Quad Flow Design Technology for Flow Balancing Hoods

Introduction

As energy efficiency codes move toward net-zero energy buildings and building envelopes are optimized, HVAC systems will be designed to provide the minimum space heating and cooling required. Current equipment and methods used in testing, adjusting and balancing HVAC systems are not robust enough to bring HVAC systems to optimal performance. Flow hoods, being the instrument of choice to rapidly evaluate HVAC systems, fail to provide accurate flow measurements due to the influence of airflow patterns dictated by diffuser styles. This issue is not well-known in the industry; however, it causes most of the frustration experienced by technicians and contractors while tuning HVAC systems.

Flow hoods are the most popular tool used by HVAC technicians and contractors due to the versatility and ease of use for airflow measurement. However, its application has been limited due to uncertainty between the flow hood and pitot traverse airflow measurements. Therefore, flow hoods are used as indicators to proportionally balance HVAC systems. Despite the uncertainty in flow hood measurements, instrumentation manufacturers have not made any changes to the 40-year standard flow hood design.

Design Limitations

Test and simulation results demonstrated the following design limitations in standard flow hoods when measuring flow from different diffuser styles:

1. Pitot arrays are sensitive to airflow patterns
2. Converging sections fail to condition airflow patterns

These results correlate well to industry frustration and uncertainty while tuning HVAC systems with flow hoods. Most HVAC systems have more than one diffuser style. HVAC technicians and contractors commonly experience confusion while comparing flow hood with pitot traverse measurements when the system has different diffuser styles. A great example of this case is balancing HVAC systems in office spaces, where square diffusers with 4-way flow patterns and linear diffusers with 1-way flow patterns are commonly used. Figure 1 shows the different airflow patterns from two diffuser styles inside of a flow hood from computational fluid dynamics (CFD) analysis.
See Figure 1 across page.

Benchmark

Dwyer Instruments Inc. has performed research testing the performance of test equipment and understanding the challenges of balancing HVAC systems using current technology.
See Figure 2 across page.

Dwyer have developed a unique Quad Flow Design Technology flow hood, the SMART Air Hood Balancing Instrument, (Series SAH), understanding the limitations in current technology and the need in the market place.

Revisiting the key elements of flow hoods, the SAH uses a smaller converging section to only direct the flow to the flow station as shown in Figure 3. Accurate flow measurements are then achieved by applying correct diffuser calibrations to flow station measurements. Test results are shown in Figure 4.
See Figures 3 and 4 across page.

Baseline Calibration

The baseline calibration consists of calibrating the SAH flow station velocity pressure to the SAH flow station average velocity pressure derived from a statistical analysis. This calibration process allows to zero and span the SAH flow station velocity pressure. The baseline calibration is performed in every production unit. After the baseline calibration is performed, the SAH can use any diffuser calibration to measure flow accurately from any diffuser listed in the SAH diffuser list shown in Figure 5.
See Figure 5 across page.

Conclusion

Optimizing HVAC Systems

The Quad Flow Design Balancing Hood provides the accuracy needed for optimizing HVAC systems. By measuring flow accurately, from a large variety of diffuser styles, there is no longer a need for troubleshooting return and supply air measurements. In addition to the convenience and versatility this offers HVAC technicians and contractors, there is no longer a need to search locations that meet the requirements for pitot traverse measurements.

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Fluidic Ltd have 25 years experience of supplying instrumentation to HVAC & Cleanroom industries, as well as process industries such as Oil & Gas, Nuclear and pharmaceutical sectors.

Michael has been a technical sales engineer with Fluidic for over 8 years and has gained an extensive knowledge of instrumentation and their applications. His main focus is the HVAC/LEV industries and as the official Scottish distributor for Dwyer instruments, Fluidic Ltd has access to instrumentation for all types of HVAC applications.

