13R, commercial quick response type. Provide semi-recessed type with white finish for acoustical tile ceilings. Sprinkler heads in GWB ceilings shall be "concealed" type.
 - 2. Provide a spare head cabinet with wrenches, the amount of spare heads for each orifice size, finish, temperature classification, pattern and length furnished in the project shall be in accordance with the following schedule:

<u>Sprinkler Heads on Project</u>	<u>Number of Spare heads of each type.</u>
Less than 300	6
300-999	12
1000 or more	24
 - 3. Provide head protection guards where required.
 - 4. Sprinkler system components shall be Viking, Central or equal.
- C. Fire Department Connection: Provide each entrance with a 5" Storz connection or siamese connection (size and type to be verified with the local fire department) at a location coordinated with the local fire department and the Architect.

2.2 WATER SUPPLIES

- A. Connect to the sprinkler water service provided.

2.3 DEVICES

- A. Detection and monitoring devices and associated wiring both within the fire protection system and to the building Fire Alarm System shall be the responsibility of the Sprinkler Contractor.

2.4 BACKFLOW PREVENTER

- A. Provide AMES MODEL 2000.

2.5 PIPING SYSTEM IDENTIFICATION

- A. Piping system and valve identification and color coding shall be in accordance with ANSI.

PART 3 - EXECUTION

3.1 PIPING LAYOUT AND DESIGN

- A. System requirements, installation requirements, design, plans, and calculations: Conform to NFPA 13R and NFPA-13, Installation of Sprinkler Systems.
- B. Sprinkler piping shall be run concealed above ceilings in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless indicated on the drawings. Coordinate pipe routing with the Architect.
- C. Pipe penetrations through walls and floors shall be in accordance with Section 23 05 00 – Common Work Results for HVAC. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Penetrations through walls shall be sleeved in accordance with Section 23 05 00. Sleeves shall be provided by the Fire Protection Contractor.
- D. Coordinate design and layout with building structure and building systems. The work shown in the contract documents has precedence for space requirements. Work of other trades may be modified or moved only with permission of the trade involved. Costs associated with modifications or relocations shall be the same as for "Substitutions" Section 23 05 00.
- E. The Architect shall review proposed system layout and reserve the right to relocate heads, substitute head system and in general review final layout for components visible in occupied spaces.

3.2 SYSTEM ACCEPTANCE

- A. Approval, flushing, hydrostatic testing, instructions, and certificates of installation: Conform to NFPA-13R, Installation of Sprinkler Systems.
- B. Disinfect the water piping in accordance with AWWA C601. Fill the piping systems with solution containing a minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Repeat disinfection if chlorine residual is less than 10 parts per million after 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.
- C. Closing in Work:
 - 1. General: Cover up or enclose work after it has been properly and completely reviewed.
 - 2. No additional cost to the Owner will be allowed for uncovering and recovering, work that is covered or enclosed prior to required review and acceptance.
- D. Cleanup and Corrosion Prevention:
 - 1. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
 - 2. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
 - 3. Before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.
- E. Instructions: On completion of the project, provide a technician familiar with the system to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

- F. Warranty: For a period of one (1) year after completion of the installation repair or replace any defective materials or workmanship. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operational condition.

3.3 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 220000 - PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections, and incidentals and the performing of operations required to provide a complete and functional plumbing system.
- B. Work shall be in accordance with the current edition of the Maine State Plumbing Code and applicable local ordinances.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00 "Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
 - 1. Piping materials.
 - 2. Valves.
 - 3. Pipe hangers.
 - 4. Fixtures and trim.
 - 5. Miscellaneous equipment.
 - 6. Water heating equipment.
 - 7. Piping, valves and equipment identification.
 - 8. Gas piping system.
 - 9. Thermostatic mixing valves.
 - 10. Firestopping.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Soil and Waste (Sanitary), Vent and Rainwater Piping:
 - 1. Below Grade: Cast iron with push-on joints or Sched. 40 PVC.

2. Above Grade: Sanitary piping shall be cast iron "no Hub" (ONLY). Vent piping may be Sched. 40 PVC at contractor's option, cast iron (ONLY) thru roof.

B. Domestic Water Piping:

1. Type L hard copper tubing and cast bronze or wrought copper solder fittings.
 2. Uponor AquaPEX, NSF rated, 180°F at 100psi, red (HW), blue (CW) and white (RHW).
 3. "Flowguard Gold" Schedule 40 solvent-welded CPVC pipe and fittings. CPVC pipe and fittings shall be rated at 100 psig at 180°F and shall meet or exceed the requirements of ASTM D2846, the IBC, and be certified by the ANSI/NSF for potable water applications. Installation, including supports, shall be per the manufacturer's recommendations.
- C. Exposed Water and Waste Piping at Fixtures: I.P.S. copper with cast brass fittings chrome plated finish, with deep one piece escutcheon plates at traverse points. Exposed waste piping at fixtures shall be Schedule 40 PVC with solvent welded joints.
- D. Solder: Lead-free (ONLY), Englehard Silvabrite 100, 440°F melting point, ASTM B32.
- E. Underground Cold Water Piping (building entrance, to 10 ft outside of building): ASTM D2737 black polyethylene tubing, 200 psi rated with brass or bronze adapters complete with stainless steel clamps. Or as specified in Civil documents.
- F. Condensate Piping: Schedule 40 PVC with solvent welded joints.
- G. Sprinkler Service Entrance Piping (to 10 ft outside of building): Cement-lined ductile iron, coordinate with Section 211313 - Automatic Fire Protection. Or as specified in Civil documents.
- H. Radon Vent Piping: Schedule 40 ABS with solvent-welded joints above grade.

2.2 GAS PIPING SYSTEM

- A. Rigid Gas Piping: Schedule 40 carbon steel pipe conforming to ASTM 120 or A53, with threaded joints and malleable iron fittings (exposed above grade).
- B. Ball Valves for Gas Service: Copper alloy with chromium plated floating ball per Federal Specification WW-V-35B, Type II, Class 3. Blowout-proof stem, reinforced teflon seats, threaded ends, quarter turn on-off, 600 WOG rating, 250 psi rating for natural gas, UL-listed as a natural gas shutoff valve, Apollo Model 80-100 series.
- C. Flexible Gas Piping: OmegaFlex TracPipe (concealed above grade no joints).
- D. Gas Pressure Regulators: Maxitrol 325 Series, lever acting, vent limiting device.

2.3 NO HUB COUPLINGS

- A. For DWV piping, couplings shall be Clamp-All HI-TORQ125, shall maintain 15 PSI hydrostatic seal, constructed with a 304SS housing and ASTM C-564 neoprene gasket. Couplings shall meet FM 1680, the IBC and local codes and requirements.

2.4 VALVES

- A. Ball Valves: Apollo 70-100 and 70-100-07 series, Watts, Nibco, or equal bronze body with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B. Blowout proof stem, reinforced PTFE seal, 600 psig WOG. Sizes 1½" and larger shall have threaded ends and lever handles. For sizes 1¼" and smaller, provide steel tee handles. Provide with stem extension as required to allow operation without interfering with pipe insulation.

- B. Check Valves: Horizontal Swing, MSS SP-80, Type 3, Class 125.
- C. Drain Valves: Provide ball valves with 3/4" hose connection and brass cap.
- D. Fixture Service Stop Valves: Angle Wheel Handle Stop, ASME A112.18M.
 - 1. Each plumbing fixture shall have individual stop valves in the hot and cold supplies.
 - 2. Service stop valves exposed in finished areas shall be chrome-plated brass; in non-finished areas, ball valves shall be used in lieu of chromed supplies.
- E. Temperature and Pressure Relief Valves: Bronze body, tested under ANSI Z21.22, AGA and ASME rated, 125 psig/210°F relief settings.
- F. Balancing Valves: Taco "Accu-Flo".
 - 1. Bronze or brass body and internals, teflon seats, memory stop, 300 psi working pressure, 250°F working temperature. Balancing devices shall have provisions for connecting a portable differential pressure gauge. Each balancing device shall be sized to provide a differential pressure reading between 2 and 5 feet with the valve full open at design flow rates.
 - 2. Install per manufacturer's recommendations for adjacent length of straight pipe.
 - 3. Submittals shall indicate gpm, size, wide open differential pressure meter reading, and actual water pressure drop.
- G. Make-Up Water Pressure Reducing Valve: Watts Regulator series U5LP bronze body, bronze internals, 200 psi working pressure, 200°F maximum temperature, adjustable pressure range 10-25 psig. Provide with inlet strainer (screen).

