MECHANICAL CODE DISCUSSION


BRENT URSENBACH

BRENT URSENBACH
bursenbach@slco.org
801-381-1449
SALT LAKE COUNTY PLANNING AND DEVELOPMENT

ONE OF THE SECTIONS briefly discussed in the last Pipeline Issue was from Chapter 14 of the 2009 IRC (International Residential Code) where we read:

IRC Chapter 14–Heating and Cooling Equipment

M1401.3 Sizing. Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

Many are familiar with ACCA Manual J which outlines procedures for completing an accurate residential load calculation. Several discussions have taken place in past issues of the Pipeline as well as a number of training opportunities focusing on Manual J load calculations and Manual D duct design. Many jurisdictions are now requiring load calculations, duct design and properly selected equipment as part of the plan review and building inspection process. The single greatest challenge contractors and code officials are facing in meeting these requirements is how to properly select heating and cooling equipment to match the loads calculated per Manual J.

Manual S documents the procedures that should be used to take the loads calculated to select and size residential furnaces, heat pumps and cooling systems. The procedures focus on the importance of using manufacturer's performance data that documents the sensible, latent or heating capacities over a wide range of operating conditions. This discussion will focus on the Altitude and Dry Climate Sensible Heat Ratio conditions that we must consider in our area.

ALTITUDE

A blower in HVAC equipment is a constant volume device, which means a 1200 CFM blower at sea level will also move 1200 CFM at 4250' in Salt Lake and also at 7000' in Park City. We are faced with a challenge for the density of thinner air at altitude reduces the amount of heat that can be moved in a cubic foot of air. The blower CFM at higher altitudes must be adjusted using the density ratio for air at the higher altitude.

Referring to Manual S, Appendix 6:

CFM at Altitude =
CFM at Sea Level ÷ Density Ratio

The density ratio to be used in this calculation is found in this table, also in Appendix 6 *(See Table A6-1, below)*:

Taking these density ratios and calculating the adjustments that must be applied for 800 CFM at 4250' in the Salt Lake Valley:

If 800 CFM at Sea Level —
CFM @ 4250' → 800 ÷ 0.856 = 935 CFM

If we apply the same formula and calculation to 400 CFM/ton and 450 CFM/ton, 2 through 5 ton values, the results are as follows *(See Table 2, below)*:

Table 2

800 CFM→ 935 CFM	900 CFM→1051 CFM
1000 CFM→1168 CFM	1125 CFM→1314 CFM
1200 CFM→1402 CFM	1350 CFM→1577 CFM
1400 CFM→1636 CFM	1575 CFM→1840 CFM
1600 CFM→1869 CFM	1800 CFM→2103 CFM
2000 CFM→2336 CFM	2250 CFM→2629 CFM

Table A6-1

1000'—0.964		
2000'—0.930		
3000'—0.896	St. George:	2941'—0.896
4000'—0.864		
5000'—0.832	Salt Lake:	4250'—0.856
6000'—0.801		
7000'—0.772	Park City:	7000'—0.722
8000'—0.743		
9000'—0.715		
10000'—0.687		

How many '5 ton drive' furnaces will move 2629 CFM with a filter, evaporator coil and duct system in place? So far the answer appears to be none. There will be many of you questioning why the above discussion involves 450 CFM/ton? This leads into the next topic of discussion.

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SHR—Sensible Heat Ratio

The Manual J calculation breaks down cooling load information into two components, sensible and latent loads. For example, we might have a sensible load of 26,000 BTUH and a latent load of 2200 BTUH, giving a total load of 28,000 BTUH. From Section 1 of Manual S the formula for SHR is:

SHR = Sensible Load ÷ Total Load

For this example: SHR = 26,000 ÷ 28,000 = .92

The actual calculated SHR must be used in selecting equipment, not a default value of 0.70 that may automatically be generated by load calculation software. The SHR is then used to determine the CFM/ton value that should be used in the equipment selection process.

Manual S recommends the following *(See Table 3, below)*:

Table 3

SHR < 0.80 →	350 CFM/ton
SHR = 0.80 to 0.85 →	400 CFM/ton
SHR > 0.85 →	450 CFM/ton

- Lower CFM/ton provide improved moisture removal—where there is a significant latent load
- Higher CFM/ton provides more sensible capacity—where moisture removal is not critical—low latent load

In conclusion, for air conditioning systems to operate correctly and at peak efficiency air flow must be increased for both altitude and for the dry climate we live in. For further information watch for the next RMGA Manual S class, or contact the RMGA to purchase copies of Manual J, D and S. ACCA also has a short guide for Manual S available for free download at: **www.acca.org/Files/?id=67**

Thanks for your comments, questions and suggestions. I especially appreciate your suggestion for future discussion topics—Brent

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Complete scholarship details are available on our website: **www.utrmga.org,** or by calling Katelyn at the RMGA office: **801-440-6783**.

Deadline: June 1

Merry Men from page 1 (in alphabetical order)

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