



DESIGN REQUIREMENTS

HVAC DUCTS AND CASINGS

GENERAL INFORMATION

- 1.1 This section applies to HVAC, ducts, casings and accessories.

DESIGN REQUIREMENTS

- 2.1 The Consultant shall verify system pressure classifications and conform with the following minimum requirements:
- a. Low static pressure classifications shall be constructed in accordance with SMACNA to minimum 2" water gauge.
 - b. Medium static pressure classifications (including all fume hood exhaust systems, supply ductwork upstream of terminal boxes, AHU outside air ductwork and AHU relief air ductwork) shall be constructed in accordance with SMACNA to a minimum 4" water gauge.
 - c. High static pressure shall be constructed in accordance with SMACNA to a minimum 10" water gauge.
 - d. All longitudinal and transverse duct joints shall be sealed. All ductwork shall be sealed to SMACNA Class 'A' standards.
- 2.2 Construct all ducts exhausting humid air from dishwashers, glasswashers, showers, driers, pools and as called for on the drawings of Type 304 ~~(316)~~ welded stainless steel. On horizontal ducts, provide pan construction with longitudinal seams at the side or on top. Provide drain pipes to indirect waste at all low points of the ductwork.
- 2.3 All exhaust ductwork serving fume hood exhaust systems fans shall be constructed of ANSI Type 304 Stainless Steel, conforming to SMACNA 4" w.g. standards (as a minimum). All seams and joints shall be continuously welded. On welded stainless steel ductwork, use extra low carbon grade steel (316 L). All welds to be picked to remove weld oxide. Passivate stainless surface after welding to remove embedded foreign material.
- 2.4 Kitchen exhaust ductwork shall be constructed from No. 16 gauge black iron or stainless steel. All longitudinal seams shall be continuously welded liquid tight.
- 2.5 Ducts that are used for toilet exhaust shall be of aluminum.

DESIGN REQUIREMENTS

- 2.6 All other ductwork shall be fabricated from either galvanized sheet metal or aluminum.
- 2.7 Specify leak testing of all duct work rated for SMACNA 4" construction and above. Ducts shall be leak tested in accordance with SMACNA requirements.
- 2.8 Suspend all ductwork properly supported from the building structure. The duct hanging system is composed of three elements: the upper attachment to the building, the hanger itself, and the lower attachment to the duct. Construct the attachments, hangers and supports for all ductwork in accordance with SMACNA Manual and standards.
- 2.9 Specify protection of all ductwork from dust/debris and moisture including shipment of ductwork, storage on site, and during installation in field.
- 2.10 Duct Sealants
- a. All joints and seams for supply and return air ductwork shall be sealed airtight with a New York City approved non-hardening resilient caulking compound. Duct leakage shall not exceed 5% of the design air quantity. The specifications shall state that if duct leakage exceeds this limit, the Contractor will reseal and rebalance the systems at no cost to the University. All ductwork shall be sealed with a high pressure duct sealant.
- 2.11 Flexible Ductwork
- a. Provide flexible duct as a factory glass fiber insulated assembly with vapor barrier jacket and a minimum thermal conductance (C-factor) of 0.23 Btu per Hr per square foot per °F at 75°F. Construct flexible duct of machine wound spiral aluminum helix, or two-ply polyester core encapsulating a galvanized steel wire helix suitable for a positive working pressure of at least 10" w.c. Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible, Second Edition (1995)", maximum 5'-0" extended length, with a maximum of one (1) 90° bend. Attach flexible duct to metal duct and end terminals with drawbands on both the inner sleeve and the outer jacket.
- 2.12 Flexible Connectors
- a. Flexible connectors shall be provided at all duct connections to air handling units (intake and discharge side), for each ductwork connection to equipment mounted on vibration isolators and/or equipment containing rotating machinery, in order to isolate the ductwork system from vibrations in the unit. Flexible connectors shall be not less than 6 inches long nor more than 10 inches long.
 - b. For high-corrosive-environment system, flexible connectors use glass fabric with chemical resistant coating, minimum weight: 14 oz./sq. yd., tensile strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling. Service temperature: minus 50 to plus 500 deg F.

DESIGN REQUIREMENTS

2.13 Volume Control Dampers

- a. Volume control dampers shall be installed at each branch take-off and in other locations where required to properly balance the air systems.
- b. Volume control dampers shall be of the opposed blade, multi-louvered type. Single blade dampers are acceptable up to a duct size of 12" x 12" or 12" in. diameter on low pressure systems (less than 2" w.g.) downstream of terminal boxes. Dampers shall have indicating quadrants and set screws. The thickness of blades shall not be less than 16 gauge.

2.14 Fire Dampers

- a. Fusible links shall be replaceable, at each fire damper provide an access door in the duct to access the fusible link.
- b. Fire dampers in stainless steel duct systems shall be type 316 stainless steel.

2.15 Smoke Dampers

- a. At each smoke damper an access door in the duct is necessary for access to the damper.
- b. Unit shall incorporate blade end switches (open and closed), and outside the duct mounted UL listed motor. Provide manufacturer's standard U.L. listed open – close – reset switch and position pilot lights in unit mounted enclosure. Enclosure to be capable of being removed for remote mounting to ensure visibility after system installation.

2.16 Combination Fire/Smoke Dampers

- a. Where there is a requirement for both a smoke damper and fire damper, it is preferred to utilize one combination fire smoke damper rather than a fire damper and separate smoke damper.
- b. Each combination fire smoke damper shall be equipped with a UL Classified "Fire Stat" (equal to Ruskin Model TS-150EZ). "Fire Stat" shall permit damper modulation during normal conditions and shall mechanically and electrically lock damper in a closed position when a duct temperature exceeds 165°F. Damper can be opened via the Fire Alarm System for smoke purge. A high temperature sensor shall prevent the damper from being opened if the duct temperature is above 35°F. Device shall include a manual reset button for local opening. Provide position indicating switches to meet requirements of smoke purge control and/or building management system controls. The damper operation and construction shall meet UL requirements.
- c. It is the University's intent that dampers shall cycle (open and close) only on call from fire alarm panel and not during units normal on/off (Day/Night) schedule.

DESIGN REQUIREMENTS

2.17 Duct Silencers

- a. Duct silencers shall be factory-fabricated and tested. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.

2.18 Turning Vanes

- a. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes. Turning vanes shall be installed in all short radius elbows and all square elbows. Turning vanes in mitered elbows shall be double thickness.

2.19 Duct Tappings and Test Connections

- a. Provide tappings in ducts for thermometers where specified. In addition, provide an airtight plugged tapping located as follows: upstream of each reheat coil, downstream of each reheat coil, in each main supply and return air duct at each floor.
- b. Provide test connection on the discharge duct from each air handling unit downstream at least 5'-0" from unit if duct is accessible, or closer to unit if necessary, install Ventlock Instrument test hold device for balancing and testing of system.

2.20 Plenums

- a. Provide drains in air intake and discharge plenums. Bottom of plenums to be constructed as drain pans. Apply two (2) coats of mastic sealant to all joints; pitch bottoms for effective drainage.

CONSTRUCTION REQUIREMENTS

- 3.1 Ductwork passing through waterproof walls or roof construction shall have counterflashing.
- 3.2 Provide approved fire stopping material around all ducts penetrating floors, walls, roofs, etc., in accordance with codes and standards.
- 3.3 Replace, without any additional cost to the contract, any ductwork or components found to be noisy after installation, with said noise resulting from faulty materials or workmanship.
- 3.4 Open ends of ducts that are not actively being worked shall be temporary covering to prevent entrance of dust and debris until connections are to be completed.

DESIGN REQUIREMENTS

- 3.5 Thoroughly clean the interior of all ductwork after installation, and prior to use. Operate all fans and remove all debris and foreign matter from the duct.
- 3.6 Follow recommended “Control Measures” included in SMACNA’s “IAQ Guidelines for Occupied Buildings Under Construction”.
- 3.7 Wherever it may be necessary to make provision for vertical hangers of the ceiling construction passing through ducts, provide streamlined shaped sleeves around such ceiling construction hangers. Make all such streamlined sleeves airtight at top and bottom of ducts.
- 3.8 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 gauge as duct. Overlap opening on all four sides by at least 1½”. Fasten flange to duct or substrate, not both.
- 3.9 Make joints and seams smooth on the inside and a neat finish on the outside. Make duct joints airtight with laps made in the direction of air flow and no flanges projecting into the air stream. Provide ducts adequately braced to prevent vibration. Provide intermediate reinforcing and/or tie rod construction, where necessary. Seal joints and seams according to SMACNA Standards.
- 3.10 Sheet metal transitions shall be made with slopes not exceeding one to seven. The inside radius of all curves and bends shall not be less than the width of the duct in the plane of bend, otherwise square elbows, with vanes, shall be used.
- 3.11 Volume extractors shall be used where radius tap or split is not possible or where square elbows inlet and outlet throat radii vary by more than 15%.
- 3.12 Duct Access Doors
 - a. Provide suitably sized access doors with hinges and cam fasteners at each;
 - control and balancing damper
 - smoke detector
 - valve
 - fire damper
 - smoke damper
 - combination fire and smoke damper
 - flow metering device
 - instrument
 - automatic damper
 - coil (each side)
 - fan motor and bearing

