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How to do a manual j

QUICK TIPSDo I Really Need a Manual J Load Calculation? Do I really need a Manual J load calculations done on my home? Let's discuss the issues and the benefits of a load calculation, then you decide! Proven Facts National surveys have determined that well over half of all HVAC contractors do not size heating and cooling systems correctly. When it is time for a new hvac system, is critical that the system is sized correctly for the best efficiency, comfort, and lowest maintenance and operating costs over the life of the new system. Older hvac systems (10 years old or more) are often unreliable and are definitely less efficient than a newer system. Hvac contractors habitually oversize equipment. They prefer to err on the large side. This costs the homeowner in higher installation costs, inefficient operation costs more on utility bills, and the equipment breaks down more often costing more for service maintenance. Oversized air conditioning equipment does not operate long enough to control excess humidity, making the home clammy and uncomfortable. This can also create a mold issue. Many contractors / installers only check the nameplate of the existing system for sizing. This method does not account for today's increased equipment efficiencies, or home improvements which undoubtedly have been done over the years. How does this contractor know that the equipment was properly sized for the home originally? He doesn't! Older structures were not sealed well. This has led to hvac systems sized 2 to 4 times larger than necessary. These homes have since had windows replaced, weather stripping added, insulation added, and gaps and cracks sealed. A much smaller system will operate efficiently, saving large amounts of energy. Many municipalities around the country are now requiring a Manual J calculation and a Manual D duct design be performed before a building permit is issued. The Manual J and Manual D calculation method Correct hvac system sizing requires looking at many factors of the home. Size, shape, and North orientation of the house Insulation levels in the attic, crawlspace, and walls Window area, window locations, type and u-value Air infiltration rates Occupant comfort preferences Lights and major home appliances, which emit heat into the home Ceiling heights and window shading many more factors Homeowners should insist that a proper Manual J load calculation be performed before signing a contract. According to ACCA (The Air Conditioning Contractors of America), Manual J is the recommended hvac load calculation method for use in the United States. Make sure that the procedure used by your contractor follows Manual J. If ducts are part of the installation, they should be sized using the ACCA's Manual D. ACCA's Manual S is used for proper Residential Equipment Selection. I couldn't say it any better. Following are quotes from the DOE (Department of Energy). Steps a Good Contractor Should Take to Size Your System Many factors affect a home's heating or cooling requirement, or "load." A good estimator will measure walls, ceilings, floor space, and windows to determine the room volumes, and will assess the R-value of the home's insulation, windows, and building materials. A close estimate of the building's air leakage is also necessary. A blower door test is the best way to measure air leakage. A good estimate will also include an inspection of the size, condition of seals on joints and insulation, and location of the distribution ducts in forced air systems. The placement of supply and return registers should be appropriate for the system type and size. The orientation of the house also affects heat gain and heat loss through windows. Overhangs can reduce solar gain through windows. Make sure the contractor uses the correct design for the outdoor temperature and humidity in your area. Using a higher summer design temperature results in oversizing air conditioners. When the contractors are finished, get a copy of their calculations, assumptions, and the computer printout or finished worksheet. This is your only proof that they did the job right. To summarize, when designing your new heating and air conditioning system, the contractor you choose should do the following: 1) Use a computer program or written calculation procedure to size the system 2) Provide a written contract listing the main points of your installation and includes the results of the heating and cooling load calculation 3) Give you a written warranty on equipment and workmanship 4) Allow you to hold the final payment until you are satisfied with the new system. Visit "Design Calculations": Benefits and Uses for the Homeowner, Builder, and the Do-It-Yourselfer Read about "The Hvac Purchaser's Dilemma: Design First or Regret It Later. Read more about Wrightsoft Manual J calculations Return to Quick Tips main page Leave "Load Calculations" and Return to HOME Please feel free to link to this page from your website. This page's URL is: Enjoy this page? Please pay it forward. Here's how... Would you prefer to share this page with others by linking to it? Click on the HTML link code below. Copy and paste it, adding a note of your own, into your blog, a Web