THE MYTH OF CERTIFIED INDUCTION RATIOS

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INDUCTION RATIOS

Over the past 30 years, we have seen several manufacturers claim the performance of their diffuser is superior to others because of their “higher induction ratios”. Then they claim a value for that induction ratio. This is a non-verifiable claim and should not be placed in the specifications.

There is presently no accepted published (or even described in a manufacturer’s catalog or literature) method for determining the “induction ratio” of a diffuser. VAV induction boxes have measurable (although with some difficulty) induction ratios. This is the ratio of the induced air quantity divided by the quantity of primary air supplied. Measuring this value is best accomplished by using temperature measurements. Knowing the quantity of supplied air, (easily measured) and the temperatures of primary air, discharged air and induced air, one can easily determine the induction ratio. Some care must be taken in measuring the discharge air temperature to ensure a true average is reported, as there may be some (often significant) variations in temperature across the discharge duct. Any other techniques are intrusive, and likely will affect the result.

A jet of air from a diffuser, on the other hand, continuously induces room air as it travels away from the outlet, with increasing mass and resulting decrease in velocity. Attempting to determine the ratio of air induced into a high velocity jet that is entrained to one surface, while possible, is only valid if the distance from the diffuser is stated (which it never is in any of the suspect specifications we have read). Measurement of the mixed air temperature would also be problematic. Temperature variations would be great across a measurement distance of probably less than a half-inch near the diffuser. The location of the temperature sensor would have to be specified to the nearest millimeter. Many sensors are sufficiently large that they would affect the induction ratio at that point, affect the measurement or cover several jet streams. I suspect one could ‘prove’ any answer one wanted.

The question of whether a diffuser will develop “Coanda” effect is also a basic physics principle. While a poorly designed diffuser may not be able to achieve a “ceiling pattern”, this is an unusual circumstance given sufficient velocity leaving the unit. Any jet of air has negative static pressure, proportional to the velocity at any point. When directed towards or along a surface, this negative pressure causes the jet to ‘stick’ to the surface. It is only when the negative buoyancy of a stream of cold air is greater than the negative pressure that the air will fall into a space (the dreaded “dumping” phenomenon). Coanda and induction are strongly related phenomenon. Low induction results from both fat jets and low velocity. Either can result in loss of Coanda as cold air falls into the space. The challenge is to have sufficient induction to warm the cold air up before it loses momentum, and Coanda. The best, and proven, method of prediction is still the use of ADPI and the T_{50}/L relationships found in ASHRAE and many manufacturers’ catalogs.

Certified Induction Ratio is therefore both unverifiable and unspecifiable. ADPI calculations will prove if a diffuser is acceptable, and will provide comfort.

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