

2. For average exhaust systems on non-corrosive applications the following metal thickness shall be supplied:

DIAMETER OF STRAIGHT DUCTS (INCHES)	U. S. STANDARD GAGE FOR STEEL DUCT		
	Class I	Class II	Class III
Up to 8	24	22	20
Over 8 to 18	22	20	18
Over 18 to 30	20	18	16
Over 30	18	16	14

Class I. Includes non-abrasive applications such as paint spray, wood-working pharmaceutical and food product, and discharge ducts from dust collectors.

Class II. Includes applications for non-abrasive material in high concentration (low pressure pneumatic conveying); moderately abrasive material; and highly abrasive materials in light concentrations. Typical applications are conveying of chemicals and wood dust; exhaust of foundry shakeouts and sand handling systems, grain dusts; coal crushing and screening; exhaust of grit blast cabinets; and grinding, buffing and polishing.

Class III. Includes applications for all highly abrasive materials in moderate to heavy concentrations and moderately abrasive materials in heavy concentrations such as low pressure conveying of tobacco; exhaust systems from sand and grit blasting and abrasive cleaning operations, from rock and ore screening and crushing, from dryers and kilns, and fly ash removal from boiler stacks.

Where aluminum duct is indicated, the following equivalent B & S gage thickness of sheets should be used:

Steel—U. S. Standard Gage	26	24	22	20	18	16	14
Aluminum—B & S Gage	24	22	20	18	16	14	12

3. For exhaust systems on corrosive applications, consideration should be given to non-corrosive materials or coatings.

4. Elbows and angles shall be a minimum of two gages heavier than straight lengths of equal diameter.

5. Hoods shall be a minimum of two gages heavier than straight section of connecting branches.

6. Where flexible piping is necessary, a non-collapsible type of flexible piping shall be used and its length shall be kept at a minimum.

Construction

1. Longitudinal joints of ducts shall be lapped, and riveted or spot-welded on 3-in. centers, maximum. Double-lock seams may be used on Class I application only.

2. Girth joints of ducts shall be made with lap in direction of air flow with 1-in. lap for diameters up to 19 in. and 1¼-in. lap for diameters over 19 in.

3. Elbows and angles shall have an inside or throat radius of two pipe diameters whenever possible. Large radii are recommended for heavy concentrations of highly abrasive dusts. Construct elbows 6 in. or less in diameter of at least five sections, over 6 in. diameter of seven sections. Prefabricated elbows of smooth construction may be used. Angles shall be pieced proportionately.

4. Hoods must be free of sharp edges or burrs and shall be reinforced to provide necessary stiffness.

System Details

1. Connect duct to fan inlet with split sleeve drawband one pipe diameter long but not less than 12 in.

2. Transitions in mains and sub-mains are to be tapered; a taper 5-in. long for each 1-in. change in diameter is recommended when possible.

3. All branches shall enter the main at the large end of the transition at an angle

not to exceed 45 deg (30 deg is preferred). Connect branches only to top or sides of main, with no two branches entering diametrically opposite.

4. Provide dead end caps within 6 in. from last branch of all mains and sub-mains.

5. Provide access openings or cleanouts every 10 ft and near each elbow, angle, or duct junction in horizontal sections except for non-corrosive gases and vapors containing no particulate matter.

6. Support ducts sufficiently to prevent placing of any load on connected equipment and to carry weight of system if plugged with material. Use maximum supporting interval 12 ft for 8 in. or smaller ducts and 20 ft for larger ducts.

7. Provide 6 in. minimum clearance between ducts and ceiling, wall, or floor.

8. Where blast gates are used for adjustment of system, place them near connection of branch to main. Provide means of locking after adjustments have been made. Butterfly-type dampers shall not be permitted.

9. Fire dampers, explosion vents, etc., should be installed in accordance with NFPA Codes or local fire ordinances.

10. Rectangular ducts can be used only when clearances prevent the use of round construction. Rectangular ducts must be as nearly square as possible. Weight of metal, lap and other construction details are to be the equal of round duct construction whose diameter equals the longest side.

11. Where State or local laws conflict with the specifications given, the more stringent regulation shall be followed. Any other deviation must be approved before installation.

AIR FLOW PRODUCING EQUIPMENT

The principal types of air moving equipment are centrifugal fans, axial flow fans, and venturi ejectors. Chapter 32 includes information on fan types, arrangements, and application. Gravity stacks have application for some systems handling higher air temperatures or steam where no air cleaning equipment is installed.

Centrifugal fans are most frequently used for the bulk of exhaust system applications due to the system pressures involved. Where air cleaning equipment is included, fans are usually located on the clean air side. The paddle wheel or modified paddle wheel designs are heavily constructed and have few blades to make them more suitable if wear, corrosion, or accumulations are a factor. The higher efficiency backward curved blade designs find application where relatively clean, non-corrosive air is handled. Forward curved blade designs have limited application due to the number, shape, and metal thickness of the short curved blades.

Belt driven fans are recommended by many designers because a change in fan speed is often needed where future changes of the system may be involved, where added pressure losses from air cleaning equipment improvements are anticipated, or where the fan may be used at some later date for another application.

The axial flow fan is used for systems having low pressure losses. Propeller or disc designs develop pressures under 1 in., the vane-axial designs develop higher pressures but seldom are used where pressures exceed 3 in.

The venturi ejector⁴⁶ is an inefficient method of air movement, but has the advantage of causing air flow without having the exhaust air pass through the air flow producing equipment. It minimizes the explosion or corrosion potentialities in certain types of system.

Fans, motors, and drives should be located so that safe and easy access for periodic inspection, servicing, and maintenance is possible.