2.5 PIPE HANGERS

- A. Adjustable Swivel Hangers:
 - 1. Pipe sizes 2" and less: Carpenter and Paterson Fig. 800, oversize for insulated piping systems.
 - 2. Pipe sizes larger than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 CT copper plated for copper piping, Fig. 126 for iron and PVC piping.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

2.6 FIXTURES AND TRIM

- A. (P-1) Water Closet: Owner furnished installed by Contractor.
- B. (P-2) Lavatory, Countertop: Owner furnished installed by Contractor.
- C. (P-3A) Stall Shower: American Standard "Acrylux" Shower Kit #3636Y1K.ST, five-piece kit (base, left panel, right panel, back panel, tempered glass door), 36"L x 36"W x 70"H overall dimensions.
 - 1. Shower Controls: American Standard "Colony Soft" FloWise #T675.507 Shower Trim Kit. Pressure-Balancing mixing valve with adjustable stop screw to limit handle turn and integral volume control. FloWise shower head (1.5 gpm) with arm and flange.

- D. (P-3B) Stall Shower: American Standard "Acrylux" Shower Kit #4834Y1K.ST, five-piece kit (base, left panel, right panel, back panel, by-pass tempered glass door), 48"L x 34"W x 70"H overall dimensions.
 - 1. Shower Controls: American Standard "Colony Soft" FloWise #T675.507 Shower Trim Kit. Pressure-Balancing mixing valve with adjustable stop screw to limit handle turn and integral volume control. FloWise shower head (1.5 gpm) with arm and flange.
- E. (P-3C) Bath/Shower: American Standard "Acrylux" AFR Bath Kit #6030Y2AK.202, five-piece kit (base, left panel, right panel, back panel, by-pass tempered glass door), 60"L x 30"W x 60"H overall dimensions.
 - 1. Bath/Shower Controls: American Standard "Colony Soft" FloWise #T675.508 Bath/Shower Trim Kit. Pressure-Balancing mixing valve with adjustable stop screw to limit handle turn, integral volume control and tub spout with diverter. FloWise shower head (1.5 gpm) with arm and flange.
 - 2. Drain: American Standard "Lift & Turn Drain" #1545.170 bath waste and overflow assembly.
- F. (P-4) Kitchen Sink, Double Bowl: Owner furnished installed by Contractor.
- G. (P-5) Washing Machine Supply and Drain: IPS Corporation (Water-Tite) plastic center drain washing machine outlet box, in-wall concealed, ¼ turn shutoff and water hammer arrestors.
- H. (P-6) Ice Maker Valve Box: IPS Corporation (Water-Tite) plastic ice maker outlet box, in-wall concealed, ¼ turn shutoff and water hammer arrestor.

2.7 MISCELLANEOUS EQUIPMENT

- A. Floor Drains: Zurn FD-2240, or Watts, cast iron body with steel flange for wood deck mounting with flexible sheet flooring, 2" bottom outlet, nickel top. Floor drains shall have "deep seal" traps and trap primer connection, connect to nearest Trap Primer.
- B. Floor (FCO): Zurn Z-1400, or Watts, adjustable floor cleanout, cast iron body, with gas and watertight ABS tapered thread plug. Provide size equal to piping served with maximum size of 4".
 - 1. Concrete floor finishes: Scoriated round polished bronze top.
 - 2. Sheet tile finishes: Scoriated square polished bronze top recessed to receive tile.
 - 3. Carpeted finishes: Scoriated round polished bronze top and carpet marker.
 - 4. Heavy-duty cleanout (HDCO): Zurn Model Z1402-HD with heavy duty cover.
- C. Wall Cleanout (WCO): Sanitary tee with threaded raised nut or countersunk-nut cleanout plug located behind Zurn Z-1468 round stainless steel wall access cover.
- D. Vacuum Breaker: Watts Model N36, 3/4" size, 20 CFM capacity.
- E. Strainer: Watts Series 777, MIL-S-16293, bronze body wye-type, 200 WOG rating, screwed end connections, 20 mesh stainless steel, monel, or bronze screen.
- F. Backflow Preventer (BFP): Conforming to AWWA C506, FCCHR-USC Manual Section 10, and UL listed. Types, sizes and capacities scheduled, Apollo, Zurn or Watts.
 - 1. Double Check (DC): Double check backflow assembly with test ports, bronze body with stainless steel springs, corrosion resistant internals, stop and waste ball valves.

2. Atmospheric Double Check (DCA): Double check continuous pressure type with atmospheric port for low hazard applications, 250°F maximum water temperature, bronze body, stainless steel internals with rubber seals and integral strainer.
 3. Reduced Pressure Zone (RPZ): Reduced pressure principle type; bronze body with stainless steel internals. Provide bronze body ball valves, test cocks, and air gap fittings.
- E. Freezeless Wall Hydrant: Zurn Model Z-1300, "Ecolotrol", Josam, or approved equal, encased, non-freeze, anti-siphon, automatic draining, flush installation, 3/4" connection, hinged cover. Wall box shall be nickel bronze construction. Wall hydrants shall have an integral backflow preventer. Furnish with key lock.
- F. Thermometers: Trerice Series V80445 or Ashcroft Series 600A-04, vapor actuated, adjustable angle, 4-1/2" diameter face, cast aluminum case, stainless steel ring, glass window, white background dial with black figures, black finished stainless steel pointer, brass movement with bronze bearings, phosphor bronze bourdon tube. Accuracy shall be to within one scale division.
1. Thermowell: Provide with brass thermometer wells projecting a minimum of 2" into the pipe with extension to face of insulation. Provide with heat transfer fluid to fill interstitial space between bulb and well.
 2. Range: 30°F to 240°F for domestic hot water systems.
- I. Pressure Gauges: Trerice Series 800 or Ashcroft Type 1005, Grade B, 3-1/2" dial, ANSI B40.1, drawn steel case, white background dial with black figures, clear glass window, brass movement, beryllium copper bourdon tube, 0 to 100 PSI range, accuracy shall be within 2% over middle half of scale and 3% over the remainder. Provide with shut off petcock and restrictor.
- J. Water Hammer Arrestor (Shock Absorber): Plumbing and Drainage Institute listed.

Schedule:

- "A" - Size #100 PDI - 0-11 Fixture Units
- "B" - Size #200 PDI - 12-32 Fixture Units
- "C" - Size #300 PDI - 33-60 Fixture Units

- K. Vacuum Breaker: Watts Model N36, 3/4" size, 15 CFM capacity.
- L. Strainer: Watts Series 777, MIL-S-16293, bronze body wye-type, 200 WOG rating, screwed end connections, 20 mesh stainless steel, monel, or bronze screen.
- J. Thermostatic Mixing Valve (TMV): Thermostatic controller shall be of capacity and size indicated. Provide regulator valve, swivel action check stops, removable cartridge, strainer, stainless steel piston and liquid fill thermal motor with bellows element mounted out of water, in rough chrome finish.
- M. Trap Primer (TP): Zurn Z-1022 or Watts Automatic Trap Primer, all bronze body with integral vacuum breaker, non-liming internal operating assembly with gasketed bronze cover, flow-thru design, low flow, operates on a 2-5psi pressure drop.
- N. Washing Machine Drain Pans: IPS Corporation, Oatey Model 34051 or Driptide, 28"x30"x1.75"D.

2.8 BACKWATER VALVES

- A. Shall be RectorSeal "CleanCheck" Model 96926, extendable backwater valve, direct-buried with cleanout plug, or approved equal. Access shall only be required from ground level for inspection, service and maintenance. Provide at building sewer exit location per the City of Portland requirements.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that plumbing may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

3.2 INSTALLATION OF PIPING

- A. Provide and erect in accordance with the best practice of the trade piping shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.
- B. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- C. Piping shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions.
- D. Install unions to facilitate removal of equipment.
- E. Copper pipe shall be reamed to remove burrs.
- F. Connections between copper and steel piping shall be made with brass fittings.
- G. Solder joints shall be made with lead free solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Caution: Lead-bearing solder is not permitted.
- H. Pipe penetrations through walls, floors and ceilings shall be in accordance with Section 15000 "Supplemental General Mechanical Requirements". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- I. Provide a cleanout in the vertical position at the base of each sanitary and roof drain drop.
- J. Sanitary and vent piping shall be sized and installed at 1/4" per foot slope. Sanitary piping 6" and larger may be installed at 1/8" per foot if approved by the Local Plumbing Inspector.

3.3 PIPE HANGERS

- A. Impact driven studs are prohibited.
- B. Copper Tubing: supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	8'	3/8"
1-1/2"	8'	3/8"
2"	10'	3/8"

- C. Cast Iron Pipe: Supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Cast Iron Size	Hanger Intervals	Rod Sizes
1-1/2"	5'	3/8"
2"	5'	3/8"
2-1/2"	5'	1/2"
3"	6'	1/2"
4"	7'	5/8"

- D. PVC Pipe: Supported at 4 foot intervals.
- E. Verticals: Supported by use of clamp hangers at every story height, and at not more than 6 feet intervals for copper piping 1-1/4" and smaller size.

3.4 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and review, uncover the work as required for the test and review. After review, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Architect and at no additional cost to the Owner.

3.5 CLEANUP AND CORROSION PREVENTION

- A. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
- B. Fixtures, piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- C. Caulk around fixtures at floor and wall.
- D. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

3.6 DISINFECTING

- A. After the entire potable water system is completed, cleaned and tested, and just before the building is ready to be occupied, disinfect the system as follows: After flushing the mains, introduce a water and chlorine solution for a period of not less than three hours before final flushing of the system.

3.7 TESTS

- A. Sanitary soil, waste and vent piping: Fill with water to top of vents, and test as required by Code.
- B. Water piping shall be tested to a pressure of 100 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two pounds per square inch. Leaks shall be repaired and system retested. Notify Architect 24 hours before test is to be performed.

3.8 INSTRUCTIONS

- A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

3.9 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 230000 - HVAC SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the heating and ventilating systems indicated.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
 - 1. Piping materials.
 - 2. Hangers.
 - 3. Valves.
 - 4. Piping, valve and equipment identification.
 - 5. Hydronic specialties.
 - 6. Gas-fired boiler.
 - 7. Finned tube radiation.
 - 8. Finned tube radiation schedule of all elements, room by room.
 - 9. Fans.
 - 10. Circulating pumps.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Hot Water Heating Piping: Type L hard copper tubing and cast bronze or wrought copper solder fittings or PEX tubing as specified below.
- B. PEX Piping: Uponor (Wirsbo) hePEX cross-linked polyethylene tubing with ProPEX brass fittings as manufactured by Uponor. Tubing shall have crosslinked polyethylene inner and outer layers with an oxygen barrier capable of limiting oxygen diffusion below 0.1 g/m³ per day at 104°F. Tubing shall be rated to handle 200°F water temperature at 80 psi. The tubing shall carry a thirty year warranty as standard.

2.2 HANGERS

- A. Adjustable Swivel Hanger: Pipe Sizes 2" and Less: Carpenter and Paterson Fig. 800 conforming to MSS-SP-58, oversize for insulated piping systems. Pipe Sizes Larger Than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 and Fig. 126 CT conforming to MSS-SP-58, provide copper plated clamps on copper pipes.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

2.3 VALVES

- A. Ball Valves: Apollo 70-100 and 70-100-07 series, Watts, Nibco, or equal bronze body with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B. Blowout proof stem, reinforced PTFE seal, 600 psig WOG. Sizes 1½" and larger shall have threaded ends and lever handles. For sizes 1¼" and smaller, provide steel tee handles. Provide with stem extension as required to allow operation without interfering with pipe insulation.
- B. Gate Valves: Nibco Model S-113 or T-113, bronze body Fed. Spec. WW-V-54, wedge disc, rising stem, screwed connection for steel pipe, sweat connection for copper tube, 150-pound class.
- C. Check Valves: Nibco Model S-413 or T-413, bronze body Fed. Spec. WW-V-51, regrinding swing check type, 200 pound class.

2.4 HYDRONIC SPECIALTIES

- A. Thermometers: Trerice Model V80445 or Ashcroft Series 600A-04, dial type, Mil Spec MIL-T-9955, 4-1/2" diameter face. Hot water system thermometers shall have a range of 30°F to 240°F with 2° increments. Provide with brass thermometer wells projecting a minimum of 2" into the pipe with extension to face of insulation. Provide with heat transfer fluid to fill the sealed interstitial space between bulb and well. Evidence of the transfer fluid leaking shall be cause for refilling and sealing the well.
- B. Pressure Gauges: Trerice Series 800 or Ashcroft Type 1005, Grade B, ANSI B40.1, 3-1/2" diameter face installed with shut off petcock and restrictor. Pressure range: 0-50 psig with 5 psi graduations, 0-100 psig with 10 psi graduations for chilled water pumps.
- C. Expansion Tanks (Captive Air Type) (ET): Taco Model as scheduled, tank shall be of capacity indicated and shall be welded steel, constructed and tested hydrostatically in accordance with Section VIII of the ASME Boiler Pressure Vessel Code. The tank bladder shall be butyl rubber and shall be removable for inspection. Tank shall have air charging and system connections, and shall be factory pressurized.
- D. Strainers: Watts Model 77S, MIL-S-16293, 125 psig minimum rating wye strainers, cast iron or bronze body, screen shall be stainless steel, monel or bronze with 20 mesh perforations. Provide with blowdown ball valve and 3/4" hose connection.
- E. Automatic Air Vents: Armstrong No. 1-AV, float type to vent air in hydronic systems. Vent constructed with cast iron body and stainless steel internals and with NPT male inlet and outlet for 1/4 inch overflow for safe water connection. 150 psi working pressure, 250°F maximum temperature.
- F. Manual Air Vents: Brass body, fiber discs, 125 psi working pressure, 240°F maximum temperature, adjustable for quick venting at system start-up.
- G. Circulator (inline) (CP): Taco model indicated, pumps shall be inline cartridge-type or close coupled pump of capacity and performance indicated with cast-iron body and bronze-fitted, 175

psig rated working pressure, 220°F maximum water temperature, carbon Ni-resist mechanical seal, flexible coupling, resilient-mounted drip-proof sleeve bearing motor. The pumps shall be factory tested, cleaned, and painted with machinery enamel. A set of installation instructions shall be included with the pump. Provide high efficiency motors if available as an option of the manufacturer. If high efficiency motors are not available as an option of the manufacturer, submit a certification stating same.

- H. Water Pressure Reducing Valve: Pressure Reducing Valves: Watts Regulator series U5-Z3 bronze body, bronze and stainless steel internals, 300 psi working pressure, 160°F maximum temperature, adjustable pressure range of 25-75 psig, with inlet strainer (screen). Valves used for make-up water applications shall have suffix "LP" and be rated for an adjustable pressure range of 10-35 psig.

2.5 GAS-FIRED BOILER/BURNER UNIT

- A. Boilers shall be high efficiency, sealed combustion, direct vent condensing type. The manufacturer shall be Triangle Tube, Rinnai, Embassy, Cadet, Laars or approved equal suitable for natural gas (4" w.g. min). The boilers shall have an integral domestic hot water storage tank. The minimum rated working pressure shall be 30 psig. Boiler-burners shall be Model and size as scheduled. Thermal efficiency shall be a minimum of 93%. Direct vent boilers shall be Energy Star compliant.
- B. Provide Stainless Steel or Schedule 40 CPVC venting/intake (per manufacturer's requirements) and Schedule 40 PVC condensate drain piping installed in accordance with the manufacturers' recommendations.
- C. Accessories shall include wall support, ASME rated pressure relief valves, thermostatic aquastat, low water cut-off, condensate neutralization kit, temperature controller and flow switch and associated wiring. Furnish with wall vent/intake termination kit.
- D. Provide boilers with packaged controls system capable of coordinating boiler circulating pump, zone circulating pumps, outdoor air reset, etc. Packaged controls shall include 2-line, 16-character LCD display and shall be capable of displaying number of cycles, hours of operation and time since last service.
- E. The boiler/burner units shall be started and adjusted by a factory representative who shall submit an efficiency report for Engineer review.
- F. Provide firestats, emergency shut-off switches, and service switches as required by NFPA 54, including associated wiring.
- G. Control Sequences:
 - 1. Hot Water Reset: Reset the supply water temperature from outside air temperature. The minimum temperature shall be 110 Deg. F. at 60 Deg. F. outside air temperature (adjustable). The maximum shall be 160 deg F at 10 deg F outside air temperature. Hot water reset shall be controlled by the packaged boiler controls. Domestic hot water production shall be controlled by the packaged boiler controls.
 - 2. Heating Hot Water Circulators (CP): The zone pumps shall operate based on a call for heat from the zone thermostat.
 - 3. Boiler (B): Shall operate to satisfy a call for heat from any zone pump or the domestic hot water load.
 - 4. Exhaust Fan: Fan/light shall operate continuously at low speed (30cfm, adj) and ramp up to high speed based on the wall mounted light switch. All bathroom exhaust fans shall have a 5 minute (adj) delay after being de-energized.

