

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ducts and duct systems.
- B. Related Sections include the following:
 - 1. Division 7 for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
 - 2. Division 8 for wall- and ceiling-mounted access doors for access to concealed ducts.
 - 3. Division 15 Section "Mechanical Insulation" for duct insulation.
 - 4. Division 15 Section "Diffusers, Registers, and Grilles."
 - 5. Division 15 Section "Power Ventilators"
 - 6. Division 15 Section "Control Systems Equipment" for automatic volume-control dampers and operators.
 - 7. Division 15 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

1.3 SYSTEM DESCRIPTION

- A. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions, which maybe altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

1.4 SUBMITTALS

- A. Product Data: For duct liner and sealing materials.
- B. Louvers
 - 1. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
 - 2. Color Chart for Initial Selection: For units with factory-applied color finishes.
 - 3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.
- C. Product Data: For the following:
 - 1. Manual-volume dampers.
 - 2. Duct-mounted access doors and panels.

- D. Ductwork:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating pressure classifications and sizes on plans.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Terminal unit, coil, and related installations.
 - 8. Hangers and supports, including methods for building attachment, and duct attachment.
- E. Louver Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- F. Louvers shall comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- G. The contractor must comply with the enclosed specification in its entirety. If on inspections, the engineer finds changes have been made without prior written approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.
- H. At the discretion of the engineer, sheet metal gauges, and reinforcing may be randomly checked to verify all duct construction is in compliance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and fire stopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle sealant and fire stopping materials according to manufacturer's written recommendations.
- C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.
- D. All ductwork and fittings delivered and stored on the job site must be capped to prevent the entry of moisture, construction dust or other debris.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel, normal service: Lock-forming quality; ASTM A 653, G60 or better.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

2.2 SEALANT MATERIALS

- A. Joint Sealant/Mastic: Shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air and moisture into the duct system. Sealer shall be UL 723 listed and meet NFPA requirements for Class 1 ductwork. Ductmate PROseal or approved equal.
 - 1. Maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer.
 - 2. Generally provide liquid sealant for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger.
- B. Flange Gasket: A butyl rubber gasket which complies with UL Standard 181 and 723 testing and meets Mil-C 18969B and TTS-S-001657. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth. Approved: Ductmate 440 Butyl gasket tape.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Support fasteners appropriate for building materials.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 - 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
 - 3. Maximum allowable deflection for transverse joints and intermediate reinforcements will not exceed 0.250 inch.
 - 4. Longitudinal Seams: Pittsburgh lock shall be used on all longitudinal seams. Snap-lock seams are not acceptable.
 - 5. If SMACNA seal class A or B is specified, the longitudinal seam shall be sealed from the inside.
- B. Slide-on Transverse Joint Connectors: Prefabricated slide-on transverse duct connectors and components will be accepted. Duct constructed using prefabricated systems will refer to the manufacturer guidelines for sheet gauge, intermediate reinforcement size and spacing, and proper joint reinforcement(s). Approved connection systems: Ductmate Industries: or W.D.C.I.
- C. Kitchen grease hood exhaust ducts: Comply with NFPA 96.

- D. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
 - 1. Return, Exhaust, and Relief Air Ducts: 2-inch wg, negative pressure.
 - 2. Supply and Fresh Air Ducts: 3-inch wg.
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of un-braced panel area, unless ducts are lined. All large ducts must be braced as required to prevent drumming.
- F. Fittings per SMACNA acceptable, specific fittings requirements below:
 - 1. Fig. 2-3 Rectangular Elbows: Type RE2 square throat with vanes or Type RE1 radius.
 - 2. Fig. 2-5 Rectangular Divided Flow Branches: Type 1, Type 2, Type 4A, or 4B.
 - 3. Fig. 2-6 Branch Connections: 45-degree entry, 45-degree lead-in, bell-mouth, or spin-in.
 - 4. Fig. 2-7 Offsets and Transitions

ROUND DUCT FABRICATION

- G. Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- H. Round ducts shall be as follows:
 - 1. Concealed Round Ducts: Shall be longitudinal Grooved Seam Flat lock (RL-5 seam) at 2-inch wg construction.
 - 2. Snap lock seams *shall not* be used for this project.
- I. Round Joints: Interior slip coupling beaded at center and fastened to duct with screws shall be used to join ducts. Seal joint with an approved sealing compound, continuously applied around joint prior to assembling and after fastening, making certain that majority of sealant resides on interior of the joint.

2.5 ROUND DUCT FITTING FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- C. Elbows: Diameters 3 through 8 inches shall be two section die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.

2.6 LOUVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Louvers:
 - a. American Warming and Ventilating, Inc.
 - b. Arrow United Industries.
 - c. Cesco Products.
 - d. Construction Specialties, Inc.

- e. Greenheck.
 - f. Ruskin Company; Tomkins PLC.
- B. Louvers shall be AMCA Licensed.
- C. Construction: 6063-T5 extruded aluminum alloy construction, drainable blades, all welded, drain gutters in head frame and each blade; downspouts in jambs to drain water from louver for minimum water cascade from blade to blade;
- D. Rectangular Extruded Aluminum Stationary Louvers: Based on Ruskin ELF375DX, or approved equal; 4 inch depth, 0.081" wall thickness, 37.5 degree angles blades, 5-3/32" blade centers. Performance Data: Based on testing 48 inch x 48 inch size unit in accordance with AMCA 500; free area: 54 percent, nominal; free area size: 8.58 square feet; Air Flow: 7,490 cubic feet per minute; Maximum Pressure Drop: 0.15 inches w.g.; Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 873 feet per minute free area velocity when tested for 15 minutes.
- E. Round Extruded Aluminum Stationary Louvers: Based on Ruskin Model ELR, 6063T5 extruded aluminum.
- F. Bird Screens: aluminum, 1/2" mesh, removable frame, re-wireable.
- G. Finish (typical for all louvers): Louvers shall receive factory applied, baked-on 50% Kynar or Hylar based color coating following thorough cleaning and pretreatment of metal. The finish shall be applied at 1.2 mils (30µm) total dry film thickness in accordance with AAMA 2604-98 Section 4.2 and 4.3. Furnish a color chart with submittals for color selection by Architect.

