# SECTION 23 33 00

# AIR DUCT ACCESSORIES

# BASED ON DFD MASTER SPECIFICATION DATED 02/17/2022

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# P A R T 1 - G E N E R A L

## SCOPE

This section includes accessories used in the installation of duct systems. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Reference Standards

Quality Assurance

Shop Drawings

Operation and Maintenance Data

PART 2 - PRODUCTS

Manual Volume Dampers

Turning Vanes

Fire Dampers

Smoke Dampers and Combination Fire/Smoke Dampers

Control Dampers

Smoke Detectors

Access Doors

Duct Pressure Relief Doors

Flexible Duct

High Temperature Flexible Duct

Duct Lining

Flashings

Duct Flexible Connections

Sound Attenuators

Hoods for Intake and Exhaust

Louvers

Air Blenders

Air Flow Stations

PART 3 - EXECUTION

Manual Volume Dampers

Turning Vanes

Fire Dampers

Smoke Dampers and Combination Fire/Smoke Dampers

Control Dampers

Smoke Detectors

Access Doors

Duct Pressure Relief Doors

Flexible Duct And High Temperature Flexible Duct

Duct Lining

Flashings

Duct Flexible Connections

Sound Attenuators

Hoods for Intake and Exhaust

Louvers

Air Blenders

Air Flow Stations

Construction Verification

## RELATED WORK

Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment

Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

Section 23 08 00 – Commissioning of HVAC

Section 23 31 00 – HVAC Ducts and Casings

## REFERENCE

Applicable provisions of Division 1 govern work under this Section.

## REFERENCE STANDARDS

NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems

SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005

UL 214

UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers

UL 555S (4th edition) Leakage Rated Dampers for Use in Smoke Control Systems

## QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions

## SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

## OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Delete the following if there are no additional requirements.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. [A/E and commissioning provider to define detailed operation and maintenance data requirements for equipment specifications added to this section.]

# P A R T 2 - P R O D U C T S

## MANUAL VOLUME DAMPERS

Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed in accordance with SMACNA Fig. 7-4, Fig. 7-5, and notes relating to these figures, except as modified below.

Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

## TURNING VANES

Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 4-3 and Fig. 4-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Chart 4-1 and Fig. 4-9.

## FIRE DAMPERS

Manufacturers: Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Phillips-Aire, Prefco, Ruskin, Safe-Air or approved equal.

Static type dampers should be used on systems where the fans shut down during a fire event. Dynamic type dampers are required (IMC 607.3) for systems where the fans remain on during a fire event. Dynamic dampers are available with various maximum velocity ratings and static pressure ratings. The designer must indicate on the drawings the fire rating and type(static or dynamic), if dynamic then indicate the velocity and static pressure rating for each damper. Suggest using different symbols for different ratings/ types, including a damper schedule or having a tagging system which includes all the needed information.

STATIC FIRE DAMPERS

Static fire damper assemblies must be UL 555 (6th edition) listed and labeled for static applications (where air systems do not operate during a fire) and meet requirements of NFPA 90A. Damper must be type B curtain type with blades out of the air stream; dampers with blades in the air stream will not be accepted. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

DYNAMIC FIRE DAMPERS

Dynamic dampers that meet the new UL standards have size limitations that potentially could necessitate a large duct being divided into multiple smaller ducts at a rated penetration. Verify availability of large dampers during design.

Dynamic fire damper assemblies must be UL 555 (6th edition) listed and labeled for dynamic applications (where air systems operate during a fire) and meet requirements of NFPA 90A. Dampers must be type B curtain type with curtain 100% out of air stream. Dampers larger than 30” by 30” or with velocity rating requirements of 3000 fpm or higher, may be multiblade type with blades located in the airstream. Velocity ratings and static pressure ratings as indicated on the drawings. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

## SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

Manufacturers: Ruskin, Johnson Controls, Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Safe-Air, Phillips-Aire, Prefco, or approved equal.

If the fan system may operate during a fire event and the anticipated pressure and velocity may be higher than 4”/2,000 fpm, then the designer must indicate on the drawings the velocity and static pressure rating for each damper. Suggest using different symbols for different ratings/ types or having a tagging system that includes all the needed information.

Smoke damper:

Smoke damper assemblies to be UL 555S(4th edition) listed and labeled, and leakage rated at no higher than Class II under UL 555S(4th edition). Unless ratings are indicated elsewhere, dampers should be rated for minimum 2,000 fpm air velocity and 4” static pressure.

Combination fire/smoke damper :

Combination fire/smoke damper assemblies to be UL 555(6th edition) and UL 555S(4th edition) listed and labeled, and have a fire rating compatible with the rating of the building assembly in which the damper is used, and be leakage rated at no higher than Class II under UL 555S.

Dynamic fire/smoke dampers that meet the new UL standards have size limitations that potentially could necessitate a large duct being divided into multiple smaller ducts at a rated penetration. Verify availability of large dampers during design.

Operation:

Provide factory installed [pneumatically][electrically] operated dampers with linkage arranged so that the damper is closed on loss of [pneumatic air pressure][power]. For electric actuation, provide electric operated dampers with linkage and UL listed operators arranged so that the damper is closed on a loss of power. Where electric actuation is controlled by the DDC system use 0-10 VDC inputs, with stall protection, and with and zero and span adjustments for modulating or 24 VAC for two-position control. Where electric actuation is controlled by the fire alarm system, use 120 VAC actuators. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Locate all operators out of the air stream unless large damper size will not allow. Provide form “C” end switches to indicate damper position.

Coordinate actuators types with 23 09 14 and 23 09 93 sequence of operation and indicate the type of actuator to be used.

For very small ducts, the pressure drop caused by the smoke damper may be significant. If so then consider enlarging the duct at the damper location.

Use airfoil shaped damper blades on the following system:

* List Systems.

Use the above sentence where the normal operating duct velocity is 2000 fpm or greater. One possible supplier of this type of damper is Ruskin with their FSD60 combination damper.

## CONTROL DAMPERS

Control dampers are specified in section 23 09 14.

## SMOKE DETECTORS

Smoke detectors are furnished and installed by the Electrical Contractor.

Coordinate locations with the electrical design consultant.

## ACCESS DOORS

General:

Access doors to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock.  Hinges shall be aluminum or steel full length continuous piano type.  Doors in concealed spaces shall be secured in place with cam sash latches.  For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access.  Use minimum 1” deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames.  For non-galvanized ductwork, use minimum 1” deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork.  Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct.  When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment.  Access doors constructed with sheet metal screw fasteners will not be accepted.

Kitchen Exhaust Ducts:

Use insulated, 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

## DUCT PRESSURE RELIEF DOORS

Construct with 12 gauge galvanized [stainless] steel frame and hinged door with polyurethane or neoprene gasket. When installed in insulated ductwork provide 1” double wall insulated duct pressure relief doors. Double wall duct pressure relief doors shall be insulated with polyurethane foam insulation or rigid fiberglass insulation. Provide springs to automatically return door to closed position when pressure is relieved. Provide with release mechanism, springs and parts out of the air stream. Set pressure relief setting at the factory. Provide sizes and pressure settings as indicated on the drawings.

Indicate the sizes and relief settings of all the pressure relief doors on the drawings.

Doors for positive pressure shall open outward and doors for negative pressure shall open inward.

## FLEXIBLE DUCT

Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

Factory fabricated, UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

The following high temperature flexible duct spec is intended for use only in industrial type applications.

## HIGH TEMPERATURE FLEXIBLE DUCT

Manufacturers: Clevaflex, Thermaflex, Wiremold, Flexmaster or approved equal.

Duct to be all aluminum construction made from soft aluminum sheet, spiral wound into a tube and spiral corrugated. The construction to be a triple mechanical lock to form a continuous and secure air tight joint.

Duct to be suitable for 600°F.

## DUCT LINING

Do not use lining unless specifically approved by DFD engineering personnel. In general, lining may be approved in the following locations:

* Five foot downstream of a supply box.
* In return air ductwork if there is a filter in the return system.
* In supply duct constructed of a solid outer shell, a perforated inner shell, and the annular space filled with glass fiber insulation.
* Transfer duct.

In the first three situations, sound calculations must be made to determine if a problem exists and to determine if one or more of the above items will solve the sound problem.

Duct lining is being restricted in use due to its deterioration over time, with pieces of insulation collecting on turning vanes, reheat coils, etc.

Manufacturer: Manville, Owens-Corning, Knauf, or approved equal.

1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.

Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.

Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.

Install liner using adhesive conforming to ASTM C 916.

## FLASHINGS

Coordinate with architectural specifications.

Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.

Flashing and counterflashing for roof curbs will be provided by others.

Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

## DUCT FLEXIBLE CONNECTIONS

Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

General Applications:

Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard.

Outdoor Applications:

Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon¿,air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal wight of 26 ounces per square yard.

Ventfabrics, Inc. products meeting this spec are Ventglas and Ventlon respectively.

Corrosive Environments:

For corrosive environments or fume exhaust applications indoors or outdoors, use a material coated with Teflon that is air and water tight, suitable for temperatures between -20°F and 500°F, and has a nominal weight of 14 ounces per square yard.

Ventfabrics, Inc. Ventel meets this specification.

Do not use connectors in kitchen exhaust ducts. Use upblast fans that are roof mounted on curbs and have no direct connection between the exhaust duct and the fan housing. Connectors that have the temperature properties that may be needed in this application will absorb the grease being conveyed; this could provide fuel to a fire if one developed.

