Heat Load Calculations

The Residential and Commercial heat load calculation is a worst case measurement of heat transfer through the building envelope components plus the internally generated heat during one hour of time. Infiltration, duct gain / loss, people and appliances are also computed. Remember that heat transfers into the building during summer and heat transfers out of the building during the winter. The heat load calculations determine hvac equipment size, room airflow amounts, and duct sizes to meet the design criteria. Think of the heat load calculation as the amount of energy that must either be added to heat the building interior or removed to cool the building interior. This heat load calculation also computes the homes latent energy transfer (moisture) which is used to select the de-humidification equipment.

Cooling worst case calculations are based on the following: 95 degree outdoor dry bulb temperature with a 78 degree outdoor wet bulb temperature, 3 p.m. hot sunny day with window coverings open, maximum occupants located in the spaces, with expected appliances and lighting operating. The desired indoor temperature is 75 degree dry bulb @ 60% relative humidity. Cooling equipment selection is based on the sensible heat gain, NOT the total heat gain! Selected cooling equipment capacity must meet both the sensible gains and the latent gains. The average Florida home has an 80% sensible load with only a 20 % latent load. Standard matched cooling equipment performance is about a 75% sensible to 25% latent removal ability. The difference in percentage between the building heat load calculation and the equipments performance is the reason why the total heat gain cannot be used to select cooling equipment. The total heat load must be divided into (1) total sensible gain and (2) total latent gain. Cooling equipment selection is based on both loads with the emphasis on total sensible heat gain, The Florida Energy code requires that the total calculated sensible heat gain must be met by the cooling equipment and also allows the designer to oversize the equipment up to 15%. Keep in mind that manual S equipment selection procedure allows one half of the unused latent heat capacity (reserve btuh) be converted and added to the sensible equipment capacity.

Heating worst case calculations are base on the following: 40 degree outdoor dry bulb temperature, pre-dawn, cold breezy night, no lighting or appliances operating. The desired indoor temperature is 70 degree indoor dry bulb @ 60% relative humidity. Heating equipment selection is based on the sensible heat loss, the Florida Energy code requires the selected heating equipment meets the total calculated sensible heat loss but not oversized by more than 15% unless staged.

Building orientation (or true north) is very important to consider before performing a heat load calculation in Florida. Building orientation is extremely important because solar heat gains through windows and glass doors account for nearly 50% of the total sensible heat gain in a typical Florida building (22% glass area to conditioned floor area). West

facing glass is by far the worst, peaking in the hot afternoon sun, some types of west glass has a heat transfer multiplier of 89 BTUH per square foot of single pane clear glass. North facing glass has the lowest heat transfer multiplier - only 30 BTUH per square foot of single pane clear glass. It's easy to see that building orientation is critical! – unless of course your building is a perfect box with equal glass amounts on all 4 walls! Also very important is the roof overhang projection ratio. The first number required in the ratio is the amount of feet the roof overhangs the building and the second number required is the window offset – or the amount of feet the window is located below the roof overhang. Overhangs project a shade line across windows and the shaded portion of the window has a heat transfer multiplier of only 30, exterior roof overhangs greatly effect the sensible heat gain and should always be calculated for each window. A "model" home having multiple orientations must have a heat load calculation performed for each different orientation to ensure proper hvac equipment sizing, room by room CFM values, and duct sizes. The hvac equipment size, CFM values, and duct sizes can vary greatly when a house is rotated to another orientation even though the building components remain exactly the same. In many cases the exact same house placed on lots facing different orientation require different amounts of air conditioning, different room by room CFM values, and different duct sizes. Contractors should be aware of this heat load shift especially on "model" homes that have large glass amounts. Be aware that designing an HVAC system based solely on the "worst" case orientation for a model home is the correct procedure only if the home actually faces the worst case, but the same calculations and HVAC duct drawing will not work for the same home if it faces a different direction! The only correct way to design HVAC systems in Florida is to know the homes orientation. Using a worst case calculation and HVAC layout for the "model" home that does not face worse case will certainly result in a home that has oversized equipment, improper room airflow, un-even temperatures, moisture control problems, and if the home is multi-story – a first floor duct system located in a sealed floor truss cavity that is not accessible for airflow adjustments.

Florida climate: mostly hot and humid, sometimes very cool and humid, not easily tamed by the standard air conditioning system. Properly designed cooling equipment will operate continuously during worst case conditions because the cooling equipment selection was based on the worst case sensible heat gain. Thermostats measure and respond to sensible heat, so during worst case conditions, equipment connected to a thermostat will operate continuously and perform well at removing humidity present in the building. This very same equipment cannot perform as well during periods when the daily outdoor high temperature is only 70 degrees and it rains for 3 days straight (February)! To accomplish desired indoor conditions during those cold rainy days, a dedicated dehumidification system is required. A stand-alone dehumidifier connected to a space mounted de-humidistat is a great approach for the Florida home during these part load conditions. Florida homes that have average building envelope seals would benefit greatly during these periods because a standard central air conditioning system cannot remove moisture without cooling the indoor air – but a dedicated de-humidifier can. During high humidity conditions outdoors, keep windows closed and limit exterior door openings because most of the latent heat (moisture) enters the structure from the outside! For tightly constructed homes, an energy recovery ventilator may be required.