

HOME

Energy Savings and Comfort

What is HVAC system sizing?

One of the most important decisions you can make about your new central heating and cooling system is sizing. System sizing refers to the process of determining how much heat your home needs to keep warm in the winter and how much cooling it needs to beat the heat in the summer and remain comfortable. Sizing must be performed before the HVAC contractor can choose the proper equipment to install. While both oversized and undersized systems can result in poor performance, oversized systems are more commonly found in homes.

A properly sized system not only helps ensure that you are comfortable, but also helps avoid adding to the strain that air conditioning places on electric system reliability during summer peak demand hours of noon to 6 PM.

A Heating, Ventilation and Air Conditioning (HVAC) system includes the following components:

- Heating unit, usually a blower/furnace combination
- Cooling units, usually an indoor evaporator coil mounted on the furnace and an outdoor condenser, containing the compressor and a coil. These two cooling units must be matched and replaced together when a new system is installed to provide the efficiency in energy use you are purchasing.*
- Filter
- Programmable electronic thermostat, and
- Duct system

To determine the proper size and type of HVAC equipment for your home, a heat gain and heat loss calculation should be performed by your contractor. This calculation considers the location, size and construction of your house. Each home has unique characteristics that influence its heat gain and/or loss. These characteristics can change when modifications are made to the house. When energy conservation measures such as ceiling and wall insulation, high performance windows or duct system improvements are installed, both the heating and cooling needs can and most times will decrease. Therefore, the original installed equipment may no longer be the right size.

Try this on for size

A properly sized HVAC system will meet all the heating and cooling needs of the occupants throughout the year as well as offer these other additional benefits:



- Provide a comfortable environment in each room of the house
- Reduce interior equipment operation noise
- Reduce heating and cooling costs
- Extend the life span of the HVAC equipment

Do the research

Your HVAC contractor must gather information to properly evaluate your house and size your system. First, the heating and cooling needs of the whole house and for each room of the house will be determined by collecting the following information:

- House or each room size
- Average ceiling height
- Exterior wall area - total house wall area minus the area of the windows and doors [Wall(s) between the house and garage are considered outside walls]

What is HVAC system sizing?

- Floor area exposed to the outside for raised floor rooms, or length in feet of slab edge exposed for slab-on-grade rooms
- Ceiling area exposed to the outside
- Area of doors exposed to outside
- Type, area, shading and orientation of windows
- Construction type, including insulation level of the wall, ceiling, floor and doors in the house or room(s)
- Measurement or estimation of the home's air leakage
- Measurement or estimation of duct leakage

Next, this information will be used to calculate the heating and cooling needs of the whole house either manually or with a computer. Room-by-room calculations are required for duct system design. Both the equipment sizing and the duct design must be satisfactorily performed for the system to work properly. Duct design is explained in another PG&E informational sheet. Using the California Energy Commission's referenced sizing methodology (ACCA Manual J&D**), contractors can then:

- Establish the total air flow needed to heat and cool the house
- Select the air conditioning components that will deliver the cooling needed based on the cooling air flow
- Select the fan, a part of the furnace, needed to provide the cooling air flow

If a heat pump is being installed, the contractor may need to perform additional calculations to select the appropriate supplemental electric resistance heat (e.g., like coils in a toaster).

Make an informed decision

When comparing bids from contractors for installing a new heating and cooling system in your home, be sure to get the same information from each. Bids should include:

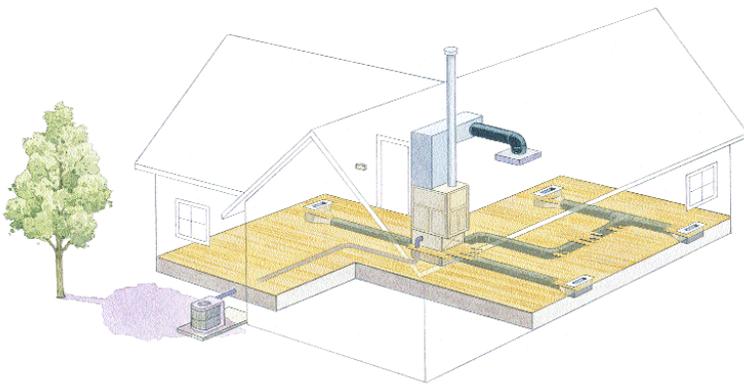
- Furnace: Manufacturer, Type, Model Number, Input BTU/hr, Output BTU/hr, Annual Fuel Utilization Efficiency (AFUE), and Furnace Cooling Cubic Feet per Minute (CFM)
- Air Conditioner Coil: Manufacturer, Type of Refrigerant Flow Metering Device, and Model Number
- Air Conditioning Condenser: Manufacturer, Type of Compressor, Model Number, and Sensible Capacity at Outdoor Design Temperature
- Sizing calculation worksheet
- Costs for equipment and installation
- Costs for options, for example: SEER 12 vs. SEER 10, maintenance agreement, air filters, extended warranty, etc.

