15890 DUCTWORK

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SPECIFIER: This section replaces
CSI MasterFormat 2004 number:
An optional keynote to the Drawings follows major product titles, for A/Es using National CAD Standard.

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PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. 07840 - Firestopping and Smoke Sealing.
   2. 15260 - Vibration Isolation.
   3. 15280 - Thermal Insulation (HVAC).
   4. 15855 - Air Handling Units.
   5. 15910 - Duct Accessories.
   6. 15940 - Outlets (HVAC).
   7. 15990 - Tests (HVAC).

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), latest edition:
   1. HVAC Duct Construction Standards (Metal and Flexible).
   2. High Velocity Duct Construction Standards.

B. National Fire Protection Association (NFPA):
   1. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals.
   2. NFPA 90A - Standard for the Installation of Air-conditioning and Ventilating Systems of Other than Residence Type.
   3. NFPA 96 - Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment.

C. National Electrical Code - NEC 70 (Edition applicable to the Project).

D. American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. (ASHRAE) 62 - Ventilation for Acceptable Indoor Air Quality.

1.3 SYSTEM DESCRIPTION

A. Provide solid double walled ducts, with minimum 2″ thick sandwiched insulation, for the first 15 feet of supply and return ductwork from each AHU to provide for sound attenuation. Provide outside air ducts with similar double walled insulation throughout the mechanical room, to prevent condensation. The use of perforated interior double wall or Mylar film to protect exposed fiberglass is not allowed. At Auditoriums or TV studios where maximum sound attenuation is required, the use of acoustical fiberglass lining with a rubberized coat in contact with the airstream is allowed, when approved by M-DCPS and the A/E sound consultant.

B. All ductwork shall be sealed to comply with SMACNA:
   1. Seal Class A.

2. Leakage Class 6 for rectangular ducts.
3. Leakage Class 3 for round and oval ducts.

C. Use of fiberglass or components containing coated or exposed fiberglass within airstreams is prohibited.

1.4 SUBMITTALS

A. Ductwork:
1. Provide 1/4" scale composite Shop Drawings. Shop Drawings shall be coordinated with other trades before submitting.
2. Catalog Cuts: Medium pressure ductwork, duct sealer, and turning vanes.
3. Catalog Cuts, Ratings, and Performance Data: Flexible ductwork.

B. Casings, Plenums, and Housings: Details of construction.

C. Provide details of proposed typical ductwork fittings including:
1. Seams and joints.
2. Elbows, vaned and radius.
3. Transitions and Offsets.
4. Taps and outlet frames.
5. Branch connections and tees.
6. Splitter dampers.

D. Variable Air Volume Boxes: Catalog cuts, certified performance tables. Certified sound power levels for both radiated and discharge air sound in 2nd through 6th octave bands, at inlet static pressures of 1, 2, 3 and 4 inches WG.

E. Electric Duct Heaters: Catalog cuts, wiring diagrams, list of materials and catalog cuts of control and safety devices, heater wire surface area of each heater.

F. Duct Hanger System: Catalog cuts and shop drawing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flexible: Genflex or Flexible Technologies.

B. Ductwork and Fittings:
1. Metalaire.
2. Semco.
3. Spiramatic.
4. United Sheet Metal.

C. Medium Pressure Ductwork Adhesive Sealing Compound:
1. Benjamin Foster #30-02.
2. 3M Hardcast.

D. Variable Air Volume Boxes (Medium Pressure):
1. Anemostat.
2. Carnes.

3. Metalaire.
4. Price.
5. Titus.
6. Trane.
7. Warren Technology.

E. Electric Duct Heaters:
1. Brasch.
2. Chromalos.
3. Electroduct Heater.
4. Metalaire.
5. Warren Technology.

2.2 MATERIALS

A. Ductwork shall be fabricated and installed according to the SMACNA Standards, except as shown on drawings or specified.

B. Ductwork shall have manufacturer's gage stamp intact.

2.3 LOW PRESSURE DUCTWORK

A. Includes ductwork from low pressure air handlers, exhaust, and outside and return air ductwork. Velocities shall not exceed 1,300 fpm and static pressures not to exceed 2 inches WG.

