THE EFFECT OF RESISTANCE ON AIR FLOW

Filters of any kind present a barrier to air flowing through the ductwork in an air handling system. This barrier creates resistance which reduces the volume of air delivered by the fan.

This phenomenon can be explained by an understanding of the pressures in an air handling system caused by the movement of air. There are three measures of pressure in an air handling system:

Static Pressure is the force in all directions. (Think of it as the pressure attempting to burst the duct.) Differential Static Pressure can be positive or negative. If the Static Pressure in the duct is higher than atmospheric pressure, it is positive. If it is lower than atmospheric pressure, it is negative. Resistance gauges installed in an air handling system measure Static Pressure (not Velocity Pressure).

Velocity Pressure is the pressure caused by the velocity of air moving in the direction of flow. It is always positive.

Total Pressure is the sum of the Static Pressure and Velocity Pressure. Air handling systems are designed with a specific Total Pressure so the fan can be sized properly.

If Total Pressure equals Static Pressure plus Velocity Pressure, then as the Static Pressure (resistance) caused by the filters increases, the velocity must decrease. Since Volume equals Velocity times Area, any reduction in velocity reduces the volume of air moved.

Resistance is called “Pressure Drop” because the Static Pressure upstream of the filters is higher than it is downstream. Therefore, the reference to “drop”.