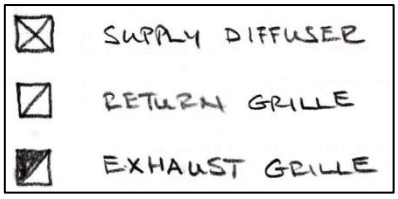
Supply Duct Sizing

This section of the course deals with Duct Sizing. At least that's what the title says. It actually deals with much more. Sizing yes, but it also details various methods for finding the pressure drops along ducts and pipes as air and water flow about. In this part of the course we are most concerned with laying out a nice looking and functional duct system and then working out how much pressure must be added by the fan to drive the required amount of air to the space.

Once you have determined:

- the supply air rate (ventilation rate), L/s;
- where the supply and return air fans are to be located; and,
- you know enough about the layout of the occupied space to position the supply diffusers and return grilles,

you are ready to size and layout the supply and return ductwork.



By far the simplest method of sizing duct is the CONSTANT FRICTION METHOD. This method is great to do by hand and many duct sizing computer programs use this method as well.

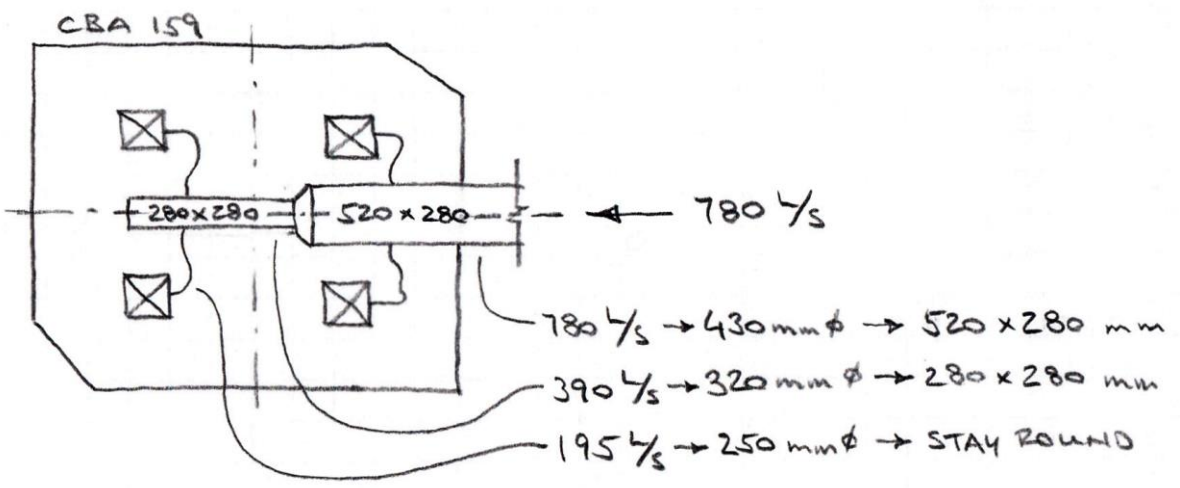
The Constant Friction Method sizes ducts so that no matter how much air passes through any meter of duct the unit pressure drop will be constant. To accomplish this, ducts need to be sized according to the demands of a flow pressure drop calculation. This could be complex but because ducted air is usually at a pressure and temperature that is fairly uniform and ducts are usually made from a material that is very smooth (sheet metal or plastic) all of the pressure drop calculations have been done for you. Pretty well all the sizing information you will need appears on Figure 9 in the Duct Sizing chapter of the ASHRAE Fundamentals Handbook. For your convenience I have reproduced it and a copy is located on the last page of this document.

To use this chart you must follow these simple rules:

- Low Velocity Design:
  - Supply Air Ducts use: 0.8 Pa/m (0.1" H_2O/100 feet)
  - Return Air Duct use: 0.65 Pa/m (0.08" H_2O/100 feet)
- High Velocity Design:
  - Use: 4.0 Pa/m

Note: Always do a Low Velocity Design … unless there is a very special reason to do otherwise. A low velocity design reduces duct costs, fan purchase costs and fan operating energy costs. It is also quieter and will incur less maintenance as the system ages.

Here is a typical supply duct example.
Supply air flowrate for the room: 780 L/s.

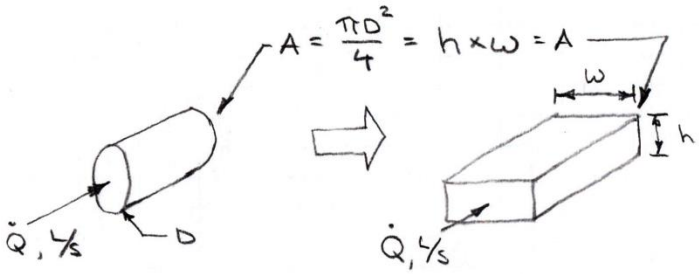


Based on "Figure 9-2 SI: Friction of Air in Straight Ducts" (see below) and a constant unit pressure drop of 0.8 Pa/m size the duct.

You do it. Confirm that the sizes indicated on the sketch are correct.

Figure 9-2 gives you all round duct sizes. In many designs round ducts are too tall to fit into the ceiling space allocated for Mechanical and Electrical services and thus the round duct sizes must be converted to rectangular duct sizes with a similar cross sectional area. You can do the following simple conversion.

This method of converting round to rectangular is accurate as long as the resulting width to height ration is 4:1 or smaller. For very wide, shallow ducts you will need to consult at table in the Duct Design chapter of the ASHRAE Fundamentals Handbook where the extra friction and turbulence in the duct's corners is accounted for. Most of the time you don't need to do this though, as you can simply keep the aspect ratio of the duct somewhere between 1:1 (square) and 4:1. Really, when needed, you can go as far as an aspect ratio of 8:1 without harm.



Placement of Supply Air Diffusers and ducts is usually quite straight forward. Just follow these simple rules:

- Divide the occupied floor space into ventilation zones.
  We will talk about this in class so be prepared to take some notes as we go along.
  You will need to know something about how the space will be used, the location of windows and outside walls, if there are any special environments that must be considered and a variety of other factors.
- Supply each zone with an air flowrate that is proportional to the amount of floor area in each zone.
- Place a supply diffuser in the approximate centre of each zone or at a location that makes sense.
- Run duct from the supply air fan to each supply diffuser.
- Be aware of interferences (lights, walls, anything else that might cause the contractor to phone you - your goal … no phone calls from the site … that's a perfect job.)

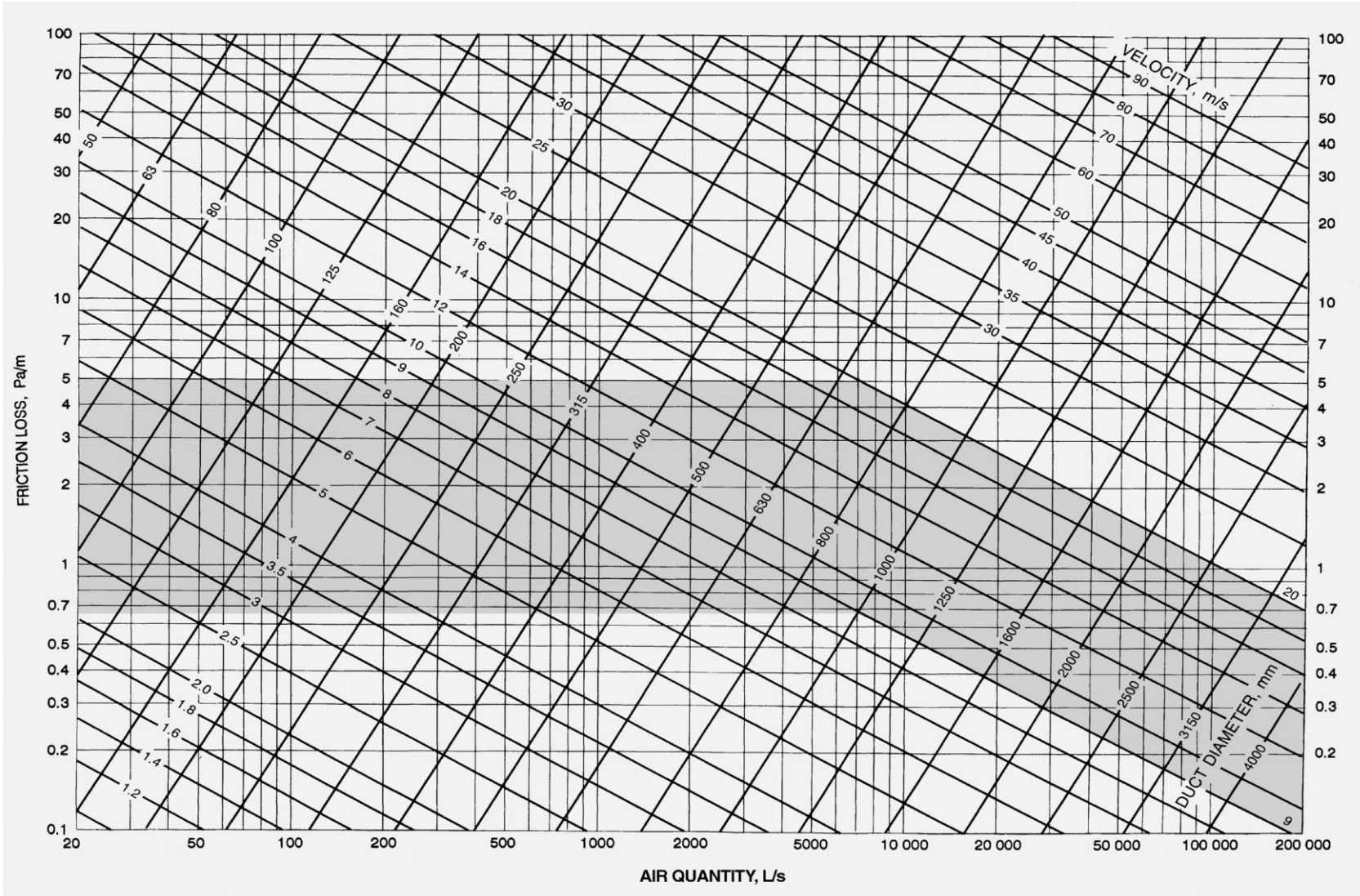


Fig. 9-2 SI Friction of Air in Straight Ducts
(Figure 9, Chapter 21, *2013 ASHRAE Handbook—Fundamentals*)