page, forums, a blog comment, your Facebook account, or anywhere that someone would find this page valuable. Copyright 2009 - 2013 perfect-home-hvac-design.com All Rights Reserved SBI! We do a lot of heating and air conditioning system design at Energy Vanguard. Alexander Bell, who goes by Andy, is our design wizard, and I've been getting involved with the process again lately. When I talk to potential clients, a lot of them tell me their contractor wants to size their air conditioner using a rule of thumb. The rule is usually something like this: Install one ton of air conditioning capacity for every 500 (or 400 or 600) square feet of conditioned floor area. How far off are they? Let's take a look. A bit of our Manual J data True HVAC designs always start with a load calculation. So we can look at the data. The graph below shows data for just a few buildings we've done in the past few years. Forty of them, to be exact. We're in the process of putting all our data into a spreadsheet so we'll have more to show later. On the horizontal axis, I plotted the conditioned floor area, in square feet. On the vertical axis, I plotted the cooling load divided by the floor area, or square feet per ton. Remember, when HVAC contractors use rules of thumb to size air conditioners, they usually pick a number between 400 and 600 square feet per ton. Here's what our data show. Note that not a single one of these load calculations was as low as the high end of the typical range used in rules of thumb. The low number on that graph is 624 square feet per ton. The majority of the cooling loads shown here are above 1,000 sf/ton. Only eight are below 1,000 sf/ton. In case you're wondering, I threw out the data for cooling loads in cold climates when I plotted this graph. We had one in Maine that was nearly 4,000 sf/ton, but that's not really relevant because Maine doesn't have much of a cooling load. Probably a majority of the homes there don't even have air conditioning. Most of the homes in the sample set were in the Southeastern U.S., including Texas, but we had a couple in California and several in the Midwest as well. The average of the 40 shown above is 1,431 sf/ton. Yes, that's about a thousand sf/ton higher than the common rule of thumb in use. "But wait," you say, "cooling load isn't the same as air conditioner size. Didn't you tell us that you have to adjust the air conditioner size when you do Manual S?" Why, yes, I did. Most of the time, the air conditioner size will be larger than the cooling load. But we're usually talking maybe 10%. So instead of 1,431 sf/ton based on the load, the actual AC size might give us 1,300 sf/ton. That's till a lot different from the 500 sf/ton rule of thumb. Oh, and that 10% difference is usually offset by the oversizing inherent in Manual J. Five facts about load calculations Here are a few points that came up in the comments to the article and on LinkedIn and Facebook as well as some takeaways that I feel need to be emphasized. 1. No matter the number, you can't use square feet per ton to size air conditioners. I posted the square feet per ton results we got from 40 Manual J load calculations in hot and mixed climates. The average was 1,431, but you can't use that to size air conditioners. You have to do an actual load calculation. Those 40 results ranged from a low of 624 to a high of 3,325 sf/ton. 2. If you tell me that your load calculations average 400-600 square feet per ton, I assume you're not doing them correctly. Is it possible that homes meeting current building and energy codes need that much air conditioning? Yes. If they have a lot of window area, they face west, and are in states with weak codes. My friend Mike MacFarland of Energy Docs in California gets 1,500 sf/ton for retrofits and achieved 3,350 sf/ton for a new zero energy home. And their design temperature is 102° F so don't tell me this doesn't apply in Florida or Arizona. 3. You need room-by-room load calculations to get the air flow right. Contractors who use whole-house rules of thumb often don't get the right amount of conditioned air for individual rooms. The result is one of the most common homeowner complaints: rooms that are too hot or too cold. (Of course, enclosure problems also play a role in this.) 4. The square feet per ton you get from Manual J still gives you an oversized system, even when you do it correctly. Mike MacFarland says he finds that Manual J results in equipment with 20-40% too much capacity. David Butler says 15%. In my own condo, for which I've measured AC runtimes for the past two years, I'm seeing about 75%. (I'll write more about my condo soon.) 5. It's easy to get whatever load you want when you do a Manual J load calculation. I've written about this before. Putting in the wrong values for windows is an easy way to add load, as is putting in too many people, using exaggerated design temperatures, and the wrong orientation. If you want 500 sf/ton, it's not hard to produce a Manual J load calculation that gives you that number. I don't think it's a matter of someone starting out thinking they want to hit 500 sf/ton. It's more a matter of not believing the lower loads and changing design temperatures, number of people, and other factors to match what they believe are the correct conditions to model. That's not the right way to do it, though. Designing an HVAC system starts with proper sizing. Look at the square feet per ton number you get to see if you're in the ballpark. If the number is less than 1,000 sf/ton, there's a good chance the number is wrong. Rules of thumb must die. Start with a real load calculation. Allison Bailes of Decatur, Georgia, is a speaker, writer, building science consultant, and the author of the Energy Vanguard Blog. Check out his in-depth course, Mastering Building Science at Heatspring Learning Institute, and follow him on Twitter at @EnergyVanguard. To properly design and install a forced-air heating and cooling system, your HVAC technician must go by the book when it comes to Manual J and Manual D for an accurate load calculation and an efficient duct system. Only then can you select the right heating and cooling system, using Manual S, that is sized and installed to your home's specifications. HVAC installation best practices Manuals J, D and S were developed by engineers at the Air Conditioning Contractors of America (ACCA) to implement universal standards and best practices for the design and installation of residential HVAC systems. Manual J and Manual D are recognized throughout the country, touted by the U.S. Department of Energy and required by most building codes. When your HVAC tech follows Manual J and Manual D and then properly sizes your new heating and cooling systems with Manual S, you reap the following benefits: Energy efficiency and comfort: Properly-sized heating and cooling systems save energy. Rule-of-thumb sizing most often results in oversized systems. This causes quick cycling, like stop-and-go traffic, as opposed to highway driving for greater fuel efficiency. Quick cycling also creates more humid indoor conditions because your A/C or heat pump doesn't cycle long enough to remove adequate moisture from the home. Initial and return on investment: Accurately-sized heating and cooling systems may save initial investment. Oversized systems cost more money, which increases your initial investment and, in combination with poor efficiency, prolongs your return on investment. This is the point at which your new heating and cooling systems have paid for themselves with energy savings over your old or less efficient systems. Indoor-air quality (IAQ): A properly-sized A/C or heat pump will help boost IAQ with balanced airflow and moisture removal. This helps prevent stagnant indoor conditions and issues with mold and mildew, bacterial growth, dust mite proliferation and a host of other IAQ concerns. You may also experience lower cooling bills with optimal indoor humidity level because more humid and sticky air feels warmer and requires longer use of your A/C or heat pump. Manual J: Residential load calculation Manual J is the protocol used for determining the amount of heating and cooling that a home requires to keep its occupants warm in the heating months and cool and dry in the cooling months. There are dozens of factors and complex calculations to consider for determining the heating and cooling load of a particular home. Your HVAC tech should use the latest software to aid in a Manual J calculation. These are some of the many factors that are considered: Number, size and efficiency of windows Local climate in regards to average high and low temperatures and humidity Orientation to the sun Air-leakage rate of the home Air-leakage rate of the duct system Amount and quality of insulation installed Lighting and heat-generating appliances Number and ages of occupants Manual D: Residential duct systems Manual D is ACCA's by-the-book methodology for determining duct sizing and installation. Good duct design is essential for balanced airflow, which determines in no small part your energy bills and home comfort. Once a Manual J calculation has been completed, your HVAC tech can design the duct system with the following criteria: Locate ducts within the conditioned spaces of your home. Design the size of each individual duct run, supply duct and return duct. Utilize appropriate spaces, such as inner walls, for supply outlets and match each supply outlet with a return grille. Seal duct seams with mastic and metal tape and insulate any ductwork in unconditioned spaces to minimize heat energy loss. Manual S: Residential equipment selection Once your HVAC tech has used Manual J and Manual D, Manual S is used to size and select the heating and cooling equipment. The goal for equipment selection is to install heating and cooling systems with the same heating and cooling capacities as the heating and cooling loads of your home. The HVAC systems available today offer homeowners a wide range of advanced features that can decrease the size of the system needed. For instance, a variable-speed blower/air handler precisely matches in real time the amount of heating and cooling needed in your living spaces. This saves energy and increases comfort. To speak with an HVAC tech who knows Manual J and Manual D to the letter, contact Griffith Energy Services today. We serve homeowners in Baltimore, Berrville, Charles Town, Dover and all surrounding regions. Written by Kevin Spain

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