SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

C. Kitchen hood ductwork.

D. Duct cleaning.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract apply to this section.

1.03 REFERENCES

A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened.

E. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

F. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

H. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

I. ASTM C 14M - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).

J. ASTM C 443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

K. ASTM C 443M - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).

L. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.

N. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association.

O. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association.

P. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

Q. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Product Data: Provide data for duct materials, duct liner, and duct connections.

B. Shop Drawings shall:

1. Be 3/8-inch scale and shall indicate all ceiling obstructions, including, but not limited to, sprinkler heads, ceiling inserts, lighting fixtures, and other ceiling or slab mounted devices that could interfere with the installation of the work.

2. Show fabrication, assembly and installation, including plans, elevations, sections, components and attachments to other work.

3. Show factory and shop fabricated ducts and fittings.

4. Include duct layout indicating sizes, configuration, liner material, and static pressure classes.

5. Indicate elevation of top of ducts.

6. Indicate dimensions of main duct runs from building grid lines.

7. Indicate fittings.

8. Indicate reinforcement and spacing.

9. Show seam and join construction.

10. Show penetrations through fire-rated and other partitions.

11. Show equipment installation based on equipment being used on project.

12. Indicate locations for duct accessories, including dampers, turning vanes, and access doors and panels.

13. Indicate hangers and supports, including methods for duct and building attachment, and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with generator construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.

4. Size and location of initial access modules for acoustical tile.

5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling, including, but not limited to, the following:

a. Lighting fixtures

b. Air outlets and inlets

c. Sprinkler

d. Access panels

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 90B and NFPA 96 standards.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.

B. Steel Ducts: ASTM A 1008/A 1008M, Designation CS, cold-rolled commercial steel, or ASTM A 1011/A 1011M, Designation CS, hot-rolled steel.

C. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

D. Flexible Ducts:

1. Manufacturers:

a. Flexmaster USA

2. Two ply vinyl film supported by helically wound spring steel wire.

    a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -10 degrees F to 160 degrees F.

3. UL Labeled, black polymer film supported by helically wound spring steel wire.

    a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.

    b. Maximum Velocity: 4000 fpm.

    c. Temperature Range: -20 degrees F to 175 degrees F.

4. UL labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.

    a. Pressure Rating: 10 inches WG positive and 1.0 inches negative.

    b. Maximum Velocity: 4000 fpm.

    c. Temperature Range: -20 degrees F to 210 degrees F.

5. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

    a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

    b. Maximum Velocity: 4000 fpm.

    c. Temperature Range: -20 degrees F to 210 degrees F.

6. UL 181, Class 0, interlocking spiral of aluminum foil.

    a. Pressure Rating: 8 inches WG positive or negative.

    b. Maximum Velocity: 5000 fpm.

    c. Temperature Range: -100 degrees F to 435 degrees F.

E. Insulated Flexible Ducts:

1. Manufacturers:

a. Flexmaster USA

2. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

   a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

   b. Maximum Velocity: 4000 fpm.

   c. Temperature Range: -10 degrees F to 160 degrees F.

3. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

   a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.

   b. Maximum Velocity: 4000 fpm.

   c. Temperature Range: -20 degrees F to 175 degrees F.

4. Multiple layers of aluminum laminate supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

   a. Pressure Rating: 10 inches WG positive and 1.0 inches negative.

   b. Maximum Velocity: 4000 fpm.

   c. Temperature Range: -20 degrees F to 210 degrees F.

5. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.

   a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

   b. Maximum Velocity: 4000 fpm.

   c. Temperature Range: -20 degrees F to 210 degrees F.

6. UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; polyethylene or aluminized vapor barrier film.

   a. Pressure Rating: 8 inches WG positive or negative.

   b. Maximum Velocity: 5000 fpm.

c. Temperature Range: -20 degrees F to 250 degrees F.

F. Stainless Steel Ducts: ASTM A 666, Type 304 for dishwasher exhaust, sterilizers, cart washers, and the like, or Type 316 for laboratory fume hood exhausts.

G. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

4. For Use With Flexible Ducts: UL labeled.

5. Acceptable Manufacturers:

a. Foster Products

b. Durodyne

H. Hanger Rod: ASTM A 36/A 36M; steel; threaded both ends, threaded one end, or continuously threaded.

I. Hanger Cable: Braided steel aircraft cable, C-type beam clamp with set screw and adjustable locking clamp. Ductmate Clutcher, or equal.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

G. Fittings shall be of same material and thickness as the duct.

H. Remove stick-on labels from exposed ductwork. Prime exposed ductwork for finish painting.

I. Review the work of other trades, and provide necessary bends, offsets, duct enlargements and stream-lined pipe and hanger casings to eliminate conflicts.

J. Duct sizes shown on plans are net interior dimensions. Adjust sheet metal size to account for interior duct lining.

2.03 DUCT MANUFACTURERS

A. Metal-Fab, Inc.

B. SEMCO Incorporated

C. United McGill Corporation

D. Kirk & Blum

2.04 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Flat Oval Ducts: Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gages heavier metal than duct.

1. Manufacturers:

a. United McGill Corporation

C. Double Wall Insulated Flat Oval Ducts: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1 inch thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.

1. Manufacturers:

a. United McGill Corporation

D. PVC Coated Steel Ducts: UL 181, Class 1, galvanized steel duct coated with 4 mil polyvinyl chloride plastic on both sides.

E. Slab Duct Ventilation System: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS, with G90/Z275 coating; corrugated, in standard sizes with support brackets, connecting couplings, elbows, end caps, spin-in-collar, wall discharge head, and soffit discharge head; designed for installation in cast-in-place concrete floor assemblies.

F. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, 1 inch thick fiberglass insulation, perforated galvanized steel inner wall; fitting with solid inner wall.

G. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

1. Provide clear wire glass observation ports, minimum 6 x 6 inch size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage back facing and 22 gage perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cu ft. minimum glass fiber media, on inverted channels of 16 gage.

2.06 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and NFPA 96.

B. Provide temporary protective coating on kitchen exhaust ductwork.

C. Construct of 16 gage carbon steel or 18 gage stainless steel, using continuous external welded joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. Slope underground ducts to plenums or low pump out points at 1:500. Provide access doors for inspection.

I. Paint buried metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

J. Encase buried metal ductwork in 3 inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.

K. Tape joints of PVC coated metal ductwork with PVC tape.

L. Insulate buried supply duct runs over 70 feet long with 1 inch thick insulation covered with plastic vapor barrier.

M. Connect terminal units to supply ducts with 1 foot maximum length of flexible duct. Do not use flexible duct to change direction.

N. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

O. Connect flexible ducts to metal ducts with liquid adhesive plus tape; draw bands; or adhesive plus sheet metal screws.

P. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

Q. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.

R. Use stainless steel with 2B finish for ductwork exposed to view and stainless steel with 2D finish for ducts where concealed.

S. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

T. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

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

3.03 SCHEDULES

A. Ductwork Material:

1. Low Pressure Supply (Heating Systems): Steel, Aluminum.

2. Low Pressure Supply (System with Cooling Coils): Steel, Aluminum.

3. Medium and High Pressure Supply: Steel.

4. Return and Relief: Steel, Aluminum.

5. General Exhaust: Steel, Aluminum.

6. Kitchen Hood Exhaust: Steel, Stainless Steel.

7. Dishwasher Exhaust: Stainless Steel, Glass Fiber Reinforced Plastic.

8. Outside Air Intake: Steel.

9. Combustion Air: Steel.

B. Ductwork Pressure Class:

1. Supply - 2 inches, minimum in main; 1 inch downstream of terminal unit.

2. Return and relief - 1 inch, minimum.

3. General exhaust - 1 inch, minimum.

4. Hood exhaust - 2 inches, minimum.

END OF SECTION 23 3100