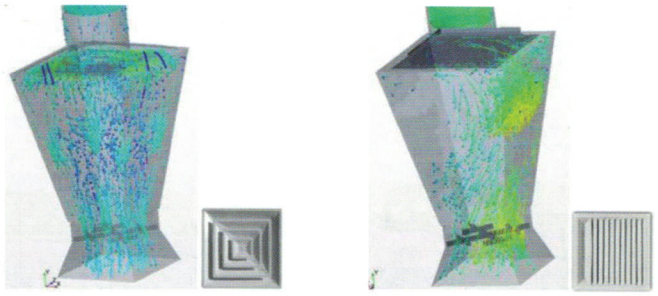

Figure 1 – Airflow patterns simulated from 4-way discharge (left) and 1-way discharge (right) diffusers inside flow hoods

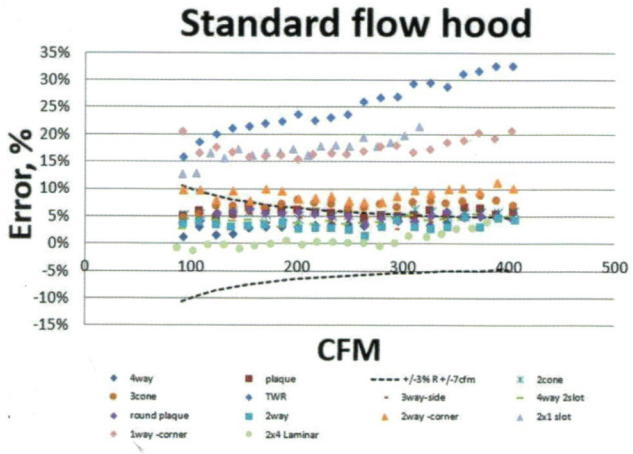

Figure 2 – Test results from comparing standard flow hood accuracy to different diffuser styles

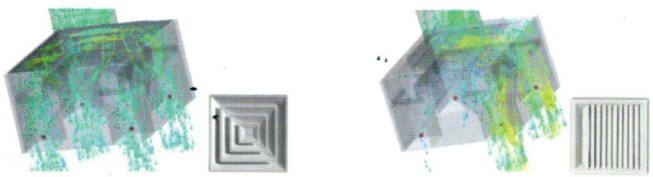

Figure 3 – Airflow patterns simulated from 4-way discharge (left) and 1-way discharge (right) diffusers inside the SAH

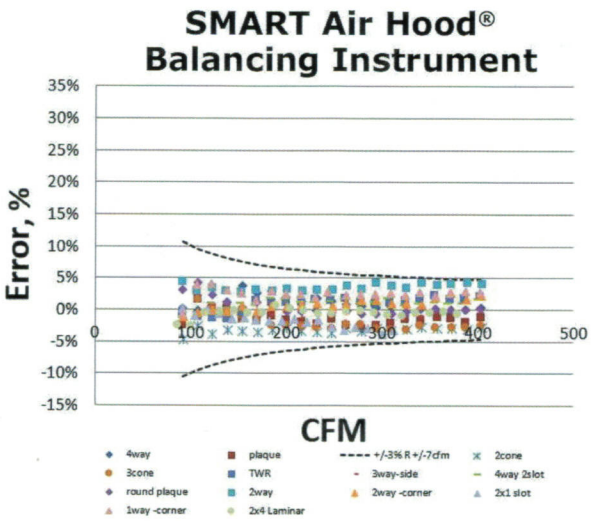

Figure 4 – Test results from comparing SAH accuracy to different diffuser styles

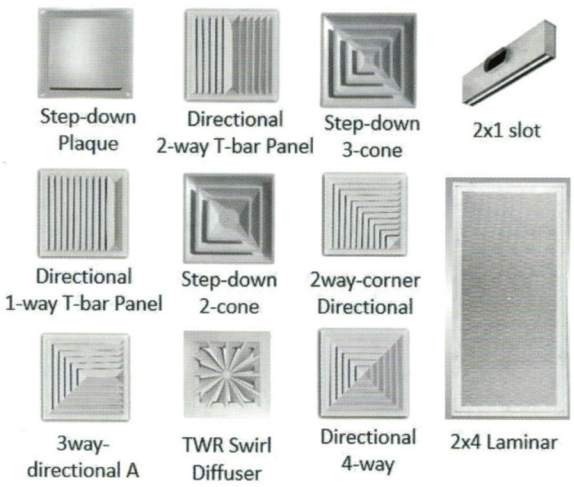

Figure 5 – A sample of the large variety of diffuser styles in the SAH diffuser list