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SPECIFICATION FOR HVAC CONSTRUCTION			

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This specification, combined with the HVAC drawings and the project specific scope of work, shall define the HVAC Contractor's construction scope and responsibilities.
- B. This specification shall be applicable to the following HVAC systems:
 - 1. General HVAC (offices, break rooms, etc.).
 - 2. Electrical Rooms, Substation Rooms, Rack Rooms, and Control Rooms.
 - 3. Building Ventilation and Exhaust.
- C. This specification shall not be applicable to the following systems:
 - 1. Paper Machine Hood Air Systems (Hood Exhaust, Pocket Ventilation, etc.).
 - 2. Mist Elimination Systems.
 - 3. Trim or Pneumatic Conveying Systems.
 - 4. High Temperature Systems above 200°F.
 - 5. High Pressure Systems above 10" w.g.
- D. The HVAC Contractor shall furnish all labor, materials, duct supports, and inline equipment supports to fabricate, erect and support the ductwork as indicated on the drawings/scope of work and as specified herein.
- E. The HVAC Contractor shall furnish all labor and materials to insulate the ductwork as indicated on the drawings/scope of work and as specified herein.
- F. The Owner shall furnish and the HVAC Contractor shall install all major HVAC equipment.
- G. The HVAC Contractor shall furnish and install minor HVAC equipment, as defined on the drawings and in the scope of work.
- H. Where the HVAC drawings and/or scope of work conflict with this specification, the HVAC drawings and/or scope of work shall govern.
- I. Duct routings shall be coordinated with work of other trades for required clearances. The HVAC Contractor shall notify the Owner or Owner's Representative where there are serious conflicts with other trades, equipment, and/or other obstructions.
- J. Requests for material or contractor furnished equipment substitutions shall be submitted, in writing, to the Owner's Representative for approval before proceeding with fabrication, construction and erection.

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1.2 REFERENCES

- A. All ductwork and equipment installation shall be in accordance with the latest edition and revision of the applicable codes and standards listed below:
1. AABC - Associated Air Balance Council.
 2. AMCA – Air Movement and Control Association International, Inc.
 3. ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
 4. ASTM - American Society for Testing and Materials.
 5. International Mechanical Code – 2012 Edition.
 6. NFPA - National Fire Protection Association.
 7. OSHA - Occupational Safety and Health Administration.
 8. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
 9. UL - Underwriters' Laboratory.
 10. State and Local Codes, Laws and Ordinances.
- B. The HVAC Contractor shall be licensed to perform the work in the state of Georgia.

1.3 QUALITY ASSURANCE

- A. Specific reference in this Specification to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be strictly adhered to by the HVAC Contractor, unless given written approval by the Owner or Owner's Representative.
- B. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of this work.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. The HVAC Contractor shall be responsible for the delivery, receiving, storage, protection and handling of ductwork and equipment furnished by the HVAC Contractor.
- B. The HVAC Contractor shall be fully responsible for assuring that the ductwork and materials are adequately secured and protected while in temporary storage on site awaiting equipment installation.

1.5 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. The ductwork drawings and equipment submittals of Owner furnished equipment shall be used for equipment location and equipment tie-in points. The HVAC Contractor

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shall make an allowance in the ductwork fabrication for the exact equipment tie-in points based on the actual field conditions.

- B. Final measurements for locating ducts and equipment shall be made on the site by the HVAC Contractor and shall be based on actual job conditions.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL AND CONSTRUCTION

- A. Ductwork may be specified with mill approval per the following:
1. Aluminum ductwork shall be constructed of first quality Type 3003-H14 aluminum sheets. Aluminum extrusions or shapes shall be used for bracing, hangers and flanges.
 2. Type 304 Stainless Steel and 316 Stainless Steel: Conform to ASTM A 240 and thickness in accordance with USS gauges.
 3. Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, G90 coating designation; with mill finish.
- B. Flanged Duct Gaskets: minimum 1" wide by 1/8" thick DURO 60 neoprene gasket or Tremco Butyl Tape.
- C. Flexible connections shall be installed at the fan inlets and outlets and as indicated on the drawings. Flexible connection material shall be "Ventglas" 30 oz./sq. yd. double coated neoprene, air and water tight glass fabric good up to ± 10 " w.g. static pressure as manufactured by Ventfabrics, or approved equal.
- D. Air diffusers, registers, grilles, louvers and other duct accessories shall be as specified on the drawings, or approved equal.

2.2 GENERAL

- A. Duct, flanges, stiffeners, bracing, grilles, registers, dampers, access doors, and all other components of ductwork shall be of the same material as the ductwork unless otherwise noted.
- B. Hardware for ductwork joints shall be stainless steel.
- C. Welded seams and connections of stainless steel and/or galvanized ductwork shall be ground free of any weld build-up, burrs, or irregularities.
- D. Bottom of duct elevations called out on the drawings indicates bottom of sheet metal with no allowance for insulation or reinforcing.
- E. The wind loading for the outdoor ductwork, per IBC 2012:
- Basic Wind Speed (3 sec. gust) – 95 mph
 - Wind Exposure Category – C

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- F. Seismic design criteria, per IBC 2012:
- Spectral Response Acceleration Coefficients
 - $S_s = 0.372$
 - $S_1 = 0.114$
 - Site Class - D
 - Seismic restraints for all ductwork shall comply with the SMACNA Seismic Restraint Manual.
- G. Construct T's, bends, and elbows with centerline radius of not less than 1-1/2 times duct diameter. Where not possible and where rectangular elbows are used, provide turning vanes. Turning vanes shall be single thickness and welded to runners. Runners shall be welded to the duct.
- H. Where dissimilar metals are used or where metals would come into contact with masonry or concrete, they shall be separated by full width gaskets.
- I. Comply with SMACNA requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
- J. Provide 4" raised collar for installation of the surface mounted supply, exhaust, and return registers on the ductwork.

2.3 TYPE 1 DUCTWORK – GENERAL HVAC

- A. Type 1 Ductwork applies to general HVAC systems in offices, break rooms, conference rooms, etc.
- B. Unless otherwise noted on the drawings and/or in the scope of work, ductwork shall be fabricated from galvanized steel in accordance with the SMACNA's "HVAC Duct Construction Standards—Metal and Flexible" and the duct design pressure as indicated in the HVAC & Process Duct Schedule in Section 3.4.
- C. Duct joints shall be companion angle flanges, "Ductmate" or TDC type joints.
- D. Longitudinal seams at corners of duct sections shall be welded or sealed using Pittsburgh lock construction. No Snap-Lock seams shall be allowed.

2.4 TYPE 2 DUCTWORK – ELECTRICAL ROOMS SUPPLY AND RETURN

- A. Type 2 Ductwork applies to air conditioning supply and return ductwork serving electrical rooms, substation rooms, rack rooms, and control rooms.
- B. Unless otherwise noted on the drawings and/or in the scope of work, ductwork shall be welded construction fabricated from aluminum in accordance with the SMACNA's "Round Duct Industrial Construction Standards" and "Rectangular Industrial Duct Construction Standards" and the duct design pressure as indicated in the HVAC & Process Duct Schedule in Section 3.4.
- C. Duct joints shall be companion angle flange construction. "Ductmate" or TDC type joints shall not be acceptable.

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2.5 TYPE 3 DUCTWORK – ELECTRICAL ROOMS PRESSURIZATION AIR

- A. Type 3 Ductwork applies to pressurization air ductwork, including ductwork routed to pressurization unit inlets and ductwork routed from pressurization unit outlets to the air conditioning unit return air.
- B. Unless otherwise noted on the drawings and/or in the scope of work, ductwork shall be welded construction fabricated from 316 stainless steel in accordance with the SMACNA's "Round Duct Industrial Construction Standards" and "Rectangular Industrial Duct Construction Standards" and the duct design pressure as indicated in the HVAC & Process Duct Schedule in Section 3.4.
- C. Duct joints shall be companion angle flange construction. "Ductmate" or TDC type joints shall not be acceptable.

2.6 TYPE 4 DUCTWORK – BUILDING VENTILATION AND EXHAUST

- A. Type 4 Ductwork applies to general industrial systems, building ventilation, general exhaust, etc.
- B. Unless otherwise noted on the drawings and/or in the scope of work, ductwork shall be welded construction fabricated in accordance with the SMACNA's "Round Duct Industrial Construction Standards" and "Rectangular Industrial Duct Construction Standards" and the duct design pressure as indicated in the HVAC & Process Duct Schedule in Section 3.4.
- C. Type 4 Ductwork material shall be as specified on the drawings and/or in the scope of work.
- D. Duct joints shall be companion angle flange construction. "Ductmate" or TDC type joints shall not be acceptable.