B. Provide galvanized steel ductwork, designed, constructed, installed and tested according SMACNA - "HVAC Duct Construction Standards" and as shown on drawings. Ductwork to have manufacturer's gage stamp. Provide cross-breaking or beading to prevent flexing, but do not reduce gage of metal below that required for flat ductwork sheets.

C. Provide galvanized steel saddles at points of support of insulated piping saddles according to Section 15051.

D. The following ductwork and plenums shall be insulated, unless noted otherwise.
1. Return air ductwork in non-conditioned spaces, including mechanical rooms and space above ceilings.
2. Return air transfer boots.
3. Return/outside air plenums at air handlers.

E. Plenums:
1. Galvanized steel with the largest dimension of 30 inches and larger shall be 18 gage.
2. Plenums shall be constructed, designed, installed, and tested according to SMACNA as specified. Joints shall be angle reinforced pocket type. Provide fully gasketed joints between plenums and filter sections.
3. Provide plenum access doors where indicated on drawings. Doors shall be constructed according to Figure 6-12 of SMACNA - HVAC Duct Construction Standards.

F. Flexible Insulated Ductwork:
1. Lightweight duct, core of corrosion resistant reinforcing wire helix permanently bonded within fabric, insulated with 1-1/2" thick, 3/4 lb. density fiberglass flexible

insulation and covered with a vapor barrier of aluminum metalized polyester film laminated to glass mesh, elastomer back coated. Duct shall meet NFPA 90A requirements and be listed as Class 1 Air Duct Material, UL 181.

2. Manufacturers:
   a. Atco Rubber Products.
   b. Genflex.
   c. Thermaflex II.
   d. Venture Type VTKC.
   e. Wiremold Co.

G. Ductwork and splitter dampers within the ductwork shall be made of the same material.

H. Turning vanes shall be provided in square elbows and shall be of same material as the ductwork. Turning vanes shall be of airfoil type, double thickness factory fabricated.

I. Filter Sections (Air Handlers): Filter section casing shall be constructed of mill galvanized steel of 18 gage. Casing shall be sized to house filters indicated on drawings.

J. Fume hood and kitchen exhaust ductwork shall be 316 stainless steel.

2.4 MEDIUM PRESSURE DUCTWORK

A. Includes ductwork from discharge of medium pressure air handlers up to and including flexible ductwork connection to medium pressure variable air volume boxes. Velocities above 2000 fpm and static pressures above 2 inches WG.

B. Provide galvanized steel ductwork, designed, constructed, installed and tested according to latest edition of SMACNA "HVAC Duct Construction Standards" and as shown on drawings. Ductwork shall have manufacturer's gage stamp.

C. Ductwork and Fittings:
   1. Round and oval ductwork shall be factory fabricated spiral type. Take offs shall be conical, 90 degrees except where 45 degree conicals are indicated on plans. Ninety degree elbows shall be constructed of not less than 5 sections. Laterals also to be conical. Oval duct reinforcing shall be by exterior stiffener angles on flat surface restrained by rods or angle sections; stiffener spacing to be based on 6 inches WG. Ductwork and fittings shall be the product of 1 manufacturer.
   2. Rectangular medium pressure ductwork shall be fabricated and installed per SMACNA "High Velocity Duct Construction Standards." Joints shall be sealed and reinforced, and seams and corners shall be sealed with sealant and angles as required for airtightness. Welded construction shall be as required for pressure classification of each system. Turning vanes shall be factory fabricated double thickness airfoil type.

D. Flexible ducts at variable air volume boxes shall be of high pressure type, 4 feet long (maximum). Core and insulation shall be as specified.

2.5 VARIABLE AIR VOLUME BOXES (Medium Pressure):

A. Terminal units shall be of the medium pressure, single duct, pressure independent, variable volume air valve type. Units shall be provided with a self-contained volume

regulator, and pneumatic regulator operator. Maximum control air consumption shall be 0.04 SCFM.

