# SECTION 233000 - AIR DISTRIBUTION

## PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide Air Distribution Materials as specified herein and as shown on the Drawings.

B. Material characteristics and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 230500, Common HVAC Materials and Methods, also apply to this section.

1.2 QUALITY ASSURANCE

A. Air Distribution Equipment Rating: In accordance with AMCA certified rating procedures and bearing the AMCA label.

1.3 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for all manufactured materials.

B. Submit operating and maintenance data.

## PART 2 - PRODUCTS

2.1 SHEET METAL

A. Quality Assurance: Galvanized steel sheet metal except where otherwise indicated. Metal gauges, joints and reinforcement in accordance with Mechanical Code, ASHRAE and SMACNA standards. Ductwork shall be fabricated to the following pressure classifications:

1. Return and local exhaust ducts: 1” negative.

2. Central exhaust system ducts: 2” negative.

3. Supply ducts from fan discharge to diffuser: 1” positive.

B. Acoustical Duct Lining: Schuller "Linacoustic," Gustin Bacon "Ultra-Liner", Owens Corning "Aeroflex" , and Certainteed “Tough Guard” approved, meeting NFPA 90A requirements for maximum flame spread and smoke developed. Mechanically attach lining to sheet metal duct with Schuller Grip Nails or Gramweld welding pins. Apply fire-retardant type adhesive similar to Schuller No. 44 adhesive, Benjamin Foster 81-99, Insul-Coustic 22 or 3M equivalent on all leading edges, joints and seams.

C. Duct Sealants and Adhesives:

1. For joints and seams exposed to the weather in lieu of soldering, United "Uni-Cast" system or approved.

2. Joint & Seam Sealants (Water Based): Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

3. Liner Adhesive: Water based, fire and moisture resistant, used to adhere insulation to metal duct. It shall comply with NFPA 90A and UL 723 requirements.

4. Duct Liner Sealant: Water based sealant, fire and moisture resistant, used to encapsulate fiberglass duct insulation to eliminate airborne fibers. Must comply with UL requirements.

5. Duct Sealing Tapes: Provide a UL 181B listed duct sealing system.

D. Optional Duct Joints for Sheet Metal Ducts: "Ductmate System" by Ductmate Industries, Inc., Ward Duct Connectors, Inc., Mez Industries, or acceptable substitute. Spiramir self-sealing round duct connector system meeting Class 3 leakage standards with EPDM o-ring seal.

E. Concealed Round Duct: Round and flat oval spiral seam duct shall be manufactured of galvanized sheet metal with spiral lock seam. Construction, gauges, and reinforcement in accordance with SMACNA standards. Fittings shall be manufactured of galvanized steel with spot welded or riveted and sealed seams or continuously welded seams. Snap lock longitudinal seam duct shall fully comply with SMACNA standards for duct gauge and seam type for appropriate pressure class. Adjustable elbows shall be minimum 24 gauge.

F. Flexible Ductwork-Low Pressure: Low pressure flexible duct, factory fabricated assembly consisting of a zinc-coated spring steel helix mechanically attached to reinforced aluminized polyester fabric tube. The composite assembly, shall meet the Class 1 requirements of NFPA Bulletin No. 90-A and be labeled by Underwriters Laboratories, Inc., with a flame spread rating of 25 or less and a smoke developed rating of 50 or under. Flexmaster, Genflex, ATCO, Wiremold, Thermaflex, Glassflex, Clevepak, Schuller, or accepted substitute.

2.2 ACCESSORIES

A. Manual Volume Dampers: Construct of material two gauges heavier than duct in which installed; single plate up to 12" wide; multiple over 12" wide. Hem both edges 1/2" and flange sides 1/2" on rectangular dampers. Use Young, Duro-Dyne, MAT, or accepted substitute damper accessories. Install with bearings at each end of damper shaft and with locking quadrant. Location of all volume dampers is not necessarily shown on Drawings; minimum required is one in each supply, return or exhaust main, and one in each branch.

B. Fire Dampers:

1. Static Fire Dampers: Constructed and installed in accordance with NFPA No. 90A and UL labeled.

2. Dynamic Fire Dampers: Constructed and approved in accordance with UL Standard 555 for horizontal or vertical installations. Selection of dampers shall not exceed manufacturer's recommended CFM at 4" of static pressure for unducted dampers and 8" of static pressure for ducted dampers.

C. Fire Rated Thermal Blanket and Diffuser Fire Damper: UL listed, non-asbestos ceramic thermal blanket for use on ceiling diffusers with curtain type fire damper to fit diffuser neck indicated.

D. Combination Fire/Smoke Dampers:

1. Constructed and installed in accordance with NFPA No. 90A, UL labeled. Provide dampers with rating equal to surrounding construction where penetrations are made through fire-resistant rated construction per applicable codes.

2. Provide access panels of proper fire rating. Size dampers to maintain free area through damper same as unobstructed run of duct or opening.

3. Each damper shall be classified by UL as a “corridor damper” for installation in tunnel corridors, shall be rated for one hour fire resistance under UL555, and shall have a minimum leakage rating of Class II under UL555S for use in smoke control systems. Each damper shall bear a UL label designating the damper as “corridor damper.”

4. In addition to the leakage rating specified herein, the dampers and their actuators shall be classified under UL555S to an elevated temperature of 250 degrees F (121 degrees C). Appropriate electric motorized operators shall be installed by the damper manufacturer at time of fabrication and damper/actuator assembly shall be factory cycled 10 times to assure operation. Assembly shall meet all applicable UL555 and UL555S criteria for both damper and actuators. Damper shall be power open-fail close design.

5. Damper manufacturer shall provide factory assembled minimum 20 gage steel sleeve. Damper shall be sealed to the sleeve with a 25/50 flame spread/smoke developed sealant material. Each corridor damper shall be equipped as standard with an electric fusible link. These fusible links shall be rated for 165 deg. F (74 deg. C) and shall be easily resettable for system testing.

6. Provide all necessary wiring and devices to close dampers on a signal from the building fire alarm system.

E. Exterior Wall Louvers: Prefabricated galvanized sheet metal fixed stormproof blades with frame to suit building construction, and with 1/2" x 1/2”, 16 gauge galvanized wire mesh on back side of all intake louvers and insect screen on exhaust/relief louvers. 4” deep, 45 degree fixed drainable type blade, AMCA 500 tested for 800 fpm without water penetration, and maximum of 0.07” wg intake pressure loss and 0.09” wg exhaust pressure loss. Provide “Kynar” protective coating and stainless steel fasteners (ASTM A167, type 302, cadmium finish, ASTM A165 type NS). Ruskin L375D as basic pattern on blade and frame, Greenheck, Cesco, American Warming, or approved.

F. Outside Air Intake/Relief Head: Rectangular aluminum cap with curb connection, flashing, 1/2" mesh galvanized bird screen and hinged access. Greenheck, Cook, Exitaire, Carnes, Acme, Powerline, Penn or accepted substitute.

G. Wall Caps: Rain screen style wall caps with extended base with flange and backdraft damper. Insect screen on bath fan outlets. No screen on dryer outlets.

H. Locking Connection Straps: 1/2" wide positive locking steel straps or nylon self-locking straps. Panduit or accepted substitute.

2.3 GRILLES, REGISTERS AND DIFFUSERS

A. Description: Provide grilles, registers and diffusers as shown on the Drawings.

B. Finishes:

1. Steel: Flat white enamel prime coat, factory applied on ceiling diffusers. Others are to have a baked enamel finish, color as selected by Architect.

2. Aluminum: Anodized clear finish unless indicated otherwise.

C. Manufacturers: Carnes, Krueger, Titus, Price, Shoemaker, and Tuttle & Bailey are accepted substitutes where only Titus model numbers are listed. Where other manufacturer's products are listed and/or "accepted substitute" is indicated, only the products or an accepted substitute for that item shall be provided.

D. Perforated Face Diffusers: Perforated snap-in or concealed hinged face plate with internal deflection blades at diffuser neck in steel or extruded aluminum frame and margin to suit the ceiling construction. Provide with opposed blade volume damper. Panel size shall be 24" x 24" where lift-out tile ceiling system is indicated. Titus PCS.

E. Ceiling Matched Return and/or Exhaust Register: To match adjacent ceiling outlets type. Use in spaces containing ceiling diffusers and/or T-bar ceilings. Provide with damper except where dampered plenums are indicated. Titus PCR.

