

GENERAL:

1. To provide minimum standards for design and installation of mechanical ductwork and accessories that will be durable, functional and reduce failures for the life of the facility.

DESIGN GUIDELINES:**A. General**

1. Design and Construction of duct systems shall comply with the following standards and guidelines:
 - a. SMACNA's HVAC Duct Construction Standards – Metal and Flexible
 - b. ASHRAE Handbooks
2. All duct systems shall be designed to minimize pressure drops to minimize associated fan energy. Maximum friction of 0.08 per ASHRAE Advanced Energy Design.
3. Maximum leakage for all duct systems is 3%. All ducts will be tested per SMACNA.
4. Indicate on the drawings the pressure classification for each duct system.
5. The pressure class of exhaust and return ductwork from the fan to the first branch duct shall be based upon the shut-off pressure of the fan.
6. Cage wash exhaust shall be ducted as a dedicated system.
7. A dedicated outside air duct, damper and airflow station shall be provided for the minimum outside airflow. A separate duct shall provide economizer airflow.

B. Ductwork Types and Liners

1. All main and branch ductwork will be constructed of galvanized sheet metal per SMACNA except for special cases such as lab exhaust. Construction will include the use of duct sealant.
2. Fume Hood Exhaust ductwork shall be Welded-304-stainless steel all the way to the fan if a dedicated system.
3. Where the fume hood exhaust is combined with general lab exhaust, the ductwork shall be Welded-304 stainless steel from the fume hood to where the ductwork combines with the general lab exhaust. In any research lab where strong acids (such as digesters) or alkalis may be used, specify welded 316 stainless steel or other materials listed as appropriate in Table 6-9 of the second edition of the ASHRAE Laboratory Design Guide. Discuss with the campus PM or AHJ.
4. Stainless steel ductwork shall be used where high moisture is present, such as showers, animal rooms, and cage wash exhaust.
5. Fiberglass ductboard for duct systems is prohibited.
6. Fibrous/fiberglass liner is prohibited.
7. Duct liner (non-fibrous) may be used but limited to return boots or where needed for acoustical purposes that cannot be achieved by other means and methods. The Project Manager must approve the use of duct liner.

C. Turning vanes, Elbows and Take-offs

1. Fabrication and installation of the turning vanes will conform to latest SMACNA Standards. Turning vanes shall be single thickness.

2. All rectangular branch duct takeoffs will use the 45 degree shoe-tap design. Spin-ins, air extractors and scoops are expressly prohibited.
3. Where dust, animal hair, or lint will be present, curved elbows shall be used for return and exhaust ducts unless otherwise approved by the Project Manager.
4. Metal elbows shall be provided at all connections to diffusers.

D. Duct Layout and Sizing

1. Show duct sizes as inside clear dimensions
2. Ducts shall run parallel and perpendicular to building lines.
3. Ensure adequate lengths of properly sized straight duct runs are designed before and after airflow measuring devices. Refer to manufacturer's installation instructions.
4. Large return and exhaust systems shall be designed with numerous branches per floor. Grilles, diffusers and registers ducted straight off of main ducting shall be avoided if possible, to prevent noise issues.

E. Plenums

1. Outside air plenums shall have a sloped floor with floor drain. Insulation of the plenums must meet or exceed ASHRAE 90.1 as if semi-heated space regardless of whether the room is conditioned.
2. A man-sized door shall be provided for access into the plenum.

F. Manual Volume/Balance Dampers

1. All manual balance dampers shall be shown on the drawings unless the damper is mounted in the diffuser.
2. Use of diffuser and grille mounted dampers must be approved by the project manager.
3. For locations where the duct static pressure will be over 2.0 iwc, dampers shall be opposed blade with adjustable quadrant and locking device with position indicator.
4. If duct static is greater than 2.0 inches, a manual balance damper shall be installed upstream of the VAV box at the branch take-off for pressure reduction.
5. For exhaust and return ducting, the drawings shall show a balancing damper in each branch as close to the main duct as practical.
6. For supply ducting, show a balance damper in branches with over 3 diffusers.
7. Splitter dampers are not allowed.
8. Remote operated dampers shall not be used unless approved by the project manager.
9. Manual balance dampers shall be installed upstream of all diffusers, grilles, and registers, even if just one diffuser, for possible future balancing needs or control stability.
10. Air flow balance dampers shall be shown on floor plans. General notes and/or typical details should be avoided unless it can clearly identify all locations applicable to the project. Regulators for these balance dampers shall not use wingnuts or notches. A hand twist locking damper handle that provides infinite range of control shall be specified.

G. Access Doors and Panels

1. Hinged access door shall be installed at all automatic dampers, fire dampers, reheat coils and any other devices requiring inspection and/or servicing.

2. Access panels shall be installed upstream of all airflow stations for cleaning and inspection.
3. Access panels shall be installed upstream or downstream of AHU control dampers mounted in the ductwork for inspections.
4. Where dust, animal hair, or lint will be present in the airstream, an access panel shall be located immediately upstream of any turning vanes.
5. Doors shall be suitable for pressure classification.
6. Doors shall open against static pressure in the duct.
7. Doors shall be fully gasketed and insulated when installed in insulated ductwork.
8. Access Doors shall be a minimum of 12" x 12".

H. Flexible Connections

1. Flex connections shall be provided at connections to all moving equipment.

I. Flexible Ductwork

1. Flexible ductwork shall not exceed 6' in extended length.
2. No flexible ductwork shall be upstream of VAV boxes.
3. Flexible ductwork shall not be used on ducted return or exhaust systems.

J. Fire Dampers

1. Fire dampers shall be installed where required by the International Mechanical Code and NFPA.
2. Temperature rating of fusible links shall be shown in the contract documents.
3. Frames shall be large enough so that there will be no obstruction to air flow when the dampers are open. Construction and arrangement of fire dampers shall be as approved in each case prior to installation. Access shall be provided for replacement of links and so labeled.
4. Fire dampers shall be approved by U.L. and so labeled and installed, shall comply with the requirements of NFPA 90A and the International Mechanical Code.

K. Sound Attenuators

1. A sound analysis is required for supply, return and exhaust ductwork systems.