Determining Static Pressure

When choosing an exhaust fan for a laboratory hood, there are two main factors to consider. These are CFM and Static Pressure. The CFM required is usually determined by the hood manufacturer to give a minimum air velocity in FPM across the face of the hood.

The static pressure (SP) is the combined resistance to airflow of the hood, straight ductwork, elbows, transitions, etc. Ductwork static pressure is figured as friction loss per 100 feet of duct at a certain CFM. Each elbow is figured as equivalent to a certain number of feet of straight duct. Use a duct calculator or the chart provided below to figure the static pressure of 100 feet of a given diameter of duct at a given CFM. Add total elbow equivalents to the length of straight duct to arrive at the total system duct length. Multiply the static pressure for 100 feet of duct by the percentage of 100 feet that you have. This will be the static pressure caused by the ductwork. Add this to the static pressure created by the hood to get the total static pressure of the system.

Example:

A four-foot hood with an opening of 48-inch wide by 15 inches high requires 100 FPM face velocity. There are 20 feet of 8-inch diameter duct with three (3) 90-degree elbows. Hood static loss as given by the manufacturer is 0.25 inch WG.

1. *CFM = 48 x 15 inches divided by 144 (sq. in. in one sq. ft.) = 5 sq. ft. x 100 FPM = 500 CFM.*
2. *Static pressure of the hood is given as 0.25 inch WG.*
3. *Using a duct calculator or the charts below, find the resistance for 500 CFM moving through 100 ft. of 8-in. diameter duct = 0.45 in. SP per 100 ft.*
4. *Find the resistance per elbow on back of duct calculator or on the charts below (one 8-in. diameter elbow is equivalent to 15 ft. of straight duct) 3 elbows at 15 equivalent feet each=45 equivalent feet*
5. *Add 20 feet for the straight duct to the 45 equivalent feet for the elbows = 65 feet.*
6. *65 ft. is 65 percent of 100 feet. Multiply 0.65 times the resistance for 100 feet (0.45 inch WG) = 0.29 inch WG.*
7. *Add 0.29 inch SP WG for the ductwork to 0.25 inch SP WG for the hood = 0.54 inch WG total static pressure for the system.*

The following charts are to be used with the above example. These are short, abbreviated tools to be used in absence of a more accurate and complete duct calculator. (Available from Central Blower Company on request.) Applying these factors to your laboratory blower calculations can assure you of getting the right fan for your exhaust requirements.

Friction Loss per 100 Feet of Duct

DUCT DIA., IN.	CFM																				
	100	200	300	400	500	600	700	800	900	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
4″	0.65	2.40	5.00	9.00																	
6″	0.10	0.30	0.70	1.20	1.80	2.60	3.50	4.50													
8″	0.02	0.08	0.16	0.30	0.45	0.60	0.80	1.00	1.30	1.60	2.30	3.00	4.00								
10″		0.03	0.05	0.10	0.14	0.20	0.30	0.35	0.45	0.55	0.80	1.00	1.30	1.60	2.00	2.40	2.80	3.20	3.70	4.20	4.80
12″		0.01	0.02	0.04	0.06	0.08	0.10	0.15	0.18	0.22	0.30	0.40	0.50	0.65	0.80	1.00	1.10	1.30	1.50	1.70	2.00
14″			0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.20	0.24	0.30	0.37	0.45	0.50	0.60	0.70	0.80	0.90
16″				0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.10	0.13	0.16	0.20	0.22	0.28	0.30	0.35	0.40	0.45

Equivalent Resistances per Elbow

in Feet of Straight Pipe

Duct Diameter	90º Elbow	Duct Diameter	90º Elbow
6″	12′	12″	25′
8″	15′	16″	36′
9″	18′	18″	41′
10″	20′	20″	46′

60˚ Elbow=.67x90˚ 45˚ Elbow=.50x90˚ 30˚ Elbow=.33x90˚