

SECTION 15910 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
- C. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers" and U.L. Standard 555S "Motor-Driven Fire/Smoke Dampers."
- D. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.
- E. SMACNA Compliance: All exhaust ducts comply with "Fire Damper and Heat Stop Guide".
- F. All fire dampers, smoke dampers, fire/smoke dampers and radiation dampers shall meet the latest local building code requirements.

1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components. Include details of construction equipment and accessories being provided.
- C. Submittals for all damper types specified in this section shall include a schedule for each damper indicating net free area, actual face velocity and pressure drop (at sea level) based on net free area & the maximum air quantity which will be passing through the damper. Submittals without this information will be rejected.
- D. Submit Heresite duct/equipment protective coating product data sheets and application instruction.
- E. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 15.
- F. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 15.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Dampers:

- a. Greenheck
- b. AWW
- c. Air Balance, Inc.
- d. Anemostat
- e. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
- f. Louvers & Dampers, Inc.
- g. Penn Ventilator Co.
- h. Pottoroff
- i. Ruskin

2. Fire Dampers and Smoke Dampers:

- a. Greenheck
- b. Air Balance, Inc.
- c. Phillips Industries, Inc. Conaire Division
- d. Ruskin
- e. Pottoroff

3. Turning Vanes:

- a. Aero Dyne Co.
- b. Airsan Corp.
- c. Barb-Aire
- d. Duro Dyne Corp.
- e. Environmental Elements Corp.; Subs. Koppers Co., Inc.
- f. Hart & Cooley Mfg. Co.

4. Duct Hardware:

- a. Ventfabrics, Inc.
- b. Young Regulator Co.
- c. Duro-Dyne Corp.

5. Duct Access Doors:

- a. Kess
- b. Greenheck
- c. Flexmaster
- d. Cesco-Advanced Air
- e. Duro Dyne Corp.
- f. Ventfabrics, Inc.

6. Flexible Connections:

- a. Duro Dyne Corp.
- b. Ventfabrics, Inc.

- c. General Rubber Corp. (Process & Exhaust Only)
- 7. Air Blenders:
 - a. Blender Products, Inc.
- 8. Constant Velocity Exhaust Fan Dampers:
 - a. American Warming and Ventilating

Note to specifier to use PVC or Heresite coating(s) for corrosive air stream and/or stainless steel (also for moisture laden airstream)

2.2 MANUAL VOLUME DAMPERS:

- A. Low Pressure Rectangular Dampers (less than 2000 FPM and under 2" W.C. S.P. Differential):
 - 1. For 12" in height or larger, use multiple opposed blade type and close fitted to ducts. The frame and blades shall be constructed of 16 ga. galvanized steel with plated steel shaft mounted with synthetic bearings. Linkage shall be in-jamb fixed type located outside the airstream made of plated steel tie bar and crank plates, with stainless steel pivots. Damper panels shall not exceed 48" wide. Provide jack shafting when duct size required is greater than 48" wide. Provide notched shaft end indicating damper position, locking quadrant to fix damper position and handle. Provide stand off bracket for insulated ducts. For flat oval and round ductwork, provide type C housing.
 - 2. For ducts less than 12" in height, frame shall be 18 ga. blade galvanized steel, steel axle with synthetic bearings locking quadrant handle and notched shaft end indicating damper position. Provide stand off bracket for insulated ducts.
- B. Low Pressure Round Dampers (less than 1800 FPM and under 1" W.C. S.P. differential):
 - 1. For low pressure spin-in fitting dampers serving individual returns/diffusers, see 15891.
 - 2. Dampers 4" diameter through 18" diameter shall be 20 ga. galvanized steel frame and blade, utilize multi-blade square dampers with transitions for ducts over 18" diameter.

Axle shaft shall be plated steel with retainers mounted on synthetic bearings with notched end shaft indicating damper position, locking quadrant and handle. Provide stand off brackets for insulated ducts.

 - a. Greenheck M80R-50 or approved equivalent.
- C. Medium/High Pressure Rectangular Dampers (less than 4000 FPM and under 6" W.C. (48" wide or less) S.P. or 8" W.C. S.P. (36" wide or less)):
 - 1. Dampers shall be opposed blade for volume control and parallel blade for isolation/shut-off service.
 - 2. Frame shall be 16 ga. galvanized steel with welded corners or 1/8" thick 6063-T5 alloy aluminum frame. Blades shall be double skin galvanized steel with single-lock seam, or .081" thick 6060-T5 extruded aluminum, airfoil shape. Blade edge seals shall be vinyl, silicone, or other approved synthetic and metallic compression seals at the jams. Axles shall be hexagonal or square plated steel mounted on bronze oilite or synthetic

(ACETAL) bearings. Linkage shall be in-jamb type located outside the airstream. Maximum damper size shall be 48" wide and 60" high. For isolation or shut-off duty, damper leakage shall not exceed 9.5 CFM/Ft² at 4" W.C. S.P. differential. Provide extended shaft with notched end indicating damper position, locking quadrant and handle. Provide stand off brackets for insulated ducts.

D. Medium/High Pressure Round and Flat Oval Dampers (less than 3000 FPM and under 4" W.C. S.P. differential):

- 1. Damper frame construction shall be galvanized steel as follows:

ROUND

Under 6" dia.....12 Gauge
6" to 18" dia.....14 Gauge

FLAT OVAL

6" to 12" wide2 x 1/2 x 14 gauge channel
13" to 48" wide2 x 1/2 x 1/8 channel

- 2. Damper blades shall be galvanized steel as follows:

ROUND

4" to 18" diameter 12 Gauge

FLAT OVAL

4" to 18" Wide 12 Gauge

- 3. Axles shall be 1/2" diameter plated steel up to 18" diameter and 18" wide flat oval, and 3/4" diameter plated steel over 18". Stainless sleeve bearings pressed in to the frame.
- 4. Provide notched end shaft to indicate damper position, locking quadrant and lever handle. Provide stand off bracket for insulated duct.

Edit as required.

- 5. For isolation or shut-off service dampers shall be provided with edge seals with a leakage rate not to exceed 7 CFM/ft² at 1" W.C. S.P. differential (based on 18" diameter).

E. Dampers in stainless steel duct shall be of equivalent construction to the above dampers, with all components made of stainless steel. Type 304 or 316 as specified for the ductwork.

F. Dampers in aluminum duct shall be of equivalent construction to the above dampers, with all components made of either aluminum or stainless steel.

Use control dampers below for special applications only. Do not use for typical commercial temperature control dampers. See Section 15970.

2.3 CONTROL DAMPERS:

- A. Dampers shall be opposed blade for volume control and parallel blade for isolation/shut-off service. Frame shall be 12 ga. galvanized steel with welded corners. Blades shall be double skin galvanized steel with single-lock seam, airfoil shape with a strength greater than 14 ga.

AWV Model VC-422
- B. Blade edge seals shall be double durometer vinyl and metallic compression seals at the jambs. Leakage shall not exceed 11.5 CFM/ft² at 4" W.C. S.P.
- C. Axles shall be solid carbon steel mounted on bronze oilite bearings. Linkage shall be in-jamb type located outside the airstream.
- D. Maximum damper size shall be 48" wide and 72" high.

Add or delete the following. Coordinate type of service to operate motors.

- E. For **isolation/and/automatic volume control dampers**, provide factory supplied pneumatic/electric motor operators with quantities, voltage/air pressure and sizes suitable for proper operation at the velocity and pressures the dampers will be operating at.

Verify specific manufacturer and model is capable of operating at specified operating pressure(s).

2.4 COUNTERBALANCED PRESSURE RELIEF DAMPERS:

- A. For velocities less than 3000 FPM and under 2" W.C. S.P. differential provide dampers with parallel blades, counterbalanced and factory-set, field adjustable, to relieve at indicated static pressure. Construct blades of 16 ga. aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

Use the following for VFD Air Bypass

- B. For velocities above 3000 FPM and static pressure differential above 2" W.C.:

Provide dampers with parallel blades, counterbalanced and factory-set, field adjustable to start to open at indicated pressure. Construct blades of 16 gauge galvanized steel up to 32" length and 14 gauge over 32" length, 3/4" diameter plated steel axles, full length, relubricable ball bearings, heavy duty carbon steel linkage located out of airstream, 10 gauge galvanized steel frame silicone blade edge seals and silicone jamb seal, full flanges on both sides, mill finish with touch -up on welds and prime coat on black steel.

2.5 FIRE DAMPERS:

- A. Fabricated Fire Dampers: Provide dampers constructed in accordance with SMACNA "Fire Damper and Heat Stop Guide."

- B. Fire Dampers: Provide dynamic rated type B or C fire dampers except as noted on drawings. Construct sleeve of galvanized steel with bonded red acrylic enamel finish, gauge as required by the listing. All fire dampers shall be UL labeled. Provide fusible link rated at 160 to 165 deg. F (71 to 74 deg. C) unless otherwise indicated. See architectural drawings for the separations and listings. Provide horizontal mounted fire damper with positive lock in closed position, and with the following additional features:
 - C. Damper Blade Assembly: Curtain Type.
 - D. Blade Material: Galvanized steel.
 - E. Provide integral sleeve type G fire dampers for sidewall air devices terminating at fire rated walls. Ruskin DIBD20-G or equivalent.
- 2.6 SMOKE DAMPERS:
- A. Rectangular Motor-Driven Smoke Dampers: Frame constructed of 16-ga. steel, type 304 stainless steel side seals, silicone edge seals, bronze oilite or stainless steel sleeve bearings, airfoil shaped galvanized steel formed interlocking blades, with factory mounted actuator motor, motor mounting bracket. Out of air stream plated steel linkage.
 - 1. Ruskin Model SD-60 or approved equivalent.

Edit Note: Use 350°F for engineered smoke control systems.
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- B. Round Motor-Driven Smoke Dampers 18" and Under: Frame constructed of 20 gauge galvanized steel, 2 layers of galvanized steel butterfly blade equivalent to 14 gauge, silicone rubber seal sandwiched between blade layers. Stainless steel sleeve bearings pressed into frame.
 - 1. Ruskin SDR-25 or approved equivalent.
 - 2. Use rectangular damper with smooth square/round transitions for dampers over 18" round.
- C. Temperature Class 250°F/350°.
- D. Factory sleeve.

Edit Note: Select pneumatic actuator unless no pneumatic is available. Coordinate voltage.
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- E. Factory mounted pneumatic spring return actuator and 120v E/P valve. Actuator shall operate on 20 psi control air pressure. Factory mounted 24V/120V spring return electric actuator.
- F. Electric Damper Actuators:
 - 1. Actuator shall have microprocessor based motor controller providing:
 - a. Electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.
 - b. Shall be incapable of burning out if stalled before full rotation is reached.
 - 2. Housing shall be steel and gears shall be permanently lubricated.

3. The actuators shall be direct coupled and employ a steel toothed clamp for connecting to damper shafts. Aluminum clamps or set-screw attachment are not acceptable.
 4. Actuator shall have UL555S Listing by the damper manufacturer for a temperature equal to the damper. Actuators shall draw no more than .23A at 120V or 24V running, or .1A holding at 120V or 24V (27 VA and 10 VA respectively for 24V power) for 70 in-# of torque.
 5. Actuator shall carry a manufacturer's 5-year warranty and be manufactured under ISO 9001 quality control
 6. Damper actuators shall be Belimo Aircontrols FSLF (30 in-#) or FSNF (70 in-#).
- G. Where indicated on drawings, or where required by the sequence of controls, provide factory mounted blade position switches to indicate fully open and fully closed.
- H. Damper actuator shall fail open/close upon loss of power/control air.
- I. UL 555S & Class II.

2.7 COMBINATION FIRE/SMOKE DAMPERS:

- A. Rectangular Fire/Smoke Dampers: 16 gauge galvanized steel frame, type 304 stainless steel side seals, combination silicone/galvanized steel edge seals, bronze oilite or stainless steel sleeve bearings, airfoil shaped galvanized steel parallel acting blades, square or horizontal plated steel axles, out of airstream in-jamb linkage with stainless steel pivots, factory sleeve, caulked and attached to damper in accordance with UL fire damper requirements.
1. Ruskin FSD-60 or approved equivalent.
 2. Ruskin FSD-60V or approved equivalent where axles must be vertical.
- B. Round Fire/Smoke Dampers 18" Diameter and Smaller: 20 gauge galvanized steel frame/integral sleeve, 2 layer galvanized steel butterfly blade equivalent to 14 gauge, silicone rubber seal sandwiched between blade layers, stainless steel sleeve bearings pressed into frame, retaining plates in accordance with the UL listing.
1. Ruskin FSDR-25 or approved equivalent.
 2. Use rectangular damper with smooth square/round transitions for dampers over 18".
- C. Paint sleeve with red enamel finish.

<p>Edit Note: Use "D" for most jobs. Coordinate voltage. Edit out electric actuator when pneumatic is available.</p>
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- D. Provide factory mounted spring return pneumatic actuator, 120V electro-pneumatic valve, 120V/24V electric actuator and electric heat actuated manual reset release device. The damper shall at all times be connected to the actuator. The damper closure shall be controlled to not less than 7 seconds and no more than 15 seconds. Release device shall be set at 165°F, unless otherwise noted. Replaceable, fusible elements are not acceptable. Actuator shall be suitable for 20 psi control air.

Edit Note: Use "E" only for projects requiring remote operation during fire conditions, such as an engineered smoke control system. Specify the reset panel and/or fire fighters control panel under either the Fire Alarm or Temperature Control Section. Coordinate with Electrical.

- E. Provide factory mounted pneumatic spring return actuator, 120V/24V electro pneumatic valve, and an automatic reset thermal release device set to close the damper at 165°F/212°F. In addition, provide a second manual reset thermal release device set to close the damper when the duct temperature is above the damper's degradation temperature. Provide factory mounted and wired terminal strip to allow field connection of normal and override circuits. "Normal" circuit shall be through both thermal release devices, "override" circuit shall bypass first thermal release device but shall include second high limit device. The damper shall at all times be connected to the actuator. Damper closure shall be controlled to not less than 7 seconds and not more than 15 seconds. Replaceable fusible elements are not acceptable. Actuator shall be suitable for 20 psi control air.

Edit Note: Use "F" for budget driven projects with control air available. Or where multiple dampers are controlled with a single E/P switch.

- F. Provide factory mounted pneumatic spring return actuator, 120V electro-pneumatic valve (where shown on the drawings) and a fusible element in the pneumatic line. The fusible element shall vent the line, closing the damper, when the duct temperature exceeds 165 deg. F. The damper closure shall be controlled to not less than 7 seconds and not more than 15 seconds. The damper actuator shall be suitable for 20 psi control air.
- G. Electric Damper Actuators:
1. Actuator shall have microprocessor based motor controller providing:
 - a. Electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.
 - b. Shall be incapable of burning out if stalled before full rotation is reached.
 2. Housing shall be steel and gears shall be permanently lubricated.
 3. The actuators shall be direct coupled and employ a steel toothed clamp for connecting to damper shafts. Aluminum clamps or set-screw attachment are not acceptable.
 4. Actuator shall have UL555S Listing by the damper manufacturer for a temperature equal to the damper.
 5. Actuators shall draw no more than .23A at 120V or 24V running, or .1A holding at 120V or 24V (27 VA and 10 VA respectively for 24V power) for 70 in-# of torque.
 6. Actuator shall carry a manufacturer's 5-year warranty and be manufactured under ISO 9001 quality control.
 7. Damper actuators shall be Belimo Aircontrols FSLF (30 in-#) or FSNF (70 in-#).
- H. Where indicated on the drawings or indicated in the sequence of control, provide factory mounted blade position switches to indicate fully open and fully closed.

- I. Damper actuator shall fail close upon loss of power/control air.
- J. 1 1/2 hour or 3 hour rating as required by construction type.

Edit Note: Use 350° for engineered smoke control systems.

- K. UL 555, 555S, Class II, 250°F/350°.
- L. Suitable for vertical or horizontal mounting.
- M. Leakage not greater than 10 CFM per square foot at 1" W.C. pressure differential.

2.8 TURNING VANES:

- A. Fabricated Turning Vanes: Provide fabricated 22 gauge, single blade or 24 gauge double bladed 4-1/2" radius, 3-1/4" spacing turning vanes and type 2, 4-1/2" wide runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" Fig 2.3.
- B. Turning vanes as a part of PVC coated air systems shall be PVC coated.
- C. Do not use trailing edge turning vanes.

2.9 DUCT HARDWARE:

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
- B. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
- C. Quadrant Locks: Provide for each manual volume damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.10 DUCT ACCESS DOORS:

- A. Access Doors for Low Pressure Rectangular Duct: Construct of same or greater gauge as ductwork served, provide double wall insulated doors for insulated ductwork. Exposed insulation adhered to door is not acceptable. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. All access doors shall have gasket and will be air tight. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors. Where a hinged door can not be fully opened a removable door may be used.
- B. Access Doors for Medium and High Pressure Rectangular Duct: Insulated double wall round door and frame arranged for "Spin-In" installation, with continuous gasket in frame for door. Leakage of less than .5 cfm at 6" W.G.

Flexmaster "Inspector Series Spin Door" or equivalent.
- C. Access Doors for Round Duct 20" and Less: Sandwich type door, constructed of an insulated double wall outer door connected to gasketed inner plate carriage bolts with hand knobs, and formed to fit the radius of the duct.

Ductmate "Sandwich" or equivalent.

- D. Access Door for Round Duct Greater Than 20": 18" round insulated double wall access door in gasketed frame, attached to duct section similar to tee fitting.
- E. Access Doors for Flat Oval Duct: Use door specified for medium and high pressure rectangular duct in flat portion, use door specified for round duct in curved portion.

Use the following for fume/exhaust systems.

- F. All access doors in exhaust system shall have inside duct surface PVC coated or at the Contractor's option, Heresite coated as specified in this section.

2.11 FLEXIBLE CONNECTIONS:

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Shelf life shall be verified to not exceed six (6) months. Any sign of cracking on interior or exterior shall be cause for replacement immediately.
- B. Use the following product types for each application accordingly:
 1. Indoor Equipment Non-Corrosive Air Systems: Heavy glass fabric, double-coated with DuPont's NEOPRENE, non-combustible fabric, fire retardant coating with good resistance to abrasion and flexing. Fabric shall be 30 oz per square yard, capable of operating at -10°F to 200°F, waterproof, air tight, 6 inches wide, complies with NFPA 90 and UL Standard #214. "Ventglas" Model as manufactured by VentFabric, Inc.
 2. Outdoor Equipment Non-Corrosive Air Systems (exposed to weather and sun): Heavy glass fabric, double-coated with DuPont's HYPALON, non-combustible fabric, fire retardant coating with superb resistance to sunlight, ozone and weather which has documented 20-year-old exposure tests. Fabric shall be 26 oz per square yard, capable of operating at -10°F to 250°F, waterproof, air tight, 6 inches wide, complies with NFPA 90 and UL Standard #214. "Ventlon" Model as manufactured by VentFabrics, Inc.
 3. High Temperature Non-Corrosive Air Systems: Heavy glass fabric coated with silicone rubber, non-combustible fabric, fire retardant coating, capable of operating and maintaining flexibility between temperatures of -25°F to 500°F. Fabric shall be 16 oz. per square yard, waterproof, air tight, 6 inches wide, complies with NFPA 90, UL Standard #214. "Ventsil" Model as manufactured by VentFabrics, Inc.
 4. Indoor Corrosive Air System: Heavy glass fabric coated with DuPont's teflon fluorocarbon resins, capable of operating between temperatures of - 20°F and 500°F. Fabric shall be 14 oz per square yard, watertight, air tight, chemically resistant to most chemicals including but not limited to sulfuric acid, acetic acid, chlorine, dimethyl ether, xylene, hexane, ozone, nitric acid, butyl acetate, ammonia gas and liquid, acetone, mercury, cyclohexane, methanol, 6 inches wide "Ventel" model as manufactured by VentFabrics, Inc.

5. Outdoor Corrosive Air Systems: Composite a 2-layer flexible duct connection using 1 layer Vent Fabrics Ventlon (sun-resistant) and 1 layer of VentFabrics Ventel (corrosion resistant), installing the Ventlon exposed to the weather and the Ventel exposed to air stream.

OR

For high pressure or severe, special duty applications.

6. For flanged fan connections provide round and/or rectangular as required, General Rubber Corporation, style 1092, carbon steel stainless steel back-up bars, 6" face to face, Neoprene elastomers, with UV resistant stabilizer, spark and corrosion resistant, suitable to 225 F. ± 2 psi (± 55.4 " W.C.) pressure rating.

For larger than 60" round diameter provide slip over type General Rubber Corporation style 1087 with stainless steel screw clamp.

Consider use of multiple small blenders for better turndown for VAV systems. CAUTION: See page 12 Blender Products Catalog, Detail #2.

2.12 AIR BLENDERS:

- A. Air blender(s) shall be of the type, size, pressure drop and capacity as scheduled and shown on the drawings.
- B. All units shall be factory built and tested, and shall be installed in strict accordance with manufacturer's recommendations and as shown on drawings.
- C. Fabrication shall be of .080 gauge aluminum, and all welded construction.
- D. Units shall be completely fixed devices, with no moving parts, that shall be capable of providing mixed air temperature within ± 6 degrees F. standard deviation from the theoretical mixed air temperature.

The following flow measuring station specification is based upon the Air Monitor fan mounted Vol-U-Probe and can be modified for duct mounted applications and is accurate to within 3% for more accurate requirements, use FAN-E and DAM1

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Engineer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES:

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

- B. Install turning vanes in square or rectangular 90 deg. elbows in supply, return and exhaust air systems, and elsewhere as indicated.
 - C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
 - D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
 - E. Provide duct access doors whether shown or not for inspection and cleaning upstream of all coils, fans, automatic dampers, fire dampers (minimum 16" x 24" in ducts larger than 18"), fire/smoke dampers, duct smoke detectors and elsewhere as indicated. Review locations prior to fabrication. Provide multiple access doors for large ductwork to provide adequate reach to equipment.
 - F. Install fire dampers and smoke dampers in accordance with manufacturers instructions.
 - G. Provide fire dampers and smoke dampers at locations shown, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction.
 - H. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing.
 - I. Provide balancing dampers on high pressure systems where indicated. Use splitter dampers only where indicated on Drawings.
 - J. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration. Provide matching flanged backing frame with flexible connector where flanged fan connections are provided.
- 3.3 COORDINATION:
- A. Coordinate with installers of other work to ensure that operators, reset devices, and fusible links are accessible at all fire, smoke, and fire/smoke dampers.
 - B. Show access space on coordination drawings. Locate over lay-in ceilings and above corridors wherever practical.
 - C. Order right/left/top/bottom arrangement as required to minimize field modifications.
- 3.4 FIELD QUALITY CONTROL:
- A. Operate installed ductwork accessories after installation to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.
 - B. After installation, test every fire and fire/smoke damper for proper operation, provide letter to the Architect/Engineer certifying this work is complete and all dampers are functioning properly.
- 3.5 ADJUSTING AND CLEANING:
- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
 - B. Label access doors in accordance with Division-15 section "Mechanical Identification".

C. Final positioning of manual dampers is specified in Division-15 section "Testing, Adjusting, and Balancing".

D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

E. Touch up all scratches in PVC or Heresite coated surfaces with respective coating finish.

3.6 EXTRA STOCK:

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 15910