

## SECTION 15900

### DUCTWORK AND ACCESSORIES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Ductwork
2. Manufactured duct joints.
3. Casings.
4. Fibrous glass ductwork.
5. Damper Operator Hardware.
6. Volume control dampers.
7. Fire dampers.
8. Combination fire and smoke dampers.
9. Smoke dampers.
10. Backdraft dampers.
11. Triple lock aluminum round ductwork (uninsulated).
12. Insulated triple lock aluminum round ductwork.
13. Insulated flexible round ductwork.
14. Flexible duct fan connections.
15. Access door hardware.
16. Duct access doors.

###### B. Related Sections:

1. Section 15010 - Basic Mechanical Requirements.
2. Section 15050 - Basic Mechanical Materials and Methods.
3. Section 15240 - Mechanical, Sound and Vibration Control - acoustical liner, sound attenuators.

4. Section 15250 - Mechanical Insulation - ductwork insulation.
5. Section 15950 - Controls - automatic dampers.
6. Section 15990 - Testing, Adjusting and Balancing.

## 1.02 REFERENCES

- A. ASHRAE - Fundamentals Handbook - Duct Design.
- B. ASHRAE - Equipment Handbook - Duct Construction.
- C. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- E. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM A527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- G. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.
- H. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- I. SMACNA - Duct Construction Standards.
- J. SMACNA - Fibrous Glass Duct Construction Standards.
- K. U1 181 - Factory-Made Air Ducts and Connectors.
- L. UL 555 - Fire Dampers, UL555C & UL555S.
- M. Uniform Mechanical Code
- N. Uniform Building Code
- O. SMACNA HVAC Duct Leakage Test Manual
- P. NFPA 91 - Exhaust Systems for Air Conveying of Materials
- Q. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations
- R. ASHRAE 62-1989 - Ventilation for Acceptable Indoor Air Quality

## 1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Ductwork:

- a. Design ductwork in accordance with ASHRAE and SMACNA guidelines, recommendations and standards unless otherwise indicated in this Design Guide.
- b. Fibrous glass ductwork will not be allowed, except for air-transfer ducts above ceilings not routed through walls, and sound-attenuation elbows.
- c. Specify that all duct construction, including sheet metal gage and reinforcement, shall follow the SMACNA HVAC Duct Construction Standards, latest edition, unless otherwise noted. SMACNA's duct construction is based on Duct Pressure Classes, which correspond to the maximum operating static pressure for the portion of the system receiving the classification from the designer. The designer needs to be aware of possible static pressure changes in system due to abnormal or emergency conditions, and account for these when selecting the Duct Pressure Classes for the various parts of the system. The designer may want to install pressure or vacuum relief devices in the ductwork to account for unusual pressure fluctuations instead of going with more heavy-duty sheet metal construction. Review with University before deciding.
- d. With larger duct systems, sheet metal cost savings can be realized if the designer specifies different Duct Pressure Classes for the portions of the system that do not experience as much static pressure due to being farther away from the fan. (Do not specify just one Duct Pressure Class for the entire system if it is a large system with static pressures that are significantly less in parts of the system than the pressures seen close to the fan. But, for personnel and equipment protection, design should allow for abnormal or emergency pressure changes as noted in the item above.) Using the SMACNA symbol for "Point of Change in Duct Construction (by the Static Pressure Class)," the designer should indicate on Drawings the points in the ductwork system where duct construction should change because of change in Duct Pressure Class.
- e. Kitchen hood exhaust ductwork shall conform to NFPA 96 and the Uniform Mechanical Code.
- f. Ductwork for special exhaust systems shall conform to NFPA 91 and the Uniform Mechanical Code.

2. Plenums:

- a. If masonry plenums or air shafts are used to handle air flow, they shall be checked for structural design strength which takes into account the maximum design pressure or vacuum, and be coated with special materials or lined with sheet metal to make them air tight.
- b. Arrangement of return air plenums must be approved by the University.

- c. All materials in plenums must be in full compliance with NFPA 90A and the Uniform Mechanical Code.
3. Sound Attenuation:
  - a. Refer to Section 15240 - Mechanical Sound and Vibration Control for coordination of duct sound attenuators, acoustical duct and plenum linings and other acoustical treatment of ductwork systems.
4. Air Leakage:
  - a. Review the duct sealing requirements listed in SMACNA HVAC Duct Construction Standards, and specify the appropriate requirements, adjusting the SMACNA sealing requirements as necessary. Special exhaust systems may require more stringent sealing requirements, especially if the exhaust fan's discharge duct (under positive static pressure) is located in an occupied area or plenum.
  - b. Pressure testing of ductwork in the 3" and higher Duct Pressure Classes is required. The SMACNA HVAC Duct Leakage Test Manual provides detailed information on leak test procedures.
5. Volume Control Dampers:
  - a. Show on the Drawings all required locations for volume control dampers in the ductwork where required for air balancing. Avoid locating dampers where it is obvious they won't be needed because of the inherent pressure drops in the system due to duct layout, longest runs, etc.
  - b. Do not install a volume damper with a frame that protrudes into an airstream. Otherwise, excessive noise and pressure drop will result. Some possible solutions are to use a damper downstream of a 45° take-off or enlarge the duct at the point of damper location.
  - c. Specify locking, indicating quadrant regulators on these volume control dampers.
6. Take-offs:
  - a. Take-offs shall be conical with a manual damper if warranted. If the main duct is not deep enough for a conical fitting, specify a 45° fitting with a round collar.
  - b. Take-offs to VAV terminal units shall not have manual dampers.
7. Fire and Smoke Dampers:
  - a. Indicate all fire and smoke dampers on the Drawings.
  - b. Coordinate locations with code review authority during design process.
  - c. Drawing notes or specifications indicating fire damper or fire/smoke damper locations to be "Where required by Code" are

not acceptable. Drawings must indicate location and type of all dampers.

- d. Specify electrical actuators requiring 120 V. Actuator shall have an auxiliary switch to monitor full-closure of the smoke damper through the BAS.
- e. Specify that the contractor shall install all fire and smoke dampers in strict accordance with their UL listing, NFPA 90A, 90B, 92A, Uniform Building code, Uniform Mechanical Code, and the manufacturer's installation instructions.
- f. Fire and smoke dampers in small ducts (under 16" in height) can cause excessive pressure drop and noise due to insufficient free area. One solution is to increase the duct size with gradual sheet metal transitions to increase the free area at the damper location. Another solution can be to specify a damper frame style that does not impinge on the duct's cross-sectional free area.
- g. Ceiling-type fire dampers are required where HVAC components penetrate fire-rated ceiling membranes. Standard fire dampers are not acceptable in this application.
- h. Combination fire/smoke dampers are often used in applications where both a fire damper and a smoke damper are required.
- i. Where both a fire damper and a smoke damper are required by code at a ceiling penetration, various types of combination fire/smoke dampers are available which are listed by UL as acceptable for a ceiling penetration. The correct selection of a ceiling-type combination fire/smoke damper depends on the type of rated ceiling construction. The alternative to a ceiling-type combination fire/smoke damper is to have a separate fire damper (appropriate for the type of ceiling construction) and a separate smoke damper. (The smoke damper must be within a certain distance of the ceiling penetration.
- j. Specify only "dynamic" rated fire dampers, which provide more positive closure than "static" rated fire dampers. Do not specify or allow "static" rated fire dampers.

8. Back-Draft Dampers:

- a. Specify motorized back-draft dampers for positive closure of air duct on exhaust systems where stack effect would open gravity type dampers.
- b. Back-draft dampers of flexible materials are not acceptable.

9. Flexible Duct:

- a. Specify flexible duct which meets the pressure class requirements.
- b. Specify a maximum length of 6 feet. Design for a maximum velocity of 600 ft/ min.

10. Flexible Duct Fan Connections:

- a. Specify at least one inch slack in these connections to insure that no vibration is transmitted from fan to ductwork.

- b. Exhaust ducts shall have flexible connections appropriate for the type of exhaust and NFPA/UMC requirements.

11. Access Doors:

- a. Specify duct access doors for inspection, maintenance and cleaning at all automatic dampers and fire and smoke dampers.
- b. Specify access panels (sheet metal covers with hemmed edges and gaskets) upstream of duct turning vanes in return air and exhaust, and before all booster (heating, reheat, cooling) coils. Panels shall be sheet metal covers with hemmed edges and gaskets screwed over the opening (do not seal).

12. Elbows:

State that:

Radius elbows with throat radius (measured at inside surface) equal to duct depth should be used wherever possible. Rectangular elbows are discouraged. If rectangular elbows are needed, they shall have single-wall turning vanes, with intermediate support rails if the length of the vanes exceeds 36". Edges of the turning vanes shall be parallel with the sides of the elbow. Rails shall be 2" wide for elbows up to 12", and 4" wide for elbows above 24" in the dimension perpendicular to the vanes.

13. Chemical Fumehood Exhaust:

Chemical fumehood exhaust shall have stainless-steel or PVC-coated ductwork. PVC-coated exhaust duct is to be used unless stainless steel is considered necessary or truly better.

14. General Exhaust:

Galvanized metal shall be used for general exhaust.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. General: All duct materials shall be non-combustible or conforming to requirements for Class 0 or Class 1 air duct materials, as per UL 181 with limitations as noted in NFPA 90A.
- B. Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz. per sq. ft. for each side in conformance with ASTM A90.
- C. Aluminum Ducts: ANSI/ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.
- D. Stainless Steel Ducts: ASTM A167, Type 304.