2.7 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

2.8 FIRE DAMPERS

- A. Fire Dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules. Dampers shall meet the requirements of the latest edition of NFPA 90A.
- B. Dampers shall be tested, rated and labeled in accordance with the latest edition of UL Standard 555. Dampers shall have a UL555 fire rating of 1 1/2 hours. Each damper shall be equipped with a heat responsive device which has been tested and approved for use with the damper assembly in accordance with UL555. The heat responsive device shall have a temperature rating of 165 °F. Dampers shall be UL labeled for use in dynamic systems. The damper shall have a dynamic closure pressure rating of 4 in. wg.

- C. Damper actuator shall be manual quadrant. Manufacturer's submittal data shall indicate actuator space requirements around the damper.
- D. UL555 Dynamic Closure Ratings shall be qualified for airflow and pressure in either direction through the damper. UL ratings shall allow for mounting damper vertically (with blades running horizontal) or horizontally.
- E. The Damper Manufacturer's submittal data shall certify all air performance pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3 and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.
- F. Damper blades shall be 16 ga. galvanized steel 3 Vee type with three longitudinal grooves for reinforcement. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 0.5 in. are unacceptable).
- G. Damper frames shall be galvanized steel formed into a structural hat channel shape with reinforced corners. Bearings shall be sintered bronze sleeve type rotating in extruded holes in the damper frame. Jamb seals shall be stainless steel compression type.

2.9 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
 - 1. Turning vanes shall be Harper double wall turning vanes fabricated from the same material as the duct. Mounting rails shall have friction insert tabs that align the vanes automatically.
 - 2. Tab spacing shall be as specified in Figure 2-3 of the 1995 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Second Edition standard. Rail systems with non-standard tab spacing shall not be accepted.
 - 3. Due to tensile loading, vanes shall be capable of supporting 250 pounds when secured according to the manufacturers instructions.

2.10 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustical lined doors where duct is of the same construction.
- B. Systems designed for 3" w.g. and less (SMACNA Seal Class B or C) shall utilize a hinged, cam or hinged & cam, square-framed access door.
- C. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.
- D. Acceptable manufacturers: Ductmate Industries, Inc. or approved equal.

2.11 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- C. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene or neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct.
- F. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- J. Coordinate layout with other finished work.
- K. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- L. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Firestopping materials and installation methods are specified in Division 7.

3.2 SEAM AND JOINT SEALING

- A. Seal all ductwork to Seal Class A: All joints.
- B. Seal externally insulated ducts before insulation installation.

3.3 DUCT ACCESSORIES INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible".
- B. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards
- C. Perform the following as directed by the controls contractor:
 - 1. Installation of:
 - a. Automatic control dampers.
 - 2. Access doors where and as required.
- D. Install duct access panels downstream from, fire dampers and all other components that require servicing.
 - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining per equipment manufacturers' requirements.
 - 2. Install access panels on side of duct where adequate clearance is available.

3.4 FIRE DAMPER INSTALLATION

- A. All fire damper installations shall comply with the manufacturer's installation instructions or any submitted deviations and must be acceptable to the appropriate authority having jurisdiction.
- B. Contractor shall provide suitable access at each fire damper to allow inspection, cycling or testing of the fire damper and replacement of the fusible link. This includes furnishing and installing duct access doors and wall or ceiling access panels as may be required.
- C. Contractor installing fire dampers shall be responsible for these access doors and panels.

3.5 CONTROL DAMPER INSTALLATION

- A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
- B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.
- C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 1/8 in. of each other.
- D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

- E. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
- F. Provide a visible and accessible indication of damper position on the drive shaft end.
- G. Support ductwork in area of damper when required to prevent sagging due to damper weight.
- H. After installation of low-leakage dampers with seals, caulk between frame and duct opening to prevent leakage around perimeter of damper.

3.6 LOUVER INSTALLATION

- A. Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. For new construction, or where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.
- B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- C. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- D. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.
- E. Form closely fitted joints with exposed connections accurately located and secured.
- F. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather tight louver joints are required.
- I. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- J. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- K. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

3.7 KITCHEN HOOD EXHAUST DUCT INSTALLATIONS

- A. Furnish and install in accordance with NFPA 96.
- B. Install ducts to allow for thermal expansion of ductwork through 2000 deg F temperature range.
- C. Install ducts without dips or traps that may collect residues, unless traps have continuous or automatic residue removal.
- D. Install access openings at each change in direction and at 20-foot intervals; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.
- E. Do not penetrate fire-rated assemblies.

3.8 CLOTHES DRYER EXHAUST

- A. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions.
- B. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. Provide riveted or welded construction, sealed 100% airtight.
- C. The male end of the duct at overlapped duct joints shall extend in the direction of airflow.
- D. Each vertical riser shall be provided with a means for cleanout.
- E. Terminate ductwork at building exterior with a backdraft damper. Screens shall not be installed at the duct termination.

3.9 HANGING AND SUPPORTING

- A. Install duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.10 CONNECTIONS

- A. Connect fans with flexible connectors.

3.11 ADJUSTING

- A. Adjust fire dampers for proper action.
- B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.12 CLEANING

- A. HVAC systems shall not be operated during construction.
- B. All ductwork shall be provided with temporary enclosures to keep the HVAC system free of dust and construction debris.

END OF SECTION 15815