B. Construction:
   1. Units shall have aluminum or zinc coated steel casings.
   2. Valve housing shall be 16 gage aluminum with internal components of aluminum and stainless steel.
   3. Pivots and slides shall ride in nylon bushings.
   4. Valve shall be formed in a venturi configuration. Valve shall be pressure independent without means of external monitoring devices such as mechanical volume regulators, flow control tubing or duct static measuring devices.
   5. A quick opening service panel shall give access to the regulator where required.
   6. Leakage through casing shall not exceed 3 percent of design volume when installed with 4 inch WG upstream and 1 inch WG downstream of the valve.
   7. Valve shall be normally open.

C. Performance: Volume regulators shall compensate for system static pressure fluctuations, completely independent of the volume setting mechanism. The regulator shall be guaranteed, by actual factory airflow test, to maintain +5 percent of constant setpoint volume under conditions of varying inlet static pressures between minimum and 6 inch WG. Velocity sensor shall be of the ring or cross type.

D. Controls:
   1. Variable volume, direct acting pneumatic operators shall be furnished and installed by the box manufacturer. Calibrated minimum and maximum air volume adjustment dials shall be provided, accessible through a quick opening panel. The operator shall adjust the air volume controller in response to room thermostat signals.
   2. Constant volume valves shall be of the same construction as the variable volume less any actuator. Air flow rate shall be factory set, pressure independent, and manually adjustable in the field.

E. Sound Levels:
   1. Discharge sound levels for boxes shall not exceed the NRC levels listed below at 3.0 inches WG inlet static pressure. Discharge sound levels shall be determined with the discharge duct lined as herein specified and with an allowance of 8 dB for room absorption.

Box CFM	NRC
0 - 230	31
231 - 450	36
451 - 730	37
731 - 1300	43
1301 - 2000	48

   2. Radiated sound levels without allowance for ceiling absorption shall not exceed NRC-38 at 3.0 inches WG inlet static pressure. An 8 dB allowance shall be deducted for room effect.

2.6 FAN POWERED VARIABLE AIR VOLUME BOXES (Medium Pressure):

A. Terminal units shall be medium pressure, single duct pressure independent, variable volume air valve, fan powered type. Units shall reset primary air volume as determined by

the space thermostat regardless of changes in the system pressure. Units shall be pneumatically operated.

B. At maximum cooling the terminal shall supply all primary air. At minimum cooling the primary air shall be 30 percent. Below 30 percent primary air the fan shall start. The heater shall not operate until primary air has reached full shut off. The primary air damper shall be normally open.

C. Fans shall be forward curved with direct drive, 4 speed split capacitor type motors. Provide combination balancing and backdraft damper on the fan discharge. Mount the fan and motor on rubber isolators.

D. Sound levels and construction shall be as previously specified in this Section for VAV boxes.

E. Manufacturers:
   1. Anemostat.
   2. Metalaire.
   3. Price.
   4. Trane.
   5. Titus.

2.7 ELECTRIC DUCT HEATERS

A. Electric duct heaters shall be open, side insert, slip-in construction type of capacities shown on the plans, UL listed, and meet requirements of latest NEC Edition.

B. Coil Terminals and Nuts: Stainless steel.

C. Bracket Bushings: High grade ceramic.

D. Resistance Wire: Iron free 80 percent nickel and 20 percent chromium.

E. Maximum Wiring Rating: 35 watts per square inch of wire surface.

F. Three-phase Heaters: Balanced three phase steps. Voltage shall be as indicated.

G. Frame and Vertical Wire Supports: Galvanized steel supports maximum 4 inches apart.

H. Terminal Box: Recessed, galvanized steel, insulated with hinged cover and latch. Box shall house safety components.

I. Primary Thermal Safety Device: UL listed 100,000 cycles, disc type, automatic reset thermal cutout.

J. Secondary Thermal Safety Device: Heat limiters in power lines.

K. Airflow Safety Devices: Pressure type airflow switch.

L. Control Contactors (per heater step): Mercury type, disconnecting full line break.

M. Control Transformer: Class 1, required heater control voltage. Provide primary fusing for heaters over 16 amps and transformer secondary fusing.

