

**SECTION 23 31 00  
HVAC DUCTS AND CASINGS**

**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Ductwork and accessories for HVAC including the following:
  - 1. Outside air and generator cooling exhaust air.
- B. Definitions:
  - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
  - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
  - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
  - 4. Exposed Duct: Exposed to view in a finished room, exposed to weather.

**1.2 RELATED WORK**

- A. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
- E. Duct accessories exposed to the air stream, such as dampers of all types and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Plenums and ducts:
    - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.

- b. Duct liner.
- c. Sealants and gaskets.
- d. Access doors.
- 2. Hanger attachments.
- 3. Flexible connections.

### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):  
ASCE7-05.....Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):  
A653-09.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process  
A1011-09a.....Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength  
E84-09a.....Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):  
90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):  
2nd Edition - 2005.....HVAC Duct Construction Standards, Metal and Flexible  
1st Edition - 1985.....HVAC Air Duct Leakage Test Manual
- F. Underwriters Laboratories, Inc. (UL):  
181-08.....Factory-Made Air Ducts and Air Connectors  
555-06 .....Standard for Fire Dampers  
555S-06 .....Standard for Smoke Dampers

## PART 2 - PRODUCTS

### 2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

B. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.

1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
3. Gaskets in Flanged Joints: Soft neoprene.

C. Approved factory made joints may be used.

## **2.2 DUCT CONSTRUCTION AND INSTALLATION**

A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:

B. Duct Pressure Classification:

1. 2 inch
2. 2 inch to 3 inch
3. 3 inch to 4 inch

C. Seal Class: All ductwork shall receive Class A Seal

D. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Provide drain for outside air louver plenum. Drain piping shall be routed to the nearest floor drain.

E. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

## **2.3 DUCT LINER**

A. Duct sizes shown on drawings for lined duct are clear opening inside lining.

B. Duct liner is only permitted to be used for return, relief and general exhaust ducts.

C. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), one inch minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.

## 2.4 FLEXIBLE DUCT CONNECTIONS

- A. Where duct connections are made to fans, install a non-combustible flexible connection of 29 ounce neoprene coated fiberglass fabric approximately 6 inches wide. Burning characteristics shall conform to NFPA 90A. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 2 inches on center. Fabric shall not be stressed other than by air pressure. Allow at least one inch slack to insure that no vibration is transmitted.

## 2.5 FINAL CONTROL ELEMENTS AND OPERATORS

- A. Fail Safe Operation: Control dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze and moisture protection.
- B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.
- C. Power Operated Control Dampers: Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
  - 1. Low Leakage Dampers: Maximum leakage in closed position shall not exceed 3 CFM/sq. ft. @ 1.0 in.wg. differential pressure for outside air and exhaust dampers.
  - 2. Leakage in closed position for the recirculation dampers shall not exceed 15 CFM/sq. ft. @ 1.0 in. wg. differential pressure.
  - 3. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
  - 4. Blades shall be galvanized steel or aluminum, 8 inch maximum width, with edges sealed as required.
  - 5. Bearing shall be nylon, bronze sleeve or ball type.
  - 6. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
  - 7. Maximum air velocity and pressure drop through free area the dampers:
    - a. Duct mounted damper: 2000 fpm.
    - b. Maximum static pressure loss: 0.20 inches water gage.
- D. Damper Operators and Relays:
  - 1. Electronic operator shall provide full modulating control of dampers. A linkage and pushrod shall be furnished for mounting the actuator on the damper frame externally. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment.

The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
  - 1. 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, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of equipment and accessories. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
  - 2. Provide duct transitions, offsets and connections to dampers and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
  - 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
  - 4. Construct plenums in accordance with SMACNA Standards, Chapter 6.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
- D. Control Damper Installation:
  - 1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
  - 2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
  - 3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by

experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

E. Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application Standard.

F. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

### **3.2 OPERATING AND PERFORMANCE TESTS**

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -