

SECTION 15890
DUCTWORK

PART 1 GENERAL

1.1 REFERENCES

- A. ASHRAE: Fundamentals Handbook, Duct Design.
- B. ASHRAE: Equipment Handbook, Duct Construction.
- C. ASTM A90: Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- D. ASTM A167: Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- E. ASTM A527: Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- F. ASTM B209: Aluminum and Aluminum Alloy Sheet and Plate.
- G. NFPA 90A: Installation of Air Conditioning and Ventilating Systems.
- H. NFPA 90B: Installation of Warm Air Heating and Air Conditioning Systems.
- I. NFPA 96: Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.
- J. SMACNA: Low Pressure Duct Construction Standards.
- K. SMACNA: High Pressure Duct Construction Standards.
- L. UL 181: Factory-Made Air Ducts and Connectors.

1.2 SUBMITTALS

- A. Submit under provisions of Section 15000.
- 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. 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. 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. No field fabrication allowed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store ducts and fittings inside weather-tight trailers or weather-tight buildings. Ductwork shall be protected from water, dirt, chemical, and mechanical damage. Contractor shall clean and/or repair any damage or dirtiness as result of improper storage.

1.5 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions.
- B. Low pressure/low velocity: 2"-WG positive or negative static pressure and velocities less than 2,500 fpm.
- C. Medium Pressure/High Velocity: 6"-WG positive static pressure and velocities greater than 2,000 fpm.
- D. High pressure/high velocity: 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 A527 galvanized steel sheet, lock-forming quality, zinc coating of 1.25-oz per sq.ft, for each side in conformance with ASTM A90. When the contract documents indicate that ductwork shall 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: 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: Not acceptable.
- J. Steel Duct with Interior Duct Liner: Not acceptable, if the duct liner is exposed to the air stream.
- K. Flexible metallic (aluminum) duct (for clothes 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. Provide duct material, gauges, reinforcing, sealing, etc. for 2" WG positive or negative static pressure.
- B. Single wall and double wall, round and flat oval ducts shall be spiral lockseam, spiral lockseam with standing rib, or longitudinal seam with solid welded construction. Fittings shall be standing seam or solid welded construction by the same manufacturer as the ductwork.
- C. Single wall, rectangular ducts, with inside clear dimension in any direction of 13" or larger, shall be Pittsburgh lockseam construction. 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. Ductwork that does not comply with these requirements shall be replaced at no cost to Florida Tech and no time extension for the contractor.
- D. Seal all transverse joints, longitudinal seams, snap-lock ducts and duct wall penetrations.
- E. Round ducts may be installed in place of rectangular ducts in accordance with ASHRAE's table of equivalent duct sizes. 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. If not possible or if square throat radius or mitered elbows are used, provide turning vanes.

- G. Increase duct sizes gradually, not exceeding 15° divergence wherever possible. Divergence upstream of equipment shall not exceed 30°; convergence downstream shall not exceed 45°.
- H. Connect flexible ducts to metal ducts with adhesive and draw bands.
- I. Use crimp joints with bead for joining round duct crimp in direction of airflow.
- J. Use double nuts and lock washers on threaded rod supports.

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. Provide 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. Fittings shall be solid welded construction. 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.
- D. Transform duct sizes gradually, not exceeding 15° divergence and 30° convergence.
- E. Seal all transverse joints, longitudinal seams, and duct wall penetrations.
- F. Provide standard 45° lateral wye takeoffs unless 90° conical tees are indicated.
- G. Use double nuts and lock washers on threaded rod supports.

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. 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. 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. Fabricated exposed and concealed ductwork of stainless steel with continuous externally welded joints and seams.

2.6 DISHWASHER EXHAUST DUCTWORK:

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards.
- B. Fabricated 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 equipment.

2.7 FUME HOOD EXHAUST

- A. All hood systems shall have dedicated ductwork and fans. Hoods utilized for perchloric acid shall be ducted individually and shall not be connected with any other hoods.
- B. Materials used in fume hood duct construction shall be compatible with the substances to be utilized in the hood. Common duct materials include stainless steel, fiberglass, and coated galvanized steel (strongly discouraged – acceptance dependent on coating – prior approval by the Florida Tech Project Representative required).
- C. The exhaust fan motor shall be installed outside of the ductwork so as not to be exposed to the contaminated air stream.
- D. Duct runs shall take the shortest and straightest path to the roof of the building as possible. Horizontal duct runs shall be minimized. When unavoidable, horizontal runs shall be sloped to allow condensate to drain into the hood or to a trapped drain line.
- E. Fume hood exhaust stacks shall be located to minimize re-entrainment of hood emissions. The following minimum considerations shall be included in stack design:
 - 1. The use of rain caps or down turned stack heads is prohibited. Ductwork that is one inch larger in diameter and four times the diameter in length than the exhaust duct will be attached over the exhaust to act as a vertical discharge rain deflector.
 - 2. The stack shall be placed to exhaust outside of the building recharge zone. This typically means a stack height of 8 to 10 feet above adjacent rooflines and 50 feet from the nearest air intake.
 - 3. Provide a stack exit velocity at least 1.4X prevailing winds speed. This typically equates to velocities of 3,200 fpm.
 - 4. All laboratory exhaust fans shall be on emergency power and be driven by a Variable Frequency Drive.

2.8 CLOTHES DRYER VENT DUCTS (EXHAUST)

- A. Dryer vent ducts shall be either galvanized steel or aluminum of minimum thickness:
 - 1. Round or enclosed rectangular 14" or less: galvanized steel 30-gauge, aluminum 26-gauge.
 - 2. Round or enclosed rectangular more than 14": galvanized steel 28-gauge, aluminum 24-gauge.
 - 3. Exposed rectangular 14" or less: galvanized steel 28-gauge, aluminum 24-gauge.
 - 4. Exposed rectangular more than 14": galvanized steel 26-gauge, aluminum 22-gauge.
- B. Nonmetallic duct not allowed.
- C. Terminate the duct outside of the building, with back draft damper.
 - 1. Do not terminate into pedestrian walkway.
- 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. 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.
- 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 Florida Tech and no time extension for the contractor.

3.2 DUCTWORK APPLICATION SCHEDULE

- A. Galvanized steel:
 - 1. Supply, Return, Outdoor and Relief
 - 2. General Exhaust
 - 3. Emergency Generator Ventilation
- B. Stainless steel for exposed and concealed ductwork:
 - 1. Kitchen Hood Exhaust
 - 2. Dishwasher Exhaust
- C. Stainless steel or aluminum:
 - 1. Shower and Locker Exhaust. Pitch horizontal ducts back to the exhaust grilles.
- D. Stainless steel or glass fiber reinforced plastic:
 - 1. Fume Hood Exhaust

3.3 ADJUSTING AND CLEANING:

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

END OF SECTION