

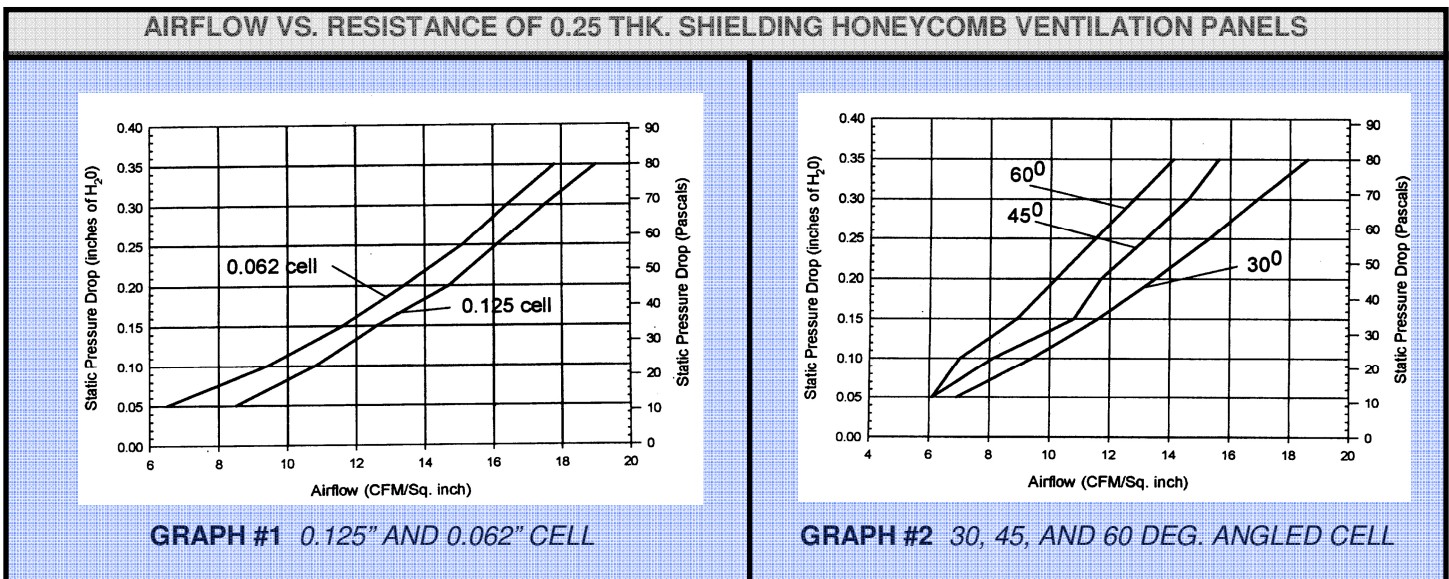
Shielding Honeycomb Ventilation Panels and Dust Filtration Characteristics

This paper presents airflow characteristics of shielding honeycomb ventilation panels and dust filtration characteristics of dust filtration panels. For a System Engineer, airflow data helps to identify the correct panel size for electronic cooling applications. The Airflow data of these shielding honeycomb ventilation panels are presented as graphs of Static Pressure Drop (Inches H₂O) vs. Airflow (CFM / Sq. inch). Airflow curves show pressure drop as airflow increases from 0.05 to 0.35 inches of H₂O. The curves are generated for all of the shielding honeycomb ventilation panels and dust filtration currently fabricated at MAJR Products Corporation.

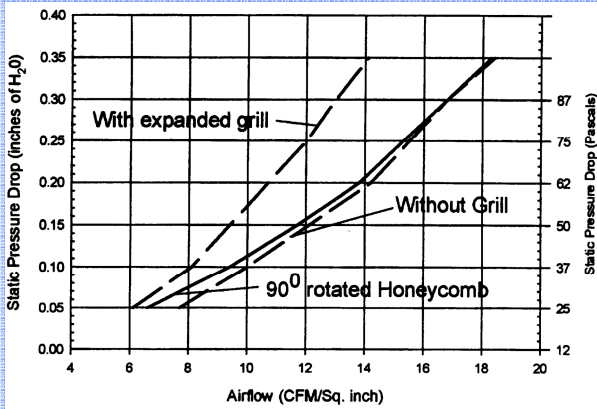
Dust arrestance characteristics of the dust filtration panels identify the following parameters: maximum dust holding capacity, atmospheric dust spot (arrestance capability), and resistance to air flow for increasing weight of dust in grams. With this data, a maintenance plan can be designed for cleaning the filtration panel in order to maximize filtration efficiency, and to anticipate airflow restriction throughout the in-service life of the system. The airflow restriction (static pressure drop) during in-service life can be tabulated by keeping a periodic log of the weight in grams of the Dust Filter. As the filter traps dust, the dust weight (arrestance capability) can be monitored by comparing the delta of initial vs. actual weight of the filter; referencing the dust fed vs. arrestance curve, one may determine the status of the filter. The filtration panels may be used in conjunction with our honeycomb ventilation panels as a filtering EMI/RFI shielding product. Airflow characteristic curves / calculations may be additive with an approximate 80% confidence level; 20% inherent error is due to non-laminar airflow effects for the honeycomb / dust filter combination.

SHIELDING HONEYCOMB VENTILATION PANEL AIRFLOW TEST DATA

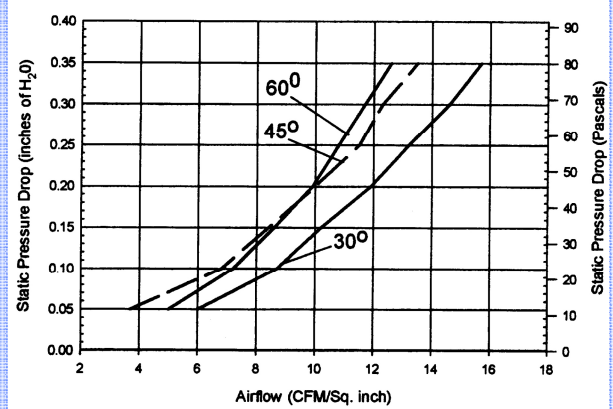
The resultant test data was graphed into a format of Static Pressure Drop (Inches H₂O) vs. Airflow (CFM/Sq.in.). The performances of all test panels are shown in Graphs 1-6.



AIRFLOW VS. RESISTANCE OF 0.50 THK. 0.125 CELL AND SPECIAL ORDER 0.25 THK. STRAIGHT / 0.25 THK. ANGLED COMBINATION SHIELDING HONEYCOMB VENTILATION PANELS

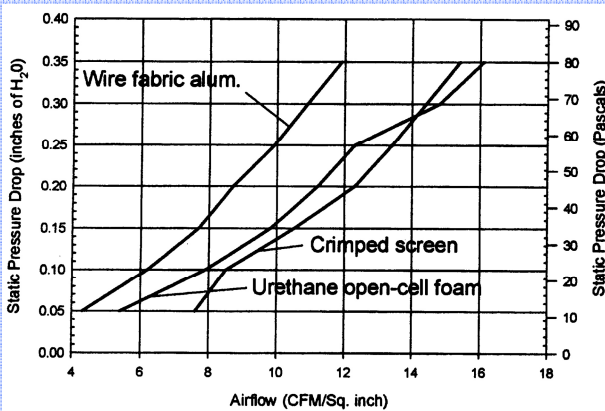


GRAPH #3 W & W/O GRILL, 90 DEG. ROTATED

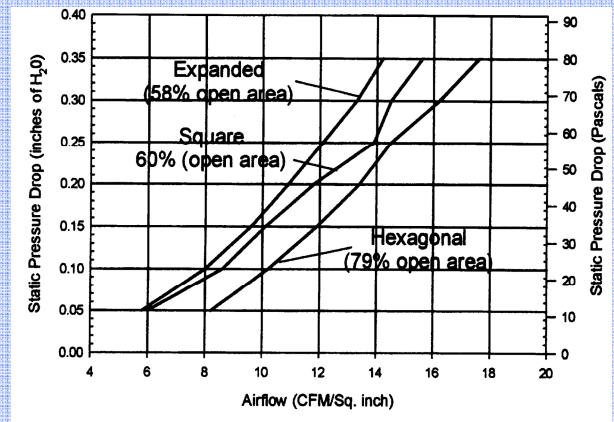


GRAPH #4 30, 45, AND 60 DEG. ANG. / STR. CELL

AIRFLOW VS. RESISTANCE OF FILTER MEDIA AND GRILLS FOR HONEYCOMB VENTILATION PANELS



GRAPH #5 WIRE FABRIC, SCREEN, AND FOAM



GRAPH #6 EXPANDED, SQUARE AND HEX. GRILLS

AIRFLOW TESTING METHODOLOGY OF SHIELDING HONEYCOMB VENTILATION PANELS

Testing was conducted in a laboratory maintained at 70 deg. F and 55 % R.H. The test set-up comprised of a uniform 12 inch x 12 inch x 60 inch long sheet metal duct with metal flanges at each end. One end was sealed against an opening in a plenum chamber using appropriate fixtures and sealant. The other end of the duct was modified so that the vent panel could be installed using sheet metal screws. The samples metal frame was then sealed to prevent leakage from the sides. A pressure tap was made on the duct at a distance of 18 inches from its open end. The plenum chamber outlet was connected to the suction side of a centrifugal blower via a series of valves and an airflow-metering device. Calibrated instrumentation was used in measuring the test parameters.

