

The School District of Palm Beach County

Project Name:

SDPBC Project No.:

SECTION 23 31 00 DUCTWORK

PART 1 GENERAL

1.1 REFERENCES

- A. ASHRAE - Handbook, Duct Design
- B. ASHRAE - Handbook, Duct Construction
- C. ASTM A90/A90M - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coating
- D. ASTM A167 - Standard Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip
- E. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
- G. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems
- H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems
- I. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- J. SMACNA: HVAC Duct Construction Standards
- K. UL 181: Factory - Made Air Ducts and Connectors

1.2 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Provide catalog cuts of materials and fittings, and indicate ductwork construction features such as gages, sizes, welds, and configuration.
- C. Mechanical Equipment Rooms (AHU): Provide $\frac{3}{8}$ " scale drawings for supply air, return air, outdoor air, relief air, etc.
 1. Provide copy to piping contractor in order for him to prepare his piping drawings.
- D. Prior to installation, the Contractor shall provide ductwork shop-fabrication drawings to the Engineer for approval.
- E. Samples: Not required

1.3 QUALITY ASSURANCE

- A. The sheet metal company fabricating the ducts shall specialize in performing the work of this section with minimum three years experience.
- B. Single wall duct with Pittsburgh lockseam construction shall be factory made or shop fabricated by the sheet metal company specialized in Pittsburgh lockseam duct fabrication.
 1. No field fabrication allowed.
- C. Double wall duct shall be factory made or shop fabricated by the sheet metal company specialized in double wall duct fabrication with minimum three years experience.
 1. No field fabrication allowed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store ducts and fittings inside weather-tight trailers or weather-tight buildings.
- B. Protect ductwork shall from water, dirt, chemical, and mechanical damage.
- C. Deliver all ductwork and fittings to the site clean of any foreign materials and provide protective covers on all openings in the duct and fittings.
 1. Remove the protective cover during installation but recover all openings at the completion of the phase of work on the system and the end of the day.

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2. If ductwork is delivered to the site unassembled, once assembled on the site cover the ends if duct is not scheduled for installation within 24 hours of assembly.

1.5 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions.
- B. Low pressure/low velocity: Is 2"-WG positive or negative static pressure and velocities less than 2,500 fpm.
- C. Medium Pressure/High Velocity: Is 6"-WG positive static pressure and velocities greater than 2,500 fpm.
- D. High pressure/high velocity: Is 10"-WG positive static pressure and velocities greater than 2,000 fpm.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: Non-combustible or conforming to requirements for Class 1 air duct materials or UL 181.
- B. Steel Ducts: ASTM A653/A653Mgalvanized steel sheet, lock-forming quality, zinc coating of 1.25-oz per sq.ft, for each side in conformance with ASTM A90.
 1. When the contract documents require ductwork be painted, provide paintable galvanized steel.
- C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K-value at 75° F and vinyl interior liner supported by helically wound spring steel wire.
- D. Stainless Steel Ducts: Per ASTM A167, Type 304.
- E. Glass Fiber Reinforced Plastic Ducts.
- F. Fasteners: Rivets, bolts, or sheet metal screws.
- G. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used with tape, or heavy mastic with membrane.
- H. Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- I. Fiberglass Ductwork is **NOT** acceptable.
- J. Steel Duct with Interior Duct Liner is **NOT** acceptable, if the duct liner is exposed to the air stream.
- K. Flexible metallic (aluminum) duct (for clothe dryer venting) is not acceptable for any HVAC ductwork application.

2.2 LOW PRESSURE/LOW VELOCITY DUCTWORK

- A. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated.
 1. Provide sheet metal duct material, gauges, reinforcing, sealing, etc. for 2" WG positive or negative static pressure.
- B. Single wall and double wall sheet metal, round and flat oval ducts shall be spiral lockseam, spiral lockseam with standing rib, or longitudinal seam with solid welded construction.
 1. Fittings shall be standing seam or solid welded construction by the same manufacturer as the ductwork.
- C. Single wall sheet metal, rectangular ducts, with inside clear dimension in any direction of 13" or larger, shall be Pittsburgh lockseam construction.
 1. Punch-button snap lock longitudinal seam construction is allowed only for low pressure/low velocity ducts with inside clear dimension in any direction of 12" or smaller.
 2. Replace all ductwork not complying with these requirements at no cost to the District and no time extension for the contractor.

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- D. Seal all transverse joints, longitudinal seams, snap-lock ducts and duct wall penetrations.
- E. May install round sheet metal ducts in place of rectangular ducts in accordance with ASHRAE's table of equivalent duct sizes.
 - 1. No variation of duct configuration or sizes permitted except by written permission.
- F. Construct tees, bends, and elbows with radius of not less than 1.5 times the width of duct on centerline.
 - 1. If radius or mitered elbows are required and not used, provide turning vanes at all 90 degree elbows in each direction at the tee intersection.
- G. Increase duct sizes gradually, not exceeding 15° divergence wherever possible.
 - 1. Divergence upstream of equipment shall not exceed 30°; convergence downstream shall not exceed 45°.
- H. Connect flexible ducts to the spin collars with dampers that insert into the metal ducts with draw bands, tape, and adhesive mastic.

2.3 MEDIUM AND HIGH PRESSURE/HIGH VELOCITY DUCTS

- A. Fabricate and support in accordance with SMACNA High Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated.
 - 1. Provide sheet metal duct material, gages, reinforcing, sealing, etc. for 6" WG positive pressure, except as indicated.
- B. Single wall and double wall, round and flat oval ducts shall be spiral lockseam construction.
 - 1. Fittings shall be solid welded or flanged construction.
 - 2. Fittings shall be by the same manufacturer as the ductwork.
- C. Construct tees, bends, and elbows with radius of not less than 1.5 times the width of duct on centerline, if not possible or if square throat radius or mitered elbows are used, provide airfoil-turning vanes.
 - 1. Provide turning vanes at all 90-degree elbows and each direction at the tees intersection.
- D. Transform duct sizes gradually, not exceeding 15° divergence and 30° convergence.
- E. Seal all transverse joints, longitudinal seams, and duct wall accessory penetrations with adhesive mastic.
- F. Provide standard 45° lateral wye takeoffs unless 90° conical tees are indicated.

2.4 DOUBLE WALL, ROUND, FLAT OVAL AND RECTANGULAR DUCTWORK

- A. Provide double wall ducts and fittings with inner sheet metal liner, 1" thick fiberglass insulation, and outer sheet metal pressure shell.
 - 1. Fittings shall be by the same manufacturer as the ductwork.
- B. Provide 1" thick, fiberglass insulation with a K-value of 0.27 at 75°F.
- C. Provide solid or perforated inner sheet metal liner as indicated by the drawings.
- D. Use perforated inner liner for sound attenuating ductwork.
 - 1. In ducts with perforated inner liner, provide 0.002" thick Mylar plastic sleeve between the inner liner and the insulation to separate the porous insulation from the air stream.
- E. At electric duct heaters, provide solid inner liners that start 6" upstream and end 6" downstream of electric duct heaters.
- F. Where double wall duct connects to single wall duct, provide double wall to single wall insulated end fitting.

2.5 KITCHEN HOOD EXHAUST DUCTWORK

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and NFPA 96.
- B. Fabricate any exposed and concealed ductwork of stainless steel with continuous externally welded joints and seams.

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2.6 DISHWASHER EXHAUST DUCTWORK

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards.
- B. Fabricate exposed and concealed ductwork of stainless steel with continuous externally welded joints and seams.
- C. Pitch horizontal ducts to drain condensed vapor back to the floor mounted equipment.

2.7 CLOTHES DRYER VENT DUCTS (EXHAUST)

- A. Dryer vent ducts shall be galvanized steel minimum 4" diameter.
 - 1. Round or enclosed rectangular 14" or less, shall be galvanized steel 30-gauge.
 - 2. Round or enclosed rectangular more than 14", shall be galvanized steel 28-gauge.
 - 3. Exposed rectangular 14" or less, shall be galvanized steel 28-gauge.
 - 4. Exposed rectangular more than 14", shall be galvanized steel 26-gauge.
- B. Nonmetallic duct not allowed.
- C. Terminate the duct outside of the building horizontally with manufactured back draft damper assembly and rain hood. Vertical discharge shall have a sheet metal gooseneck curb at the roof deck penetration.
 - 1. Do not terminate into pedestrian walkway.
 - 2. Do not terminate the discharge within 10 feet of any condensing units.
- D. Secure all joints and seams with metal tape, do not use screws, and mount in place.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- B. Provide openings in ductwork where required to accommodate EMCS controllers.
- C. Connect VAV boxes to medium or high pressure/high velocity ducts directly, do not use flexible duct.
- D. Connect ceiling diffusers to low pressure/low velocity ducts with 5' minimum to 10' maximum laying length of flexible duct.
- E. Connect return air grilles to low pressure/low velocity ducts with 5' minimum to 10' maximum laying length of flexible duct.
- F. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers and provide access doors for cleaning.
 - 1. Provide access doors at each 90° horizontal elbow.
- G. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent dust from entering the ductwork system.
- H. Metal round duct shall be mechanically fastened (screws) a minimum of 3 points at each joint of duct run. Not applicable if continuously welded.
- I. Where indicated, provide double wall ductwork. At the discharge and inlet of central station AHUs, provide the following minimum lengths of double wall ductwork:
 - 1. Multizone: 0' supply air, 20' return air
 - 2. Single Zone: 20' supply air, 20' return air
 - 3. Variable Air Volume: 30' supply air, 20' return air
 - 4. If branch ducts are necessary in the double wall main duct, provide double wall branch ducts to obtain the minimum lengths of double wall ductwork.
 - 5. Double wall ducts shall have all joints buttered prior to assembly to prevent insulation from fraying.

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- J. Do not install ductwork within the building until the building is weather-tight. All ductwork damaged by weather shall be replaced at no cost to the District and no time extension for the contractor.

3.2 DUCTWORK APPLICATION SCHEDULE

- A. Galvanized sheet metal
 - 1. Supply, Return, Outdoor and Relief
 - 2. General Exhaust
 - 3. Kiln Ventilation
 - 4. Shower and Locker Room exhaust, pitch horizontal ducts to the exhaust intake grilles.
- B. Galvanized Sheet Metal or Aluminum
 - 1. Emergency Generator Ventilation
- C. Stainless steel for exposed and concealed ductwork:
 - 1. Kitchen Hood Exhaust
 - 2. Dishwasher Exhaust
- D. Stainless Steel or glass fiber reinforced plastic:
 - 1. Chemical Fume Hood Exhaust

3.3 ADJUSTING AND CLEANING:

- A. Clean duct systems with high power vacuum machines.
- B. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.
- C. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION