

SECTION 23 3314 - DUCTWORK SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Smoke dampers.
5. Combination fire/smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors and panels.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.
12. Louvers.
13. Duct Sound Attenuators.

1.2 SUBMITTALS

A. Product and Technical Data: For each type of product indicated, including (but not limited to) installation requirements, dimensions, color charts and water penetration data for louvers, wiring diagrams, dynamic insertion loss and self-noise data for attenuators, and air pressure drop information.

B. [LEED Submittals:

1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2007, Section 5 - "Systems and Equipment."
2. Any data that can be used for recycled content and regional materials credits.]

C. Operation and maintenance data.

D. Northwestern University Maintenance Requirement Forms, see Division 01.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating, and with AMCA 500-L for louver performance.

C. For louver finishes, comply with applicable SSPC and AAMA requirements.

- D. For duct sound attenuators, they shall be tested in accordance with ASTM E-477-99 silencer test standard in a certified test facility which is NVLAP accredited for the testing.

1.4 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 except for Lab exhaust, which shall be Type 316.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6, except for louvers, which are to be Temper T5.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DAMPERS – BACKDRAFT, VOLUME, FIRE, SMOKE, FIRE/SMOKE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance.
 - 2. Cesco.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Prefco (Basis of Design)
 - 6. Ruskin Company.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced.

- B. Maximum Air Velocity: 3000 fpm.
- C. Maximum System Pressure: 2-inch wg.
- D. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.
- E. Blades: Multiple single-piece blades, maximum 6-inch width with sealed edges.
- F. Blade Action: Parallel.
- G. Return Spring: Adjustable tension.
- H. Bearings: Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.
- I. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Material: Galvanized steel.
 - 6. Screen Type: Bird.
 - 7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- 1. Show dampers on Drawings.
- 2. Damper and blade material to match ductwork material
- 3. Standard leakage rating.
- 4. Suitable for horizontal or vertical applications.
- 5. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Rectangular dampers shall be single blade type in ducts up to 11" high and shall be opposed blade type in ducts 12" high and above.
 - b. Round dampers shall be single blade type.
 - c. Stiffen damper blades for stability.
- 7. Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.
- 8. Provide locking indicating quadrant regulators on all dampers. Where rod lengths exceed 30-inches, provide a regulator at both ends.
- 9. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- 10. Jackshaft:
 - a. Size: 1-inch diameter.

- b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
- c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

11. Damper Hardware:

- a. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
- b. Include center hole to suit damper operating-rod size.
- c. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

- A. Fire dampers shall be dynamic, multiple airfoil blade type (not curtain type) with integral wall sleeve, constructed in accordance with UL Standard 555.
- B. Closing rating in ducts up to 8-inch wg static pressure class and minimum 4000-fpm velocity.
- C. Dampers shall be for horizontal or vertical mounting and shall be of sizes shown on the drawings.
- D. Dampers shall have 1-1/2 or 3 hour rating as shown on drawings, replaceable 212 degree F fusible link, and access panels (with UL 181 rated viewports), for installation on both sides of damper.

2.6 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Multiple blade type (not curtain type); fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- D. Blades: Airfoil, multiple.
- E. Leakage: Class III, and, all seals to be metal-to-metal.
- F. Rated pressure and velocity to exceed design airflow conditions, and dampers to be rated for 4,000 fpm and 8" pressure minimum.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- H. Damper Motors: **[Modulating]** [or] **[two-position]** action, electric.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Motors."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in [Division 25 Section "Integrated Automation."] [Division 26 Sections.]
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Dampers shall be supplied/installed with access panels (with UL 181 rated viewports), for installation on both sides of damper.
- K. Accessories:
1. Auxiliary switches for [signaling] [fan control] [or] [position indication].
 2. [Momentary test switch] [Test and reset switches], [damper] [remote] mounted.

2.7 COMBINATION FIRE/SMOKE DAMPERS

- A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL, multiple blade, not curtain type. Basis of Design Prefco Model 5010.
- B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm velocity.
- C. Fire Rating: 3 hours.
- D. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
- E. Heat-Responsive Device: Reusable electric "McCabe™" link, with an external manual reset lever (see drawing details). The releasing device shall be 24Vdc in compliance with UL 873. The resettable link shall be 280°F, and UL 33 listed.
- F. Smoke Detector: Furnished by electrical.
- G. Blades: Roll-formed, horizontal, interlocking, minimum 0.034-inch- thick, galvanized sheet steel.
- H. Leakage: Class I
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, minimum 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.

- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: two-position action.
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 25.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Non-spring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 24 or 115 V as called for by control systems specifications, sequences, or on drawings, and as required, single phase, 60 Hz, and as coordinated with electrical contractor.
- N. Accessories:
 - 1. Auxiliary switches for signaling or position indication.
 - 2. Test and reset switches, remote mounted.
 - 3. Access panels (with UL 181 rated viewports), for installation on both sides of damper.
 - 4. Other as required.

2.8 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

- A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- B. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular, and 24" x 24" or as close to 24" x 24" as possible.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches

2.11 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturer: Ventfabrics, Model Ventglas.

- B. Materials: Flame-retardant or non-combustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Material shall be crimped into a metal edging strip and shall be approximately 3 inches wide.
- E. Indoor System, Flexible Connector Fabric: Minimum 0.024 " thick glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Tensile Strength: Minimum 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Minimum 0.024" thick glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Casco.
 - 2. Flexmaster U.S.A., Inc., Type 6.
 - 3. Thermaflex, Model M-KE.
- B. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2007.
- D. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.
- E. Flexible Duct Securement:

1. Clamps: Stainless-steel band with hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.15 LOUVERS

- A. Horizontal, Drainable-Blade Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of MESTEK, Inc.
 - b. Airolite Company, LLC (The), Basis of Design, Model K6856.
 - c. Cesco Products; a division of MESTEK, Inc.
 - d. Greenheck Fan Corporation.
 - e. Ruskin Company.
2. Louver Depth, Blade Angle, and Free Area: 6 inch depth, blades at 45° angle, and minimum free area of 49.4%.
3. Frame and Blade Materials of Construction and Nominal Thickness: Not less than 0.081 inch, and constructed of ASTM B221 aluminum extrusions, Alloy 6063-T5.
4. Fabrication: Welded.
5. Frame Type: XXXXXXXXXX
6. Sill Type: Extended.
7. Mullion Type: Exposed.
8. Sleeve: Minimum 16 gage galvanized steel, by contractor.
9. Size and performance data: See schedules/drawings.
10. Finish: 2-coat, oven cured Kynar 500, 2.0 mils dry film coating thickness per AAMA 2605.
11. Louver Performance Ratings:
 - a. Free Area: Not less than 7.9 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration: Not less than 1065 fpm.
 - c. Air Performance: Not more than 0.072-inch wg static pressure drop at 700-fpm free-area intake velocity.
 - d. Air Performance: Not more than 0.17-inch wg static pressure drop at 1000-fpm free-area exhaust velocity.
12. Wind Loads: Determine loads based on a uniform pressure of **XX lbf/sq. ft. based upon project structural wind values and other data**, acting inward or outward.
13. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
14. Screens: 1/2" aluminum birdscreen finished same as louver, located **XXXXX**.
15. Insulated Blank-off Panels: XXXXXXXXXXXXXXXX.

2.16 DUCT SOUND ATTENUATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerocoustic.
 2. Aerosonics.
 3. Commercial Acoustics, Metalform Corp.
 4. Industrial Acoustics.
 5. McGill AirFlow LLC.
 6. Pottorff/Dynasonics.
 7. Ruskin Sound..
 8. Semco.
 9. Vibro-Acoustics.
- B. General Requirements:
1. Factory fabricated.
 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Shape:
1. Rectangular straight with splitters or baffles.
 2. Round straight with center bodies or pods.
 3. Rectangular elbow with splitters or baffles.
 4. Round elbow with center bodies or pods.
 5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel minimum 22 ga.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel.
1. Sheet Metal Thickness for Units up to 24 Inches (600 mm) in Diameter: 0.034 inch (0.85 mm) thick.
 2. Sheet Metal Thickness for Units 26 through 40 Inches (660 through 1000 mm) in Diameter: 0.040 inch (1.02 mm) thick.
 3. Sheet Metal Thickness for Units 42 through 52 Inches (1060 through 1300 mm) in Diameter: 0.05 inch (1.3 mm) thick.
 4. Sheet Metal Thickness for Units 54 through 60 Inches (1370 through 1500 mm) in Diameter: 0.064 inch (1.62 mm) thick.
- F. Inner Casing and Baffles: ASTM A 653/A 653M, [G90 (Z275)] [G60 (Z180)] galvanized sheet metal, 0.034 inch (0.85 mm) thick, and with 1/8-inch- (3-mm-) diameter perforations.
- G. Special Construction:
1. Suitable for outdoor use.
 2. High transmission loss **to achieve STC XX**

- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
 - 1. [Select type from 1 and 2]
 - a. Reactive type (No Media) Controlled impedance membranes and broadly tuned resonators without absorptive media.
 - b. Dissipative Film-lined type with fill material for Hospital use.
 - 1) Fill Material: Inert and vermin-proof fibrous material
 - 2) Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
 - 3) Lining : Mylar film
- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 - 1. Joints: slip or flanged connections.
 - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Accessories:**
 - 1. Factory-installed end caps to prevent contamination during shipping.
- L. Source Quality Control: Test according to ASTM E 477.
 - 1. Testing **to** be witnessed by [**Architect**].
 - 2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm (10-m/s) face velocity.
 - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg (1500-Pa) static pressure, whichever is greater.
- M. Performance and Characteristics: See schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts, and according to manufacturer's instructions/recommendations..
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. All dampers to be accessible and labeled, and are to have at least 24" around them for servicing, adding up to and including valves, actuators, and other devices that need service or need to be accessed to provide service.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated.
- H. Install fire **[and smoke]** dampers according to UL Listing.
- I. Install combination fire/smoke dampers according to UL Listing.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils and VAV box reheat coils.
 2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Upstream from manual volume dampers, modulating dampers, backdraft dampers, humidifiers, and equipment.
 6. Adjacent to and close enough (and on both sides of) to fire, smoke, and combination fire/smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. Maximum 20-foot spacing.
 8. Upstream from turning vanes.
 9. Maximum 10-feet from every 90° elbow.
 10. Control devices requiring inspection.
 11. Up and down stream of airflow measuring stations.
 12. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.
- L. Access Door Sizes:
1. Hand Access: 24" x 24", or 24" by the duct height/width.
 2. Head and Hand Access: 18 by 16 inches.
 3. Head and Shoulders Access: 21 by 16 inches.
 4. Body Access: 25 by 16 inches.
 5. Body plus Ladder Access: 25 by 17 inches.
 6. Where fusible links are located, there must be a 24" access panel installed.
- M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- Q. Flexible duct elbows at diffusers are not allowed, elbows at diffusers must be sheet metal, see drawing detail(s).
- R. Connect flexible ducts to metal ducts with draw bands.
- S. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- T. For louvers, use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection. Form closely fitted joints with exposed connections accurately located and secured. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors/panels and verify that purpose of access doors/panels can be performed.
 - 3. Operate fire, smoke, and combination fire/smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3314

NORTHWESTERN UNIVERSITY
PROJECT NAME _____
JOB # _____

FOR: _____
ISSUED: 03/29/2017

THIS PAGE IS INTENTIONALLY BLANK