2.6 FINNED TUBE RADIATION (FTR-#)

- A. Finned tube radiation (FTR) shall be of manufacturer, type, size, and capacity scheduled.
- B. Finned Tube Radiation (Wall Hung): Heating elements shall have aluminum fins with integral fin collars mechanically bonded to the tube. Provide element mounting system consisting of wall mounted mounting brackets and pipe cradles on 4' centers. Cradles shall run on nylon guides for noiseless operation. Enclosures shall be 18 gauge steel or as indicated, shall be continuous, and shall mount to a continuous channel mounting strip at the top of the enclosure. The bottom of the enclosure shall fasten to the pipe mounting brackets. Provide a continuous urethane gasket or caulking between the top mounting channel and the wall to prevent dust streaking. Provide end caps, corner pieces, access panels and enclosure extensions as required. Provide factory enamel finish - color by Architect.
- C. Manufacturer's local representative shall provide a schedule of all elements for the project. The room by room schedule shall include the design information, heating outputs (btuh) with all correction factors included, element lengths, cover lengths and accessories.

2.7 FANS (EF-#): FANS SPECIFIED BY ELECTRICAL, SEE LIGHTING FIXTURE SCHEDULE

- A. Duct penetrations for exhaust fans thru wall shall have Broan Model 647 wall caps for 4" round ducts, 0.025 Aluminum natural finish, spring-loaded backdraft damper and bird screen.
- B. Duct penetrations for range hood fans thru wall shall have Broan Model 649 wall caps for 3-1/4" x 10" ducts, 0.025 Aluminum natural finish, spring-loaded backdraft damper and bird screen.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that the heating system may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 INSTALLATION OF PIPING

- A. In general, piping shall be run concealed above ceilings in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless written authorization is given by the Architect.
- B. Provide and erect in accordance with the best practice of the trade piping shown on the Drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.
- C. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- D. Piping shall be erected so as to provide for the easy and noiseless passage of heating fluid under working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size.
- E. Water mains shall be run level or pitch slightly upward so that no air pockets are formed in the piping. The mains shall be set at elevations such that the runouts feeding equipment shall have no pockets where air can collect except where vents are provided. Provide drains at low points in the piping systems.

- F. High points in water piping shall be provided with manual vents.
- G. In the erection of water piping, make proper allowances for expansion and contraction. Piping shall be anchored as necessary to control expansion. Hot water runouts to units shall be the size as indicated on the Drawings and shall come off the main downward or off the side with a minimum of two 90° elbows provided on runout from main.
- H. Install stop valves and unions to facilitate isolation and removal of equipment. Provide final connections for hydronic specialties furnished under other sections of the Specifications.
- I. Steel piping with screwed connections. Threads on piping shall be full length and clean-cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used. Pipe threads: standard pipe threads, machine cut and full length. Pipe: reamed to remove burrs and up-ended and rapped to dislodge dirt and scale. Joint compound shall be applied to male thread only. If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied. Caulked threads will not be permitted.
- J. Connections between copper and steel piping shall be made with bronze fittings.
- K. Install thermometer wells for temperature gauges and sensors, projecting a minimum of 2" into the pipe with extension to face of insulation. Piping 1-1/2" and smaller shall be enlarged to 2" where wells are installed. Wells shall be installed in active sections of piping. Fill wells with heat transfer fluid.
- L. Solder joints shall be made with non-lead solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Hot wipe solder at each fitting.
- M. PVC piping shall have solvent welded joints except at connections to equipment and valves which shall be screwed for sizes 2" and smaller and flanged for sizes 2-1/2" and larger. Solvent welded joints: Pipe ends deburred, and beveled. Pipe end and fitting: Cleaned and dried, primed to soften bonding surfaces. Pipe end: Apply even full layer of solvent cement after priming. Before cement starts to set, insert pipe end into fitting and turn 1/4 turn to evenly distribute cement. Hold joint together until cement sets-up, wipe excess cement off joint.
- N. Pipe penetrations through walls, floors and ceilings shall be in accordance with Section 23 05 00 "Common Work Results for HVAC". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- O. Automatic Air Vents: Shall be installed with a manual isolation valve. The vent discharge shall be piped to a local floor drain.

3.3 PIPE HANGERS

- A. Impact driven studs are not acceptable.
- B. Pipes (copper or steel) shall be supported at intervals and rod sizes as follows, double nuts on hangers and on beam clips.

Pipe Size	Hanger Intervals	Rod Sizes
1/2"		5' 3/8"
3/4"		6' 3/8"
1"	7'	3/8"
1-1/4"	8'	3/8"
1-1/2"	9'	3/8"
2"	10'	3/8"
2-1/2"	11'	1/2"
3"	12'	1/2"

- C. Verticals: Supported at the base and at intervals as follows by use of clamp hangers:

Steel Pipe: Not more than 16 ft.

Copper Pipe and Tubing:

1-1/2" and larger - Not more than 12 ft.

1-1/4" and smaller - Not more than 6 ft.

- D. Provide welded steel saddles at each hanger on steel piping systems 4" and larger.
- E. PVC Piping: Supported at 4' intervals.

3.4 INSTALLATION OF BOILERS

- A. Assemble boiler sections, jacketing, burner, combustion controls, operating controls, and safety controls per NFPA-54 and manufacturer's instructions. Provide boiler interconnecting power and control wiring. Hydrostatically test the boiler for leaks prior to installation of jacketing. Repair leaks and retest as required.
- B. The boiler/burner units shall be started and adjusted by a factory representative in the presence of the Architect. The factory representative shall provide a field efficiency report to the Engineer at the completion of the start-up. The report shall include, but not be limited to:
 - CO₂ reading (%).
 - Stack draft (in W.G.).
 - Stack temperature, room temperature.
 - Combustion efficiency (%).

Incorporate the field test results in the "Operations and Maintenance" manuals.

3.5 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

3.6 TEST AND ADJUST

- A. Piping Systems: Test with water to a pressure of 75 psi and hold for a period of two hours. Repair any leaks and retest the piping system; repeat process until systems are leak-free. Test piping before it is insulated.
- B. Before operating any system, flush the piping to remove oil and foreign materials.
- C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- D. Demonstrate that the HVAC systems have free and noiseless circulation of water, that all air has been purged and that systems are watertight.
- E. Correct defects which develop in operational testing, conduct additional testing until defect free operation is achieved.
- F. Provide balancing and adjusting of terminal devices in accordance with Specification Section 23 05 93.

3.7 CLEANUP AND CORROSION PREVENTION

- A. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

3.8 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.9 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.

1.2 WORK SHOWN ON DRAWINGS

- A. The drawings accompanying this specification, as a part thereof, are working drawings indicating the location and arrangement of the increments of the systems of this section of work. Material deviation from this arrangement, process or means of application, shall bear the Engineer's review stamp before the change is made on the job or materials are ordered. Changes made without such review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings are not intended to show in minute detail minor items of installation or materials such as specific fittings or findings.

1.3 MATERIALS AND LABOR

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Provide, when required, labeled samples of material or equipment specified herein or proposed to be used in this work.

- D. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the specifications.

1.4 EQUIPMENT INSTALLATION IN HEATING SEASON

- A. The system shall be installed such that the construction area will have sufficient heat to maintain temperature above 40°F throughout the construction period.

1.5 COOPERATION BETWEEN TRADES

- A. Provide information sufficiently in advance of this work, so that work by the other trades may be coordinated and installed without delays. Furnish and locate sleeves, supports, anchors and necessary access panels.
- B. Where work is concealed, assure it does not project beyond finished lines of floors, ceilings, or walls.
- C. Equipment or piping requiring access found to be located above sheetrock ceilings shall be brought immediately to the attention of the Architect for resolution.

1.6 VISITING THE PREMISES

- A. Not applicable.

1.7 ORDINANCES, AUTHORITIES, PERMITS, AND FEES

- A. Obtain necessary permits and licenses, give notices and comply with laws, ordinances, rules, regulations or orders affecting the work, and pay fees and charges in connection therewith.
- B. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

1.8 PROTECTION OF WORK AND MATERIALS

- A. Protect and care for materials delivered and work performed until the completion of the work. Defective equipment or equipment damaged in the course of storage, installation or test shall be replaced or repaired to the satisfaction of the Engineer at no additional cost to the Owner.

1.9 INSURANCE

- A. Purchase and maintain Public Liability and Property Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the General Conditions.

1.10 APPLICABLE CODES

- A. Work and materials shall conform to the latest rules and regulations listed below and these rules and regulations hereby are made part of this specification. They include, but are not necessarily limited to the following:

American Society for Testing and Materials (ASTM)
Underwriters' Laboratories, Inc. (UL)
Air Moving and Conditioning Assoc. (AMCA)
American Society of Heating, Refrigerating, and Air
Conditioning Engineers (ASHRAE)

American Society of Mechanical Engineers (ASME)
National Electrical Manufacturers Association (NEMA)
Institute of Electrical and Electronics Engineers (IEEE)
American National Standards Institute (ANSI)
National Fire Protection Association (NFPA)
American Water Works Association (AWWA)
Local Fire Code
Local Plumbing Codes
American Welding Society
International Building Code (IBC)
Maine Uniform Building and Energy Code (MUBEC)

1.11 SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, three (3) copies, to be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", "Submit Specified Item", or "Rejected" less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).
- B. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes. Typical similar items would be "Diffusers and Registers", "Valves and Controls". Rejection of individual items shall not be cause for rejection of the entire document.
- C. Clearly indicate item(s) to be reviewed on each submission by highlighting or underlining intended item(s). Submissions not clearly marked shall be returned "Amend and Resubmit".
- D. Shop drawings must bear the Engineer's review stamp. In the event that the Engineer returns shop drawings "Amend and Resubmit" or "Rejected", the shop drawing must be revised and resubmitted for review.
- E. Furnishing of the specified item must still produce the results and performance, dependability and quality reasonably to be expected within the spirit of the specifications, drawings, and the standard of good mechanical performance normal to the trade.

1.12 SUBSTITUTIONS

- A. Where the specifications allow the substitution of a product, still this product is subject to review by the Engineer in accordance with the paragraph entitled "Shop Drawings". Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the Engineer is first obtained. The (ONLY) notation in the specification is an exception to this and leaves no option.
- C. For materials or equipment which are supplied with integral or factory applied finish, the colors will be considered in evaluating substitutions.
- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The cost of any changes because of substituted item shall be borne by the Contractor requesting such change.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EQUIPMENT SUPPORTS

- A. Furnish and install equipment supports for mechanical equipment as required. Supports shall be subject to review by the Engineer.

3.2 SLEEVES AND PREPARED OPENINGS

- A. Coordinate cutting, patching and setting of sleeves, frames, framing and lintels for openings with other trades. Sleeves shall be furnished by the Contractor. All penetrations through concrete shall be sleeved as required by IBC and the Maine State Internal Plumbing Code.
- B. Failure to give timely notice of and to locate openings and furnish sleeves shall cause no additional expense to the Owner.

3.3 CONNECTION TO EQUIPMENT

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

3.4 ACCESS TO EQUIPMENT

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

3.5 ACCESS PANELS

- A. Access panels shall be provided where indicated on the drawings and as required for access to valves and other serviceable components.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.

3.6 PAINTING OF EQUIPMENT

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.

3.7 GUARDS

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings.

3.8 LUBRICATION

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.

3.9 ELECTRIC MOTORS AND MOTOR CONTROLS

- A. Unless otherwise noted, motors, motor starters and other electrical accessories which are specified under Mechanical specifications shall be selected with characteristics as follows:
 1/2 Horsepower and less - 120 volt, 1 phase, 60 Hz.
 3/4 Horsepower and greater - 240 volt, 1 phase, 60 Hz.
- B. Motors shall be built in accordance with the latest applicable NEMA, IEEE and ANSI Standards. Motors shall be of the latest type and quality specified under individual items of equipment and shall comply with the 2009 American Recovery and Reinvestment Act.
- C. Magnetic motor starters for mechanical items of equipment shall be furnished under Division 16 unless the starter is an integral part of a factory packaged item of equipment. Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters shall have single phase protection or shall have relays installed to provide this feature. Starters shall be equipped with suitable step-down transformers to provide required control voltage.
- D. Motors shall have a minimum continuous duty service factor of 1.15. Minimum motor efficiency shall be:

<u>MOTOR HORSEPOWER</u>	<u>PERCENTAGE EFFICIENCY</u>	<u>(1200RPM)</u>	
		<u>(1800 RPM)</u> <u>RPM)</u>	<u>(3600</u>
1, 1½, 2, 3			----
5	78.0	76.0	87.4
7.5	87.4	86.3	89.4
10	89.8	87.7	89.7
	90.3	89.0	

3.10 CLEANING OF SYSTEMS

- A. Piping systems shall be thoroughly cleaned and flushed prior to initial operation.
- B. Thoroughly clean exposed portions of the mechanical installation, removing labels and foreign substance.
- C. Furnish detergents, solvents, cleaning compounds, and tools required for cleaning operations.
- D. Keep the premises free from accumulation of waste material or rubbish and at the completion of the work, remove from the job site tools, scaffolding, surplus materials, and rubbish, leaving the work areas "broom" clean.

3.11 STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.
- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

3.12 OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Engineer. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

3.13 MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this specification or as directed by the Engineer, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

3.14 MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.
- E. Materials shall be provided to Owner upon project completion.

3.16 GUARANTEES

- A. An item becomes "defective" when it ceases to conform to the Contract Documents. Guarantees begin on the date of issuance of a certificate authorizing final payment or certificate of substantial completion with the Owner taking occupancy or beneficial use thereafter.
- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for not less than one (1) year. Guarantee shall further state that the Contractor will, at his own expense, repair or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects.
- C. Repeated malfunctioning or failure in service of any item or work of the system is sufficient cause for the Engineer to order the removal of the item, and its replacement with new item at the expense of the Contractor.

3.17 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 230700 - INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- C. The drawings and the specifications including Section 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the heating, ventilating, and plumbing systems.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
 - 1. Piping insulation.
 - 2. Duct insulation.
 - 3. Equipment insulation.
 - 4. Insulation application schedule.
 - 5. Vapor barrier coating.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Mech/Elect Rooms and attic.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures (attic) and spaces not air conditioned.
- C. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- D. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- E. Exposed: Visible from a finished or unfinished space.

1.5 MANUFACTURER'S STAMP OR LABEL

- A. Packages or standard containers of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation shall be asbestos-free.

1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS

- A. Materials shall have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with NFPA 255, ASTM E84, or UL 723.
- B. Provide materials with flame resistant treatments not subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, or heat.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors for securing insulation to ducts or equipment.

PART 2 PRODUCTS

2.1 PIPING INSULATION

- A. Fiberglass: Heavy density preformed fiberglass Knauf "Earthwool 1000", or Johns-Manville with thermal conductivity of $k = 0.24 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ at 100°F mean temperature. Insulation shall conform to ASTM C547 Class I and shall be suitable for 450°F service. Fitting insulation shall be of same material used for pipe.
 - 1. Insulation Jacket: All service (ASJ) type conforming to Fed. Spec. HH-B-100B Type I. Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be factory premolded, one-piece, PVC covers with pressure sensitive taped joints. Jackets in exposed locations shall have a white surface suitable for field painting. Provide vapor barrier as required by service.
- B. Flexible Unicellular: Flexible unicellular (Armaflex) with thermal conductivity of $k = 0.27 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ at 75°F mean temperature. Insulation shall conform to ASTM C534, Type I, Tubular and shall be suitable for 200°F service. Fitting insulation shall be of same material used for pipe. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.
- C. Fittings, Flanges, and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, $1.02 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ thermal conductivity, white color.

2.2 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be $0.32 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment): Flexible unicellular (Armaflex) with thermal conductivity of $0.27 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

2.3 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), $0.29 \text{ Btu-in/hr-ft}^2\text{-}^\circ\text{F}$ conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

2.4 VAPOR BARRIER COATING

- A. Raw (cut) ends of fiberglass pipe insulation shall be finished (protected) with the application of a suitable vapor barrier coating or finishing cement (mastic) to maintain the continuous visual and functional integrity of the insulation jacket. Mastic shall be Childers "Chil-Perm" CP-30, elastomeric resin, or approved equal, applied in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.

2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 GENERAL

- A. Insulate after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and are dry.
- B. Install insulation with jackets drawn tight and cement down longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems and pipe penetrations through fire rated assemblies. Extend surface finishes to protect ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Keep insulation dry during the application of the finish. Bevel and seal the edges of exposed insulation.
- C. Unless otherwise indicated, do not insulate the following:
 1. Factory pre-insulated flexible ductwork.
 2. Factory pre-insulated ductwork, plenums, casings, mixing boxes, and filter boxes.
 3. Chrome plated pipes and fire protection pipes.
 4. Vibration isolating connections
 5. Adjacent insulation
 6. ASME stamps, nameplates, access plates
 7. Ductwork exposed to view in a normally occupied space.
 8. Hydronic specialties: Low water cutoff, relief valves, relief valve discharge piping, pressure reducing valves, and expansion tanks.
 9. Unions and flanges at equipment required for frequent service.

