

SECTION 15731 -SPLIT SYSTEM HEATING AND AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ducted Split Systems.
- B. Forced air furnaces.
- C. Controls.
- D. Refrigerant and condensate piping and insulation.

1.2 REFERENCE STANDARDS

- A. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2006.
- B. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2006.
- D. NFPA 211 - Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances; National Fire Protection Association; 2003.

1.3 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.4 WARRANTY

- A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 DUCTED SPLIT SYSTEMS

- A. Air Handling Units
 - 1. Air Handling Units shall be factory fabricated draw through type with 1" throwaway filters, DX coils, electric heat and blower as scheduled on drawings, minimum capacities as indicated. Units shall provide capacities scheduled when positioned in configurations shown on drawings. Units shall include integral 24v transformer. Units shall be wired for single point of connection.

- power supply. All units shall be listed with UL and ARI 210/240 certified.
2. Casing shall be constructed of heavy duty sheet steel on galvanized steel frame, with baked enamel finish. Removable panels shall be provided for fan and coil sections and shall provide full access to all internal parts. Unit shall have filter access panel and filter rack. Casing shall have foil faced R04.2 (minimum) insulation. All insulating materials shall meet the requirements of NFPA 90A. Knockouts shall be provided for electrical wiring. Units shall have integral primary condensate pan with primary and secondary drain connections. Condensate drain pan shall be sloped toward drain, and of PVC or galvanized steel construction.
 3. Fans
 - a. Fans shall be forward curved, centrifugal, dynamically and statically balanced. Fan motors shall have permanently lubricated bearings, and thermal overload protection. Fan shall be mounted on vibration isolators.
 - 1) 1-1/2 to 5 tons: Fans shall be 3 speed. Provide variable speed air handlers where scheduled on plans.
 - 2) 7-1/2 to 20 tons. Adjustable belt drive with oversized motor available for high static application.
 - b. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
 - c. Sound Ratings: AMCA 301; tested to AMCA 300.
 4. Coils
 - a. Refrigerant Coils:
 - 1) Aluminum fins bonded to copper tube, pressure and leak tested to 375 psig.
 - 2) 7-1/2 to 20 tons: Dual circuits, where two stages are indicated on schedule. Split face for maximum latent performance at part load.
 - 3) Headers: Seamless copper tubes with silver brazed joints.
 - 4) Liquid Distributors: Brass or copper venturi distributor with seamless copper distributor tubes.
 - 5) Configuration: Down feed with bottom suction.
 - b. Electric Coils:
 - 1) Assembly: UL listed and labelled, with terminal control box and cover, splice box, coil, casing and controls.
 - 2) Coil: Exposed helical coil.
 - 3) Casing: Die formed channel frame of galvanized steel.
 - 4) Controls: Automatic reset thermal cut-out, built-in magnetic contactors air flow proving device.
 - c. Controls
 - 1) Controls shall include magnetic contactor for evaporator fan motor, low voltage terminal strip.
 - 2) 1-1/2 to 5 tons:

- (a) Capillary tube or flow control/check valve refrigerant control, unless TXV valve is recommended for application by equipment manufacturer.
 - 3) 7-1/2 to 20 tons:
 - (a) TXV valve refrigerant control.
 - (b) Evaporator defrost control for low evaporator temperatures to prevent compressor slugging.
 - 5. Filters
 - a. 1-1/2 to 5 tons: Section with filter guides, access doors for face loading. 1" deep disposable flat filters.
 - b. 7-1/2 to 20 tons: Section with filter guides, access doors from both sides, for side loading with gaskets. 2" pleated filters.
 - 6. Condensate Piping and Secondary Drain Pan
 - a. Condensate piping shall be copper or Schedule 40 PVC. All condensate piping within building shall be insulated with a minimum of 1/2" Armaflex unless otherwise specified.
 - b. Secondary drain pans shall be fabricated out of a single sheet of 24 gauge galvanized sheet metal to form a 1-1/2" deep (minimum) seamless pan with formed and sealed corners.
 - 7. Equipment Supports
 - a. Equipment supports shall be sized and designed to support the equipment and shall be fabricated from galvanized steel.
 - b. See submittal requirements in 15001.
- B. OUTDOOR UNITS
- 1. General
 - a. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, charging valves.
 - b. Construction and Ratings: In accordance with ARI 210/240. Testing shall be in accordance with ASHRAE Std 23.
 - c. Performance Ratings: Energy Efficiency Rating (EER) (and Coefficient of Performance (COP) for Heat Pumps) not less than prescribed by ASHRAE Std 90.1, or the Florida Energy Code.
 - 2. Casing
 - a. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish. Surfaces shall be satisfactorily tested to a 500 hour salt spray test. Provide drain holes for elimination of rain.
 - b. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors.
 - c. Provide removable access doors or panels with quick fasteners or piano hinges.
 - 3. Coils

- a. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of refrigerant.
 - b. Coil Guard: Louvered or PVC coated steel wire grille.
4. Fans and Motors
- a. Vertical discharge direct driven, statically and dynamically balanced propeller type condenser fans with aluminum blades and fan guard on discharge.
 - b. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in current and thermal overload protection.
5. Compressors
- a. Compressor: Hermetic scroll type or hermetic reciprocating, quantity as scheduled. Provide two stage compressors where scheduled on plans.
 - b. Mounting: Statically and dynamically balance rotating parts and mount on rubber-in-shear vibration isolators. Units of 10 tons and greater shall have internal spring isolation.
 - c. Lubrication System: Units of 7-1/2 tons and greater shall have Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.
 - d. Motor: Constant speed 3600 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter where applicable.
 - e. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.
6. Refrigerant Circuits
- a. Where 2 stages are scheduled, provide each unit with a minimum of two independent refrigerant circuits, factory supplied and piped.
 - b. For each refrigerant circuit, provide:
 - 1) Filter dryer.
 - 2) Insulated suction line.
 - 3) Suction and liquid line service valves and gage ports.
7. Controls
- a. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, factory wired with single point power connection.
 - b. For each compressor, provide contractor, integral overload protection, solid state time delay, and control power transformer or terminal for controls power. For each condenser fan, provide contractor.
 - c. Provide safety controls as follows:

- 1) High discharge pressure cutout switch for each compressor.
 - 2) Low suction pressure cutout switch for each compressor.
 - 3) Anti-short cycle timer for each compressor.
 - 4) Low ambient operating controls as indicated on schedule.
8. Equipment Supports
- a. See 15001 for requirements.

C. Thermostat

1. Provide a programmable thermostats with automatic changeover, adjustable deadband, and a minimum ranges of 55F to 85. Thermostat shall have separate, adjustable 7 day/24 hr. occupied and unoccupied schedules for system (compressor and blower) and ventilation (cycle with compressor or continuous during occupied period.)
2. Thermostat shall be compatible with equipment selected and shall be capable of performing control functions indicated. Match number of stages of heating and cooling as indicated on equipment schedules.
3. Provide manufacturer's recommended thermostats capable of optimizing multistage compressors and variable speed air handlers for humidity control where scheduled on plans.

2.2 REFRIGERANT PIPING AND ACCESSORIES

A. Tubing shall be Type ACR complying with ASTM B 280.

B. Insulate refrigerant suction piping as follows:

1. Above Grade or in PVC conduit: 3/4" thick, preformed, flame retardant, nitrile rubber based elastomeric insulation similar to Armstrong FR Armaflex.
2. Below Grade: 1" thick, pre-formed rigid cellular glass type similar to Pittsburgh Corning Foamglas. Finish with two coats of asphalt base mastic equal to Foster 60-25 reinforced with layer of glass fabric.
3. All insulation materials and coatings shall meet flame spread and smoke developed ratings per NFPA 90A when tested in accordance with ASTM Standard E-84. Smoke developed rating shall be less than or equal to 50, and flame spread rating shall be less than or equal to 25. All coatings and mastics shall be non-flammable in wet state.

C. Pipe Hangers

1. Pipe hangers shall be Auto-Grip, Fee and Mason, Grinnel, or approved equal, steel clevis hangers selected within the manufacturer's published load ratings.
2. Use vibration isolators in hanger rods whenever piping is subject to vibration, or where shown on drawings.

D. Sleeves

1. Sleeves shall be 18 gauge galvanized steel or preformed plastic. Sleeves shall be sized to allow approximately 1/8" gap around the pipe or its insulation.

2.3 GAS FURNACE COMPONENTS

- A. Heat Exchanger: stainless steel welded construction for direct vent, sealed combustion application.
- B. Burner: Atmospheric type with adjustable combustion air supply.
 - 1. Gas valve, two state provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 2. Electronic pilot ignition, with electric spark igniter.
 - 3. Combustion air damper with synchronous spring return damper motor.
 - 4. Non-corrosive combustion air blower with permanently lubricated motor.
- C. Burner Safety Controls:
 - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Flame Rollout Switch: Installed on burner box and prevents operation.
 - 3. Vent Safety shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
 - 4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- D. Operating Controls:
 - 1. Cycle burner by room thermostat to maintain room temperature setting.
 - 2. Supply fan energized from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction in configurations shown on plans.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. For belt driven air handlers, install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connects are parallel with minimum one inch flex between ductwork and fan while running.
- D. For ducted systems, provide sight glass in liquid line within 12 inches of coil.
- E. Condensate Drain Pan and Piping
 - 1. Run condensate drain lines (primary and secondary) from each air handling unit as noted on the Drawings. For primary line, provide a cleanout and trap (minimum depth per manufacturer) to prevent back suction into the air unit. Drain lines shall be sized to match equipment drains, but

not less than 3/4". Condensate drain piping (primary and secondary) shall be copper when installed in a plenum rated ceiling cavity or plenum rate room. If in question, contact Design Engineer.

2. Provide secondary drain pan positioned under air handling units, supported by suitable means consistent with standard industry practice or as indicated on plans.
 3. Insulate primary drain line piping in unconditioned spaced within the building.
- F. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.
- G. Install outdoor units level on concrete base, location as indicated. Where indicated on plans, install air handlers on concrete base, maintaining adequate clearance for condensate drain trap.
- H. Refrigerant Piping
1. Size and stall all refrigerant piping to complete the system connecting heat pumps/condensers to air handlers in accordance with the equipment manufacturer's instructions based on equipment size, route of piping (length of run and change in elevation), and good refrigeration system practice including reconnecting to existing heat pump/air conditioning units, where indicated. Braze all joints with silver alloy solder.
 2. Refrigerant pipe crossing a passageway in any building shall be not less than 7-1/2 feet above the floor or against the ceiling.
 3. Refrigerant piping installed in or below concrete floors shall be encased in pipe duct. Where piping passes through concrete or masonry walls, ceiling, floors, or beams, such piping shall be provided with metal sleeves or thimbles.
 4. Insulate refrigerant suction piping.
 5. After completion of entire system and before any pipe is covered, test the entire refrigerant circuit to assure that it is absolutely tight. Conduct low-side and high-side test in accordance with the Florida Building Code for minimum test pressure for the refrigerant used.
 6. After completion of leak testing, evacuate and charge the system utilizing a procedure approved by air conditioning unit's manufacturer.
 7. Controls
 - a. Furnish all controls and control wiring to provide for proper performance of equipment. Provide auxiliary contactors as necessary to accomplish control sequences.
 - b. Install all high voltage (120V or above) control wiring in EMT conduit. Install low voltage control wiring in conduit unless concealed in walls or above finished ceilings not used as supply or return air plenums. Do not run low voltage control wiring in the same conduit as high voltage control or power wiring.

3.2 Install gas fired furnaces in accordance with NFPA 54.

- A. Provide vent connections in accordance with NFPA 211.

END OF SECTION

SECTION 15810 - DUCTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Duct Insulation.

1.2 RELATED REQUIREMENTS

- A. Section 15820 - Duct Accessories
- B. Section 15850 - Air Outlets and Inlets.
- C. Section 15950 - Testing, Adjusting, and Balancing.

1.3 REFERENCE STANDARDS

- A. ASTM A 36/A 36M - Standard Specification for Carbon structural Steel; 2005.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hop-Dip Process; 2004a.
- C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- D. SMACNA (DCS) - HVAC Duct Construction standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 2005
- F. NAIMA - North American Insulation Manufacturer's Association.

1.4 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A standards.

PART 2 PRODUCTS

2.1 MATERIALS

- A. The following requirements are for the different materials allowed to be used for this project. See schedule at the end of Part 3 for acceptable locations of acceptable duct materials.
- B. Galvanized Steel Ducts: Hop-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G60/Z180 coating.
- C. Insulated Flexible Ducts:
 - 1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
 - a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 - b. Maximum Velocity: 4000 fpm.
 - c. Temperature Range: -20 degrees F to 210 degrees F.
- D. Hanger rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 MANUFACTURED METAL DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction standard - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2.3 DUCT INSULATION

- A. General: Duct insulation shall be the required thickness and material to provide a minimum thermal resistance "R" of 6. Rating shall be at 75 degrees F, tested in accordance with ASTM C-518 or ASTM C-177.
- B. Coverings and lining shall have a flamespread rating of not over 25 without evidence of continued progressive combustion and a smoke developed rating of not over 50, and shall not flame, flow, smolder or smoke when tested in accordance with ASTM C 411 at the designated maximum service temperature.
- C. For determination of R-value of flexible duct wrap, the installed wrap shall have an assumed thickness of 75% of the nominal thickness, allowing for 25% compression.
- D. Insulation: ASTM C 553; flexible noncombustible blanket.
 - 1. "K" value: ASTM C 518, 0.25 at 75 degrees F.
 - 2. Maximum service temperature: 250 degrees F.
 - 3. Maximum moisture absorption: 0.20 percent by volume.
- E. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture vapor transmission: ASTM E 96; 0.02 perm.
 3. Secure with pressure sensitive tape.
- F. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. General
1. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
 2. Provide 45 degree entry on all tees used for branch duct to main duct connections. Splitters and extractors shall not be used unless specifically called for on drawings.
 3. Use spin-in fittings (no scoop) with manual volume dampers for all diffuser and grille connection takeoffs, unless otherwise indicated on drawings.
 4. Install flexible duct connections to diffusers and grilles with a minimum of 1" before fastening. Support flexible duct from building structure to minimize bends and sags. Duct shall be fully extended. Do not lay on light fixtures or ceiling.
 5. Make all duct work connects to air handler units, including fan terminal units, with flexible connectors.
 6. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
 7. Provide air foil turning vanes for all rectangular elbows where indicated on drawings. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline where radiused fittings are called for in drawings.
 8. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- C. Metal Duct
1. Fabricate and support in accordance with SMACNA HVAC Duct construction standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated on equipment schedules.

3.2 INSULATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated ducts conveying air below ambient temperature (all supply, return, and outside air ducts):
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations, except fire rated walls as noted on drawing.
 - 4. Install insulation adjacent to duct mounted electric heaters in accordance with heater manufacturer's recommendations. Ensure duct coverings are interrupted at the immediate area of operation of heater as required to meet the clearances specified as a condition of the equipment listing.
 - 5. Seal all joints in insulation system with mastic.

3.3 SCHEDULES

- A. Ductwork Material:
 - 1. Supply and Return: Galvanized Steel. All joints (ductwork and insulation) shall be 100% sealed with pressure sensitive tape and mastic. See special requirements above for outdoor ductwork.
 - 2. General Exhaust: Steel (insulated).
 - 3. Outside Air Intake: Steel (insulated).

3.3 SCHEDULES

- A. Ductwork Material:
 - 1. Supply and Return: Galvanized Steel. All joints (ductwork and insulation) shall be 100% sealed with pressure sensitive tape and mastic. See special requirements above for outdoor ductwork.
 - 2. General Exhaust: steel (insulated).
 - 3. Outside Air Intake: steel (insulated).
- B. Ductwork Pressure Class:
 - 1. Supply and Return: 2 inch.
 - 2. General Exhaust: 1/2 inch.
 - 3. Outside Air Intake: 1/2 inch.

END OF SECTION

SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices.
- B. Backdraft dampers.
- C. Duct test holes.
- D. Fire dampers.
- E. Flexible duct connections.
- F. Volume control dampers.

1.2 RELATED REQUIREMENTS

- A. Section 15810 - Ductwork and Insulation.

1.3 RELATED STANDARDS

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.
- C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; 2003.

PART 2 PRODUCTS

2.1 TURNING VANE ELBOWS

- A. Turning Vanes shall be double thickness with 24 gauge rails and hollow vanes fabricated/manufactured in accordance with SMACNA Duct Construction Standards.

2.2 BRANCH CONNECTIONS

- A. Branch connection fittings shall be the 45 degree entry type fabricated and installed in accordance with SMACNA Duct Construct Standards.

2.3 BACKDRAFT DAMPERS

- A. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.4 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.5 FIRE DAMPERS

- A. Manufacturers:
 - 1. Ruskin Company: www.ruskin.com.
 - 2. Substitutions: As allowed by Section 15001.
- B. Ceiling Dampers: Galvanized steel, 22 gauge frame and 16 gauge flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
- C. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- E. Multiple Blade Dampers: 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination tire/balancing dampers.

2.6 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction standards - Metal and Flexible, and as indicated.
- B. Flexible duct connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retarded neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz. per sq. yd.
 - 2. Metal: 3 inches wide, 24 gauge thick galvanized steel.

2.7 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 - 1. Ruskin Company: www.ruskin.com.
 - 2. Substitutions: As allowed by Section 15001.
- B. As a minimum, all dampers shall have the following features:
 - 1. Molded synthetic sleeve type bearings, corrosion resistant.
 - 2. Square or hexagonal axles positively locked into the damper blade.

3. Externally visible position indicators with wing nut lock device.
- C. Single Blade Manual Volume Dampers
 1. Round: Ruskin MDRS25 or equal.
 2. Rectangular: Ruskin MD25 or equal.
- D. Splitter Dampers:
- E. Opposed blade balancing dampers shall be 16 gauge minimum galvanized steel with zinc-plated hardware and bronze or nylon bearings. Blades shall not be over 8" wide. Maximum leakage shall be less than 1% at a static pressure of 4" w.g.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 15810 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts where indicated.
- C. Provide duct test holes where required for testing and balancing purposes.
- D. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Prior to bidding, review architectural plans for last minute changes on locations of fire rated walls. Install with required perimeter mounting angles, sleeves, breakaway duct connection, corrosion resistant springs, bearings, bushings and hinges.
- E. Demonstrate re-setting of fire dampers to Owner's representative.
- F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- H. Use splitter dampers only where indicated.
- I. Provide opposed blade dampers as necessary to supplement multiple speed air handling units to obtain scheduled total airflow.
- J. Provide single blade balancing dampers at duct take-off to diffusers, grilles, and registers, unless included in diffuser or register schedule. If impractical due to space limitations, an opposed blade damper shall be provided as an accessory to the diffuser, grille or register.

END OF SECTION

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.

1.2 REFERENCE STANDARDS

- A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.
- B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

1.3 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Submit Test and Balance report.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Procedures for formal deficiency reports, including scope, frequency and distribution.

1.4 QUALITY ASSURANCE (moved to PART 3)

- A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standard for Testing, Balancing and Adjusting of Environmental Systems.
- B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

- C. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the State in which the Project is located.

1.5 WARRANTY (moved to PART 3)

- A. Furnish AABC National Performance Guaranty for this project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
- B. Begin work after completion of systems to be tested, adjusted or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
- B. Confirm the proper functions of all components as noted in the sequence of operations including, but not limited to, interlocks, overrides, and damper positions & equipment operations based on occupied and unoccupied modes of operation.
- C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Provide instruments required for testing, adjusting and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.4 INSTALLATION TOLERANCES

- A. Air Handling System: adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 45 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark setting of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. After building occupation, recheck points or areas (up to 20%) as selected and witnessed by the Engineer, at no additional cost.

3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Upon completion of test and balance work, insert all data into a complete type written report and submit six copies of this report to the owner (via the architect).

END OF SECTION