

Manual J, D & S - Frequently Asked Questions for Connecticut

Q: Why do I need to perform a load calculation (Manual J) for a Replacement System?

A: For several reasons; buildings are improved over time (i.e. windows, insulation, and weatherization), equipment selection and system types have an impact on loads and it is unlikely a load calculation with the current sensitivities was ever performed. The load calculation is a requisite requirement for equipment selection in the Manual S process.

Q: When do I perform a Block Load versus a Room-by-Room Load calculation?

A: A block load may be performed on an existing house with an existing distribution system (for the given system type). In any case where the distribution system is being modified, added, or newly installed then a Room-by-Room procedure is required before the equipment is selected and any distribution system installed.

Q: Can I use an online load calculator tool for Manual J?

A: Code requires you to perform a load calculation using the procedures in Manual J-8. Version 8 is much more refined than previous versions and has particular sensitivities for duct locations and loads as well as window gains. The Air Conditioning Contractors of America (ACCA) has a list of software vendors who have software that is approved to perform the load calculations. All of the online calculators that have been reviewed to date do not meet the Manual J-8 capabilities; therefore you may not use them for your load calculations.

Q: Do I need to perform load calculations for Ductless Mini-Split systems?

A: YES. Be forewarned that many of the mini-split OEM's are not currently producing the engineering documentation to perform Manual S calculations correctly. Given the typical configuration of most mini-split systems using surface mounted air terminals and all of Connecticut having an outdoor design temperature below the AHRI rating temperature of 95°F, the selected system will probably have capacity in excess of its rated value. Since the surface mounted air terminals have a performance advantage of not using a ducted distribution system, there is no reason to select a system with more capacity than the given load.

Q: How do I perform a Manual J load calculation for a Ductless Mini-split system if there aren't any ducts?

A: Most Manual J load calculation software assumes you are using ducted distribution systems. Manual J-8 compliant software is required to perform more accurate duct load calculations than the outdated (and retired) Manual J-7 methods; however there isn't a "No-Ducts" option in most of the software. In

order to get the correct load calculation, you must therefore set the ducts as being “In the Conditioned Space” for both the supply and return. This basically turns off the duct calculations in the software.

Q: Can I use a Ductless Mini-Split Heat Pump as the primary heating system in a home?

A: Code requires all heat pumps to be sized to the cooling load. Code also requires that 100% of the calculated heating load is covered at design conditions. For most heat pumps, this means the size you can select will likely be short on meeting the total heating requirements of the home and therefore must provide a supplemental system to cover the balance. If your mini-split system has variable refrigerant flow technology, then you may oversize the system by 30% of cooling. If the result of this means the system has enough heating capacity to meet the heating load, then a supplemental system is not required. This situation is only likely to happen in a very well insulated and sealed home.

Q: I am installing a radiant panel heating system and have software from an OEM that performs the loads and tubing design. Can I use that for my Manual J documentation?

A: This is a bit tricky: the short answer is yes, but you will also need to use a Manual J-8 compliant software package to calculate the loads. Some radiant design packages allow you to enter the loads and dimensions for a given room to calculate the tubing layout (without entering in all the building components). Therefore you can use your results from an approved Manual J-8 software package to get the respective room heating loads for the radiant software. You should also be aware that several of the Manual J-8 software suites are also capable of designing radiant systems. If there is any cooling you will also need use the Manual J-8 software anyway, so there is almost no additional effort to get both heating and cooling calculations at the same time.

Q: What is Manual S? Can't I just replace the old system with a new system of the same capacity?

A: Manual S is the process of determining the capacity of candidate equipment for a given load at the local design conditions. This process adjusts equipment capacity for the given local altitude, outdoor air and return duct loads (entering coil). The adjusted capacity may be significantly different than its nominal rated capacity. Return duct (entering coil) loads are the combination of heat transfer through the duct walls, leakage through seams, intentional ventilation introduced into the return duct before the coil and in some cases fan heat (add-on coils).

You cannot just install a new system because the required CFM may be significantly different; many older systems had lower CFM requirements for their respective capacity, therefore the designer needs to ensure the any existing ducts can support the candidate new equipment.

In order to perform a Manual S procedure, you will need to determine the Entering Coil loads (either in Manual J software, or spreadsheet and psychrometric chart) and using the local design conditions plot these on an OEM performance table – or better yet, use one of the available online OEM capacity calculators. There are only a few OEM's who do not have a contractor-based online equipment selection tool that lets you enter the coil conditions and outdoor conditions to calculate capacity for a candidate system.

There is also the issue of using third-party coils. Unfortunately many third-party OEM's do not provide extended performance tables (as required by AHRI), or other calculators to actually determine their capacity (and other performance indicators) at your design conditions. Because of this, you may be required to contact OEM's to get custom performance calculations in order to meet Manual S requirements when using a third-party coil. We currently know of one third-party coil OEM that has a spreadsheet-based calculator.

Q: Is there a simple chart on the Manual S sizing requirements?

A: There is an entire chapter and several charts with explanations in Manual S. For your convenience, here is a boiled-down summary chart (for Connecticut):

General Cooling Capacity Factors			
Equipment Tested and Rated by AHRI	Single Speed Compressors	Multi/Variable Speed Compressors	GWHP
Total Maximum sizing factor	1.15	1.20 (multi), 1.30 (variable)	1.25(single), 1.30(multi), 1.35(variable)
Latent	Minimum = 1.0 (may go to 1.50 or higher if needed to meet sensible minimum)		
Sensible	Minimum = 0.90		
General Heating Capacity Factors			
Minimum	1.0		
Maximum	1.4 (up to 2.0 allowed)		

Q: Do I need to perform a Duct Design (Manual D) on existing systems?

A: NO. A duct design (Manual D) is only required when the distribution system is being initially installed or modified (extended) to serve a new space (i.e.: addition).

Q: Can I hire a third-party to perform my calculations?

A: YES, however you are still responsible for ensuring it is done correctly, therefore you must ensure the designer has all the pertinent information to perform such engineering. To help illustrate this, a designer needs a full set of building drawings (not just floor plans) to determine ceiling heights, slopes, overhangs, knee-walls and other features needed as inputs.

Q: Am I required to perform Infiltration or Duct Leakage testing on existing homes and duct systems?

A: The short answer is "NO" providing the duct system is not being extended, modified or replaced, however performing such tests will provide a much higher level of engineering and may provide insight and opportunity to an comfort or energy issues in the building.

Q: How much time will it take me to do all these calculations?

A: This of course depends on the complexity of the house, your proposed solution and your experience in using the various design tools available. A typical house will require 2 to 3 hours to perform a full set of Manual J, S & D calculations and produce documentation. A simple replacement can take less time.

Q: How can I provide customer quotes if I have to do a load calculation and equipment selection engineering?

A: Contractors who are already doing this often provide a menu of quotes for different equipment combinations subject to final engineering upon a contract. There are also contractors who do a home survey and perform a quick block load to get into the ballpark to provide a tighter group of quote options.

Q: I just did a load calculation and it works out to 1,283 square feet per ton. I was told cooling equipment should come in around 500 square feet per ton. How can this be?

A: Equipment capacity requirements are highly sensitive to window types and shading, including overhangs, building infiltration and duct location, R-value and leakage class. A house with average ducts located in an attic may need ½ to 1 ton or more Air Conditioning capacity than the same house where the ducts are located in the basement. This one parameter alone (duct location) is just one example of why it is important to perform a load calculation for each building. Once you've start doing more calculations you will quickly find most houses range from 700 to 1,200 square feet per ton!

Q: Where can I get help with performing load and equipment engineering?

A: There are many resources. First the software suite you are using most likely has many online videos to help you with using their software to perform a particular task. Check with your local electric utility to see if they have any programs that deal with HVAC design. Local community college or technical career schools may offer some curriculum on the subject. Suppliers often host or sponsor training. Check with the Air Conditioning Contractors of America (ACCA) to see what courses they may be offering (you do not need to be a member). You might also check in with your local trade organization(s) on hosting a class or mechanism to provide training and support. Check with colleagues (distant competitors) if they have any experience with the software or methods you are using.

Q: Do I need to own the ACCA Manuals (J, S & D) to do the engineering calculations?

A: If you are using software to perform the calculations, the manuals will not help you to use the software interfaces directly, but they will provide the background reference in case you want to know what the underlying calculations and procedures are. With that said, Manuals S & D are much more practical, and if you want or need to see examples on how to select equipment for different situations, or how to do duct designs manually (which really isn't hard), then these are the two documents we would suggest you start with.

Q: My load calculation software shows recommended tons. Is this the same as Manual S?

A: No unfortunately not. You need to select equipment with airflow and capacity that meets the design loads. The recommended tons method uses the Sensible Heat Ratio to calculate capacity. This method doesn't adjust for entering duct conditions or actual airflow available for a system.

Q: Can I reduce the indoor cooling design temperature – my customer wants the house to cool to 72 degrees?

A: Short answer is no. Your customer just gave you an important clue about the existing system and conditions: the house has excess humidity, and the customer is turning down the set point to make the system run longer to remove the moisture. Reducing the indoor design temperature is actually counter-productive for achieving the desired comfort a modern cooling system is intended to provide.

Q: What software can I use to perform load calculations?

A: Here is a list of the currently approved (ACCA) software products available at the time of this printing:

Software Vendor and Software Title	Website
AdTek AccuLoad (Manual J) and AccuDuct (Manual D)	http://www.adteksoft.com/
Avenir LoopCAD (Radiant) and HeatCAD	http://www.avenir-online.com/
Caramel Software HVAC ResLoad-J for iPad	http://www.carmelsoft.com/
Elite Software RHVAC	http://www.elitesoft.com/
EnergyGauge USA Residential Buildings	http://www.energygauge.com/
Wrightsoft Right-Suite Universal	http://www.wrightsoft.com/

Q: Where can I see the current mechanical codes for Connecticut?

A: You can view the currently enforced Connecticut codes online:

Online Resource	Website
State of CT – Department. of Administrative Services: Division of Construction Services	http://www.ct.gov/dcs/
ICC Online Code Viewer	http://publicecodes.cyberregs.com/icod/index.htm

Q: Where can I get additional help or questions answered regarding Manual J, S & D?

A: Check out ACCA's website (www.ACCA.org) , your local trade association may have members who can help, your local distributor or you may contact me (Buck Taylor) at the information provided below.

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