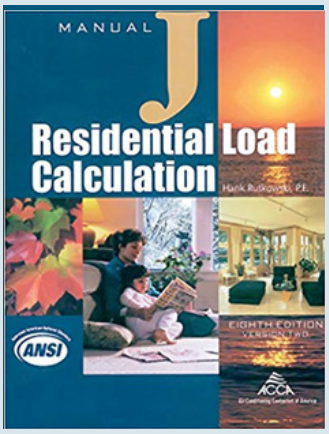
SEDAC
SMART ENERGY DESIGN ASSISTANCE CENTER

Manual J Load Sizing

Energy Code Smart Tips

What is Manual J?



Manual J is a protocol developed by the Air Conditioning Contractors of America (ACCA) to assess a home's heating and cooling needs and size HVAC equipment correctly. It determines the amount of heating and cooling that a home requires, and helps to properly size heating and cooling systems to save energy.

The Illinois Energy Code (based on IECC 2018) and ASHRAE 90.1 require the use of Manual J to properly size heating and cooling systems for energy efficiency and comfort. Using Manual J brings many other benefits as well. It reduces energy costs and initial investment costs because you will not be paying for oversized equipment. Right-sized HVAC equipment also improves indoor air quality through balanced airflow and moisture removal.

Why Modern Buildings Need Manual J

For decades, the residential HVAC industry relied on simple methods (such as the one on the right) to quickly estimate the required tonnage of heating and cooling systems. For a time, these estimates mostly worked.

However, modern homes are more efficient and better insulated. They have better lighting and more efficient appliances, which can reduce loads. Modern homes require more care in designing the HVAC system to ensure comfort in every room and to avoid oversizing or undersizing. Manual J is used to determine heating and cooling loads for proper HVAC equipment sizing.

Instructions

1. Print this page.
2. Carefully cut out the holes.
3. Stand on curb across the street and hold page 1 foot from your face.
4. Find the hole that's the closest match.
5. Size HVAC accordingly

Consequences of Improper Equipment Sizing

- Undersized equipment won't maintain comfort throughout the home, and some spaces may become too hot or too cold in extreme weather.
- Oversized equipment will short cycle, reducing both lifespan and efficiency of the appliance.
- Oversized equipment short cycling will also prevent some rooms from properly conditioning, becoming too hot or too cold, increasing service calls.
- Oversized cooling equipment won't control humidity properly, leading to IAQ issues, structural damages, and occupant service calls.
- Oversized equipment wastes money for larger equipment, duct diameters, and electrical circuits, unnecessarily increasing construction costs.

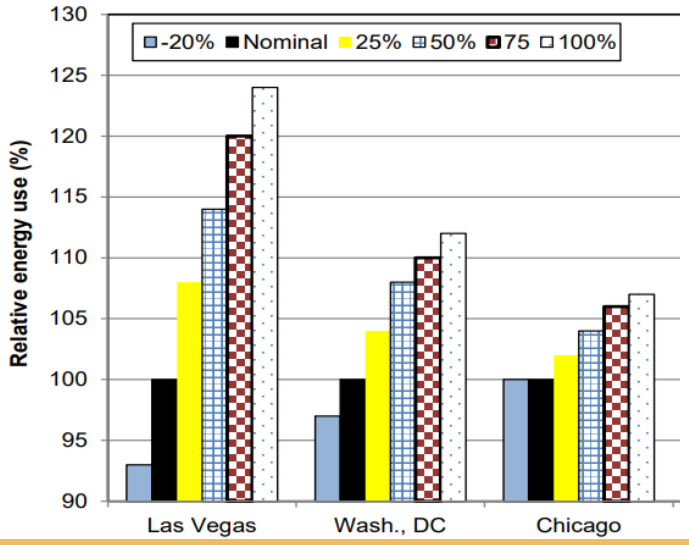
smartenergy.illinois.edu | **800.214.7954** | sedac-info@illinois.edu
Smart Energy Design Assistance Center, 1 Saint Mary's Road, Champaign, IL 61820

Efficiency Impacts of Improper Sizing

Just how much more might you pay in energy costs for an oversized HVAC system? The graph to the right, from NIST Technical Note 1848, shows the impact of oversizing on heat pump performance.

In this study, researchers tested the energy performance for different sized heat pumps, while maintaining the connected ductwork at the same size. They documented a substantial increase in energy consumption as the unit size increased.

Oversized equipment also leads to higher repair costs and a shorter system lifespan because the system starts and stops more than necessary.



Manual J Verification: Tips and Resources

For code officials and planners reviewing Manual J for their projects, what are the key things to check to verify accuracy of the Manual J?

- Location must match actual site
- Design Outdoor Temperatures must not deviate from ACCA weather tables unless superseded by local code
- Indoor design conditions must be set at 75F for cooling and 70F for heating unless superseded by local code

The Air Conditioning Contractors of America (ACCA) has a number of resources about Manual J and equipment sizing at www.acca.org/codes. Resources include:

- A Residential Plans Examiner Review Form (portion shown below)
- A Verifying Manual J Procedures brochure
- Videos about equipment sizing

Check out SEDAC's other energy code resources at **smartenergy.illinois.edu/energy-code/resources**

ACCA
Air Conditioning Contractors of America

Residential Plans Examiner Review Form for HVAC System Design (Loads, Equipment, Ducts)

Form
RPER 1.01
8 Mar 10

County, Town, Municipality, Jurisdiction

HVAC LOAD CALCULATION (IRC M1401.3)

Design Conditions

Winter Design Conditions

Outdoor temperature _____ °F
Indoor temperature _____ °F
Total heat loss _____ Btu

Summer Design Conditions

Outdoor temperature _____ °F
Indoor temperature _____ °F
Grains difference _____ Δ Gr @ _____ % Rh
Sensible heat gain _____ Btu
Latent heat gain _____ Btu
Total heat gain _____ Btu

Building Construction Information

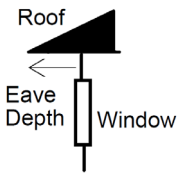
Building

Orientation (Front door faces) _____
North, East, West, South, Northeast, Northwest, Southeast, Southwest

Number of bedrooms _____
Conditioned floor area _____ Sq Ft
Number of occupants _____

Windows

Eave overhang depth _____ Ft
Internal shade _____
Blinds, drapes, etc
Number of skylights _____



HVAC EQUIPMENT SELECTION (IRC M1401.3)

smartenergy.illinois.edu | **800.214.7954** | **sedac-info@illinois.edu**
Smart Energy Design Assistance Center, 1 Saint Mary's Road, Champaign, IL 61820