## SOUND ATTENUATORS

Note that this specification is not applicable for sensitive areas in hospital applications or similar areas.

Manufacturers: Industrial Acoustics Company, Environmental Elements Corporation, Semco, Dynasonics, United McGill, Price, VAW, Vibro Acoustics or approved equal.

Construct of a 22 gauge galvanized steel outer casing, and 26 gauge galvanized, perforated steel inner liner. Seams and joints of outer casing to be air tight.

Fill annular space between outer casing and inner liner with acoustic fill that is inert, inorganic, and of a density sufficient to obtain the specified acoustic performance. Material must meet requirements of NFPA 90A with a flame spread index of 25 or less and smoke developed rating of 50 or less.

Acoustical and aerodynamic performance is indicated on schedules on the drawings.

## HOODS FOR INTAKE AND EXHAUST

Manufacturers: Acme, Ammerman, Carnes, Cook, Greenheck, Louvers and Dampers, Penn, or approved equal.

Select one of the two following types of hoods.

Use low silhouette type hoods.

Use louvered penthouse type hoods with drainable blade louvers.

Select one of the following two types of construction. Galvanized hoods with a baked enamel finish should only be used where the hoods are clearly visible and aesthetic appearance is a primary concern.

Construct hoods of aluminum.

Construct hoods of galvanized steel with a baked enamel finish; color to be selected by the Architect during the submittal stage.

For hoods and louvered penthouses maintain minimum 30 inches from bottom of air intake to finished roof.

Provide bird screen and motor operated damper for each hood.

## LOUVERS

Louvers can be provided by the General Prime Contractor under the architectural specification or by the mechanical contractor; edit the following paragraphs as appropriate and coordinate this with architectural specifications and drawings. Regardless of where the louvers are specified, they must meet the requirements stated below.

Louvers Provided by GPC:

Louvers are specified in the architectural section of these specifications.

Regardless of who provides the louvers, provide minimum of 30 inches from bottom of louver to finished roof, bottom of areaway or grade. Healthcare facilities require more than 30” (see healthcare code). For some louvers it may be desirable to locate the louvers above the first floor to prevent the intentional contamination of air. Review with DFD on a case by case basis.

Louver Provided by Division 23 Contractor:

Manufacturers: Airolite K6776, Industrial Louvers 658, American Warming and Ventilating LE-31, Construction Specialties 6177, Ruskin ELF6375DX or approved equal.

Similar to Airolite Type K6776, extruded aluminum alloy not less than 12 gauge (.081" thick), 6063 series frame and blades, all-welded assembly, 35 degree or 45 degree blades with water baffle, 6 inches thick. Provide with bird screen of ½” x ½” mesh aluminum in 12 gauge aluminum frame and an aluminum sill. [Locate the bird screen on the outside of the louver where indicated on the drawings.] Locate the bird screen inside of the louver unless noted otherwise.

If the louver is used for air intake and is located out of view (for example in a full height area well) then located the bird screen on the outside of the louver so that the leaves, trash etc. that get sucked into the bird screen can be easily removed.

Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a free area not less than 50% based on a 48" x 48" section, a water penetration less than 0.1 oz/square foot under AMCA test at 1000 feet per minute, and an intake pressure drop less than 0.20 inches of water at 1000 feet per minute.

Finish to be anodized or Kynar 500 in a custom color to be selected by the Architect. Furnish sufficient paint in the same color as the louver to paint the outer surface of panels over unused portions of louvers and to paint the interior portion of ductwork visible through the louvers.

## AIR BLENDERS

The velocity of air through an air blender must be within the manufacturer's recommended range to provide mixing of airstreams. On variable volume systems at low load or reduced air volume, velocities may fall below the recommended range. Air blenders are therefore more effective on constant volume systems unless measures are taken to reduce net face area as the air volume is decreased.

Manufacturers: R-M Products, or approved equal.

Construct units of not less than .08 inch aluminum of all welded construction. Units to be completely fixed devices capable of providing mixed air temperatures within 6°F of the theoretical values.

## AIR FLOW STATIONS

Air flow stations are specified in section 23 09 14.

The A/E must show the location of these devices on the drawings so the sheet metal contractor can estimate the labor involved to install them.

# P A R T 3 - E X E C U T I O N

## MANUAL VOLUME DAMPERS

Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

## TURNING VANES

Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Chart 4-1 and Figure 4-9.

## FIRE DAMPERS

Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles on both sides of rated partition. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

The A/E must coordinate the location of all fire dampers, smoke dampers and combination fire smoke dampers. All dampers must be installed in accessible locations and access to these dampers must be coordinated. The dampers must have adequate access to allow for servicing and testing of the dampers.

## SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

Smoke Damper Installation;

Install smoke dampers in locations indicated on the drawings in accordance with the manufacturer's instructions. Install an access door adjacent to each damper for inspection and cleaning.

Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

Combination Fire/Smoke Damper Installation;

Install combination fire/smoke dampers in locations indicated on the drawings in accordance with the manufacturer's instructions. Install an access door adjacent to each damper for inspection and cleaning. .

Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

The A/E must coordinate the location of all fire dampers, smoke dampers and combination fire smoke dampers. All dampers must be installed in accessible locations and access to these dampers must be coordinated. The dampers must have adequate access to allow for servicing and testing of the dampers.

## CONTROL DAMPERS

Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

The A/E must coordinate the location of all control dampers. All dampers must be installed in accessible locations and access to these dampers must be coordinated. The dampers must have adequate access to allow for servicing and testing of the dampers.

## SMOKE DETECTORS

Installation and wiring of detectors will be by the Electrical Contractor. Install an access door at each detector location.

When detectors are to be installed within air handling systems, show the intended location on the mechanical drawings and coordinate with the electrical consultant. It is very difficult to properly identify the correct location of detectors on the electrical drawings.

## ACCESS DOORS

Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, “SMOKE DAMPER” or “FIRE DAMPER”. Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

## DUCT PRESSURE RELIEF DOORS

Install where shown on the drawings. Provide sizes and relief settings as indicated on the drawings. Install per the manufacturer’s written instructions.

Include pressure relief doors on VAV systems to protect ductwork damage in the case of equipment or controls malfunction. Include on other system where equipment or control malfunction may cause damage to ductwork. Show the locations, sizes and pressure settings of all needed pressure relief doors on the drawings.

## FLEXIBLE DUCT AND HIGH TEMPERATURE FLEXIBLE DUCT

Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

Penetration of any partition, wall, or floor with flexible duct will not be accepted.

## DUCT LINING

Do not use lining unless specifically approved by DFD engineering personnel - see comments in Part 2 of this section.

Apply lining to the following ductwork:

* List Duct Systems

List ductwork to be lined if approved by DFD engineering personnel.

Do not apply lining to the following ductwork:

* Outside air ductwork.
* Kitchen exhaust ductwork.
* Dishwashing exhaust ductwork.
* Shower exhaust ductwork.
* Pool ventilation ductwork.
* Supply, return and exhaust ductwork associated with shop ventilation systems where air handling units are in the shops.
* Fume hood exhaust ductwork.
* Supply ductwork associated with ventilation systems serving hospital critical areas.

Hospital critical areas are defined as operating rooms, delivery rooms, nurseries, recovery rooms, intensive care units, and similar occupancies.

Install liner in compliance with the latest edition of NAIMA’s Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8” with the fasteners.

## FLASHINGS

Flashing for roof curbs, equipment supports or rails located on roof, will be installed by others.

## DUCT FLEXIBLE CONNECTIONS

Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 7-8. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon¿ coated fabric when making the connector.

## SOUND ATTENUATORS

Install sound attenuators in locations indicated on the drawings. Where modular installation is required, install units in a galvanized steel frame equipped with gaskets or seals between modules to prevent bypass of air.

The A/E must indicate installation locations that are in agreement with the manufacturer's recommendations.

## HOODS FOR INTAKE AND EXHAUST

Install in locations indicated on the drawings, coordinating the roof opening location with the General Prime Contractor. Curbs are covered in Section 23 05 29.

## LOUVERS

Edit the following paragraphs and coordinatewith Part 2, depending on who is furnishing the louvers. Also coordinate with architectural specifications and drawings.

Louvers are furnished and installed by others.

Furnish louvers to the General Prime Contractor for mounting in exterior walls. Connect outside air intake duct to the louver, sealing all connections air and water tight.

Provide bird screen on [inside][outside] of active louver area where none is provided with louvers. Where louvers are equipped with inside birdscreen, remove screen at all locations where duct connections are not made.

Install insulated metal panel on unused portion of louver. Panels must be sealed weathertight to louver assembly with flashing as required for proper drainage to outside of building. Paint outside surface of panel to match louver prior to installation. Where ductwork is visible through louver when viewed from outside the building, paint inside of duct to match louver color.

## AIR BLENDERS

Install air mixing devices where indicated on the drawings and in strict accordance with manufacturer's recommendations.

The installation indicated on the drawings must be in agreement with the manufacturer's recommendation.

## AIR FLOW STATIONS

Install where indicated on the drawings and/or as scheduled and in accordance with manufacturer's recommendations.

Provide access doors upstream and downstream of all duct mounted air flow stations of the size necessary for maintenance purposes. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated on the drawings.

The installation indicated on the drawings must be in agreement with the manufacturer's recommendation

## CONSTRUCTION VERIFICATION

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION