SECTION 230550

VIBRATION ISOLATION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Centrifugal Inline Fans: Section 233415.

1.02 SUBMITTALS

A. Product Data:
   1. Catalog sheets, specifications, and installation instructions.
   2. Vibration isolator schedule showing usage.

PART 2 PRODUCTS

2.01 MANUFACTURERS/COMPANIES

A. Amber-Booth Co.

B. Korfund Dynamics Corp.

C. Mason Industries Inc.

D. Vibration Eliminator Co., Inc.

E. Vibration Mountings and Controls, Inc.

2.02 COMBINATION RUBBER AND SPRING ISOLATORS

A. Type: Combination rubber and spring type designed for insertion in a split hanger rod for isolating equipment from the overhead construction.
   1. Approved isolators: Amber Booth Type BSSR, Korfund Type VX, Mason Industries, Type DNHS, Vibration Eliminator Co. Type SNRC and Vibration Mountings and Controls Type RSH.

PART 3 EXECUTION

3.01 APPLICATION

A. Provide vibration isolators for mechanical equipment as specified.

B. Select isolation devices for uniform static deflection, in accordance with the distribution of weight and forces.
   1. Whenever rotational speed is the cause of disturbing frequency, utilize the lowest operating speed of the equipment in determining the type of isolation required.
   2. Selection shall result in uniform loading and deflection, even when equipment weight is not evenly distributed.
   3. Select springs for a total deflection greater than the selected static deflection, to provide an adequate safety factor.

3.02 VIBRATION ISOLATION SCHEDULE

A. Fans:
   1. Suspended Fans: Provide combination rubber and spring type isolators, designed for insertion in a split hanger rod.

3.03 FIELD QUALITY CONTROL

A. Field Inspections:
   1. Prior to initial operation, inspect the vibration isolators and seismic snubbers for conformance to drawings, specifications, and manufacturer's data and instructions.
      a. Check for vibration and noise transmission through connections and ductwork.

B. Spring Isolator Inspection
   1. After installation of spring isolators or protected spring isolators, and seismic restraint devices, the equipment shall rock freely on its spring isolators within limits of stops. Eliminate or correct any interferences.

END OF SECTION

SECTION 230594

BALANCING OF SYSTEMS

PART 1 GENERAL

1.01 SUBMITTALS

A. Quality Control Submittals:
   1. Testing, Adjustment and Balancing Reports:
      a. Submit final testing and balancing results on applicable report forms, as approved or furnished by the environmental systems balancing council or bureau, which is certifying the independent member agency performing the Work, required by this Section. Each final systems report form shall bear the signature of the person performing the Work and recording the data and the signature of the certified supervisor for the performing agency. Submit simultaneously with the final reports, a list of the instruments used with the last date of calibration for each instrument.

1.02 QUALITY ASSURANCE

A. Qualifications:
   1. Provide the services of a certified independent agency for the testing, adjustment and balancing of all air distribution and hydronic distribution systems complete with all connected apparatus and equipment. The agency shall be certified by the Associated Air Balance Council Bureau - AABC, Los Angeles, Cal. 90026 or by National Environmental Balancing Bureau - NEBB, Arlington, Va. 22209.
   2. The Work shall be performed by skilled mechanical technicians under the direct supervision of certified personnel in the employ of the independent agency. The supervisor shall be personally certified by the national council or bureau.

1.03 SEQUENCING AND SCHEDULING

A. Scheduling:
   1. Perform environmental systems testing and balancing after cleaning, miscellaneous testing, adjustment and operational testing Work has been completed.
   2. Send written notification to the Director a minimum of five days prior to the performance of testing and balancing Work. Perform testing and balancing Work in the presence of the Director's Representative.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. General Information: Test instruments are included in this specification for information only. Balancing of air systems shall be performed by qualified personnel utilizing company owned test instruments, which will remain the property of the company. Use test instruments which are in first class operating condition, with individual calibration histories to guarantee their accuracy. Test instruments shall be of type and kind as required by the type of system installed. Trade names and manufacturer's names are mentioned in this section for descriptive purposes only; instruments of equivalent range and capabilities may be utilized.

B. Air Balancing Instruments:
   1. Manometers: Inclined with ranges of 0 to 1/4 inch and 0 to 1 inch; Combination inclined and vertical with a range of 0 to 5 inches and U tube type, 18 inches.
   2. Portable "Magnehelic" Draft Gages: Ranges 0 to 1/2 inch, 0 to 1 inch and 0 to 5 inches.
   3. Anemometers: Deflecting vane type with a range of 100 to 3000 fpm, similar to Alnor Velometer Model 6000 BP and 4 inches diameter rotating vane type.
   4. Pitot Tubes: ASHRAE standard type, stainless steel, 5/16 inch diameter, lengths as required.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Inspection: Prior to the environmental testing and balancing of air distribution systems, the certified supervisor in the employ of the testing and balancing agency shall inspect the installations and notify of any Work which must be performed or modified prior to initiating testing and balancing procedures.

B. Performance: Test and balance environmental air distribution systems, including all connected equipment and apparatus, so as to conform to the design conditions. Perform the Work of this section in accordance with the published standards of the balancing council or bureau, which is certifying the member firm. Record all test readings, calculations and results.

END OF SECTION

SECTION 230719

INSULATION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Through Penetration Firestops: Section 078400.

B. Painting: Section 099103.

1.02 ABBREVIATIONS

A. FS: Federal Specification.

B. K: Thermal Conductivity, i.e., maximum Btu per inch thickness per hour per square foot.

C. pcf: Pounds per cubic foot.

D. PVC: Polyvinylchloride.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog sheets, specifications and installation instructions for insulation materials and jacket materials.
   2. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate option selected.

B. Quality Control Submittals:
   1. Installers Qualification Data:
      a. Name of each person who will be performing the Work, and their employer's name, business address and telephone number.
      b. Furnish names and addresses of the required number of similar projects that each person has worked on which meet the qualifications.

1.04 QUALITY ASSURANCE

A. Qualifications: The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of 5 years.

B. Regulatory Requirements:
1. Insulation installed inside buildings, including duct lining materials, laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 PRODUCTS

2.01 INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.
1. Block or Board Insulation: Minimum density 3.0 pcf and 6.0 pcf as specified; ASTM C 612:
a. Type IA or IB (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
b. Type II (Suitable for Temperatures 451 to 850 degrees F): K of 0.44 at 300 degrees F.
c. Type III (Suitable for Temperatures 851 to 1000 degrees F): K of 0.44 at 300 degrees F.
d. Type IV (Suitable for Temperatures 1001 to 1200 degrees F): K of 0.37 at 300 degrees F.
e. Type V (Suitable for Temperatures 1201 to 1800 degrees F): K of 0.42 at 300 degrees F.
2. Blanket Insulation:
a. For Ductwork (Suitable for Temperatures Up to 450 Degrees F): Minimum density 1.0 pcf, K of 0.31 at 75 degrees F; ASTM C 553, Type II.

B. High Density Jacketed Insulation Inserts for Hangers and Supports:
1. For Use with Fibrous Glass Insulation:
a. Ductwork: Fibrous glass board, minimum density 6 pcf, K of 0.26 at 75 degrees F, conforming to ASTM C 612, Type IA or IB.

C. Cements:
1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.
2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.02 JACKETS

A. Laminated Vapor Barrier Jackets for Ductwork: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Types I and II.
1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.
2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.

2.03 ADHESIVES, MASTICS, AND SEALERS

A. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

B. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

C. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

D. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

2.04 MISCELLANEOUS MATERIALS

A. Insulation Fasteners for Ductwork and Equipment:
   1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.
   2. Type: Weld pins, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:
   1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.
   2. Type: Same construction as jacket.

C. Wire, Bands, and Wire Mesh:
   1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel, gage as specified.
   2. Bands: Galvanized steel, 1/2 inch wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.
   3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform the following before starting insulation Work:
   1. Install hangers, supports and appurtenances in their permanent locations.
   2. Complete testing of ductwork, and equipment.
   3. Clean and dry surfaces to be insulated.

3.02 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

3.03 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced while installing insulation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated ductwork and equipment.

C. Insulation Inserts For Use with Fibrous Glass Insulation:
   1. Ductwork: Install 6 pcf density jacketed fibrous glass board, same thickness as adjoining insulation, sized for full bearing on supporting trapeze member, and as required to enable abutting to adjoining insulation and overlapping of jacketing.

3.04 INSTALLATION OF DUCTWORK INSULATION

A. Fibrous Glass Board Insulation Application:
   1. Secure insulation to ductwork, with duct insulation fasteners spaced 3 inch in from all corners of ducts, with intermediate fasteners on maximum 16 inch centers in all directions.
   2. Butt edges of insulation and fill voids with similar insulation.
   3. Seal minimum 1-1/2 inch wide longitudinal jacket laps continuously with vapor seal adhesive.
   4. Lap circumferential joints with 4 inch wide jacket material and seal laps continuously with vapor barrier lap adhesive, or seal continuously with minimum 3 inch wide pressure sensitive sealing tape, of same material as jacket.

B. Fibrous Glass Blanket Insulation Application:
   1. Cut insulation to stretch-out dimensions as recommended by insulation manufacturer.
   2. Remove 2 inch wide strip of insulation material from the jacketing on the longitudinal and circumferential joint edges to form an overlapping staple/tape flap.
   3. Install insulation with jacketing outside so staple/tape flap overlaps insulation and jacketing on other end.
   4. Butt ends of insulation tightly together.
      a. Rectangular and Square Ductwork: Do not compress insulation at duct corners.
   5. Staple longitudinal and circumferential joints with outward clinching staples minimum 6 inches on center, and seal with pressure sensitive sealing tape.
   6. Cut off protruding ends of fasteners flush with insulation surface and seal with pressure sensitive sealing tape.
   7. Install duct insulation fasteners on bottom side of horizontal duct runs, when bottom dimension of the duct is in excess of 24 inches in width.
   8. Install duct insulation fasteners on sides of duct risers having a dimension over 24 inches in size.
   9. Seal tears, punctures, and penetrations of insulation jacketing with sealing tape.

10. Secure insulation to ductwork with fasteners spaced in accordance with the following schedule:

DUCT DIMENSION	SPACING OF FASTENERS (MINIMUM)
Up to 24 inches	None required.
24 inches to 48 inches	Horizontal Runs: 2 rows - 16 inches on center. Risers: 16 inches on center, all directions.
49 inches to 60 inches	Horizontal Runs: 3 rows - 16 inches on center. Risers: 16 inches on center, all directions.
61 inches and over	Horizontal Runs: 16 inches on center, all directions. Risers: 16 inches on center, all directions.

C. Bench Insulated Ductwork:
1. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork, which will not permit adequate space for installation of insulation after ducts are installed.

3.05 DUCTWORK SERVICE INSULATION SCHEDULE

A. Insulate all ductwork service except where otherwise specified.

B. Do not insulate the following ductwork service items:
1. Exhaust fans.
2. Flexible ductwork connections.

3.06 DUCTWORK SERVICE INSULATION MATERIAL SCHEDULE

LOCATION	SERVICE	INSUL. MATERIAL	MINIMUM INSUL. THICKNESS	JACKET TYPE	MINIMUM REQUIRED R VALUE
Inside building but exposed to outside air temp., e.g., ventilated attic.	All Ducts.	Fibrous Glass Blanket	2	I or II	R-8
		Fibrous Glass Board	2	I or II	

END OF SECTION

SECTION 230933

TEMPERATURE CONTROL SYSTEM – ELECTRIC ELECTRONIC

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Control Wiring: Section 260523.

1.02 SUBMITTALS.

A. Product Data:
   1. Catalog sheets, specifications, standard schematic drawings and installation instructions for each item specified. Include a valve schedule and flow diagram of system.

PART 2 PRODUCTS

2.01 MANUFACTURERS/COMPANIES

A. Barber Colman Co.

B. Honeywell Co.

2.02 MATERIALS

A. General:
   1. All temperature control equipment shall be the product of one manufacturer, unless otherwise specified.

2.03 MISCELLANEOUS PRODUCT REQUIREMENTS

A. Unless otherwise specified or indicated, the following features are required for the equipment specified:
   1. Humidity control equipment installed on insulated surfaces: Provide extension pieces or rigid insulating mounting back plates, of depth as required, so that equipment backs finish flush with final insulated surface.
   2. Acceptable Manufacturers: Johnson Service Co., Honeywell Co.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide electric operated systems of humidity control, as noted on the drawings and as specified. Provide all necessary relays, mounting brackets, gages,

switches and accessories required, even though not specifically called for, so as to result in complete workable systems.

B. Control Wiring: Install complete control wiring systems in accordance with applicable electric sections included in this specification.

C. General Notes:
1. Test all electric equipment provided under this Section.

END OF SECTION

SECTION 233113

METAL DUCTWORK

PART 1 GENERAL

1.01 REFERENCES

A. American Conference of Governmental Industrial Hygienists (ACGIH).

B. National Fire Protection Association (NFPA).

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.02 SUBMITTALS

A. Shop Drawings:
   1. Layouts for areas in which it may be necessary to deviate substantially from layout shown on the Drawings. Show major relocation of ductwork and major changes in size of ducts. Minor transitions in ductwork, if required due to job conditions, need not be submitted as long as the duct area is maintained.
   2. Details of intermediate structural steel members required to span main structural steel for the support of ductwork.
   3. Method of attachment of duct hangers to building construction.

B. Product Data: Material, gage, type of joints, sealing materials, and reinforcing for each duct size range, including sketches or SMACNA plate numbers for joints, method of fabrication and reinforcing. Include ACGIH figure numbers for hoods if applicable.

1.03 QUALITY ASSURANCE

A. SMACNA: Gages of materials, fabrication, reinforcement, sealing requirements, installation, and method of supporting ductwork shall be in accordance with the following SMACNA manuals, unless otherwise shown or specified:
   1. HVAC Duct Construction Standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet Metal:
   1. Galvanized Steel: ASTM A653, Class LFQ (lock forming quality), coating designation G-90.

B. Duct Hangers:
   1. Strap Hangers: Same material as ducts, except that hangers for stainless steel ducts in unfinished spaces may be galvanized steel.
   2. Rod Type Hangers: Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with 2 removable nuts each end for positioning and locking rod in place. Unless stainless steel, galvanized or cadmium plated; shop coat with metal primer.

C. Miscellaneous Fasteners and Upper Hanger Attachments:
   1. Sheet Metal Screws, Machine Bolts and Nuts: Same material as duct, unless otherwise specified.
   2. C Clamps: Fee & Mason Co.'s 255L with locking nut, and 255S with retaining strap.

2.02 FABRICATION - GENERAL

A. Dissimilar Metals: Separate dissimilar metals used for ductwork with 12 oz vinyl coated woven fiberglass duct connector fabric, such as Duro Dyne's Glasseal. No separation is required between screws or rivets and the materials in which they are inserted.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install ductwork to allow maximum headroom. Properly seam, brace, stiffen, support and render ducts mechanically airtight. Adjust ducts to suit job conditions. Dimensions may be changed as approved, if cross sectional area is maintained.

B. Provide necessary transformation pieces, and flexible fabric connections for ductwork connected to air handling equipment or air inlet and outlet devices.

3.02 SEALING SEAMS, JOINTS, AND PENETRATIONS

A. Seal ductwork in accordance with the SMACNA Manual except for the following:
   1. Ductwork Specified to be Insulated: Conform with Seal Class A for all pressure classes.

3.03 HANGERS FOR DUCTS, UNDER 2 INCHES W.G.

A. Install hangers for ducts as specified in the SMACNA Manual, with the following exceptions:
   1. Rectangular ducts up to 42 inches wide, not having welded or soldered seams, and supported from overhead construction; extend strap hangers down over each side of the duct and turn under bottom of duct a minimum of 2 inches. Secure hanger to duct with 3 full thread sheet metal screws, one in the bottom and 2 in the side of the duct.

2. Rectangular ducts 43 inches wide and over, and all sizes of duct with welded or soldered seams, and supported from overhead construction; use trapeze hangers.
3. Prime coat plain steel rods threaded at the site immediately after installation with metal primer.

3.04 UPPER HANGER ATTACHMENTS

A. General:
1. Secure upper hanger attachments to structural steel or steel bar joists wherever possible.
2. Do not use drive-on beam clamps, flat bars or bent rods, as upper hanger attachments.
3. Avoid damage to reinforcing members in concrete construction.
4. Metallic fasteners installed with electrically operated or powder driven tools may be used as upper hanger attachments, in accordance with the SMACNA Manual, with the following exceptions:
   a. Do not use powder driven drive pins or expansion nails.
   b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.
   c. Do not support a load, in excess of 250 lbs from any single welded or powder driven stud.
   d. Do not use powder driven fasteners in precast concrete.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by ductwork support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.
1. Secure upper hanger attachments to steel bar joists at panel points of joists.
2. Do not drill holes in main structural steel members.

C. Attachment to Wood Construction:
1. Secure strap hangers to the sides of wood beams with one No. 18 x 1-1/2 inch long (minimum) wood screws or 2 No. 16 x 1-1/2 inch long (minimum) drive screws. Do not hammer in wood screws.
2. Secure rod hangers to angle iron clip angles, bolted or screwed to the sides of the wood beams with 3/8 inch bolts or 3/8 inch lag screws. Install hanger rods with a threaded end through a hole in the angle, secured with a double nut, one above and one below the angle. Do not use lag screws in wood beams, having a nominal face width under 2 inches. Install bolts or lag screws in the side of beams at mid-point or above.
3. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.

3.05 DUCT RISER SUPPORTS, UNDER 2 INCHES W.G.

A. Support vertical round ducts by means of double-ended split steel pipe riser clamps bearing on floor slabs or adjacent structural members, at every other floor through which the riser passes.

B. Unless otherwise specified or shown on the drawings, support vertical rectangular ducts by means of two steel angles, secured to duct and resting on floor slab or adjacent structural steel member, at every other floor through which the duct passes. Size supports as follows:

MAX. SIDE DIMENSION (inches)	SUPPORT ANGLE (inches)	SECURE TO DUCT WITH	MIN BEARING AT EACH END (inches)
36	1 x 1 x 1/8	Screws	2
48	1-1/2 x 1-1/2 x 1/8	Bolts	3
60	2 x 2 x 1/8	Bolts	3
61 - up	2-1/2 x 2-1/2 x 3/16	Bolts	4

END OF SECTION

SECTION 233300

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Metal Ductwork: Section 233113.

1.02 REFERENCES

A. ACGIH: American Conference of Governmental Industrial Hygienists.

B. AMCA: Air Movement and Control Association.

C. NFPA: National Fire Protection Association.

D. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

E. UL: Underwriters Laboratories, Inc.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, diagrams, standard schematic drawings, and installation instructions for each manufactured product. Submit SMACNA Figure Numbers for each shop fabricated item.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Unless otherwise shown or specified, comply with the applicable requirements of the following:
      a. SMACNA: Gages of materials, fabrication, sealing, and installation shall be in accordance with the SMACNA Manuals.
         1) HVAC Duct Construction Standards.
      b. UL: Standards No. UL181, UL555, and UL555S.

1.05 MAINTENANCE

A. Special Tools:
   1. Two keys or socket wrenches for each type of damper adjustment screw or device on manual damper regulators.

PART 2 PRODUCTS

2.01 DAMPERS

A. Balancing Dampers (Galvanized Steel):
   1. Types:
      a. Standard Damper: 40 cfm/sq ft maximum leakage rate at 1500 fpm and 1 inch wg for 48 inch wide damper (based on AMCA 500).
   2. Frame: 16 gage galvanized steel hat channel with corner braces, and welded joints.
      a. Frame Size:
         1) Dampers 13 inches high and under: 3-1/2 inch x 3/8 inch top and bottom frames.
         2) Dampers over 13 inches high: 5 inch x 1 inch.
   3. Blades:
      a. Standard Damper: Single skin, 16 gage galvanized steel with longitudinal reinforcing grooves. Single blade dampers are acceptable for ducts up to 14 inches high.
   4. Axles: 1/2 inch plated steel hex positively locked to blade, and connected to frame through extruded hole with molded synthetic sleeve bearings.
   5. Extended Shaft Assembly: Consisting of outboard support bracket, extended shaft rod, extended shaft.
      a. Suitable for 2 inches of insulation.
   6. Damper Operation:
      a. Standard Damper: Manually operated by lockable hand quadrant.
   7. Linkage:
      a. Single Section Dampers: In-frame fixed type with removable 1/2 inch dia control shaft extending 6 inches from damper frame, and outboard support bearing.
   8. Finish: Mill galvanized.

B. Fire Dampers, Dynamic Systems:
   1. UL Classified and Labeled:
      a. Mark dampers in accordance with UL555, including but not limited to the following:
         1) Fire Damper, 1-1/2 hr fire resistance rating.
         2) For use in dynamic systems.
         3) Maximum rated air flow and pressure difference across damper.
         4) Directional arrow indicating air flow.
         5) Mounting position (horizontal or vertical, or both).
   2. Acceptable Manufacturers:
      a. Air Balance, Inc., or Ruskin Manufacturing Div., Phillips Industries.
         1) Furnish Style, or Type B (blades out of air stream when damper in open position).

C. Multiple Blade Type Combination Fire/Smoke Dampers:
   1. UL Classified and Labeled:

a. Fire Resistance Rating 1-1/2 hr.
b. Leakage Classification: Class II.
c. Degradation Test Temperature: 350 degrees F.

2. Actuator: Electric motor with fusible link override.

D. Manual Damper Regulators:

1. For Dampers Installed in Exposed, or Accessible Concealed Ductwork: Indicating quadrant with heavy metal handle, end bearing, and means for locking damper in all positions.
2. For Dampers Installed in Inaccessible Concealed Ductwork: Concealed type with indicating regulator in cast metal box with cover plate. Furnish assembly complete with duct end bearing, adjustment coupling, and damper extension rods.

2.02 FLEXIBLE CONNECTIONS – FABRIC

A. Static Pressures under 6 inches WG: Woven Fiberglass fabric with Hypalon coating; similar to Duro Dyne Corp.'s Durolon.

B. Factory prefabricated and pre-assembled connectors of fabric materials specified above are acceptable with minimum 24 gage galvanized steel edges similar to Duro Dyne Corp.'s Metal-Fab or Super Metal-Fab as required by free fabric length.

2.03 GASKET MATERIAL

A. Flanged Joints in Ducts: 1/8 inch thick reinforced inert plastic of the self-conforming type, of same width as flange.

2.04 SEALANTS

A. Acceptable Manufacturers: Duro Dyne Corp.; Foster Products Div., H.B. Fuller Co.; Hardcast Inc.; United Sheet Metal Div., United McGill Corp.

B. U.L. Listed adhesives (liquid or mastic), scrim, tapes, or combinations thereof, as required for pressure class; suitable for system operating temperatures; compatible with media conveyed within, insulation (if any), and ambient conditions.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Unless otherwise shown or specified, install the Work of this Section in accordance with the manufacturer's printed installation instructions and the SMACNA Manual.

3.02 FLEXIBLE FABRIC CONNECTORS (INSTALLATION)

A. Make ductwork connections to air handling equipment with flexible fabric connectors. Install connectors with sufficient slack to prevent vibration transmission.

B. Free Fabric Length: Install fabric connectors a minimum of three inches in length for ducts having a maximum diameter of 18 inches, or maximum side dimension of 30 inches, and a minimum of five inches in length for duct diameters over 18 inches or side dimensions over 30 inches.

C. Secure fabric connectors to fans, casings and ducts as follows:
   1. Round Connectors: Secure with No. 12 USS gage x 1 inch wide galvanized steel draw bands. Secure bands with bolts and nuts.
   2. Rectangular Connectors: Secure with 1 inch x 1/8 inch thick flat galvanized steel bars, with screws or bolts on maximum 8 inch centers, or with approved sheet metal slip joints. Tightly crimp fabric into sheet metal joint and secure complete joint with sheet metal screws on maximum 6 inch centers.

D. Fabric connectors may be factory pre-fabricated pre-assembled units, with minimum No. 24 USS gage metal edges, secured to fabric with double lock seams.

E. Do not paint fabric connectors.

END OF SECTION

SECTION 233415

CENTRIFUGAL IN-LINE FANS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Vibration Isolation: Section 230550.

B. Metal Ductwork: Section 233113.

C. Flexible Connections: Section 233300.

1.02 SUBMITTALS

A. Product Data: Catalog sheets, including rated capacities of each unit, dimensional data, operating weights, accessories, material finishes, and installation instructions.

B. Quality Control Submittals:
   1. Certified fan performance curves.

C. Contract Closeout Submittals:
   1. Operation and Maintenance Data: Deliver 2 copies covering the installed products, to the Director's Representative.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Each fan shall bear AMCA Seal indicating that fans comply with AMCA 211, Certified Ratings Program - Air Performance, and AMCA 311, Certified Sound Ratings Program for Air Moving Devices.
   2. Operating Limits: Classify according to AMCA 99-2408.
   3. Sound power level ratings shall comply with AMCA Standard 301, Method for Calculating Fan Sound Ratings from Laboratory Test Data.
   4. Electrical components shall be UL listed and labeled.

1.04 REFERENCES

A. ABMA: American Bearing Manufacturer's Association (formerly AFBMA).

B. AMCA: Air Movement and Control Association.

C. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units to the extent allowable by shipping limitations, with protective crating and coverings.

PART 2 PRODUCTS

2.01 ACCEPTABLE FANS

A. Greenheck Fan Co., PO Box 410, Schofield, WI 54476, (715) 359-6171, www.greenheck.com
   1. Direct Drive Fans: Model SQ.

B. Penn Barry Ventilation, 1401 North Plane Road, Richardson, TX 75081, (972) 234-3202, www.pennbarry.com.
   1. Direct Drive Fans: Model Centrex Inliner SX.

C. Loren Cook Co., P.O. Box 4047, Springfield, MO 65808, (417) 869-6474, www.lorencook.com.
   1. Direct Drive Fans: Model SQI-D.

2.02 CENTRIFUGAL IN-LINE FANS

A. Housing: Rigid galvanized steel structural members and galvanized steel panels.
   1. Inlet Cones: Deep spun or die formed type.
   2. Inlet and Discharge Duct Collars: Angle flanges, with drilled or punched holes at uniform intervals, extending beyond the housing to provide continuous duct connections
   3. Support Angles: Heavy gage steel, shipped loose, for installing vibration isolation or bolting unit to solid foundation.
   4. Vibration Isolation: Isolates motor assembly from fan housing.
   5. Removable Access Panels: Galvanized steel with neoprene gaskets, minimum of 2 required.

B. Centrifugal Fan Wheel: Statically and dynamically balanced backward inclined type constructed of aluminum, spark resistant, non overloading, and matched with deeply spun venturis.

C. Direct Drive Motor: Directly connected, totally enclosed fan cooled, continuous duty, permanently lubricated, multi-speed type with thermal overload protection.
   1. Wired to external junction box.

D. Disconnect Switch: Unit mounted, UL approved for the use, non-fused safety type, NEMA 1 enclosure, factory wired from motor to external junction box.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of fans. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install fans in accordance with manufacturer's printed installation instructions.

B. Suspended Fans: Suspend fans from building construction with vibration isolation devices. See Section 230550.

C. Support fans independent from ductwork. See Section 233300.

D. Install units with clearances for service and maintenance.
   1. Provide clearance for complete wheel, motor and shaft removal.

3.03 FIELD QUALITY CONTROL

A. Inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Pre-start Up:
   1. Remove shipping blocking, and bracing.
   2. Verify lubrication for grease bearings and other moving parts.
   3. Set dampers in connected ductwork in proper position.

C. Start Up:
   1. Energize motor, verify proper operation of drive system, and fan wheel.

END OF SECTION