- E. For many applications, PVC-coated exhaust duct for chemicals may be used or even preferred in place of stainless steel.
- F. Sealant: Non-hardening, non-asbestos, water resistant, UL classifies as fire resistive, compatible with mating materials.
- G. Duct liner in evaporative cooling systems: Manville Permacote Linacoustic Duct Liner, or equally-coated duct liner installed per manufacturer's recommendations. Alternate: Armacell AP Armaflex or Armacell AP Coilflex elastomeric duct liners.

## 2.02 MANUFACTURED DUCT JOINTS

- A. Manufacturer: Ductmate Industries, Inc. or approved equal.
- B. Transverse duct joints may be made with the Ductmate System, or approved equal, components of standard catalog manufacture.

## 2.03 CASINGS

- A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards.

## 2.04 FIBROUS GLASS DUCTWORK

- A. Not allowed.

## 2.05 DAMPER-OPERATOR HARDWARE

- A. Manufacturers:  
  
Duro Dyne  
Ventfabrics Ventlok Regulators

## 2.06 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards.

## 2.07 FIRE DAMPERS

- A. Manufacturers:  
Only manufacturers who meet the codes standards and codes listed below.
- B. Specify that fire dampers shall be constructed, tested, and labeled in accordance with UL555 Standard and shall also be in compliance with NFPA 90A.
- C. Specify that fire dampers shall be installed in accordance with their UL listing, NFPA 90A, and the manufacturer's installation instructions.

## 2.08 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:  
Only manufacturers who meet the standards and codes listed below.
- B. The combination fire/smoke dampers shall be constructed, tested, and labeled in accordance with UL555/UL555S Standards and shall also be in compliance with NFPA 90A.
- C. The combination fire/smoke dampers shall be installed in accordance with their UL listing, NFPA 90A, and the manufacturer's installation instructions.
- D. Provide UL-rated electrical actuator requiring 120 V. Actuator shall have an auxiliary switch to monitor full-closure of the smoke damper through the BAS.

## 2.09 SMOKE DAMPERS

- A. Manufacturers:  
Only manufacturers who meet the standards and codes listed below.
- B. The smoke dampers shall be constructed, tested, and labeled in accordance with UL555S Standard and shall also be in compliance with NFPA 90A.
- C. The smoke dampers shall be installed in accordance with their UL listing, NFPA 90A, and the manufacturer's installation instructions.
- D. Provide UL-rated electrical actuator requiring 120 V. Actuator shall have an auxiliary switch to monitor full-closure of the smoke damper through the BAS.

## 2.10 BACKDRAFT DAMPERS

- A. Manufacturers:  
  
Air Balance  
Airstream  
American Warming/Air Balance  
Arrow United  
C.E. Sparrow  
Louvers and Dampers, Inc.  
Prefco  
Ruskin
- B. Backdraft dampers furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.

## 2.11 TRIPLE-LOCK ALUMINUM ROUND DUCTWORK (UNINSULATED)

- A. Manufacturers:  
  
Flexmaster Triple Lock Type NITL Flexible Aluminum Air Duct.  
Hercules  
Omni-Air

Thermaire

## 2.12 INSULATED TRIPLE LOCK ALUMINUM ROUND DUCTWORK

### A. Manufacturers:

Flexmaster Triple Lock Type TL-M Alum. Duct Insulated.  
Hercules  
Omni-Air  
Thermaire

## 2.13 INSULATED FLEXIBLE ROUND DUCTWORK

### A. Manufacturers:

Cleva-Flex  
Flexmaster Type 5  
Flexmaster Type 8M  
Genflex  
Hercules  
H.K. Porter Co.  
Omni-Air  
Owens-Corning  
Schuller  
Thermafex  
Wiremold

## 2.14 FLEXIBLE DUCT FAN CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards, and as indicated.
- B. UL Listed fire-resistant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz. per sq. yd, crimped into metal edging strip.

## 2.15 ACCESS DOOR HARDWARE

### A. Manufacturers:

Duro Dyne  
Ventfabrics Ventlok Series

## 2.16 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards as indicated.
- B. Access doors with sheet metal screw fasteners are not acceptable.

## 2.17 TRANSITIONS

Diverging transitions shall not exceed 15° per side. Converging transitions shall not exceed 30° per side.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Specify: All flexible ductwork shall be secured to collars with metal bands. Plastic bands are not allowed. Length shall not exceed 6 feet, and shall be supported at least every 3 feet.
- B. In general, for project specifications, remove “Design Requirements” subparagraph A in Part 1, paragraph 1.03, “System Description” of this Design Guide and use list to expand on specific requirements for the specific project.

#### 3.02 TESTING

Specify the following:

- A. Fire and smoke dampers shall be tested under the supervision and approval of the University's testing staff.
- B. Fire dampers shall be activated and reset under the supervision of the University's representative.

END OF SECTION 15900