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Codes Committee



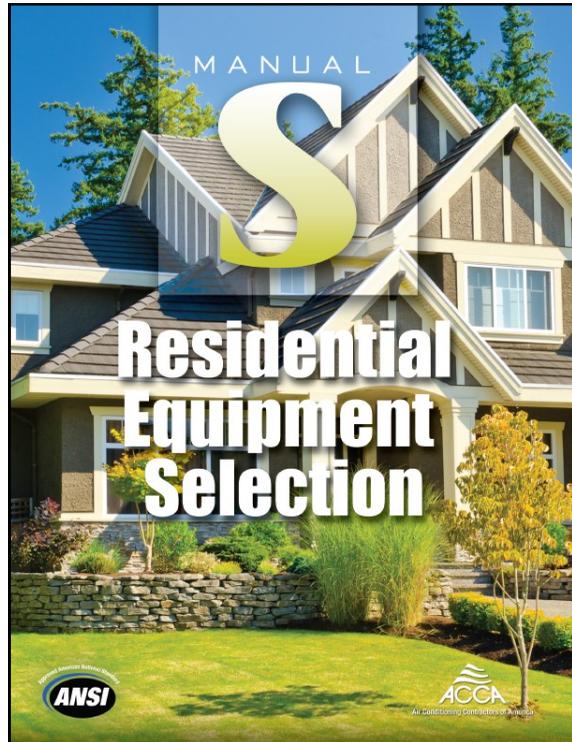
2800 Shirlington Road
Suite 300
Arlington, VA 22206

Phone: 703-575-4477
Fax: 703-575-9147

ACCA (Air Conditioning Contractors of America) is dedicated to excellence in the HVACR industry. As the largest HVACR contractor organization, ACCA is committed to helping its members succeed. Some of the fundamental ways in which our efforts are seen, are in the technical resources and industry standards, that guarantee quality HVACR design, installation and maintenance.

The ACCA Codes Committee was formed to address code issues and in particular, to advise and assist ACCA in beneficially representing the contractors in the code processes that affect the HVAC industry. This document has been written for code officials, seeking to verify that HVAC equipment has been selected in order to meet the home's load requirements.

Verifying ACCA Manual S® Procedures



Includes
Equipment
Selection
Checklist
& Example



**For a more detailed analysis
on the design process**

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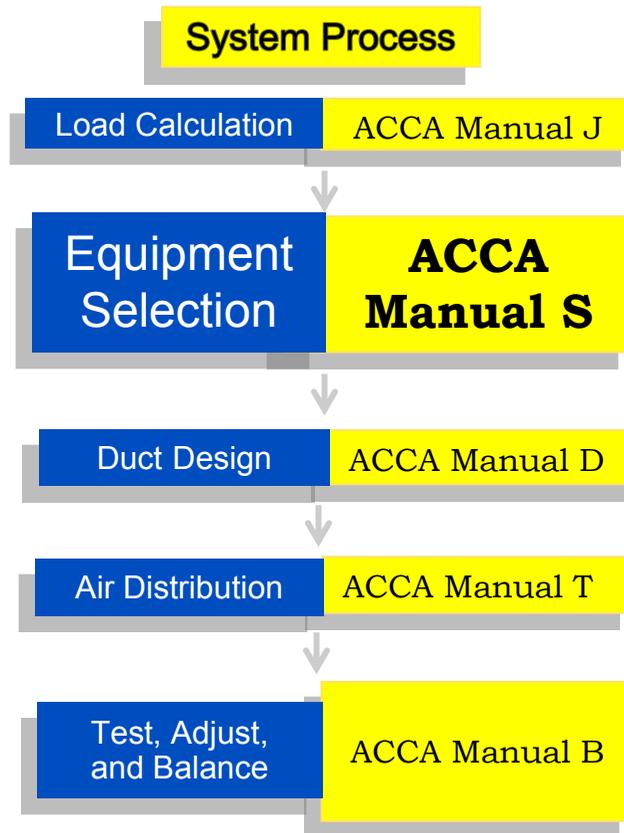
Verifying ACCA Manual S® Procedures

Why is proper equipment selection important?

Achieving occupant satisfaction is the principal goal of any HVAC design. Occupant satisfaction is maximized when the heating and cooling equipment are the correct type and size to meet the capacity requirements from the Manual J load calculation.

For residential equipment selections, ACCA's Manual S®, is the only procedure recognized by the American National Standards Institute (ANSI). If the Manual J load calculation is done then the next step is to select the equipment that will deliver the necessary heating and cooling.

ACCA'S Residential Design Manuals



What problems come from the wrong size equipment?

Undersized equipment will not meet the customer's comfort requirements at the design specifications.

Oversized equipment will create other problems:

- Degraded humidity control in the summer.
- Occupants may suffer the effects of an increased potential for mold growth. These same conditions also may contribute to asthma and other respiratory conditions.
- The temperature may feel right at the thermostat but the temperature in other rooms will suffer from the oversized equipment going through short operation cycles. Short cycles can cause temperature swings as the equipment over-conditions, stops, then over-conditions, etc...
- Hot and cold spots between rooms because the thermostat is satisfied but the room is not.
- Oversized equipment generally requires larger ducts, increased electrical circuit sizing and larger refrigeration tubing. These cause higher installed costs and increased operating expenses.
- The equipment starts and stops more frequently, this causes excessive wear and can increase maintenance costs / service calls.

In these unfavorable conditions occupants will experience discomfort and dissatisfaction.

What are some reasons for oversized equipment?

Manufacturers take great care in measuring and testing how well their equipment performs at different operating conditions.

When contractors use this data to select the equipment they will meet the heating and cooling needs of their customers.

Two main reasons for oversized equipment are either that: (1) a guess was made on the equipment's capacity at the design conditions or (2) mistakes were made in the selection process.

Equipment Selection Checklist			
#	Key Item	Verify	Verification Questions
1	Design Conditions	The design conditions fall within specifications.	Do the design conditions fall within the minimum standards for this region as found in Manual J8 Table 1A or 1B? (A)
		The information from the Manual J load calculation was transferred accurately.	Was the Total Heat Gain / Loss information used to evaluate equipment candidates? (B)
2	OEM's Performance Data	The equipment manufacturer's performance parameters match the design parameters used to calculate the heat load.	Does the manufacturer's performance parameters match the design parameters used to calculate the home's heat load (i.e., outdoor dry-bulb, indoor dry-bulb, and indoor wet-bulb)?
			If the performance data parameters are more than 5% greater or less than the design parameters then did the contractor interpolate the equipment manufacturer's performance parameters to match the design parameters used to calculate the heat load?
3	Equipment Performance	Estimated Cooling – CFM based on Temperature Difference	Was the Sensible Heat Ratio calculated? (Sensible Load / Total Load)? (C)
			Was the SHR used to find the proper air flow? (D)
		Equipment selected satisfies Total Btus (for cooling the Sensible and Latent load)	Is the total heating capacity of the selected equipment $\leq 140\%$ of the designed total heating load? (If not reduce equipment size) (E)
			Is the total cooling capacity of the selected equipment $\leq 115\%$ of the designed total cooling load? (If not reduce equipment size) (F)
			Does the "Sensible" and/or "Latent" capacities of the selected equipment meet the load's requirements? (G)
			If a heat pump in a very cold climate (heating is primary concern) does the total cooling capacity of the selected equipment exceed 125% of the designed total cooling load?
4	Auxiliary Heat	Heat Pump Balance Point	Does the electric auxiliary heat provide the necessary BTUs to makeup difference in capacity from the heat pump's balance point to the design load conditions? (H)

Equipment Selection using an Example Checklist															
Design			Application Data: Equipment Capacity												
Winter Design Conditions			A furnace was selected for comparing "heating only" design and performance. Other types of equipment may be used.												
Outdoor °F:	27°F (A)	From Manual J8 Table 1A or 1B													
Indoor °F:	70°F (B)	Manual J8 §3-6 defaults to 70°F													
Total Calculated Heat Loss	50,981Btu/h	Determined by Manual J8 load calculation	Furnace Model Number:	FU600300	Fictitious furnace										
Summer Design Conditions			A heat pump was selected for comparing cooling and heating design and performance. Other types of equipment may be used.												
Outdoor °F:	85°F (A)	From Manual J8 Table 1A or 1B													
Indoor °F:	75°F	Manual J8 §3-6 defaults to 75°F													
Entering Wet Bulb (EWB):	63°F (B)	Manual J8 §3-6 defaults to 63°F EWB ($\approx 75^\circ\text{F} / 50\% \text{RH}$)	Outdoor Unit Model Number:	HP-030	Fictitious heat pump										
Total Heat Gain	27,543Btu/h (G)	Determined by Manual J8 load calculation	Total Cooling Capacity ($\leq 115\%$)	28,400Btu/h (F)	These capacities are from manufacturer's performance data at the DESIGN CONDITIONS : 85°F ODT, 1,000CFM, and 63°F EWB										
Sensible Heat Gain	23,321Btu/h (G)		Sensible Cooling Capacity (\approx Sensible Gain)	21,600Btu/h (G)											
Latent Heat Gain	4,222Btu/h (G)		Latent Cooling Capacity (\approx Latent Gain)	6,800Btu/h (G)											
Sensible Heat Ratio (SHR)	85% (C)	See formula below	Indoor Unit Model Number:	AH-030	Fictitious air handler										
Design Air Flow	1,116 CFM (D)	The "TARGET" airflow, we look for equipment that operates in this range ($\pm 10\%$), on medium fan speed	Indoor Blower CFM (CFM in manufacturer's performance data at rated capacity-medium fan speed):	1,000 (D)	The actual equipment rated airflow, (medium fan speed optimal) should fall within target CFM, ($\pm 15\%$)										
$\text{SHR} = \frac{\text{Sensible Heat}}{\text{Total Heat Gain}} = \frac{23,321 \text{ Btu/h}}{27,543 \text{ Btu/h}} = 85\%$			Btuh Difference between Heat Pump Balance Point and Total Heat Loss (H) $30,281 \text{ Btu/h}$												
$\text{CFM} = \frac{\text{Sensible Heat Gain}}{\text{Design Temp} \times 1.1} = \frac{23,321 \text{ Btu/h}}{19 \times 1.1} = 1,116 \text{ CFM}$															
<table border="1"> <thead> <tr> <th colspan="2">Sensible Heat Ratio versus Temperature Design Value</th> </tr> <tr> <th>SHR</th> <th>Recommended Temp. Design</th> </tr> </thead> <tbody> <tr> <td>Below 0.80</td> <td>21°F</td> </tr> <tr> <td>0.80 – 0.85</td> <td>19°F</td> </tr> <tr> <td>Above 0.85</td> <td>17°F</td> </tr> </tbody> </table>			Sensible Heat Ratio versus Temperature Design Value		SHR	Recommended Temp. Design	Below 0.80	21°F	0.80 – 0.85	19°F	Above 0.85	17°F	Auxiliary Heat (Circle): (H) Electric Gas Oil		
Sensible Heat Ratio versus Temperature Design Value															
SHR	Recommended Temp. Design														
Below 0.80	21°F														
0.80 – 0.85	19°F														
Above 0.85	17°F														
From Manual J8 Tables		From Manual J8 Load Calculation	From Equip. Performance Data												