Specifications

Air Flow testing was performed in accordance with the following test specifications.

Test performed:

Air Flow vs. Static pressure drop

Test Specification:

ASTM0737 (modified)

.05 - .35 Inches H₂O (Static pressure)

Air flow data pt. (CFM/Sq. inch) @ every .05 inch H₂O

(Testing as shown in Figure 1 results in the determination of Static Pressure Drop from .05 to .35 inches of water vs. Air Flow in CFM/Sq. inch)

Test Specimen Description

Air Flow test specimens are 12 in. x 12 in. panels (air flow area). The honeycomb and/or filter media with and without grills were fabricated into a through hole mounting frame. All hole patterns and panel sizes match to facilitate testing when mounted into the affiliated airflow testing ductwork.

Data description

The curve of Static Pressure Drop -vs.-Airflow for all test filters increases in resistance of static pressure (Inches H₂O) with increasing airflow (CFM/Sq.in.). This gradual increase in static pressure is due to the inherent resistance to airflow that the test panel offers to the air stream. Oscillation of the Static Pressure Drop -vs.-Airflow curve is due to non-laminar airflow caused by wind currents throughout the ductwork. For all graphs of Static Pressure Drop -vs.-Airflow the x-axis was set to view the range of static pressure drop from .05 to .35 (Inches H₂O).

Airflow Testing Conclusion

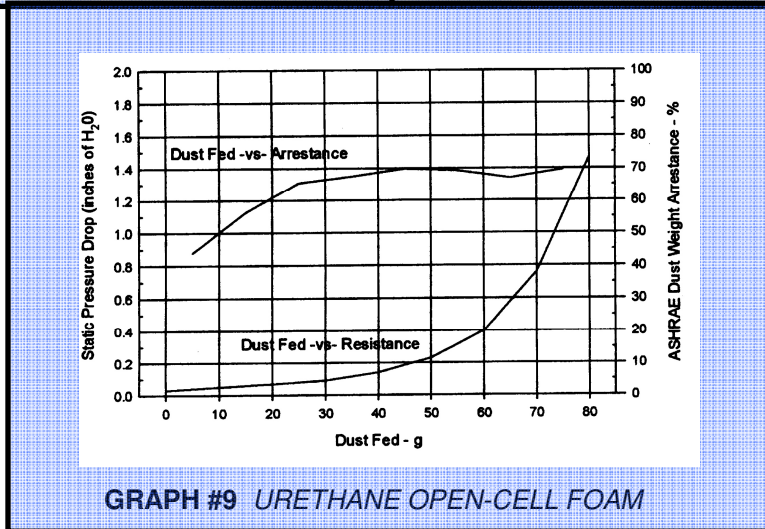
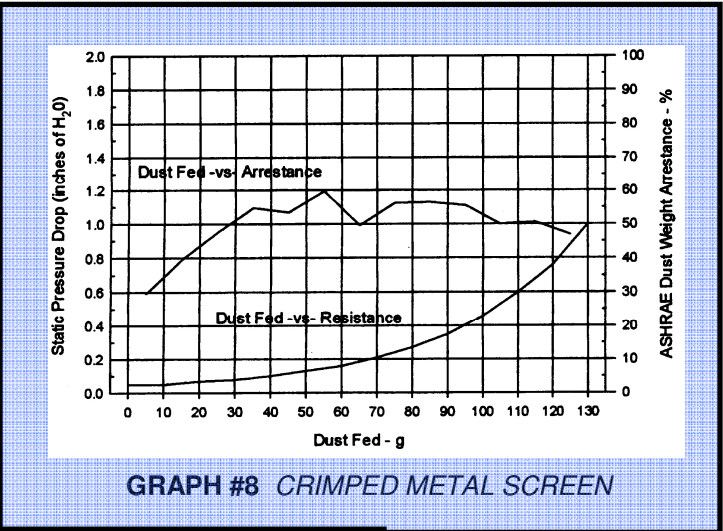
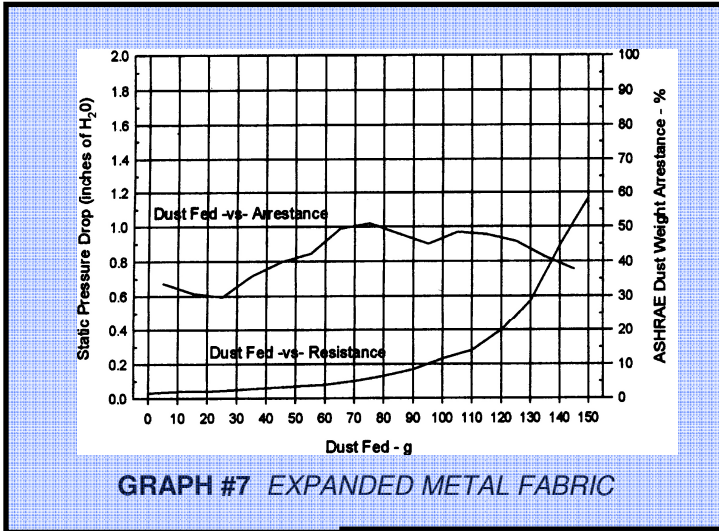
All testing was in accordance with a modified ASTM 0737 specification. The data as presented in graphs 1-6 provides insight into airflow characteristics and allows a product engineer to design by parameters such as static pressure drop (Inches H₂O), and airflow (CFM) of the Shielded Honeycomb Ventilation Panels and filter media manufactured at MAJR Products.

FILTRATION PANEL DUST ARRESTANCE

TEST DATA

The resultant filtration panel test data is presented as graphs of Static Pressure Drop (in. H₂O) and Dust Weight Arrestance (%) -Vs- Dust Fed (g). The graphs for each panel are shown in Figures 7- 9. The curve of Dust Fed - vs. - Resistance for all test filters increases in resistance (static pressure in. H₂O) with incrementing dust feeding. The increase in static pressure is due to build-up of dust on the filter openings. The curve for Dust Fed - vs. - Arrestance increases for all panels to a point of maximum arrestance then levels off. Oscillation of the leveling dust fed - vs. - arrestance curve is due to clogging and unclogging of dust during the dust feeding cycles. As seen for all panels, at the point of maximum dust arrestance, the dust fed - vs. - resistance starts to increase rapidly.

DUST FED VS. RESISTANCE AND ARRESTANCE PER STATIC PRESURE DROP



DUST ARRESTANCE TESTING METHODOLOGY OF SHIELDING HONEYCOMB VENTILATION PANELS

Testing was conducted in a laboratory maintained at 68 deg. F and 65 % R.H. The test set-up comprised of a uniform 12 inch x 12 inch x 108 inch tall sheet metal duct with metal flanges at each end. System airflow is created by a vacuum pump at the end of the test configuration, which draws air in at the dust feeder. The dust feeder emits an ASHRAE standard dust at a specified rate into the sheet metal duct fixture which holds the test panel. Calibrated instrumentation was used in measuring all test parameters.

ASHRAE52.1 testing involves many stages. The first stage is testing of airflow through the test panel at a specified rate; this rate along with 50%, 75%, and 150% of the specified rate is recorded and graphed. The second stage measures dust spot efficiency. The method utilized, is the reading of dust spot samplers (paper discs). The paper discs are located up and down stream of the test filter during increasing dust increments. The discs are evaluated with an opacity meter; this instrument detects light passing through the paper converting the intensity of the light into an efficiency rating scale (0- 100%).

All filter panels tested were under 20% efficient for trapping the atmospheric dust therefore classified as Group 1 filters. Group 1 filters are defined as open cell foam, expanded metal and / or screen samples. The third stage of testing involves testing for dust arrestance (%) and maximum dust holding capacity of the test filter. A high efficiency dust filter is placed downstream of the test filter; an initial weight is taken. Weight readings are then taken at specified intervals throughout the incremental dust feeding cycle. Graphing of the filter dust weights determines dust weight arrestance (%) vs. dust fed (g). The dust fed is also plotted against the static pressure drop detected by the static taps up and down stream of the test panel. Graphing of the static pressure drop during the incremental dust feeding into the airflow system results in the determination of Dust Fed (g) vs. Resistance or static pressure drop (Inches H₂O).

Specifications

Dust Arrestance Testing was performed in accordance with the following test specifications.

Test performed:

Airflow vs. Dust Arrestance

Test Specification:

ASHRAE Standard 52. 1

Airflow rate (300 CFM)

Test dust feed rate (2g / 100 ft³)

Testing results in the determination of Dust fed (g.) vs. Static Pressure (in. H₂O) and Arrestance (% dust weight).

Test Specimen Description:

Dust arrestance test specimens are 12 in. X 12 in. panels (airflow area). The filter media was fabricated into a through hole mounting frame. All hole patterns and panel sizes match to facilitate testing when mounted into the affiliated dust arrestance testing ductwork.

Dust Arrestance Conclusion

All data generated was in accordance with ASHRAE 52. 1 (filtration industry standard), and defines the filtration characteristics of each filter. The data as presented in Graphs 7-9 provides insight into filtration characteristics of the panels tested and allows our customers to design by parameters such as maximum dust holding capacity, static pressure drop (in. H₂O), and filtration characteristics throughout the in-service life of the filtration panel.