Table 2 in Chapter 1 of Maria’s Restaurant shows the heat transfer multiplier for windows for heating as 17.94 and for cooling as 54.86. If the window size was changed to 200 square feet would the winter heat loss and the summer heat gain be changed enough to need a larger HVAC system?

The winter window heat loss would become 200 × 17.94 = 3,588 Btuh.

The summer window heat gain would become 200 × 54.86 = 10,972 Btuh.

Since the window size was increased by 40 square ft. the outside wall area was decreased from 200 to 160 ft2. Again using the Table 2 values for the walls calculate new values for the winter heat loss and the summer heat gain.

The winter wall heat loss would be 160 × 1.90 = 304 Btuh.

The summer wall heat gain would be 160 × 1.31 = 209.6 Btuh.

The total winter loss was 34,384 Btuh before the window size was changed what is it after the change?

First, the total heat loss for the windows plus the wall for the original Table 2 values is 2,870 plus 380 or 2,870 + 380 = 3,250 Btuh.

Second, the total heat loss for the new values is 3,588 plus 304 Btuh; 3,588 + 304 = 3,892 Btuh.

Third, the change to the total of 34,384 would be 3,892 – 3,250 + 34,384 = 35,026 Btuh.

35,026 – 34,384 = 642; 642 ÷ 34,384 × 10 = 1.87% For the heating, increasing the load by 642 Btuh (less than 2%) will not generally result in needing to increase heating equipment sizing.

The total summer heat gain was 71,666 Btuh before the window size was changed what is it after the change?

First, the total heat gain for the windows plus the wall for the original Table 2 values is 8,777 plus 263 or 8,777 + 263 = 9,040 Btuh

Second, the heat gain for the new values is 10,972 plus 209.6 Btuh; 10,972 + 210 = 11,182 Btuh.

Third, the change to the total of 71,666 would be 11,182 – 9040 + 71,666 = 73,808 Btuh

For Cooling, increasing the load by 2,142 Btuh by 3% moves the total from 5.97 tons to 6.15 tons and most likely not change the equipment sizing requirement.

For a building, the total summer heat gain due to infiltration is listed as 1,108 Btuh, and there is a total cooling load of 115,534 Btuh. The total winter heating load is listed as 111,764 Btuh with an infiltration load of 3,632 Btuh. Calculate what percentage of those values is due to the infiltration.

First, for summer heat gains infiltration is 1,108 Btuh; 1,108 ÷ 115,534 ×100 = 0.959%

Second, for winter heat gains infiltration is 3,632 Btuh; 3,632 ÷ 111,764 ×100 = 3.25%

Based on the summer heat gains estimate the cooling equipment’s size in tons needed to cool the restaurant area, the kitchen area, and the total tonnage for the restaurant.

First, for summer heat gains in the seating area from Table 2: 71,666 ÷ 12,000 = 5.972 Tons

Second, for summer heat gains in the cooking area from Table 3: 115,534 ÷ 12,000 = 9.628 Tons

Third, for the total tonnage 9.628 + 5.972 = 15.6 tons

A cooling load calculation on Manual N states that the sensible heat is 75,000 Btuh and the latent heat is listed as 25,000 Btuh. What is the total cooling load?

25,000 + 75,000 = 100,000 Btuh

Field Notes:

One would be surprised by how often a builder changes a wall or roofing material, without giving a thought to the HVAC design implications. Technicians who understand building materials and how they are put together as assemblies can often spot problems with changes made to the original design plans. Thus, those who only focus on the mechanical and electrical sections may miss a big design change during construction that wrecks their load calculations.