N. Each heater step shall be equally distributed over the full face of the coil.

O. Built-in fuses for overcurrent protection per 48 amps of heater capacity shall be provided.

PART 3 EXECUTION

3.1 GENERAL

A. Install low and medium velocity ductwork as shown on drawings. 90 degree bends shall not be made in medium pressure flexible ducts.

B. Before systems are tested and balanced, ducts shall be thoroughly cleaned and blown out.

C. Where interferences arise during construction, make transition or division of ductwork on basis of pressure drop equivalent to original size. Obtain approval from A/E before fabrication.

3.2 INSTALLATION

A. Install ductwork materials and accessories according to the latest edition of SMACNA Low Velocity Duct Construction Standards as specified. These written specifications shall take precedence in case of conflict.

B. Seal all duct joints with sealer as specified for field sealing of high pressure ductwork according to SMACNA.

3.3 LOW PRESSURE DUCTWORK

A. Seams and joints in ductwork shall be made airtight. . Make exhaust ducts passing through return air chases airtight.

B. Install flexible ductwork shall be installed in sizes to match diffuser necks as indicated on drawings schedules. Duct length shall be not less than 5 feet and no longer than 7 feet. Duct shall be adequately supported to prevent kinks and sharp bends. Install according to manufacturer's recommendations and as shown on drawings.

3.4 MEDIUM PRESSURE DUCTWORK

A. Seal medium pressure ductwork seams, joints, connections, rivets, and screw heads well with an adhesive sealing compound of synthetic rubber type. Adhesive sealer shall be UL listed conforming with NFPA 90A. The entire system shall be airtight.

B. Sharp metal edges are not allowed to extend into air stream. Air inlet collars on VAV boxes shall conform to and be flush with flexible tubing or other inlet conditions. Duct joints shall be lapped in direction of air flow.

C. Sealing Duct Joints: Shop procedure for sealing high pressure duct joints is as follows:
   1. Before fittings and joints are assembled, apply sealer to rivets, groove seams, and tap off collars on internal side of metal. Pittsburgh lock pocket must be flooded with sealer, and duct assembled.

2. Brush sealer around reinforcing rod washers, corners, rivets, notches, and tap-off collars after ducts are assembled.
3. Coat inside of connecting joint and duct surface with sealers, where possible, sealing on inside of ductwork.

D. Field procedure for sealing duct joints is as follows:
1. Spread sealer on inside of joints of duct to be assembled. Immediately after joints are assembled, apply sealer around outside of joints.
2. After 24 hours, spread a second coat of sealer over joints and allow to dry for 24 hours before testing.
3. Where joints are not accessible for proper sealing, cut hand holes in duct and seal joints from inside. Take special care to seal all duct corners.
4. When testing ducts for leaks, mark leaks and reseal without pressure in duct and allow to dry for 24 hours.

3.5 DUCTWORK SUPPORTS AND HANGERS

A. Provide support and hangers according to SMACNA HVAC Duct Construction Standards.

B. Hangers shall be galvanized steel hung from inserts or clip angles secured to structure with expansion bolts in shear or tension as follows:
1. Roof Slab: In tension.
2. Structural Beams: In shear, 12 inches minimum from bottom of beam.
3. Joists: Use existing forming bolts openings only. Hangers shall be bent under ductwork at least 2 inches. Hangers for ducts over 48 inches wide shall be secured to bottom and sides of duct.

3.6 DUCT HEATERS

A. Install according to manufacturer's recommendations.

3.7 VAV BOXES

A. Installation shall be according to duct standards or as indicated on drawings.

3.8 DUCT PENETRATIONS TO FLOOR AND FIRE WALLS

A. Joints around duct penetrations shall be packed with fire safing insulation and sealed with fire and smoke barrier caulk as specified in Section 07840, Firestopping and Smoke Sealing.///