

SECTION 15810

HVAC DUCTS AND CASINGS

PART 1 –GENERAL

1.1 SUMMARY

- A. Section includes metal ductwork, nonmetallic ductwork, casing and plenums, buried ductwork, kitchen hood ductwork, duct cleaning.

1.2 RELATED SECTIONS:

- A. Section 09050 - Paints and Coatings: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.

1.3 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- E. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- F. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- G. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- I. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- J. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.

- K. NFPA 90B (National Fire Protection Association) - Installation of Warm Air Heating and Air Conditioning Systems.
- L. NFPA 96 (National Fire Protection Association) - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- M. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) – HVAC Air Duct Leakage Test Manual.
- N. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) – HVAC Duct Construction Standards - Metal and Flexible.
- O. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) – Fibrous Glass Duct Construction Standards.
- P. UL 181 (Underwriters Laboratories, Inc.) - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. When a rectangular or round duct shape is specified and there is no mention of alternate shape use then only shape specified shall be installed unless written permission is first obtained from responsible Stanford Facilities engineer. When alternate shape /configuration is permitted the replacement will have same or lower friction loss as the one originally specified. This will be measured per ASHRAE guidelines. When duct of one material is specified the alternate material can only be used with written permission from responsible engineer.
- B. Locations and routing shall be selected in such a way that ducts will not interfere with any access door, hatch or equipment. Duct shall not be installed in a way that it will be stepped on by maintenance personnel. In a situation where this is not possible provide cat walk over the duct.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures
- B. Shop Drawings: Indicate duct fittings, gages, sizes, welds, and configuration for all systems. Submit shop drawings for approval before fabrication.

- C. Product Data: Submit data for duct materials, duct liner, duct connectors and other duct accessories. . If internal duct liner is specified it shall be of approved type, none fiber shedding and permanently secured to duct
- D. Test Reports: Provide pressure tests. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- E. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.
- F. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements. Glass fiber duct or flexible duct shall be used only if approved for the project.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01770 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts, sizes, and duct fittings. Record changes in fitting location and type. Show additional fittings used. Flexible ducts shall be insulated type unless used for exhaust air where permitted by codes. Insulation shall be fiber glass with factory assembled outer vapor barrier. All material shall be fire retardant.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards.
- C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETING

- A. Section 01330 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing Work of this section.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.
 - 1. Find out clearances are available for duct installation and that ducting will not interfere with maintenance of any existing or new equipment or obstruct any access.

PART 2 –PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lockforming quality, having G90 zinc coating in conformance with ASTM A90.
- B. Steel Ducts: ASTM A366, A569 or A568.
- C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14.

Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
- D. Stainless Steel Ducts: ASTM A167, Type 304 or 316.
- E. Concrete Ducts: ASTM C14; hub and spigot concrete sewer pipe with ASTM C443 joints, rubber gaskets.
- F. Fasteners: Rivets, bolts, or sheet metal screws.
- G. Hanger Rod: ASTM A36; steel or galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 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. Seams shall be formed and assembled with proper dimension and proportion for tight and secure fit-up. Longitudinal seams shall be either Double Corner Seam (Slide Lock Seam) or Pittsburgh Seam with Pocket depth of 3/8" minimum.
- B. For round ducts, use spiral seam, butt weld or lapped & seam welded.
- C. Transverse joints shall be flange type with gaskets, Ductmate or approved equal or capped flanged type, drive slip with reinforcement. The sheet metal ends shall be brought up between 2 vertical sides of the angles 1/2 inch high before ended. All bolts with flanged joints must be 5/16" minimum dia. at 6" maximum spacing. For higher pressure joints must be spot welded, riveted or bolted to duct wall at 6" max. spacing centers beginning and ending with fasteners at corners. All flanged joints shall have sheet metal cap. Seal all joints with SMACNA approved water tight sealant.
- D. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation. Elbows, vaned elbows, branch connections, transitions, splitters, etc. shall conform to Section II, SMACNA LPDCS. Test holes shall be airtight and noncorrosive with screw cap and gasket. All elbows shall have inside radius not less than the width of the duct in direction of the curve. Full duct cross section areas shall be maintained through out the transition
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints. Use flexible ducts to connect rigid ducts to outlets or terminals in locations accessible for service only. Flexible ducts shall have no plastic exposed to either the inside or outside surface of the duct core. Flame test 25 maximum and smoke developed 50 maximum. Maximum length of

each connecting flex duct shall not exceed 8 ft.

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

H. Flexible Ducts

1. Two ply vinyl film supported by helical 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.
 - d. Attach with three sheet metal screws equally spaced.
2. UL Label, black polymer film supported by helical 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
3. UL labeled multiple layers of aluminum laminate supported by helical 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
4. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical-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
5. 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 432 degrees

I. Insulated Flexible Ducts

1. Two ply vinyl film supported by helical 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.

2. Black polymer film supported by a helical-wound spring steel wire; fiberglass insulation; polyethylene 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
3. Multiple layers of aluminum laminate supported by helical wound spring steel wire; fiberglass insulation; polyethylene 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
4. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene 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
5. UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; polyethylene 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

J. Flat Oval Ducts

1. Machine made from round spiral lock-seam duct with light reinforcing corrugations; fittings manufactured of at least two gages heavier metal than duct.

K. Double Wall Insulated Flat Oval Ducts

1. Machine made from round spiral lock-seam 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.

L. PVC Coated Steel Ducts

1. UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 4 mil thick on both sides.

M. Slab Duct Ventilation System

1. ASTM A527 galvanized steel, corrugated, 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.

N. Double Wall Insulated Round Ducts

1. Round spiral lock-seam duct with galvanized steel outer wall, 1 inch thick fiberglass insulation, galvanized steel inner wall; fitting with solid inner wall.

O. Transverse Duct Connection System

1. SMACNA "E" rated SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.3 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 6-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 access 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.
- 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.

2.4 BURIED UNDERGROUND DUCTS

- A. Buried ducts may be concrete encased sheet metal or PVC jacketed sheet metal, fiberglass reinforced plastic or concrete as indicated.
- B. Fabricate metal ductwork in accordance with SMACNA Low Pressure Duct Construction Standards, except as indicated. Fabricate using two gages heavier material than indicated for 2 inch wg pressure class.

2.5 KITCHEN HOOD EXHAUST DUCTWORK

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- B. Construct of 18 gage stainless steel, using continuous external welded joints welded by a Certified Welder

PART 3 –EXECUTION

3.1 EXAMINATION

- A. Section 01330 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller. Use (3) #8 sheet metal screws and duct sealer.
- D. Use double nuts and lock washers on threaded rod supports.
- E. Slope underground ducts to plenums or low pump out points at 1:500. Provide access doors for inspection.
- F. Paint buried metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.
- G. Connect flexible ducts to metal ducts with draw bands.
- H. Set plenum doors 6 to 12 inches above floor. Arrange door swing so that fan static pressure holds door in closed position.

- I. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.
- J. Duct supports, unless specified otherwise elsewhere, shall be per SMACNA and seismic supports to be installed for Seismic Zone IV gravity forces for horizontal and vertical movement.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide Pitot 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.
- B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp, per design.
- C. Connect terminal units to supply ducts directly or with five foot maximum length of flexible duct, per design. Do not use flexible duct to change direction.

3.4 CLEANING

- A. Section 01770 - Execution Requirements: Final cleaning.
- B. 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 that may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- C. Clean duct systems with high power vacuum machines. Protect equipment that may be harmed by excessive dirt with filters, or bypass during leaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION