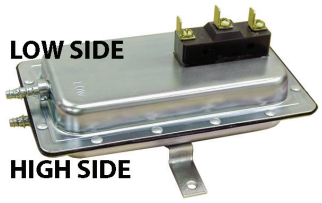
Effects of Air Flow Restriction on AFS™ Air Switch Operation



An orifice is a flow-restriction device that can be inserted into the flow inlet or outlet of an air switch in order to delay the fill or bleed time of the cavity. The result of reducing the flow rate of air into or out of an air switch is a delay in the operating action of the air switch. The air flow ramping rate for measuring the set point of an air switch containing an orifice using an unrestricted measurement device is calculated as a percentage of the air flow rate that is used to calibrate unrestricted air switches. When measuring the set point of an air switch containing a flow-restricting orifice, the measuring device and the air switch should contain the same size restricting orifice in order to obtain accurate measurements of the air switch set point. If only one device has an orifice restrictor, the flow of air into both devices must be reduced to a rate that negates the effect of the orifice in order to obtain accurate measurement of the air switch set point.

The top two rows of the table below show the area of the unrestricted flow inlet/outlet in square inches (col. 2). The initial flow is through 100% of the inlet area (col. 3), and is therefore 100% of the possible flow at a given flow rate (col. 4). Next, the available orifices are shown (col. 1), along with their flow areas in square inches (col. 2). The orifice areas are percentages of the inlet/outlet area (col. 3). They produce flow rates that are percentages of the original flow (col. 4).

Standard Inlet ID (in.)	Area (in^2)	Flow Area %	Flow %
0.136	0.015	100.00%	100.00%
Orifice ID (in.)	**Restricted Area (in^2)**	**Restricted Flow Area %**	**Restricted Flow %**
0.035	0.0009621	7.85%	27.71%
0.028	0.0006158	4.96%	22.27%
0.023	0.0004155	3.36%	18.33%
0.016	0.0002011	1.60%	12.64%
0.010	0.0000785	0.63%	7.93%

The table below shows the original fill or bleed time conditions for the high and low side cavities of an AFS™ at a reference fill rate of 544 in^3/minute (≈1.4"w.c.). Next, the available orifice areas are shown, with the resulting fill/bleed times for each cavity, at the reference fill rate.

Low Side		High Side	
Cavity Volume (in^3)	Unobstructed Fill or Bleed Time (seconds)*	Cavity Volume (in^3)	Unobstructed Fill or Bleed Time in Seconds*
6.02	0.013	6.63	0.014
*Through 0.125" ID inlet at reference flowrate of 544 in^3/minute.			
Orifice ID (in.)	Resulting Fill Time (seconds)	Orifice ID (in.)	Resulting Fill Time (seconds)
0.035	0.169	0.035	0.186
0.028	0.262	0.028	0.288
0.023	0.387	0.023	0.426
0.016	0.813	0.016	0.894
0.010	2.063	0.010	2.269

Note :
The information in this document is intended for reference use only: it may be affected by specific application parameters and operations.

Precision. *Every Day.*

1111 Brookpark Road
Cleveland, OH 44109
T 216-398-0330
F 216-398-8558