F. Sidewall Supply Register: Double deflection grille with face bars parallel to long dimension on ceiling type and horizontal on wall type; bars to be individually adjustable, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper. Titus 300RL.

G. Sidewall or Ceiling Return or Exhaust Register: Face bars parallel to long dimension on ceiling type and horizontal on wall type; bars set at 35 degrees to 45 degrees, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper. Titus 350RL series.

H. Sidewall or Ceiling Return, Exhaust or Relief Grille: Face bars parallel to long dimension on ceiling type and horizontal on wall type; bars set at 35 degrees to 45 degrees, spaced on 0.66" to 0.75" centers. Titus 350 series.

## PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Air Handling Equipment Installation and Arrangement: Install and arrange as shown on Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.

B. Equipment Access Panels: Locate free of all obstructions such as ceiling bars, electrical conduit, lights, ductwork, etc.

C. Filters: Install specified filters in supply units and systems prior to start-up.

3.2 INSTALLATION OF GRILLES, REGISTERS AND DIFFUSERS

A. Size and air handling characteristics shall be as shown on the Drawings.

B. Locate, arrange, and install grilles, registers and diffusers as shown on the Drawings. Locate registers in tee-bar ceilings with diffusers centered on the tile unless indicated otherwise.

3.3 DUCTWORK INSTALLATION

A. Support: Install ductwork with 1" wide strap cradle hangers not more than 8' on centers or as required by code. Support terminal units independent of adjacent ductwork. Attach to available building construction according to good practices for materials involved. Manufactured hanger system acceptable in lieu of fabricated hangers at contractors option. Ductmate “Clutcher” system or approved.

B. Elbows and Fittings: Construct elbows with throat radius equal to duct width in plane of turn or make them square and provide double wall, air foil turning vanes.

C. Fittings: Make transitions and take-offs as shown on Drawings. Provide volume dampers and splitter dampers as indicated on Drawings and as specified. Straight saddle tees are not allowed.

D. Acoustical Duct Lining: Acoustically line all fan unit intake and discharge plenums, all ductwork indicated as lined on the Drawings, all sheet metal ductwork specified per Section 230700 as insulated, where exposed to view or subject to damage in areas such as mechanical rooms, and, at the Contractor's option, all insulated ductwork specified in Section 230700. The duct size noted on the Drawings is the clear opening of the duct with insulation. Insulation shall not reduce duct size listed.

E. Manual Volume Dampers: Location of all volume dampers are not necessarily shown on the Drawings. Provide a minimum of one volume damper in each supply, return or exhaust branch.

F. Duct Insulation: Specified in Section 230700.

G. Sealing: Seal all ductwork and plenums to make airtight at seams, joints, edges, corners and at penetrations. Install sealant materials in accordance with manufacturer's requirements.

H. Flexible Duct Connections:

1. Install in full extended condition, free of sags and kinks, using only the minimum length required to make the connection.

2. Make all joints and connections with 1/2" wide positive locking steel straps or nylon self-locking straps. Connecting duct shall have retention bead or flexible duct shall be attached with 2 screws in addition to strap.

3. On vertically suspended ducts, secure with a minimum of three sheet metal screws on a maximum of 8" on center.

3.4 FIRE DAMPERS

A. Provide fire dampers with rating equal to surrounding construction where penetrations are made through fire resistant rated construction per applicable codes and installed in accordance with UL label requirements. Locate fusible links for easy service or replacement and provide access panels of proper fire rating. Size fire dampers to maintain free area through fire damper same as unobstructed run of duct.

3.5 SMOKE DAMPERS

A. Same as fire dampers above except provide complete wiring including electrical connections between field connected components and the fire alarm system specified in the electrical specifications.

3.6 NEW DUCTWORK CLEANING

A. Store all ductwork materials on pallets or above grade, protected from weather, dirt/mud and other construction dust.

B. Remove all accumulated dust, dirt, etc. from each duct section as it is being installed.

C. Prior to installation of diffusers, grilles and registers, install temporary system filters and cover all diffuser, grille and register openings with temporary 25% efficiency filter materials and start the fan systems. Operate fans a minimum of 8 hours. Remove all temporary filters at the end of that period.

D. Clean all diffusers, grilles and registers just prior to project final completion.

END OF SECTION 233000