FIELD VS FACTORY

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We recently did a high-rise project that used fan-powered boxes. These boxes were series boxes that were served by a dedicated outside air unit. The speed control for these particular fan-powered boxes was controlled by a voltage input from the building automation system. The project specified that the manufacturer's voltage/cubic feet per minute (CFM) table was to be used to set the primary airflow. After setting the voltage to get the required fan CFM, we were then directed to put a piece of cardboard with a hole in it over the return opening where the filter usually sits. We were to then hang a lightweight string over the hole in the cardboard, and by adjusting the primary air, make it so the string was neutral to the opening. At this point the primary airflow would be equal to the fan airflow and at design.

We tried this technique on multiple boxes and each time we checked the primary air with a pitot tube traverse on the inlet of the primary air. We found that some boxes were perfect and spot-on while others were found to be as much as 50 percent higher than what the chart was saying it should be. We presented this data to all of the project leads and explained that the way they wanted us to test these boxes was not correct and would not deliver the result they expected. Furthermore, the units would also waste a lot of energy and not provide optimal heating/cooling when needed. The system may work, but it would not be at optimum performance.

After debating the issue over the phone multiple times with multiple people, a meeting was scheduled to test these boxes in front of the appropriate personnel to demonstrate that the method specified to test the variable air volume(VAV) boxes would yield results with errors. We spent a full day retesting these boxes. Everyone agreed that something was wrong.

The general contractor suggested that we might be testing a bad sample. He asked that we take one of the boxes that was spot-on, switch the program card with the worst box that had issues and retest. A day or two later the mechanical and control contractor had the card switched on the box that was having issues. So now we had a box that was having issues but with a program card that was spot-on when it was in a different box. We retested the troubled box and – what a surprise – we

still had the same results. We talked to the general contractor, explained our findings and how there were still issues. It was then suggested that we should try switching the fan motors to cover all the bases. The motors were swapped a few days later and we came back to do more testing. So now we had a program card and a motor from a box that was spot-on in the box that was having issues. The box was retested and we still had the same results with the box. The primary airflow was approximately 50 percent above design.

The manufacturer was then called by the engineer and general contractor. They explained the problem and the manufacturer told them to send the box in for testing. Since this wasn't a single box issue, they didn't believe that sending one box back was an option. The manufacturer swore time and time again that their box, if sent back, would do exactly what the voltage-to-CFM chart said it would. Finally, the manufacturer came out to the jobsite where we tested the boxes again. Once more, we proved that the VAV's airflow would not be correct if set up as the manufacturer specified.

After all of this, we were still directed to use the manufacturer's method. As professionals, we could not knowingly set up a building incorrectly. We discussed the issue directly with the mechanical contractor and told them how we planned on balancing these boxes. We explained the who, what, where, when, and why so they knew it was getting done correctly as opposed to what we were directed to do.

In the end, the building worked as intended. The boxes were balanced by traversing every inlet primary air duct to calibrate and set the primary air. The fan powered side of the box was then done using the voltage/CFM chart. The fan CFM was verified by traversing the discharge of the box. If the discharge was above design, the voltage input was then manipulated to get the CFM to design. Some boxes did not need any changes, but others did. Once all the boxes were balanced on the respective air handler that served them, the air handler was tested. The air handler total was within the design amount of the primary box totals. That would not have been the case if the boxes were set up as specified. The air handler would have been delivering a lot more air than what the boxes totaled.

In closing, it is always necessary to make sure that readings are correct. Laboratory test results sometimes may not transfer over to field installs. Verify, verify, verify.