DESIGN GUIDELINE 230020
DUCT SYSTEM DESIGN

Related Sections

U-M Design Guideline Sections:
230030 - Laboratory Ventilation Design

U-M Master Specification Sections:
233100 - HVAC Ducts & Casings
233300 - Air Duct Accessories & RGDs

General

A/E duct designs shall, at minimum, be in general compliance with SMACNA standards.

The A/E's duct specification shall state that duct construction shall, at minimum, meet SMACNA duct construction standards . The A/E's duct specification shall state that the Contractor shall provide their duct construction standards as their first shop drawing submittal so that the A/E can verify compliance with SMACNA standards.

Although typically SMACNA's HVAC Duct Construction Standards, Metal and Flexible, will apply, the A/E's spec. should also reference other standards if appropriate, e.g. SMACNA industrial duct standards.

The A/E shall provide a table that identifies the duct construction requirements for the project. At minimum the table shall include the following:

- Service/Location and/or System
  e.g. Fume hood exhaust upstream of laboratory terminal units
- Duct Material
  e.g. Stainless Steel (SS), Galvanized, Galvanized Plastic Coated Duct (PCD), etc.
- Pressure Classification
  e.g. -2.0" w.g.

Design

Future Capacity: The amount of future air flow capacity the duct system shall be capable of handling, if any, shall be determined in consultation with the U-M Design Manager.

For duct pressure classifications greater than +/- 2" w.g., duct velocities shall not exceed 2500 FPM without the specific permission of the U-M Design Manager.

The amount of diversity assumed in the duct design shall be stated in the Design Intent Document.

Duct aspect ratios should be limited to a maximum of 4:1.

Round duct elbows constructed with centerline radius equal to or greater than 1-1/2 duct diameter shall be specified. Gored elbows are not permitted.

For rectangular duct, the AE shall design radiused rectangular elbows with r/W ratios of 1.00 or above, to the greatest extent possible. Squared elbows with turning vanes should be indicated when radiused elbows are impractical to fit .

Transition slopes should generally be 1/3 or less.

Indicate access panels on plans wherever ducts contain devices requiring maintenance or calibration, such as air flow stations, humidifiers, fire and smoke dampers, reheat coils, etc.

Indicate maintenance access by "dashing out" no-fly-zones in front of DDC terminal equipment controllers, laboratory air flow unit controllers, filters, and at other major duct mounted components.

Flexible duct shall be properly supported and shall not exceed 8' in length. The A/E should consider specifying flexible elbow duct supports (sample: www.flexflowelbow.com). Provide a detail demonstrating proper flex duct support.

Flexible duct connected to the inlet of terminal units shall be separated with a 24" long section of rigid metal duct located between the flex and the unit inlet. Provide a detail indicating this requirement.

Duct sound liner that is directly exposed to the air stream shall not to be used, except in exceptional circumstances and only with the permission of the U-M Design Manager. Utilize other duct design methods such as low velocities, directional changes, etc. for noise control. Double wall perforated duct with sound liner behind is permitted, provided a Tedlar or Mylar wrap is located between the sound liner and the perforated metal is specified. Sound attenuators shall be similarly specified or shall be packless type.

Materials/Construction

Galvanized duct shall be specified as G-90.

Fibrous glass duct shall not be used. Exception: This material may be used for "return boots" or short transfer ducts, i.e. for short segments of duct that are not hard connected to the duct system, used for the purpose of sound attenuation.

The A/Es specification shall define seal class as corresponding to the definitions found in SMACNA's HVAC Duct Construction Standards, Metal and Flexible. Specify the following seal classes:

- Ductwork rated for pressure of 2" w.c. or less: Class C (seal transverse joints only.)
- All other ductwork: Class A (seal all transverse joints, longitudinal seams, and duct wall penetrations).

Duct Sealant shall be specified as asbestos free.

Exhaust Duct

The A/E shall research the specific effluent being exhausted and shall specify duct materials and duct joining systems that will cost effectively provide long life and safe operation. Determine if a dedicated exhaust system is required or if multiple effluent sources can be safely exhausted through common exhaust ducts.

For the typical general research laboratory exhausting highly dilute, low corrosivity effluent, the following materials are often selected:

- Fume Hood Exhaust to Main Lateral: PCD
- Room General Exhaust (exhausting room only, to maintain required air change rates, *not* exhausting specific point sources): Galvanized Duct
- Autoclaves, Glass Washer/Glass Dryers, and similar moderately steam laden exhaust, from source to Main Lateral: stainless steel, welded longitudinal joints, duct sealant at transverse joints and duct wall penetrations, sloped down and back toward source to promote condensate drainage.
- Exhaust Mains/Laterals Above Lay-In/Accessible Ceilings, conveying fume hood, autoclave, or similar exhaust that is heavily diluted with room general exhaust: Galvanized duct.
- Exhaust Mains/Laterals/Risers in Shafts: PCD
- Exhaust Mains/Laterals/Risers exposed in penthouses and machine rooms: Galvanized Duct

The A/E' specification shall indicate that duct accessories and fasteners shall match the specified duct material, e.g. SS fasteners in SS duct, plastic coated components in PCD.

Tie rods shall not be permitted in exhaust duct running in shafts.

Exhaust with a heavy steam component, e.g. vivarium cage/rack washers, shall be specified as stainless steel duct with all seams, joints, and duct wall penetrations seal welded.

For positively pressurized sections of hazardous exhaust located inside buildings, including penthouses and machine rooms, specify that all duct seams, joints, and duct wall penetrations shall be seal welded. Locating positively pressurized hazardous exhaust in such locations is poor design practice. Obtain U-M Design Manager's permission first.

See U-M Design Guideline 230030 - Laboratory Ventilation for additional information on laboratory exhaust.

Installation

Duct leakage testing is required on all but very small U-M projects, and shall be specified as follows:

Leakage testing shall occur before duct is insulated or otherwise concealed.

Testing pressure shall match the duct's construction pressure class.

All ductwork with a pressure classification greater than 2" w.g. (positive and negative) or that is specified as "seal welded" shall be leak tested.

Ducts shall be leak tested per the procedures in SMACNA's HVAC Air Duct Leakage Test Manual.

Prior to testing, isolate any components that might be damaged by leak testing.

Duct leakage shall not exceed SMACNA Leakage Class 3.

Duct specified as seal welded shall demonstrate zero leakage.

Reseal and retest as required to achieve the specified leakage class.

Duct shall also pass an audible and touch test (2" from duct), conducted by the owner's representative, regardless of pressure class. All gross leaks and audible noise shall be eliminated.