

Right Sizing Heating/ Cooling Systems

Overview

Size matters! Whether you are installing equipment in a new home or replacing existing equipment, the size of the equipment should match the needs of your home. DPER requires comprehensive heating load calculations and subsequent equipment sizing calculations for new construction, but currently does not ask for calculations for furnace or system replacements. The absence of requirement should not stop you from ensuring your replacement equipment is right sized. This document provides general information about sizing regardless of building new or replacing equipment, benefits of right sizing, best practices, and resources for more information.

When is This Applicable?

For new construction, the Washington State Energy Code R403.6 Equipment sizing requires heating and cooling equipment to be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. For furnace or system replacements, sizing calculations are not required but are highly recommended in order to achieve related benefits.

A snapshot view of the sizing estimation portion of the DPER Energy Compliance Form.



What Makes it Green?

When equipment is right sized, the following benefits are possible:

- Save money on initial equipment cost.
- Save wear and tear on equipment by preventing short-cycling which can occur if it isn't properly sized.
- Improve comfort and health when equipment and ducts are properly sized and positioned.

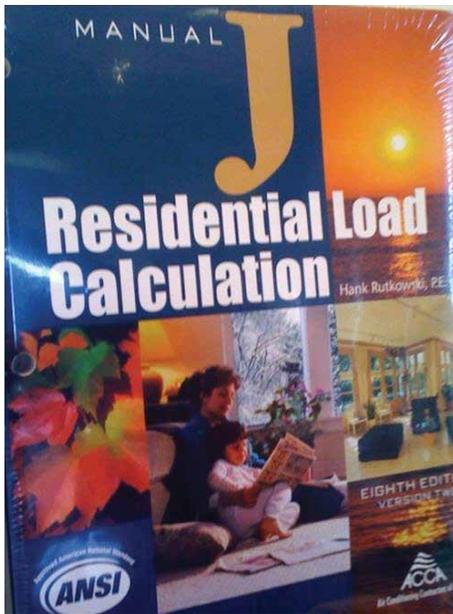
Best Practices

Whether building new, remodeling, or replacing, it is important and valuable to consider a whole house approach to heating and cooling. Improvements or changes in one part of the house, such as increasing attic insulation or air sealing, can improve the energy efficiency of your home thereby decreasing the size needed for your heating and cooling equipment.

In order to achieve the biggest bang for your buck:

- Ensure the whole house, including any planned upgrades, is fully considered when sizing equipment.
- For furnace or equipment replacement, ask your mechanical contractor to provide the load calculations prior to providing equipment estimates. Communicate any planned changes in your home including air sealing, insulations, window replacements, or additions.
- Ensure ducts (where applicable) are well sealed and properly positioned to optimize distribution of heated or cooled air throughout your home.





Manual J is the Industry's standard for calculating residential heating and cooling loads. Ask your mechanical contractor to follow this standard instead of rules of thumb. Source: O'Brien & Company.

Applicable references/standards

Bulletin 36: Mechanical Permits FAQs. Application requirements include, but are not limited to:

- Name and license number of Contractor
- Manufacturer, Size and Model Number of Furnace

Resources

For the complete King County Green Building Handbook and individual Green Sheet PDF files, please visit our website at: <http://kingcounty.gov/property/permits/publications/greenbuild.aspx>. For additional information, please email

dperwebinquiries@kingcounty.gov or call 206-296-6600.

See these related DPER Green Sheets (GS):

- Furnace Replacement, GS Number 18
- Thermostat, GS Number 16
- Duct Sealing, GS Number 11
- Fresh Air Ventilation, GS Number 14
- Insulation, GS Number 13
- Alternative Heating Systems, GS Number 19

PSE Rebates and Offers: Puget Sound Energy offers rebates for various energy efficient approaches.

Strategy Guideline: HVAC Equipment Sizing: describes the equipment selection of a split system air conditioner and furnace for an example house in Chicago, Illinois, as well as a heat pump system for an example house in Orlando, Florida. While these climates are different than King County, this resource is included because it contains useful definitions and process tips.

An Energy Upgrade on a Budget: This article covers an interesting case study of a residential energy upgrade and includes a subsection about energy calculations.

ACCA Manual J Brochure and **ACCA Manual S Brochure:** These resources provide consumers with information of how heating and cooling loads and equipment size, respectively, are properly calculated. While you will still need to complete the Energy Compliance Form, these are helpful resources

Saving Energy with Manual J and Manual D: This provides straight talk about the resistance to performing necessary calculations as well as the actual and perceived benefits of right sizing.

Permit Tips

For New Construction: Sizing your heating and cooling systems is included as part of your building permit for new construction. Talk to a DPER plans examiner prior to submitting your permit to better understand and implement the requirements. The following tips will also save you time and hassle:

- Provide Manual J (or S) Forms along with permit application.

In addition to the [Energy Compliance Form](#), clearly note the size and location of your heating and cooling equipment on your plans.

DPER will conduct an inspection (most often during framing), so be sure your heating and cooling equipment are accessible and documentation (either on the equipment itself or with the manual) is easy for the inspector to access.

For existing system upgrades/changes, DPER does not require sizing forms. See the Best Practices section for tips to have your system properly sized even if the calculations are not required.

Residential Heating System Sizing Estimation

Heating and cooling systems for residential projects shall be sized in accordance with ACCA Manual S or equiv.

Indoor Design Temperature	70		
Outdoor Design Temp	Township and Range	City:	
Design Temperature Difference =		(Use 22 for Design default if outdoor design temperature is not known)	
(Indoor - Outdoor Design Temp)		(recommended outdoor design temperatures shown on page 5)	
Conditioned Floor Area (ft ²) =		Average floor height =	ft.
Conditioned Volume (floor area X average floor height) =			
Sum of UA (heat loss of bldg)			
Envelope Heat Load		other fuels	electric
Sum of UA X Design Temperature Difference =			Btu / Hour
Air Leakage Heat Load		<i>Convert Btu / hr to electric KW: Btu ÷ 3413</i>	
CV X 0.6 X Design Temperature Difference X .018 =			Btu / Hour
Building Design Heat Load			KW
Air Leakage + Envelope Heat Load =			Btu / Hour
Building and Duct Heat Load			KW
Building Design Heat Load x 1.15 or 1.0 () =			Btu / Hour
<i>Use 1.15 if ducts are located in unconditioned space: Building Design Heat Load X 1.15</i>			
<i>Use 1.0 if ducts are located in conditioned space: Building Design Heat Load X 1.0</i>			
Maximum Heating Equipment Output			
Use Building and Duct Heat Load X 1.40 for Forced Air Furnace =			Btu / Hour
Use Building and Duct Heat Load X 1.25 for Heat Pump system =			KW

Actual heat sizing calculation to be supplied by mechanical contractor at time of equipment installation.