DESIGN REQUIREMENTS

- b. Provide access doors not smaller than 18 inches by 18 inches for ducts 36" and wider. Ducts smaller than 36" are to be provided with access doors 12 inches by 12 inches. Ducts smaller than 12 inches, the access door shall be square 2 inches smaller than the width, but not less than 8 inches by 8 inches.
- c. Where removable hung ceiling panels are installed below access doors, provide markers showing the access door location clearly.
- d. All access doors in ductwork that is either acoustically lined or insulated shall be of the double panel type, flush interior with 1" fiberglass board set in between 18 gauge exterior and 22 gauge interior casing.
- e. Single panel access doors shall be fabricated of 18 gauge up to 12" x 12" and 16 gauge when larger.
- f. Access doors shall be provided with heavy angle iron frames and shall be fitted with two (2) hinges and window type fasteners. Access doors located on the bottom of ducts shall have cam fasteners in lieu of hinges in order to avoid interference with ceiling channel supports.
- g. Install hinged walk-in type casing access doors in large plenums. Construct casing access doors 48" high x 18" wide (larger where possible) complete with heavy duty hinges, hardware, and Ventlok #260 latch handles.
- h. Install access doors to open against system air pressure.

3.13 Access Doors In Walls And Ceilings

- a. Provide an access door at each control and balancing damper, smoke detector, valve, fire damper, smoke damper, combination fire and smoke damper, located above ceiling or inside the wall that is not accessible by removal of grille or from the air shafts. Access doors shall be 12" x 12" (minimum) unless otherwise indicated on plans; rigid construction with two hinges and a latch. In plenum ceilings, provide felt between the door and frame to make an airtight seal.
- b. Door shall be suitable for flush mounting, prime coated with rust inhibitive paint, concealed frame, flush screwdriver operated locks with metal cams and anchors as required.

3.14 Support Requirements

- a. Support each duct independently.
- b. Support ducts using metal hangers and brackets. Hangers shall have sufficient strength and durability and sufficient resistance to the corrosive effects of the atmosphere to

DESIGN REQUIREMENTS

which they will be exposed. Hangers shall not be used in direct contact with a dissimilar metal that would cause galvanic action in the hanger, duct, fastenings or structure.

- c. Support vertical ducts securely at each floor level by continuous lengths of structural angles of a size at least equivalent to that for stiffening. The angles shall be fastened to the opposite sides of the duct and shall extend across the opening and bear upon the structure of slab on both sides of the opening.
- d. Provide sections of ducts containing filters, coils or fans with metal framing and hangers of adequate strength to support such equipment.
- e. Prime coat exposed steel hangers and supports.
- f. Seal the space around the duct, where ducts pass through floor and walls, with non-combustible material to prevent the passage of flame and smoke.
- g. Hangers, supports, anchors and guides for stainless steel duct are to be plastic coated where the support is in contact with the duct.
- h. Duct Hanger to be support per New York City code (at minimum).
- i. Multiple stacked ducts can be cradle hung with sufficiently sized angle iron and rods.
- j. Rectangular ducts over 6 inches in width shall be hung with galvanized rods fastened to galvanized angles running under the duct. The duct shall not be secured to the hanger.
- k. Provide inserts, fishplates and other methods recommended by SMACNA for supporting hangers. Do not use or submit power-actuated fasteners, expansion nails or pins for supporting duct hangers.
- l. Provide supplementary steel as required to support ductwork.

3.15 Equipment Requirements - Sleeves and Seals

- a. Install sleeves and seal and bare duct or insulated duct as specified herein and as shown in the details on the Drawings.
- b. Above Grade Masonry Floors and Walls
 - 1. Duct Penetrations
 - a) Provide structural support at floor opening as required, or for walls, provide steel lintel to support masonry above opening.
 - b) Provide minimum No. 14 gauge galvanized sheet metal sleeves.



DESIGN REQUIREMENTS

- c) Provide escutcheon on both sides.
 - d) For insulated ducts, provide calcium silicate duct insulation through floor or wall opening.
 - e) For fire-rated ducts, fill voids to full depth with intumescent fire stopping material as indicated.
- c. Gypsum Board, Plaster or Wood Partitions
 - 1. Duct Penetrations
 - a) Provide minimum No. 25 gauge galvanized steel stud header and support.
 - b) Provide minimum No. 20 gauge galvanized steel sheet metal sleeves.
 - c) Provide escutcheon on both sides.
 - d) For insulated ducts, provide calcium silicate duct insulation through wall opening.
 - e) For fire-rated ducts, fill voids to full depth with intumescent fire stopping material as indicated.
- d. Floor Sleeves
 - 1. On dry floors, extend sleeve $\frac{1}{2}$ - inch above floor.
 - 2. In mechanical equipment rooms, toilet rooms, kitchens, laboratories, etc., extend sleeve 1 inch above floor

REFERENCE

- 4.1 The applicable CSI Specification Section is 23 31 00.