The sizing calculation worksheet, mentioned above, either prepared manually or computer generated, should provide the following data:

- Inside and outside design temperatures
- Heating Load BTU/hr
- Sensible Cooling Load BTU/hr
- Latent Cooling Load BTU/hr
- Cubic Feet per Minute (CFM) Cooling Air Flow



When comparing contractors' bids, remember a properly sized system will follow three general rules: 1) Furnace Output BTU/hr should be at least 1.3 times the Heating Load BTU/hr, 2) the Furnace Cooling CFM should be 0.9 times or greater the Cooling Air Flow CFM, and 3) the Air Conditioner Condenser's Sensible Capacity should be equal to or greater than the Sensible Cooling Load.



Ask about your duct system

The duct system distributes the heated or cooled air throughout your home. In cases where central air conditioning is being added to a home where it did not exist before, the ducts should be sized to handle the cooling air flow. Where an existing central air conditioner is being replaced, and you have a room or rooms where it never seems to get warm or cool, the ducts should be sized and any adjustments made to correct the air flow to the affected room(s). The ducts should then be inspected for leaks and damage. Leaky ducts mean energy and money is wasted in both the heating and cooling seasons. Some contractors will offer to perform a "duct leakage test" to determine duct air leakage that is expressed as a percentage of system air flow. The test requires the contractor to hook up a machine called a "duct tester fan" to the return air register to verify what air leakage exists in your duct system. Leaks must be sealed with a UL181 mastic or non-cloth duct tape. Cloth duct tapes do not last. In existing homes, the average duct leakage is 34% and can reasonably be reduced to 12% or less. "Tight ducts" for new homes as defined by the California Energy Commission must have duct leakage of less than 6%.

BTU (British Thermal Unit) - The amount of thermal energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit at sea level.

SEER (Seasonal Energy Efficiency Ratio) - A rating for central air conditioners. SEER 10 is the minimum for new units manufactured after January 1, 1992.

ACCA (Air Conditioning Contractors of America) - A national organization that publishes technical manuals and calculation procedures.

Sensible Cooling Load - BTU's needed to be removed in order to lower the thermostat temperature independent of the BTU's related to humidity.

Latent Cooling Load - BTU's needed to be removed to lower humidity.

AFUE (Annual Fuel Utilization Efficiency) - A laboratory derived efficiency for heating appliances which accounts for chimney losses, jacket losses, and cycling losses, but not distribution losses or fan/pump energy.

CFM (Cubic feet per minute) - Unit used to express the air flow of fans or ducts.

* This paragraph describes a system arrangement called a "split system". Another system arrangement is called a "packaged unit". This arrangement has both the heating and cooling units in one enclosure and can be found mounted on the roof or on the ground.

** Contractors can use other methods to determine load and/or sizing calculations, including methods developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

Get involved

Tell your HVAC contractor about how your existing system works and whether you are satisfied with it or not. Here are some questions to ask yourself: Are you too hot in the summer and/or too cold in the winter? Is each room in the house maintaining the same temperature as the other rooms? Is one room always hot or always cold? Does your system cycle on and off frequently or did it run constantly and never shut off? Does the system seem noisy? Did you install ceiling, wall or floor insulation or new high performance windows? This information will aid in assessing the current system setup and help determine the design and specifications for an ideal replacement system.

Here is a checklist to ask your HVAC contractor to ensure a thorough system sizing is performed:

- *Have the contractor check the existing system for any comfort concerns you had about your home.*
- *Inspect the duct system for deteriorated or disconnected ducts, duct leakage, or insulation level.*
- *Perform a "duct leakage test" to assess duct system performance.*
- *Consider the new windows and insulation, if applicable, in the sizing calculations.*
- *Match and replace both the indoor and outdoor unit.*
- *Replace the existing thermostat with a programmable electronic thermostat for more accurate control.*

Not all contractors perform a heat loss and heat gain calculation when sizing for a new replacement system. Contractors who do perform this calculation and other important services such as duct leakage tests may cost a little more and take a little more time upfront but it will enable you to maximize the level of comfort in your home.

For more information...
Check out the SmarterEnergy Web site at:

www.pge.com/smarterenergy
or call the Smarter Energy Line,
1 800 933-9555

Related Fact Sheets Available to You From Pacific Gas and Electric Company

A WHOLE-SYSTEM APPROACH TO HEATING AND COOLING

HOME HEATING

HOME COOLING

HEAT PUMP

WHY IS DUCT TESTING IMPORTANT?



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