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NEW ARTICLE

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FIVE STEPS TO DESIGNING AND INSTALLING A RIGHT-SIZED HVAC SYSTEM



Although ACCA Manual J has been the industry standard for a long time, many residential HVAC systems still rely on outdated rules of thumb, simplified guidelines, and conservative guesses or default software inputs rather than project-specific building data. This has led to the unfortunate prevalence of oversized heating and cooling equipment connected to poorly designed duct systems.

Improving the design, sizing, and installation of these systems is essential to meet the performance demands of modern, efficient homes and ensure occupant comfort. While some architects and builders view this as solely the HVAC contractor's domain, builders who understand how to verify that a system design matches your project's actual efficiency are critical.

Here are five steps to help you achieve those goals:

1

INCORPORATE ACTUAL BUILDING ENVELOPE SPECS INTO DESIGN:

While we always promote improving the quality of the thermal envelope for performance, comfort, and equipment efficiency, the first step in HVAC design is to ensure the design aligns with how the house will be built. Incorporate actual R-value/U-value from the builder's specifications or compliance energy model. Obtain the builder's typical blower door results and incorporate them into the design infiltration value. Using default values or prescriptive code requirements for insulation and infiltration to determine the Manual J loads often does not align with the builder's intentions and real-world performance. For accurate load calculations, you need accurate specifications.

2 USE REAL WINDOW PERFORMANCE DATA:

Accurate U-values and solar heat gain coefficients (SHGC) must be included in load calculations. Since windows can account for over 40% of the cooling load, relying on window default values often leads to incorrect, oversized A/C equipment. Request the window schedule, including the U-value and SHGC for the selected windows, and verify the proper orientation of the house.

3 CONSIDER HVAC SYSTEM DESIGN WITH THE HOME:

Design projects with HVAC equipment and ductwork layout in mind. Locate HVAC equipment and, when possible, ducts within the home's conditioned envelope. Incorporate the builder's duct leakage targets or code minimum requirements in the design. Right-sizing reduces equipment size, resulting in lower total airflow and smaller duct requirements. Use ACCA Manual S to select equipment and Manual D to design the duct system based on Manual J calculations.

4 SEAL DUCTS AND AIR-HANDLING EQUIPMENT:

Treat air-handling and duct distribution systems like plumbing; install them to be tight. Leaky ducts cause energy loss and indoor air quality issues. Seal all joints, elbows, and connections with mastic or Aeroseal, not duct tape, and require tested values that do not exceed the minimum required by the IECC.

5 TEST, VERIFY, AND COMMISSION:

Finally, verify system performance through testing:

- **Duct Tightness:** Pressure-test at 25 Pa in accordance with the IECC or testing standard goal.
- **Static Pressure:** Verify that the measured Total External Static Pressure does not exceed the equipment maximum rated value and is consistent with the designer's expected operating pressure.
- **Total System Flow:** Measure total system flow with a flow grid and verify it is within 10% of design flow.
- **Room-to-Room Pressure:** Test pressure with a digital manometer, ideally within 3 Pa, with the doors closed and the air handler running.
- **Delivered Airflow:** Verify that each supply and return airflow is within 10% or 20 CFM of Manual D design calculations using flow-capture hoods or other calibrated measurement devices.
- **A/C System Charge:** Verify refrigerant charge using manufacturer-approved procedures. Many installed systems are incorrectly charged and operate well-below specified performance.

A properly designed building enclosure deserves an HVAC system designed with equal precision. If your trade partners are unwilling to embrace performance-based design, testing, and commissioning, it may be time to build a new team.

Builders who require performance-based design and commissioning of the HVAC systems consistently deliver homes that are more comfortable, energy-efficient, durable, and reliable for the homeowners.