POWERS FASTENERS

Sample Specification

Section 23 30 xx - HVAC Ducts and Casings

The intent of this Sample Specification is to illustrate the use of ICC-ES Acceptance Criteria as reference standards in the proper specification of concrete anchors and fasteners which meet the requirements of the International Building Code. Powers Fasteners assumes no liability for any errors and omissions within this Sample Specification and/or its improper use. Please consult with a design professional prior to specifying any product.

SECTION 23 31 xx

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

D. Buried ductwork.

E. Kitchen hood ductwork.

F. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section ***01 6116*** - Volatile Organic Compound (VOC) Content Restrictions.

B. Section ***03 3000*** - ***<<Cast-in-Place Concrete; or*** _____***>>***.

C. Section ***09 9000*** - ***<<Painting and Coating; or*** _____***>>***: Weld priming, weather resistant, paint or coating.

D. Section ***11 4000*** - ***<<Foodservice Equipment; or*** _____***>>***: Supply of kitchen range hoods for placement by this Section.

E. Section ***23 1030.51*** - ***<<HVAC Air Duct Cleaning; or*** _____***>>***: Cleaning ducts after completion of installation.

F. Section ***23 0713*** - ***<<Duct Insulation; or*** _____***>>***: External insulation and duct liner.

G. Section ***23 3300*** - ***<<Air Duct Accessories; or*** _____***>>***.

H. Section ***23 3600*** - ***<<Air Terminal Units; or*** _____***>>***.

I. Section ***23 3700*** - ***<<Air Outlets and Inlets; or*** _____***>>***.

J. Section ***23 0593*** - ***<<Testing, Adjusting, and Balancing for HVAC; or*** _____***>>***.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals***; 2005***.

B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel***; 2005***.

C. ASTM A 240/A 240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications***; 2007***.

D. ASTM A 276 - Standard Specification for Stainless Steel Bars and Shapes***; 2008a***.

E. ASTM A 480/A 480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip***; 2008b***.

F. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process***; 2009***.

G. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar***; 2003***.

H. 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 Hardenable***; 2007a***

I. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength***; 2008***

J. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate***; 2007***.

K. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]***; 2007***.

L. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe***; 2007***.

M. ASTM C 14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]***; 2007***.

N. ASTM C 443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets***; 2005a***.

O. ASTM C 443M - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)***; 2007***.

P. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials***; 2010***.

Q. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements***; 2009***.

R. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements***; 2006***.

S. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements***; 2010***.

T. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements***; 2009***.

U. ICC-ES AC70 - Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements***; 2010.***

V. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association***; 2009***.

W. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems National Fire Protection Association***; 2009***.

X. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association***; 2008***.

Y. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association***; 1985, First Edition***.

Z. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association***; 2005***.

AA. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association***; 2003***.

AB. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines***; 2001***.

AC. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.***; Current Edition, Including All Revisions***.

1.04 SUBMITTALS

A. See Section ***01 3000*** - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for ***<<duct materials; duct liner; duct connections; and _____>>***.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for ***<<_____ pressure class and higher; kitchen hood exhaust; glass fiber duct; or _____>>*** systems.

D. Samples: Submit ***<<two; or _____>>*** samples of typical shop fabricated ***<<duct fittings; or _____>>***.

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

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

G. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed ***<<specified requirements; recommended fabrication and installation requirements; or _____>>***.

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

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ***<<three; or _____>>*** years of ***<<documented; or None - N/A>>*** experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum ___ years of ***<<documented; or None - N/A>>*** experience.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to ***<<NFPA 90A; NFPA 90B; NFPA 96; and _____>>*** standards.

1.07 FIELD CONDITIONS

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 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel, unless otherwise indicated.

B. Low Pressure Supply (Heating Systems): ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; aluminum; fibrous glass; None - N/A; or ___>>***.

C. Low Pressure Supply (System with Cooling Coils): ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; aluminum; fibrous glass; None - N/A; or ___>>***.