2.7 DUCT HANGERS AND SUPPORTS

- A. Ductwork shall be securely anchored and free from vibration. Ducts shall be hung level to the elevations shown on the drawings.
- B. Design, fabricate, and install hangers and supporting systems in accordance with Section IV of the SMACNA HVAC Duct Construction Standards, with the following exceptions:
 1. Strap type hangers shall be utilized only on ducts less than 12 inches wide. Ducts greater than 12 inches wide shall use trapeze type hangers.
 2. For trapeze hangers, all threaded rods shall be a minimum 1/2 inch diameter.
 3. Hangers shall be secured with double nut and washer.
- C. Materials:
 1. Duct hangers shall be constructed of the same material as the ductwork with which it is in contact unless noted otherwise on the drawings.
 2. If support metal differs from metal used in duct construction, different materials shall be separated by a full neoprene gasket.

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- D. Refer to SMACNA HVAC duct construction standards for hanger spacing.
- E. Ductwork shall be independently supported from building structure only and not from equipment or other system supports.
- F. Provide duct supports on each side of expansion joints and flexible connections.
- G. Hangers shall be attached to building structural steel by means of C-clamps with retaining clips or, where beams run parallel with the duct, from auxiliary steel angles attached to the beams.
- H. Sway bracing shall be provided at the ends of all ducts and at points of juncture of branch ducts and trunk ducts. Sway bracing shall be provided at points not more than 30 feet on center along all ducts. Sway bracing shall be of the same material as hangers. An "X" brace shall be formed between vertical hangers secured at ends and center.

2.8 DAMPERS

- A. Furnish and install all manual balancing dampers as shown on the drawings.
- B. Damper size, manufacturer, and model number shall be specified on the drawings.
- C. Damper material of construction shall match the duct material of construction that the damper is installed in.
- D. Round dampers shall be butterfly type furnished with manual locking quadrant mounted securely to the damper frame.
- E. Rectangular dampers shall be opposed blade type furnished with manual locking quadrant mounted securely to damper frame.
- F. Fire dampers:
 1. Static fire dampers shall be constructed and tested in accordance with UL safety standard 555.
 2. Unless noted otherwise on the drawings, static fire dampers of 1-1/2 hour rating shall be Ruskin IBD60 STYLE A or Ruskin IBD60 STYLE B.
 3. Unless noted otherwise on the drawings, static fire dampers of 3 hour rating shall be Ruskin IBD630 STYLE B.
 4. Combination fire/smoke dampers shall be constructed and tested in accordance with UL safety standard 555S.
 5. Combination fire/smoke damper size, manufacturer, and model number shall be specified on the drawings.

2.9 DUCT ACCESS DOORS

- A. Access doors shall be located as shown on the drawings.
- B. Doors and hinges (hardware) shall match the material of the ductwork the door is installed in.

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C. Minimum size of access doors shall be:

10" thru 12" Duct: 8" x 12" door
13" thru 30" Duct: 12" x 18" door
Over 30" Duct: 18" x 18" door

2.10 FLEXIBLE CONNECTIONS

- A. Flexible duct connections shall be provided where indicated on the drawings.
- B. Flexible connections shall not be stretched tight, but shall, after installation, be capable of movement in any direction at least 2" without pulling tight. Connections shall be approximately 6" long.
- C. Flexible connections shall consist of double layer neoprene coated fabric (Ventglass or approved equal) with heavy waxed cord stitching at corners and seams to assure airtight integrity of the connection.

2.11 DUCT INSULATION

- A. Insulation and finishes shall be installed per the manufacturer's recommendations.
- B. Tightly butt joints and securely attach insulation materials to duct.
- C. Clean and dry ductwork prior to insulation application.
- D. Extend insulation through walls, floors, and similar penetrations without interruption.
- E. Where ductwork penetrates floor, ceiling, or wall, close off space between duct and adjacent work with stuffing insulation for insulated ductwork and caulk seal airtight, unless specified otherwise or detailed otherwise on the drawings. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Access doors shall not be covered with insulation, but rather shall be insulated independently of the ductwork with the same insulation thickness as the duct insulation.
- G. TYPE 1 – FLEXIBLE FIBERGLASS DUCT WRAP:
 - 1. Flexible inorganic blanket of glass fiber with a factory applied vapor barrier facing with FSK 25 facing.
 - 2. Thickness: 2 inch
 - 3. Density: 1.0 pound per cubic foot.
- H. TYPE 2 – RIGID FIBERGLASS BOARD WITH MASTIC:
 - 1. Owens Corning Type 705 fiberglass insulation with all service jacket (ASJ Max) factory applied vapor barrier facing, or approved equal.
 - 2. Thickness: 2 inch (unless otherwise noted on the plans or in the scope of work).

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3. Density: 6 pound per cubic foot.
4. Insulation shall be impaled over welded metal pins on a maximum spacing of 12" on centers.
5. Coat entire surface of jacket with Foster 30-36 Sealfas, or approved equal. Imbed 10x20 white glass cloth into the wet first coat and smooth out free of wrinkles. Apply a second coat over the membrane in the same manner as the first to provide a smooth finish.

I. TYPE 3 – RIGID FIBERGLASS BOARD WITH STAINLESS STEEL JACKET:

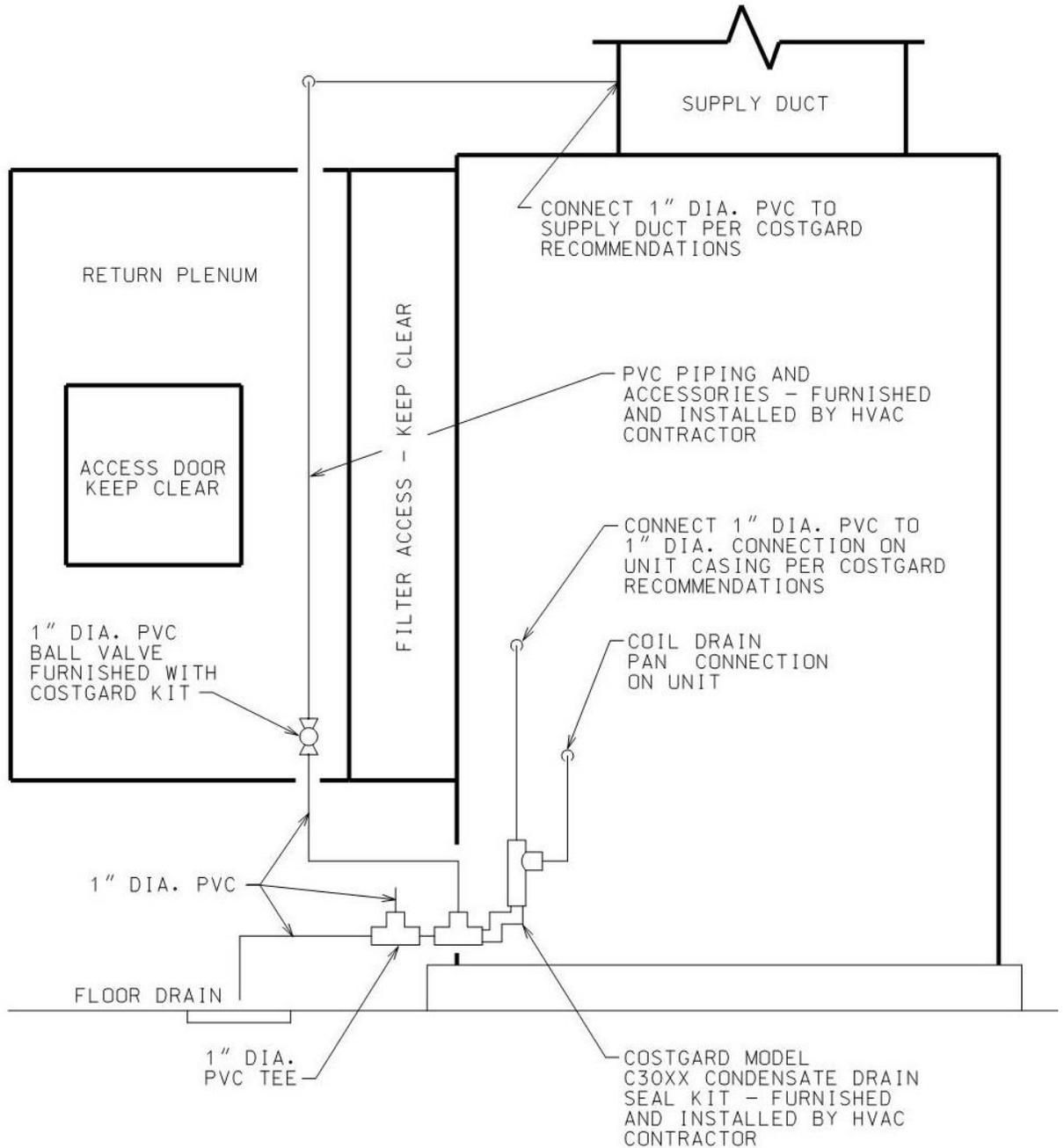
1. Owens Corning Type 705 fiberglass insulation with all service jacket (ASJ Max) factory applied vapor barrier facing, or approved equal.
2. Thickness: 2 inch (unless otherwise noted on the plans or in the scope of work).
3. Density: 6 pound per cubic foot.
4. Insulation shall be impaled over welded metal pins on a maximum spacing of 12" on centers.
5. Stainless steel jacketing shall be 0.016" thick smooth mill finish of Type 304 stainless steel on straight ductwork and 0.024" thick on elbows and irregular surfaces
6. Jacketing shall be water tight.

2.12 POSITIVE AIR SEAL CONDENSATE DRAINS

- A. Where noted on the drawings and/or scope of work, the HVAC Contractor shall furnish and install a positive air seal condensate drain for A/C units per the manufacturer's recommendations.

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- B. The positive air seal condensate drain shall include a CostGard Model C30XX condensate drain kit and PVC piping as shown on the detail below.



POSITIVE SEAL CONDENSATE DRAIN DETAIL

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- C. The 1" diameter connection in the A/C unit casing downstream of the cooling coil shall be provided by the A/C unit supplier. If the A/C unit was received without this connection, the HVAC Contractor shall notify the Owner. The A/C unit supplier will modify the casing, if required, to add this connection.

PART 3 - EXECUTION

3.1 GENERAL

- A. During construction, provide tape polyethylene on open ends of ductwork to prevent construction debris from entering the ductwork. All ductwork shall be absolutely free of any dust, metal or construction debris. The inside of the ductwork shall be thoroughly cleaned prior to fan start-up.
- B. Ductwork shall be sealed to a SMACNA Seal Class A.
- C. Flanged joints shall mate true without the use of shims or spacers.
- D. All duct transitions (reducers) shall have a minimum slope of 1:4 unless otherwise noted on the drawings.
- E. Provide airtight and watertight duct flashing through wall and floor penetrations.

3.2 START-UP AND COMMISSIONING

- A. Start-up and commissioning of major HVAC equipment shall be directed by the Owner and equipment suppliers. The HVAC Contractor shall provide support during start-up and commissioning, as required.

3.3 TESTING AND BALANCING

- A. The HVAC Contractor shall employ an independent Testing and Balancing Contractor.
- B. The Testing and Balancing Contractor shall adjust manual balancing dampers in the duct headers and supply grilles to achieve the design airflows.
- C. After balancing is completed, dampers shall be locked into place with final position permanently marked on the locking quadrant.
- D. The Testing and Balancing Contractor shall issue a balancing report to the Owner within 5 business days of completion of balancing each system.
- E. If noted on the drawings and/or scope of work, the Testing and Balancing Contractor shall perform duct leakage testing. Testing shall be completed and accepted by Owner prior to insulation of the ductwork.
1. The HVAC Contractor shall assist the Testing and Balancing Contractor in performing the duct leakage testing, which includes installation of blank-off sheets, seal the blank-off sheets, disassemble, reassemble, and seal segments of ductwork to accommodate leakage testing and for compliance with test requirements as required to perform for the duct leakage testing.

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2. Duct leakage tests shall be performed according to SMACNA's "HVAC Air Duct Leakage Test Manual." Conduct tests at static pressures equal to duct design pressure.
3. After the system is placed in operation, the Testing & Balancing Contractor shall survey all joints for audible leaks or leaks that can be felt and shall be repaired by the HVAC Contractor as necessary to eliminate leakage. Leakage greater than 50 cfm at 2" w.g. shall be repaired, patched and retested at no additional expense to the Owner.

3.4 HVAC AND PROCESS DUCT SCHEDULE

- A. Unless otherwise noted on the drawings and/or the scope of work, ductwork shall be fabricated and installed in accordance with the following HVAC & Process Duct Schedule

DUCT SYSTEM	DESIGN PRESSURE	DUCT MATERIAL	INSULATION
Type 1: General HVAC	±2" w.g.	Galvanized Steel	Type 1 (Above Ceiling) Or Type 2 (Exposed)
Type 2: Electrical Rooms Supply and Return	±4" w.g.	Aluminum	Type 2 in Unconditioned Spaces and Mechanical Rooms
Type 3: Electrical Rooms Pressurization Air	±4" w.g.	316 Stainless Steel	None
Type 4: Building Ventilation and Exhaust	Varies See drawings	Varies See drawings	Varies See drawings

END OF SPECIFICATION