Real World Air Handling vs. Published Data

What to believe and how to use it

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Fan manufacturers across the globe print data along with their fans to show Air Handling Manufacturer's (OEM's) how much air a given fan will move. The majority of these manufacturers test their products using standards established by Air Moving and Control Association (AMCA) publications.

When measuring air flow using a wind tunnel and unless otherwise noted by the manufacturer, centrifugal fans in housings are tested under ideal conditions with unobstructed inlets and a new, clean, straight length of outlet duct in accordance with AMCA Standard 21. When considering a real world air handler, the AMCA 210 test will not replicate what the installing engineer or OEM design engineer sees in the installed system because published data from these tests will never directly match real world applications of fans in AHU's. However, since each fan must use the same set of rules for testing so that all testing labs use the same standard for measurement, the ideal conditions specified in AMCA Standard 210 have been adopted as the correct and appropriate benchmark since they measure the fan's total potential for flow without any possible penalties that one might see in an actual system.

Once a field service contractor or OEM installs a fan the airflow through the equipment should be verified to ensure that the fan provides the required amount of flow and pressure. These measurements should be taken with the air handler in actual operation as opposed to lab conditions. With the flow and pressure measurements of fan performance, one can compare the data achieved versus the manufacturer published data and will find that the manufacturer's published performance will indicate a higher flow than what is measured in the real world application. Resistance to flow is indicated by static pressure measurements taken at the intake side of the cabinet (negative SP

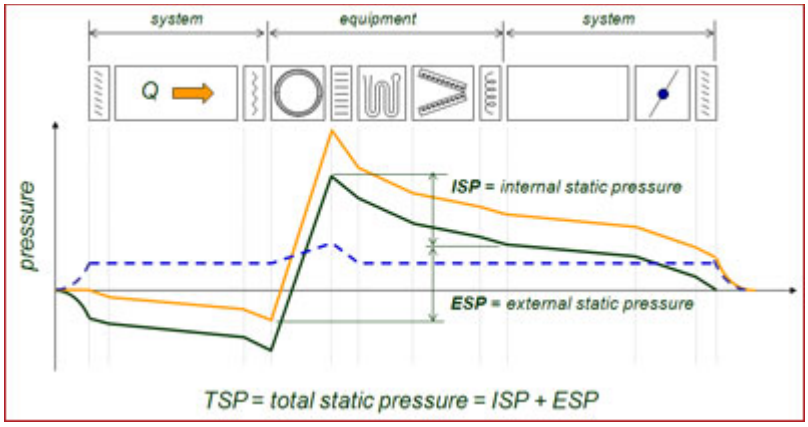

Figure 1

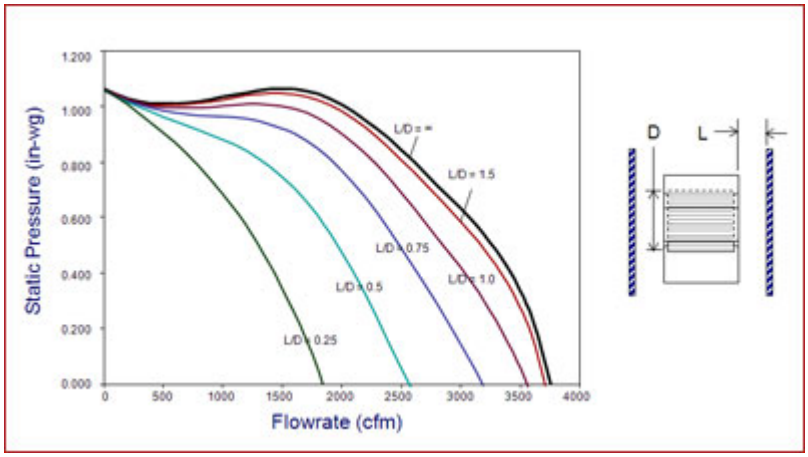

Figure 2

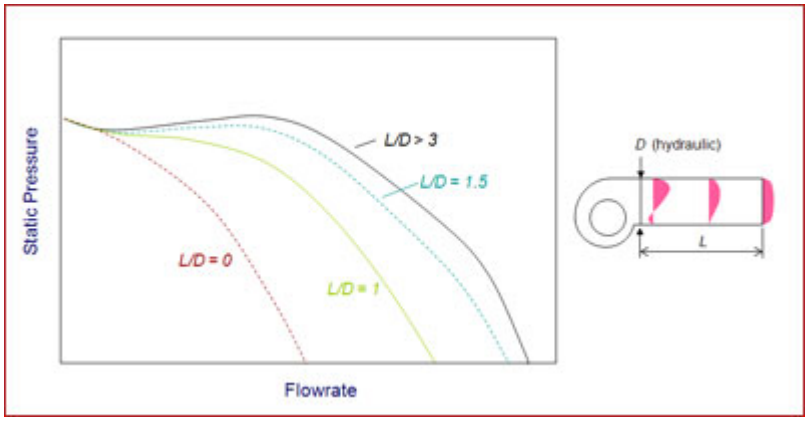

Figure 3

reading) and the exhaust side of the cabinet (positive SP reading). The total static pressure is the combination of the external static pressure and internal static pressure of the equipment [Figure 1]. The total static pressure reflects airflow resistance caused by the real world application changes. These system effects as they are commonly referred to can be explained by three different conditions.

The first major system effect that can be seen is the decrease in flow (CFM) as the total static pressure increases. This is one of the affinity or fan laws which correlate a change in pressure to a change in flow. This increase in total static pressure compared to lab conditions is typically because of common, every-day AHU design requirements like filters, ducting, take-offs, ERV's, IAQ products and all of the lengths and turns that ducting may take in order to condition a building. Since ideal conditions are used in the lab, the addition of these obstructions to the airflow has a negative effect on the amount of air flowing out of the system.

A second major system effect is the loss of airflow due to the overall cabinet constraints. As AHU's are designed, space is always a consideration. In an effort to save space, a manufacturer may place fans close to cabinet walls. The closer the cabinet side wall of the AHU is to the fan inlet, the greater the fan performance loss will be [Figure 2].

The third major system effect that leads to AHU air performance changes compared to manufacturer data is due to static regain. Static regain is the effect where some of the air velocity is converted to static pressure [Figure 3]. This duct acts very much like a rifle barrel and allows for the volume of air to take full advantage of the space and normalize its flow and pressure [Figure 4]. However, in AHU design, blowers are usually bulk head mounted or mounted with very short discharge areas, this has a negative effect on airflow and leads to the fourth major loss in flow and like the AHU cabinet wall and inlet or outlet design, the effect cannot be measured as a change in total static pressure.

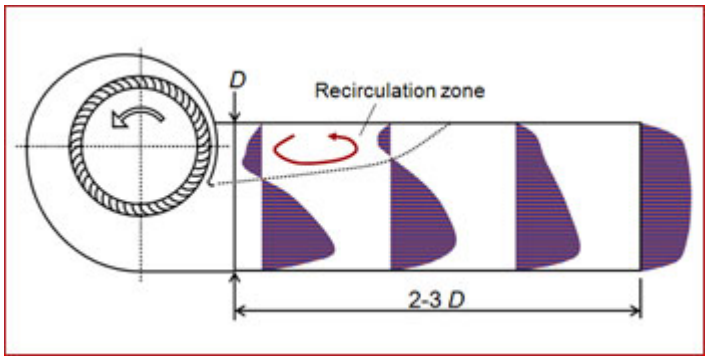

Figure 4

With all of these major, real world effects which change system airflow and AHU performance, the solution for comparing a manufacturer's air performance measurements to a specific unit or application is challenging. Lau regularly performs these tests of actual performance for its customers and many OEM's perform these tests themselves. To schedule this service, contact your Lau sales engineer.