3.3 PIPING INSULATION

- A. Pipe Insulation (Fiberglass): Place sections of insulation around the pipe and joints, tightly butt into place. Draw jacket laps tight and smooth. Secure jacket with fire resistant adhesive, or factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps.
- B. Flanges, Unions, Valves and Fittings Insulation (Fiberglass): Factory fabricated removable and reusable insulation covers. Place factory pre-molded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling or with metal or plastic tacks made for securing PVC fitting covers and secure with PVC vapor barrier tape.
- C. Pipe Insulation (Flexible Unicellular): Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, unions, valves, and fittings.
- D. Where penetrating roofs and exterior walls, insulate piping to a point flush with the underside of the deck or wall and seal with a vapor barrier coating.
- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields (16 gage maximum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 4" long. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation

systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.

- F. PVC or Metal Jackets: Provide over insulation. Machine cut jacket to smooth edge of circumferential joints. Overlap metal jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9 inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing. Solvent weld PVC jacket system to provide continuous watertight seal.

3.4 DUCT INSULATION

- A. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.

3.5 EQUIPMENT INSULATION

- A. General Procedures: Apply equipment insulation suitable for temperature and service to fit as closely as possible to equipment. Join sections of insulation with adhesive. Bevel insulation around name plates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Provide vapor barrier seal at joints and seams for "cold" equipment.
- B. Heating Equipment: Provide semi-rigid mineral fiber board insulation. Seal longitudinal and lateral seams with FSK tape. Bond cuts, ends, and mitered sections with adhesive. Provide a vinyl-acrylic mastic coating on exposed fiberglass ends.
- C. Cold Equipment: Provide flexible unicellular sheet insulation, bond cuts, butt joints, longitudinal joints and ends with vapor barrier adhesive. Vapor seal exposed edges to equipment.

3.6 INSULATION APPLICATION SCHEDULE

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
PIPING:		
Domestic Cold Water Piping (Including PEX and CPVC)	1/2"	Fiberglass w/ASJ or Flexible Unicellular
Domestic Hot Water Piping and Domestic Hot Water Recirculation Piping (Including PEX and CPVC)	1"	Fiberglass w/ASJ or Flexible Unicellular

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
PIPING:		
Hot Water Heating Supply and Return Piping (Including PEX and CPVC)	1-1/2"	Fiberglass w/ASJ
Condensate Drain Piping	1/2"	Flexible Unicellular

DUCTWORK:

Bathroom and kitchen hood exhaust ductwork 36" from the backdraft damper at the exterior wall	3"	Ductwrap, FSK
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EQUIPMENT:

Water Meter	1/2"	Flexible Unicellular
Backflow Preventer	1/2"	Flexible Unicellular
Flexible Connectors, Valves, etc.	1/2"	Flexible Unicellular

3.7 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

* END OF SECTION *

SECTION 233000 - HVAC FOR DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.2 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the ductwork systems indicated.
- B. Ductwork shall be protected from dirt and debris in accordance with SMACNA Standard "Duct Cleanliness for New Construction".

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
 - 1. Ductwork.
 - 2. Ductwork accessories.
 - 3. Firestopping materials and methods.
 - 4. Dampers.
 - 5. Ductwork sealing products.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Classification of Ductwork: Low pressure ductwork: up to 2" W.G. static pressure.

- B. Materials: Unless otherwise indicated low pressure ductwork shall be galvanized steel. Galvanized sheet metal shall be new galvanized steel sheets of lock forming quality with zinc coating that will not flake or peel under forming operation.
- C. Construction for Low Pressure Round and Rectangular Ductwork:
 - 1. Material: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq.ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 2" W.G. pressure class.
 - 2. Fittings: Shall be constructed in accordance with SMACNA Standards and shall be of the types indicated (ONLY).
 - 3. Longitudinal joints shall be Pittsburgh lockseam (ONLY). Button punch snap locks are not acceptable.
 - 4. Joints shall be sealed to SMACNA seal class B.

2.2 DUCTWORK ACCESSORIES

- A. Joint Sealer:
 - 1. Hardcast Two-Part II DT tape with RTA-50 indoor/outdoor activator.
 - 2. Hardcast Duct-Seal 321 water based indoor/outdoor sealant.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that the duct systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.
 - 3. Ductwork shall be protected from dirt and debris in accordance with SMACNA Standard "Duct Cleanliness for New Construction".

3.2 INSTALLATION OF DUCTWORK AND AIR DEVICES

- A. Provide and erect in accordance with the best practice of the trade ductwork shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Architect. Sizes given are "inside - clear" dimensions and not necessarily that of sheet metal. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards", NFPA, and the requirements of the IMC code.
- B. Joint Sealing: See PRODUCTS section.
- C. Longitudinal joints: See PRODUCTS section.
- D. Turns shall be made with long radius elbows or, if physically impossible to use long radius elbows, shall be square turns with specified turning vanes. CAUTION: Turns not conforming to this requirement shall be ordered removed and replaced with properly built turns.

- E. Access Doors: Provide access doors for concealed apparatus requiring service and inspection in the duct system including but not limited to dampers, sensors and motors, and upstream and downstream from duct coils.
- F. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Insure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
- G. Duct Supports: Unless otherwise indicated, provide one-inch wide by 16 gage galvanized steel sheet metal strips on each side of ducts. Anchor risers in the center of the vertical run to allow ends or riser free vertical movements. Attach supports only to structural framing members. Do not anchor supports to metal decking unless a means is provided (architectural review required) for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- H. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, as indicated or required. For round ducts, securely fasten flexible connections using stainless steel clinch-type draw-band. Nylon drawbands may be used if installed using the drawband manufacturer's lever-action tightening tool. For rectangular ducts, lock flexible connections to metal collars.
- I. Flexible Ducts: Provide where indicated. No fiberglass shall be in contact with air flow. Flexible duct length shall not be more than 4'-0". Install with metal band hangers and without excess length, provide maximum extension of flex duct. Securely fasten flexible ducts to metal collars using a stainless steel or tool-tightened nylon drawband on the duct core and a second drawband on the insulation vapor barrier. If the duct exceeds 12 inches diameter, position the drawband behind a bead on the metal collar. Taping in lieu of drawbands is not allowed.
- J. Any deviation in the duct system must be submitted as a shop drawing and stamped. CAUTION: Any deviation not submitted and favorably reviewed will be ordered removed from the system and replaced with that which is shown on the Drawings.
- K. Discrepancies between actual field conditions and the Contract Documents shall be brought to the attention of the Architect prior to fabrication.
- L. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- M. Transitions with a slope greater than 4 to 1 shall be ordered removed from the system and replaced with a transition which meets this criteria.
- N. Joints and seams at intake and exhaust plenums and joints on intake and exhaust ductwork for a distance of 3 feet from the plenum shall be sealed watertight on the bottom and side joints and seams.
- O. Isolation dampers at intake and exhaust louvers and vent hoods shall be sealed to the ductwork to provide an airtight assembly with similar performance characteristics to the isolation damper.
- P. Ductwork serving clothes dryers shall not have sheetmetal screws. All joints shall be taped with VentureTape 1580P, 2.0-mil annealed aluminum foil tape coated with a heavy application of mastik adhesive, UL 181B-FX listed

3.3 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.

- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

3.4 TEST AND ADJUST

- A. Before operating any system, the system shall be cleaned out to remove dust and foreign materials.
- B. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- C. Correct defects which develop during the test period, conduct additional testing until defect free operation is achieved.

3.5 CLEANUP AND CORROSION PREVENTION

- A. Ductwork and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to duct systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces.

3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.7 FIRESTOPPING

- D. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

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SEE ATTACHED UL DESIGNS FOR REFERENCE

Fire-resistance Ratings - ANSI/UL 263

See General Information for Fire-resistance Ratings - ANSI/UL 263

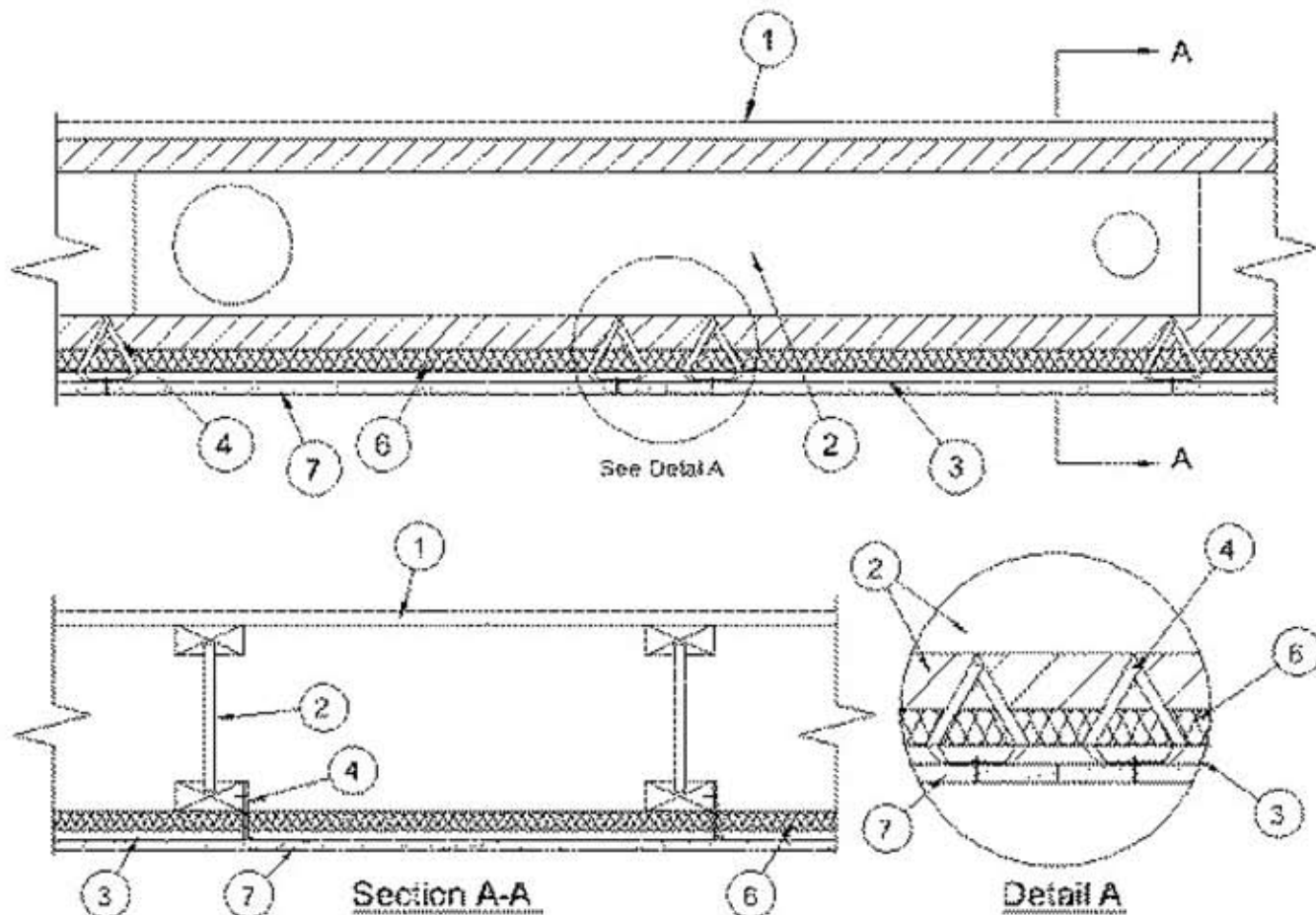
Design No. L530

March 12, 2013

Unrestrained Assembly Rating — 1 Hr

Finish Rating — 39 Min

Load Restricted for Canadian Applications — See Guide BXUV7



1. **Floor Systems** — The flooring system shall consist of one of the following:

System No. 1

Subflooring — Min 3/4 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood to be perpendicular to the trusses with end joints staggered 4 ft. Plywood secured to trusses with construction adhesive and No. 8d cement coated nails spaced 12 in. OC along each truss. Adhesive applied as 3/8 in. diam bead to top chord of trusses and grooved edges of plywood.

2. **Structural Wood Members*** — Min 9-1/2 in. deep "I" shaped wood joists spaced max 24 in. OC. Min joist bearing on bearing plate shall be 2 in. Joists secured to bearing plates with two 8d nails at each end. Circular holes may be cut in the web of joists in accordance with the manufacturer's published installation instructions.

WEYERHAEUSER NR — Types TJI®/L65, TJI®/L90, TJI®/H90, TJI®/HD90, TJI®/HS90, TJI® 100C, TJI® 300C .

3. **Furring Channels** — Nom 7/8 in deep, formed of min 0.019 in. thick (26 gauge) galv steel installed perpendicular to joists. Furring channels spaced 1-1/2 in. from and on each side of gypsum board end joints and 24 in. OC away from end joints. Channels secured to joists with support clips (Item 4) at each joist location. At channel splices, adjacent pieces overlapped 6 in. and tied with double strand of No. 18 SWG galv steel wire at each end of overlap.

4. **Support Clip — Steel Framing Members*** — One support clip to be used to support furring channels at the intersection with each joist. Support clips nailed to side of joist bottom flange with one 1-1/2 in. long No. 11 gauge (0.125 in. diam shank) nail.

SIMPSON STRONG-TIE CO INC — Type CSC

5. **Stabilizer Strap** — (Not Shown) - Nom 3/4 in. wide by 6 in. long by min 0.023 in. thick (24 gauge) galv steel straps used to prevent rotation of the support clips (Item 4) at gypsum board end joints and along walls. At gypsum board end joints (3 in. OC spacing of furring channels), stabilizer straps span between the channels and are screw-attached to the furring channels adjacent to each support clip location using No. 8 self-tapping steel screws. On furring channels nearest to and parallel with wall, one end of the stabilizer strap is screw-attached to the furring channel, adjacent to each support clip location, using No. 8 self-tapping steel screws. The free end of the stabilizer strap is twisted 90 degree, bent upward, and screw- or nail-attached to the side of the structural wood member bottom flange on the side of the support clip nearest the wall.

6. **Curtain Wall Insulation** — Nom 1 in. thick, 48 in. long with width of batt equal to on center spacing of structural wood members (max 24 in.). Batts inserted between furring channels and bottom flange of joist with long dimension perpendicular to furring channels and with butted end joints centered over furring channels.

THERMAFIBER INC — FireSpan 90

7. **Gypsum Board*** — 1/2 or 5/8 in. thick, 4 ft wide. Sheets of wallboard installed with long dimension perpendicular to furring channels and fastened to channels with 1 in. long wallboard screws located 3/4 in. and 6 in. from wallboard side joints and 12 in. OC in the field. At butted end joints, two furring channels are used which extend a min of 6 in. beyond each end of joint.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Types FRPC, Type C

CERTAINTED GYPSUM CANADA INC — Type C

CGC INC — Type C, IP-X2

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC

LAFARGE NORTH AMERICA INC — Types LGFC-C, LGFC-C/A

NATIONAL GYPSUM CO — Types FSK-G, FSW-G, FSK-C, FSW-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-C

TEMPLE-INLAND — Type TG-C

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Type C, IP-X2

USG MEXICO S A DE C V — Type C, IP-X2

8. **Finishing System** — (Not Shown) - Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

*Bearing the UL Classification Mark

Last Updated on 2013-03-12

Design Usage Disclaimer:

Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Listed or Classified products, equipment, system, devices, and materials. Authorities Having Jurisdiction should be consulted before construction. Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot address every construction nuance encountered in the field. When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction. Only products which bear UL's Mark are considered as Classified, Listed, or Recognized.

Fire-resistance Ratings - ANSI/UL 263

See General Information for Fire-resistance Ratings - ANSI/UL 263

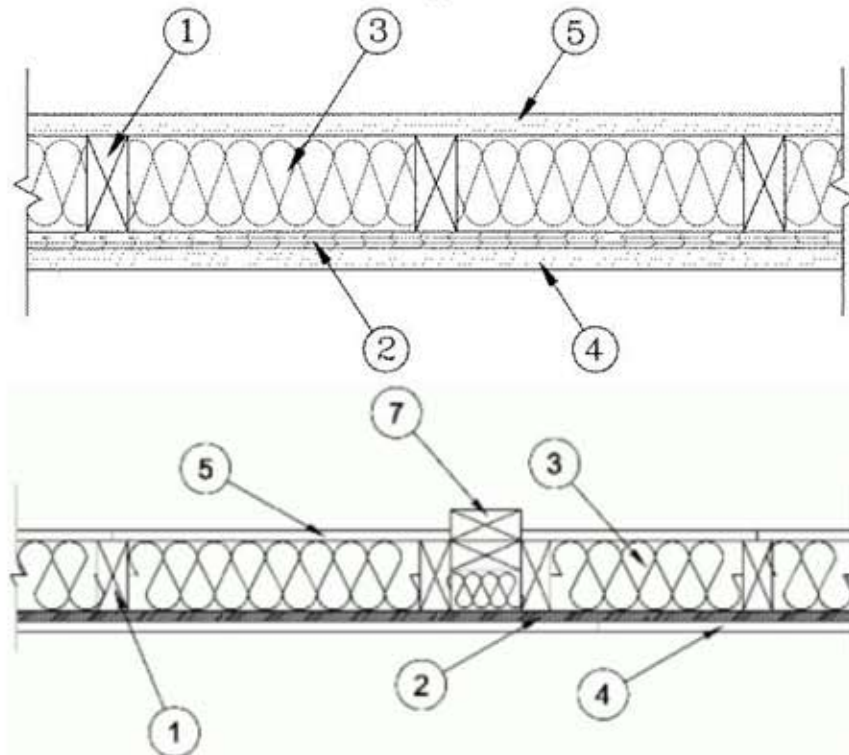
Design No. U344

April 18, 2013

Bearing Wall Rating — 1 Hr.

Finish Rating — 26 Min.

Load Restricted for Canadian Applications — See Guide BXUV7



1. **Wood Studs** — Nom 2 by 4 in. spaced 24 in. OC, laterally braced, and effectively fire stopped at top and bottom.

2. **Wood Structural Panel Sheathing** — Nom 15/32 in. thick, 4 ft wide APA Rated Sheathing 32/16. Exposure 1, plywood or oriented strand board (OSB) per PS1, PS2 or APA Standard PRP-108. Installed with long dimension of sheet (strength axis) or face grain of plywood, parallel with studs. Vertical joints centered on studs, and staggered one stud space from wallboard joints. Horizontal joints backed with nom 2 by 4 in. wood backing. Attached to studs on exterior side of wall with 6d cement coated steel box nails spaced 12 in. OC along interior studs and 6 in. OC at perimeter of panels.

3. **Batts and Blankets*** — 3-1/2 in. thick foil-faced glass fiber batts. Supplied in rolls 23 in. wide. Density to be nom 0.70 pcf. Placed in stud cavity and secured to studs with 5/8 in. long steel staples spaced nom 12 in. OC.

See **Batts and Blankets*** (BZJZ) category for names of Classified Companies.

3A. **Fiber, Sprayed*** — As an alternate to Batts and Blankets (Item 3) — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product with a nominal dry density of 2.7 lb/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product.

U S GREENFIBER L L C — INS735 & INS745 for use with wet or dry application. INS510LD, INS515LD, INS541LD, INS735, INS745, INS765LD, and INS770LD are to be used for dry application only.

3B. **Fiber, Sprayed*** — As an alternate to Item 3 and 3A — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in

accordance with the application instructions supplied with the product. Nominal dry density of 4.58 lb/ft³.

NU-WOOL CO INC — Cellulose Insulation

3C. Fiber, Sprayed* — As an alternate to Batts and Blankets (Item 3) - Spray applied cellulose fiber. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. The minimum dry density shall be 4.30 lbs/ft³.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

4. Gypsum Board* — 5/8 in. thick, 4 ft wide, applied horizontally or vertically. Attached to studs through plywood sheathing with 8d cement coated nails 2-3/8 in. long, 0.113 in. shank diam, 9/32 in. diam head nails spaced 7 in. OC along studs and at perimeter of panels. When used in widths other than 48 in., wallboard is to be installed horizontally. Joints exposed or covered with tape and compound.

When Item 6, **Steel Framing Members***, is used, gypsum panels attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C.

CERTAINTED GYPSUM INC — Type C or Type X (Finished Rating is 23 minutes) Type EGRG, Type GlasRoc.

CERTAINTED GYPSUM CANADA INC — Type C or Type X (Finished Rating is 23 minutes).

CGC INC — Type AR, C, IP-X2, IPC-AR, SCX, SHX, ULX, WRC, WRX.

LAFARGE NORTH AMERICA INC — Types LGFC6, LGFC6A, LGFC-C, LGFC-C/A.

NATIONAL GYPSUM CO — Type FSW-6 (finish rating 20 min).

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types PG-11, PGS-WRS.

TEMPLE-INLAND — Types TG-C, Type X, Veneer Plaster Base - Type X, Water Rated - Type X, Sheathing - Type X, Soffit - Type X, GreenGlas Type X.

THAI GYPSUM PRODUCTS PCL — Type C or Type X

UNITED STATES GYPSUM CO — Types AR, C, FRX-G, IP-X2, IPC-AR, WRC, SCX, SHX, ULX, USGX or WRX.

USG MEXICO S A DE C V — Type AR, C, IP-X2, IPC-AR, SCX, SHX, ULX, WRC or WRX.

4A. Gypsum Board* — (As an alternate to Item 4) - 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically and secured as described in Item 4.

TEMPLE-INLAND — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min).

4B. Wall and Partition Facings and Accessories* — (As an alternate to Items 4, 4A) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically only and secured as described in Item 4.

SERIOUS ENERGY INC — Type QuietRock ES, Type QuietRock QR-527.

5. Gypsum Board* — 5/8 in. thick, 4 ft wide applied horizontally or vertically. Attached to studs or blocking at 7 in. OC with 6d cement coated nails, 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads. When used in widths other than 48 in., wallboard to be installed horizontally. Joints exposed or covered with tape and compound.

When Item 6, **Steel Framing Members***, is used, gypsum panels attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C.

CGC INC — Type AR, C, IP-X1, IP-X2, IPC-AR, SCX, ULX, WRX.

LAFARGE NORTH AMERICA INC — Types LGFC6, LGFC6A, LGFC-C, LGFC-C/A.

NATIONAL GYPSUM CO — Type FSW-6 (finish rating 20 min).

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types PG-11, PGS-WRS.

TEMPLE-INLAND — Type TG-C, GreenGlass Type X

UNITED STATES GYPSUM CO — Type AR, C, FRX-G, IP-X1, IP-X2, IPC-AR, SCX, ULX, USGX or WRX

USG MEXICO S A DE C V — Type AR, C, IP-X1, IP-X2, IPC-AR, SCX, ULX or WRX

5A. **Gypsum Board*** — As an alternate to Item 5 - (not shown) - 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board. When used in widths of other than 48 in., gypsum boards are to be installed horizontally. Joints exposed or covered with tape and compound.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C (Finished Rating is 25 minutes).

CERTAINTED GYPSUM INC — Type C or Type X (Finished Rating is 23 minutes) Type EGRG, Type GlasRoc.

CERTAINTED GYPSUM CANADA INC — Type C or Type X (Finished Rating is 23 minutes).

CGC INC — Type AR, C, IP-X2, IPC-AR, SCX, SHX, ULX, WRC or WRX (Finished Rating is 24 minutes).

THAI GYPSUM PRODUCTS PCL — Type C or Type X

UNITED STATES GYPSUM CO — Type AR, C, FRX-G, IP-X1, IP-X2, IPC-AR, SCX, ULX, USGX or WRX (Finished Rating is 24 minutes).

USG MEXICO S A DE C V — Type AR, C, IP-X1, IP-X2, IPC-AR, SCX, ULX or WRX (Finished Rating is 24 minutes).

5B. **Gypsum Board*** — (As an alternate to Items 5 and 5A) — 5/8 in. thick gypsum panels, with square edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last 2 screws 1 and 4 in. from edge of board or nailed as described in Item 5. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

TEMPLE-INLAND — GreenGlas Type X

5C. **Gypsum Board*** — (As an alternate to Items 5 through 5B) - 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically and secured as described in Item 5.

TEMPLE-INLAND — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min).

5D. **Wall and Partition Facings and Accessories*** — (As an alternate to Items 5 through 5C) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically only and secured as described in Item 5.

SERIOUS ENERGY INC — Type QuietRock ES, Type QuietRock QR-527.

6. **Steel Framing Members** — (Optional, Not Shown)* — Furring Channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Items 4 and 5.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6a) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips. . RSIC-1 clip for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) clip for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL INC — Types RSIC-1, RSIC-1 (2.75).

7. **Non-Bearing Wall Partition Intersection** — (Optional) Two nominal 2 by 4 in. stud or nominal 2 by 6 in. stud nailed together with two 3-1/2 in. long 10d nails spaced a max. 16 in. OC, vertically and fastened to one side of the minimum 2 by 4 in. stud with 3 in. long 10d nails spaced a max 16 in. OC, vertically. Intersection between partition wood studs to be flush with the 2 by 4 in. studs. The wall partition wood studs are to be framed by with a second 2 by 4 in. wood stud fastened with 3 in. long 10d nails spaced a max. 16 in. OC, vertically. Maximum one non-bearing wall partition intersection per stud cavity. Non-bearing wall partition stud depth shall be at a minimum equal to the depth of the bearing wall.

*Bearing the UL Classification Mark

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