D. Buried Supply or Return: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<concrete encased sheet metal; concrete pipe; fiber glass reinforced plastic; galvanized steel; PVC jacketed sheet metal; None - N/A; or ___>>***.

1. Fabricate using two gages heavier material than indicated for ***2 inch WG (500 Pa)*** pressure class.

E. Medium and High Pressure Supply: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; None - N/A; or ___>>***.

F. Return and Relief: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; aluminum; None - N/A; or ___>>***.

G. General Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; aluminum; None - N/A; or ___>>***.

H. Kitchen Cooking Hood Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; stainless steel; un-galvanized steel; None - N/A; or ___>>***.

1. Construct of ***<<16 gage (1.52 mm); ___ gage (___ mm)>>*** un-galvanized steel using continuous external welded joints in rectangular sections.

2. Construct of ***<<18 gage (1.27 mm); ___ gage (___ mm)>>*** stainless steel using continuous external welded joints in rectangular sections.

I. Dishwasher Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; fiber glass reinforced plastic; stainless steel; un-galvanized steel; None - N/A; or ___>>***.

1. Construct of ***<<16 gage (1.52 mm); ___ gage (___ mm)>>*** un-galvanized steel using continuous external welded joints in rectangular sections.

2. Construct of ***<<18 gage (1.27 mm); ___ gage (___ mm)>>*** stainless steel using continuous external welded joints in rectangular sections.

J. Grease Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<stainless steel; un-galvanized steel; None - N/A; or ___>>***.

1. Manufactured double-wall duct with ***<<16 gage (1.52 mm); ___ gage (___ mm)>>*** un-galvanized steel outer wall.

2. Manufactured double-wall duct with ***<<18 gage (1.27 mm); 20 gage (0.95 mm); ___ gage (___ mm)>>*** stainless steel outer wall.

3. Manufactured double-wall duct with ***<<20 gage (0.81 mm); 24 gage (0.51 mm); ___ gage (___ mm)>>*** aluminum inner wall.

K. Fume Hood Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; glass fiber reinforced plastic; stainless steel; None - N/A; or ___>>***.

L. Outside Air Intake: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; None - N/A; or ___>>***.

M. Combustion Air: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; None - N/A; or ___>>***.

N. Evaporative Condenser Intake and Exhaust: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; None - N/A; or ___>>***.

O. Emergency Generation Ventilation: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<galvanized steel; None - N/A; or ___>>***.

P. Transfer Air and Sound Boots: ***<<1/2 inch w.g. (125 Pa); 1 inch w.g. (250 Pa); 2 inch w.g. (500 Pa); ___ inch w.g. (___ Pa)>>*** pressure class, ***<<fibrous glass; None - N/A; or ___>>***.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with ***<<G60/Z180; G90/Z275; or _____>>*** coating.

B. Un-Galvanized Steel for Ducts: ***<<ASTM A 1008/A 1008M, Designation CS, cold-rolled commercial steel; ASTM A 1011/A 1011M, Designation CS, hot-rolled steel; or _____>>***.

C. Aluminum for Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

D. Stainless Steel for Ducts: ***<<ASTM A 240/A 240M; ASTM A 276; ASTM A 480/A 480M; ASTM A 666; or _____>>***, Type ***<<304; 316; 302; or _____>>***.

E. Concrete Pipe for Buried Ducts: ***<<ASTM C 14 (ASTM C 14M) Class 1 Nonreinforced; ASTM C 14 (ASTM C 14M) Class 2 Nonreinforced; ASTM C 14 (ASTM C 14M) Class 3 Nonreinforced; or _____>>*** hub and spigot concrete sewer pipe; ***<<ASTM C 443 (ASTM C 443M); or _____>>*** joints with ***<<standard; oil-resistant; or _____>>*** rubber gaskets.

F. PVC Coating for Steel Ducts: ***<<4 mils (0.1 mm); ____ mils (____ mm)>>*** polyvinyl chloride plastic ***<<on both sides; on outside and 2 mil (0.05 mm) thick on inside; or _____>>***.

1. Manufacturers:

   a. _____.

   b. _____.

   c. _____.

   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

G. Asphalt Coating For Buried Ducts:

1. Manufacturers:

   a. _____ Model _____.

   b. _____ Model _____.

   c. _____ Model _____.

   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

H. 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 Products:

a. _____ _____.

b. _____ _____.

c. _____ _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

I. Hanger Rod: ASTM A 36/A 36M; steel***<<, galvanized; or None - N/A>>***; threaded both ends, threaded one end, or continuously threaded.

J. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

6. Powder Actuated Anchors: Complying with ICC-ES AC70.

7. Gas Actuated Anchors: Complying with ICC-ES AC70.

8. Other Types: As required.

9. Manufacturers:

a. Powers Fasteners, Inc: www.powers.com.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Duct systems have been designed for metal duct. At the ***Contractor***'s option, fibrous glass duct may be substituted for metal duct.

D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

E. 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 ***<<air foil; or*** _____**>>** turning vanes of perforated metal with glass fiber insulation.

F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

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

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

I. 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.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Flat Oval Ducts: Machine made from round spiral lockseam duct.

1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
2. Fittings: Manufacture at least two gages heavier metal than duct.
3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
4. Manufacturers:
   a. _____ Model _____.
   b. _____ Model _____.
   c. _____ Model _____.
   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

B. Double Wall Insulated Flat Oval Ducts: Machine made from round spiral lockseam duct.

1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
2. Fittings: Manufacture with solid inner wall.
3. Inner wall: Perforated galvanized steel.
4. Insulation:
   a. Thickness: ***<<1 inch (25 mm); ___ inch (___ mm)>>*** fiberglass.
   b. Insulation K Value: _____.
   c. Insulation Density: _____.
5. Manufacturers:
   a. _____.
   b. _____.
   c. _____.
   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

C. Slab Duct Ventilation System: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS, with G90/Z275 coating designed for installation in cast-in-place concrete floor assemblies.

1. Fittings: ***<<Elbows; End caps; Connecting couplings; Spin-in-collar; Sofit-discharge head; Support Brackets; Wall discharge head; and _____>>***
2. Manufacturers:

a. _____ Model _____.

b. _____ Model _____.

c. _____ Model _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

D. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, ***<<perforated; or None - N/A>>*** galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2. Insulation:

a. Thickness: ***<<1 inch (25 mm); ___ inch (___ mm)>>***.

b. Material: ***<<Air; Fiberglass; or _____>>***.

c. Insulation K Value: _____.

d. Insulation Density: _____.

3. Manufacturers:

a. AMPCO by Commercial Products Group of Hart & Cooley, Inc***<<; Model _____; or None - N/A>>***: www.ampcostacks.com.

b. Selkirk by Commercial Products Group of Hart & Cooley, Inc***<<; Model _____; or None - N/A>>***: www.selkirkcorp.com.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

E. Fiber Glass Reinforced Plastic (FRP) Ducts: Glass fiber reinforced plastic, minimum ***3/16 inch (5 mm)*** wall thickness.

1. Manufacturers:

a. _____.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

F. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.

1. Insulation: Fiberglass insulation with ***<<polyethylene; aluminized; or _____>>*** vapor barrier film.

2. Pressure Rating: ***<<10 inches WG (2.50 kPa); ___ inches WG (___ kPa)>>*** positive and ***<<1.0 inches WG (250 Pa); ___ inches WG (___ Pa)>>*** negative.

3. Maximum Velocity: ***<<4000 fpm (20.3 m/sec); ___ fpm (___ m/sec)>>***.

4. Temperature Range: ***<<-10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C); _____ (_____)>>***.

5. Manufacturers:

a. _____.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

G. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.

1. UL labeled.
2. Insulation: Fiberglass insulation with ***<<polyethylene; aluminized; or*** _____***>>*** vapor barrier film.
3. Pressure Rating: ***<<4 inches WG (1000 Pa); ___ inches WG (___ Pa)>>*** positive and ***<<0.5 inches WG (175 Pa); ___ inches WG (___ Pa)>>*** negative.
4. Maximum Velocity: ***<<4000 fpm (20.3 m/sec); ___ fpm (___ m/sec)>>***.
5. Temperature Range: ***<<-20 degrees F to 175 degrees F (-28 degrees C to 79 degrees C); _____ (_____)>>***.
6. Manufacturers:

   a. _____.

   b. _____.

   c. _____.

   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

H. Flexible Ducts: Multiple layers of aluminum laminate supported by helically wound spring steel wire.

1. UL labeled.
2. Insulation: Fiberglass insulation with ***<<polyethylene; aluminized; or*** _____***>>*** vapor barrier film.
3. Pressure Rating: ***<<10 inches WG (2.50 kPa); ___ inches WG (___ kPa)>>*** positive and ***<<1.0 inches WG (250 Pa); ___ inches WG (___ Pa)>>*** negative.
4. Maximum Velocity: ***<<4000 fpm (20.3 m/sec); ___ fpm (___ m/sec)>>***.
5. Temperature Range: ***<<-20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C); _____ (_____)>>***.
6. Manufacturers:

   a. _____.

   b. _____.

   c. _____.

   d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

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

1. Insulation: Fiberglass insulation with ***<<polyethylene; aluminized; or*** _____***>>*** vapor barrier film.

2. Pressure Rating: ***<<10 inches WG (2.50 kPa); ___ inches WG (___ kPa)>>*** positive and ***<<1.0 inches WG (250 Pa); ___ inches WG (___ Pa)>>*** negative.

3. Maximum Velocity: ***<<4000 fpm (20.3 m/sec); ___ fpm (___ m/sec)>>***.

4. Temperature Range: ***<<-20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C); _____ (_____)>>***.

5. Manufacturers:

a. _____.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

J. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Insulation: Fiberglass insulation with ***<<polyethylene; aluminized; or _____>>*** vapor barrier film.

2. Pressure Rating: ***<<8 inches WG (2.0 kPa); ___ inches WG (___ kPa)>>*** positive or negative.

3. Maximum Velocity: ***<<5000 fpm (25.4 m/sec); ___ fpm (___ m/sec)>>***.

4. Temperature Range: ***<<-20 degrees F to 250 degrees F (-28 degrees C to 99 degrees C); _____ (_____)>>***.

5. Manufacturers:

a. _____.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

K. Transverse Duct Connection System: ***<<SMACNA "E" rated; SMACNA "J" rated; SMACNA "F" rated; or _____>>*** rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

1. Manufacturers:

a. Elgen Manufacturing; ***<<Model _____; or None - N/A>>***: www.elgenmfg.com.

b. _____ Model _____.

c. _____ Model _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

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 (100 mm); 6 inch (152 mm); __ inch (__ mm)>>*** high concrete curbs. At floor, rivet panels on ***<<8 inch (200 mm); ___ inch (___ mm)>>*** centers to angles. Where floors are acoustically insulated, provide liner of ***<<18 gage (1.20 mm); ___ gage (___ mm)>>*** galvanized expanded metal mesh supported at ***<<12 inch (300 mm); ___ inch***

(___ mm)>> centers, turned up ***<<12 inches (30 mm); ___ inches (___ mm)>>*** 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 (150 X 150 mm)*** size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide ***16 gage (1.50 mm)*** back facing and ***22 gage (0.80 mm)*** perforated front facing with ***3/32 inch (2.4 mm)*** diameter holes on ***5/32 inch (4 mm)*** centers. Construct panels ***3 inches (75 mm)*** thick packed with ***4.5 lb/cu ft (72 kg/cu m)*** minimum glass fiber media, on inverted channels of ***16 gage (1.50 mm)***.

2.06 FIBROUS GLASS DUCTS

A. Fibrous Glass Ducts: ***<<1 inch (25 mm); 1-1/2 inch (40 mm); or _____>>*** thick rigid glass fiber with aluminum foil, glass scrim and kraft or plastic jacket vapor barrier; maximum ***0.23 K value at 75 degrees F (0.034 KSI at 24 degrees C)***.

1. UL labeled to UL 181.

2. Manufacturers:

a. _____.

b. _____.

c. _____.

d. Substitutions: ***<<See Section 01 6000 - Product Requirements; or Not permitted>>***.

B. Fabricate in accordance with SMACNA Fibrous Glass Duct Construction Standards, except as indicated.

C. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.

D. Staple duct joints and tape with ***3 inch (75 mm)*** wide ***2 mil (0.05 mm)*** thick or ***2 inch (50 mm)*** wide ***3 mil (0.75 mm)*** thick aluminum pressure sensitive tape, UL approved.

E. Staple duct joints and tape with ***<<2-1/2 inch (63 mm); ___ inch (___ mm)>>*** wide pressure sensitive tape, UL approved.

F. Staple duct joints and tape with ***3 inch (75 mm)*** wide heat activated chemical bonding tape.

G. Do not use fibrous glass ducts within ***12 inches (300 mm)*** of electric or fuel fired heaters.

H. Maximum stress exerted on structural steel members: ***<<22000 psi (152 MPa); ___ psi (___ MPa)>>***.

I. Maximum temperature: ***<<250 degrees Fahrenheit (121 degrees Celsius); ___ degrees Fahrenheit (___ degrees Celsius)>>***.

J. Conform to safety standards NFPA 90A and 90B.

2.07 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, SMACNA Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines and, and NFPA 96.

PART 3 EXECUTION

SECTION 23 31 xx

HVAC DUCTS AND CASINGS

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install in accordance with manufacturer's instructions.

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

D. Buried Supply Duct: Insulate duct runs over ***<<70 feet (20 m); ____ feet (____ m)>>*** long with ***<<1 inch (25 mm); ___ inch (___ mm)>>*** thick insulation covered with plastic vapor barrier.

E. Buried Metal Ductwork: Paint according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Buried Metal Ductwork Without Factory Jacket: Paint with one coat ***<<and seams and joints with additional coat; or None - N/A>>*** of asphalt base protective coating.

G. Buried Metal Ductwork: Encase according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1. Provide adequate tie-down points to prevent ducts from floating during concrete placement.

2. Introduce no heat into ducts for 20 days following placement of concrete.

H. Fibrous Glass Ducts: Install in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.

I. Flexible Ducts: Connect to metal ducts with ***<<adhesive.; adhesive plus sheet metal screws.; draw bands.; liquid adhesive plus tape.; mechanical fastener; or _____>>***

J. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

K. PVC Coated Metal Ductwork: Tape with PVC tape.

L. Underground Ducts: Slope to plenums or low pump out points at 1:500. Provide access doors for inspection.

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

N. 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.

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

P. Use crimp joints with or without bead for joining round duct sizes ***<<8 inch (200 mm); ____ inch (____ mm)>>*** and smaller with crimp in direction of air flow.

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

R. Connect terminal units to supply ducts ***<<directly or; or None - N/A>>*** with ***one foot (300 mm)*** maximum length of flexible duct. Do not use flexible duct to change direction.

S. Connect diffusers or light troffer boots to low pressure ducts ***<<directly or; or None - N/A>>*** with ***5 feet (1.5 m)*** maximum length of flexible duct held in place with strap or clamp.

T. Set plenum doors ***6 to 12 inches (150 to 300 mm)*** above floor. Arrange door swings so that fan static pressure holds door in closed position.

U. At exterior wall louvers, seal duct to louver frame ***<<and install blank-out panels; and install blank-out panels supplied in Section 08 9100; and install blank-out panels supplied in Section _____; None - N/A; or _____>>***.

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 that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

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

END OF SECTION