



## Residential Heating and Cooling Load Calculations

### Introduction (Why You Should Do Load Calculations)

Load calculations are required by three different codes in California:

1. Section 1105.1 of Title 24, Part 4 (California Mechanical Code) requires that residential cooling systems be sized according to ACCA Manual J and ACCA Manual S. Section 601.2.1 of the California Mechanical Code requires that residential ducts be sized in accordance with ACCA Manual D. Manual D requires room-by-room load calculations according to ACCA Manual J.
2. Section 150.0(h)1 of Title 24, Part 6 (California Energy Code) requires ACCA Manual J load calculations, or equal, on all new systems, whether in a new home or an existing home.
3. Section 4.507.2 of Title 24, Part 11 (California Green Code) requires ACCA Manual J, Manual S equipment selection, and Manual D duct system design on all new systems, whether in a new home or an existing home.

ACCA is Air Conditioning Contractors of America. They published ANSI approved standards for residential HVAC design that are referenced in most building codes across the country. These are considered the industry standard for residential HVAC design.

- **ACCA Manual J** is for heating and cooling load calculations
- **ACCA Manual S** is for heating and cooling equipment sizing
- **ACCA Manual D** is for duct system design and sizing

Load calculations estimate the heat loss and gain on a home in the winter and summer, respectively. The results of these calculations are used to select the optimal size heating and cooling equipment. There is a somewhat narrow range of equipment size that will maximize comfort and efficiency. Historically, everyone believed that bigger equipment was “safer” – less likely to result in inadequate comfort complaints, even at the expense of some efficiency (higher bills). Extensive research and education have made it widely known that **oversized** equipment will cause “short cycling”, which will cause serious comfort issues, higher energy use and shortened equipment life. Furthermore, the problem is greatly exacerbated by reduced airflow caused by undersized ducts. While dual speed and variable speed systems have made the problem less critical, it is still common to install an oversized system. It is safe to assume that over many years of “playing it safe”, using rules of thumb, and sheer ignorance has resulted in a typical home in CA (and many other parts of the country) having a system that is oversized and ducts that are undersized. **There is no excuse for this to continue.**

As California strives to switch from fossil fuels to renewable sources of electricity, it needs to be pointed out that heat pumps are much more susceptible to problems caused by poor design than gas furnaces. **If we want to convince homeowners to electrify, we must provide them with a good experience from**

both a comfort and energy efficiency standpoint. Many would argue that in terms of public relations and overall acceptance, *comfort* is the more important of the two. *Doing proper load calculations, equipment sizing and duct system design is critical to a comfortable and efficient heat pump system.*

## **HVAC Contractors**

Load calculations are time consuming and complicated.

Traditional software is very difficult to learn. You can either do load calculations yourself or hire someone to do them for you. Actually, that's not entirely true. Our service is a combination of the two. We do the grunt work for you by getting the house into the software, then you can fine tune it yourself. (You will need to have a fully licensed version of *Kwik Model with EnergyGauge Loads*. Visit [www.kwikmodel.com](http://www.kwikmodel.com))

Send us the house plans and energy features (via an online form) and we can build the 3D model for you for cheaper than your time is worth to do it yourself. We will send you the Kwik Model 3D project file that you can then open in your copy of Kwik Model and make adjustments as needed. You can also use it to size ducts and evaluate room airflows. We provide room-by-room loads at no extra cost.

If you don't have Kwik Model 3D, you can take the code compliant, Manual J certified, load calculations that we send you and use them.

If you don't have house plans, we recommend CubiCasa. A phone app that creates a very accurate and professional looking floor plan by scanning the house. (visit [www.cubi.casa](http://www.cubi.casa)) There is no charge for a basic floor plan. You will need to add window dimensions (this will change soon) and ceiling heights to the plan.

CubiCasa guarantees a 24-hour turnaround on their floor plans.

Once we have all the information we need, we guarantee a 24-hour turnaround on the load calculations.

Is that too long? Ask the homeowner to have the load calculations done in advance, before you even visit their house. See below.

Please send questions to [kwikmodel@gmail.com](mailto:kwikmodel@gmail.com).

## **Load Calculations for Homeowners**

Have us do your home's load calculations for you. Are you shopping for a new HVAC system? You will eventually. Chances are your existing system is oversized and the ducts are undersized (see Introduction, above). Most contractors will just want to replace like-for-like. Are you willing to live with an oversized system for another 15-20 years?

Are you considering upgrading to a heat pump? You definitely need to have your system carefully designed.

Knowledge is power. Have your heating and cooling load calculations done by an independent third-party. You will own these calculations and can provide them to any contractor that is bidding on your new system. We create a 3D model of your house using Kwik Model with EnergyGauge Loads. If your contractor uses the same load calculation software, we provide you with the project file that you can give to them to do a complete system design including proper equipment sizing and duct system design.

Here's how it works:

1. If you have a set of architectural plans, please provide us an electronic copy. This can be a scan or a good photograph.
2. If you don't have a set of plans, you can easily create some by using CubiCasa, a phone app that creates very professional, detailed floor plans by just scanning your house with your phone. Visit [www.cubi.casa](http://www.cubi.casa)
3. Complete the information survey about your home's energy features here: <https://form.jotform.com/223345923210144>
4. We can send you a cost estimate with just the plans.
5. Once we have all of the information, within 24 hours we will send you a detailed, ACCA compliant load calculation report and the project file.
6. This will tell you how much heating and cooling your house needs. This is invaluable information to properly size your heating and cooling system. Better yet, the loads are done on a room-by-room basis, which is crucial to designing a good duct system (or evaluating an existing one).

Please send questions to [kwikmodel@gmail.com](mailto:kwikmodel@gmail.com).

*DISCLAIMER: Installing contractor always ultimately responsible for the performance and code compliance of the systems they install. Load calculations are just one component of a well-designed system. Coded Energy, Inc. is not responsible for the accuracy of the information provided to us.*