RESIDENTIAL COOLING & HEATING LOAD CALCULATIONS
FOR
WARM, HUMID CLIMATES

by
David A.Wojcieszak, P.E., C.I.A.Q.P.
Wojcieszak & Associates, Inc., P. O. Box 2528, Stuart, Florida 34995
E-Mail: david@dwojo.com (772) 286-8696

Introduction

The 2001 American Society of Heating, Refrigerating and Air-Conditioning Engineers Handbook, Chapters 28 and 29, outline general procedures for calculating cooling and heating loads for all types of buildings. A majority of the calculation process involves sensible heat. Very little attention focuses on latent heat. However, the removal of latent heat in warm, humid climates is critical. Chapter 24 includes a section on moisture control options in warm, humid climates which provides valuable information. This information has to be included in the calculation process for proper sizing.

Sizing Software

Several manufacturers provide computer software to perform the calculations required to produce a load calculation for equipment sizing. A majority of the programs are based on AACCA@, Manual J, 8th Edition. When selecting the software, it is important the software be flexible, calculate different design days, and have adjustable infiltration rates.

Building Input Data

Load calculations are affected by:

- Skin Loads (windows and structural components)
- Internal Loads
- Infiltration and Ventilation

The sizing is most affected by the glass loads and infiltration. These two items normally comprise sixty percent of the design load, while the remainder is comprised of all the other loads.

Skin Loads

Skin loads are composed of walls, glass, roofs, floors, and doors. The glass load is the major contributor with the roof load the next largest component. Non-glass doors can be included in the wall loads to expedite the calculation. Loads should be calculated several times during the design and construction process. First, with initial glass data, and second, with glass shop drawings indicating the actual glass to be installed for the project.

Internal Loads

People, equipment, lighting, and ductwork make up the internal loads in residences. ASHRAE recommends twice as many occupants as bedrooms, when special entertainment provisions are not required. The occupant load shall be evenly distributed among the living areas. People should not be included in the bedroom loads.

Equipment is to be limited to the kitchen area unless other specific requirements are known. A load of 1200 btu/hour of sensible load has been proven to be satisfactory. Venting of appliances such as dryers will help to overcome the intermittent load of the dryer.

The internal lighting load is always a critical issue. In most cases, the lighting load is small and should not be included in the load calculation.

Heat gains in duct systems are negligible when all the ducts are included within the conditioned space. Gains for duct not installed within the conditioned space have to be accounted for; however, the gain is still minimal.

Infiltration & Ventilation

The moisture carried into the building by infiltration and ventilation in warm, humid climates must be accounted for in the load calculation. Infiltration comprises a major portion of the latent gain into the structure which is the main component for high indoor relative humidities. The building envelope should be designed to reduce infiltration. The reduction of infiltration can lower interior moisture levels as well as energy costs.

Design Data

Heat load calculations indicate maximum loads occurring on a design day. Additional loads should be calculated for average days and night time conditions which in warm, humid climates are more severe. Safety factors should not be used in the calculation. Weather data should match the actual location and not the closest large town. Load calculations may also require additional input relative to special conditions for people and equipment. The end result should be a calculation which provides sizing for maximum loads and average loads. Equipment can then be properly selected.

References

ASHRAE. 2001. *2001 ASHRAE Handbook – Fundamentals* , Edition I-P, p. 24.8, p. 28.1-29.40. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.