

Why is HVAC right sizing so important?

Matching the system to the house

An HVAC system does not stand alone

The heating, ventilation and air conditioning (HVAC) system provides both conditioned and fresh air to help keep occupants comfortable and healthy. However, the efficiency of the HVAC system depends on the characteristics and quality of other building components, including windows, insulation and air sealing. Incorrect equipment sizing reduces system performance while making a home less comfortable and escalating energy costs. Understanding the importance of equipment right sizing will help produce a lower cost, healthier and more comfortable indoor environment.

Right-sizing an HVAC system

The first step in right-sizing the HVAC system is properly calculating the cooling and heating load according to ACCA Manual J. Manual J calculations include a safety factor, so there is no need to upsize the equipment. In fact, oversizing equipment often results in more callbacks, lower customer satisfaction, and increased liability.

A properly designed HVAC system will:

- Maintain proper temperature and humidity levels to improve comfort
- Adequately ventilate and provide fresh air
- Filter air to remove pollutants
- Reduce energy waste

What do climate zones have to do with it?

Every home needs an HVAC system, but the ratio of cooling to heating will differ depending on geographic location. Missouri has a mixed climate, experiencing both freezing cold nights, and hot, humid days. Therefore, the HVAC system must be carefully designed to efficiently perform under a wide range of weather. The energy code provides guidance on how to meet these demanding requirements effectively and efficiently.

Why an oversized HVAC system is a bad idea

Nevertheless, HVAC equipment is being consistently and significantly oversized in Missouri.

When a HVAC system is oversized, negative factors arise:

- Increased up-front cost
- The need for larger ducts
- Decreased humidity control
- Higher energy demand

In particular, uncontrolled humidity can severely impact occupant health by increasing the potential for mold growth, allergic reactions and respiratory problems. An oversized HVAC system will short cycle and not provide the necessary dehumidification. Oversizing equipment reduces the system's efficiency and creates greater temperature variations throughout a home. These factors add up and can increase the cost of running the system by 10-15%, decrease indoor air quality, reduce equipment life and even compromise building materials.

What's wrong with "rule of thumb"?

In the past it was standard practice for HVAC designers to oversize systems (or size systems by "rule of thumb") to compensate for unknowns such as air leakage, duct leakage and insulation levels. However, for years studies have consistently shown that new homes are built to a higher standard and consume far less energy than the old "rule of thumb" calculations estimated. A small investment in blower door and duct leakage testing will provide critical information for right sizing equipment. The minimal cost of testing is easily offset by less expensive HVAC equipment and materials being required, fewer callbacks and reduced contractor liability.



HVAC right-sizing common issues and resources

While each Manual J calculation is unique, there are common issues and errors that should always be double checked for accuracy.

These include:

- Climate zone and orientation
- Outside design dry bulb temperatures
- R-values for walls, floors, slabs and ceilings/roof match plans
- Indoor design temperatures of 72° for winter and 75° for summer
- Indoor design humidity of 30% in winter and 50% in summer
- Window U-Factor and SHGC (with appropriate credit for permanent shading)

Other helpful resources

Scan the QR code or follow the link to view the following resources:



- ACCA Manual J Brochure
 - List of ACCA-approved Manual J software
 - Strategy Guideline: Accurate Heating and Cooling Load Calculations
 - James City County, VA HVAC Review Form
- linktr.ee/MEEACodesTeam