V. Thermal Efficiency

Winter:
Coldness
remains outdoor

Summer:
The rooms are protected
against the heat from outside

Heat
remains
indoor

A comfortably
cool climate
against the heat
from the outside

The highly effective thermal insulation and heat storage of AERCON provides a comfortable room climate and excellent thermal energy efficiency.

A. Basic Principles

Thermal protection in buildings directly influences the use of energy for heating and cooling, as well as the ability to control the room climate. Less thermal protection results in more energy usage for heating and cooling and a much less comfortable room environment.

The thermal protection requirements for the external construction elements of buildings are generally categorized into one of two groups, either summer or winter.

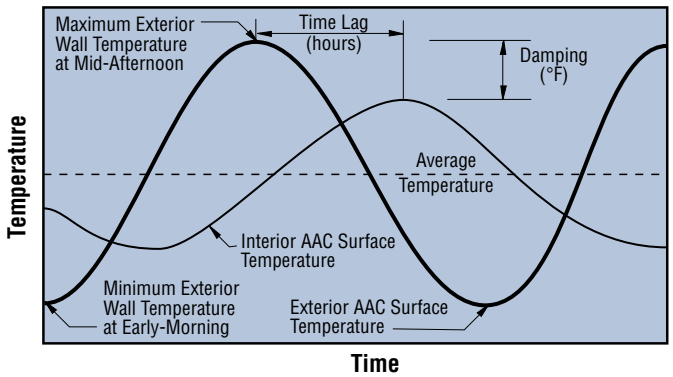
The thermal protection for winter conditions is intended to minimize heat loss from the building, thus allowing the building to be economically heated. Furthermore, the interior surfaces of the building's external thermal envelope should not drop below a certain minimum temperature in order to avoid condensation. The thermal protection properties must, therefore, be determined by considering both criteria.

In contrast, the thermal protection for summer conditions is intended to minimize heat gain from the warm outside temperatures and sun rays, thus allowing the building environment to be economically controlled in a comfortable state. Thermal protection in the summer is mainly determined by the capability of the exterior building elements to store and dissipate heat. This property is determined by the mass and thermal conductivity of the building material. As shown below, the thermal mass and thermal conductivity establish the thermal inertia, which causes a damping and time lag of the temperature peaks.

With AERCON, a construction material is available that optimally combines the material properties necessary to provide excellent thermal energy efficiency for the building. Additional thermal protection is not required.

An AERCON building system also provides a nearly airtight envelope, which is critical in controlling the comfortable and healthy indoor environment. A major emphasis in heating and cooling system design is to minimize "uncontrolled" ventilation air. By providing an airtight building envelope, AERCON minimizes the "uncontrolled" air changes and allows the ventilation air to be "controlled". Elements such as dust and pollen can be filtered out of the ventilation air before they invade the building. By use of a dehumidifier, the moisture content of the ventilation air can also be controlled which optimizes the comfortable indoor environment. Overall, the volume and quality of ventilation air can be easily and accurately controlled in an AERCON building - thus providing a comfortable, economical and healthy environment.

These excellent thermal protection properties of AERCON exterior walls were confirmed in a study by the Florida Solar Energy Center.



B. Equivalent R-Value

In order to compare an AERCON exterior wall with conventional wall construction methods (wood stud frame and concrete masonry), the Florida Solar Energy Center determined equivalent R-values for an AERCON wall. Weather data for Orlando, Florida, as developed in the Typical Meteorological Year (TMY 1981) database, served as the basis for the outside conditions. In order to uncouple the effect of wall orientation, it was assumed that only diffuse radiation would be present on the outside wall surfaces.

The study included calculations for six conditions, winter and summer average days, winter and summer peak days, and cooling and heating seasons.

The study compared an 8-inch thick AERCON wall to both a conventional wood stud frame wall and CMU block wall. The typical wall sections studied are shown in Figure A. The calculated static R- and U-Values, neglecting thermal mass effects, are shown in Table 1.

The results of the study, which include the thermal mass effects, are shown in Table 2. They represent the insulation value required to be added to either a wood stud frame wall or a CMU block wall to achieve an equivalent thermal system. For example, during an average summer day, the 8-inch AERCON wall performs like either a wood stud frame wall insulated with R-20.4 fiberglass batt insulation or an 8-inch CMU block wall insulated with R-8.6 rigid insulation. That means that nearly 6 inches of batt insulation would have to be added to a wood stud frame wall and over 2 inches of rigid polystyrene insulation to a CMU block wall to equal the performance of the AERCON wall, as illustrated in Figure B!

It should be pointed out that one of the simplifying assumptions made for this study was that only diffuse radiation would be present on the outside wall surfaces, i.e. no direct sunlight would strike the walls. If the study would be expanded to include the effects of the direct radiation, the results would show that an AERCON wall would perform even better!

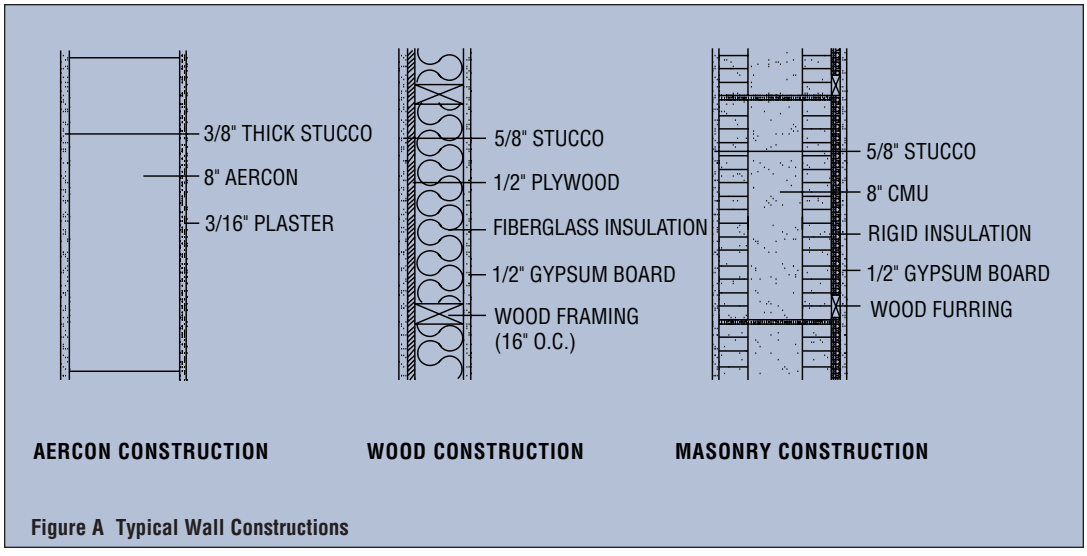


Figure A Typical Wall Constructions

Table 1 Nominal Overall R- (and U-) Values of Wall Systems including Air Film Coefficients		
Wall System	R-Value, (R) (h ft² °F/BTU)	U-Value, (U) (BTU/h ft² °F)
8 inch AERCON Wall (AC2)	11.5	0.087
R-11 Frame Wall (25% framing)	9.0	0.111
R-19 Frame Wall (25% framing)	13.2	0.076
CMU Block Wall w/R-3 Added Insulation	4.9	0.204
CMU Block Wall w/R-5 Added Insulation	6.6	0.151
CMU Block Wall w/R-8 Added Insulation	11.2	0.090
CMU Block Wall w/R-10 Added Insulation	13.1	0.076

Table 2 Insulation Value Required to Match an 8" AERCON Wall		
Simulation Basis	**Wood Stud Frame Wall** Equivalence Based on the Fluxes Summed in Load Direction Only	**8" CMU Block Wall** Equivalence Based on the Fluxes Summed in Load Direction Only
Peak Summer Day	17.9	8.6
Average Summer Day	20.4	8.6
Peak Winter Day	16.7	8.5
Average Winter Day	16.5	8.5
Cooling Season	19.6	8.5
Heating Season	16.9	8.5

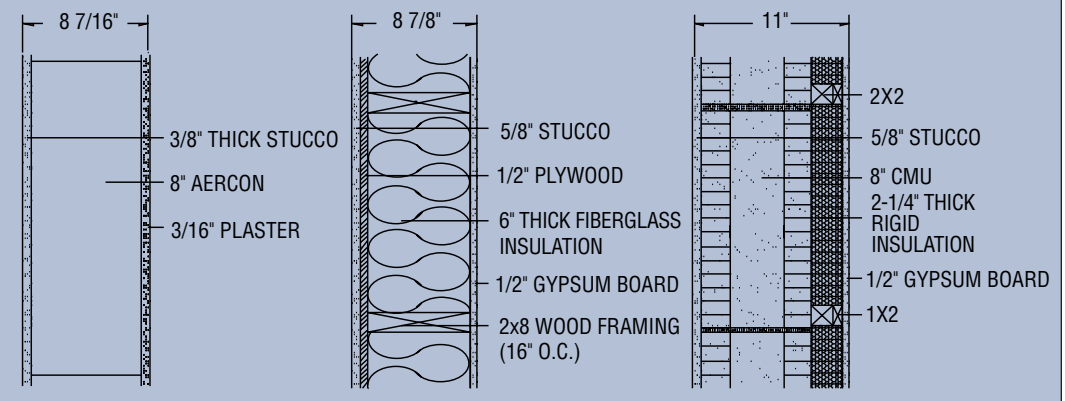


Figure B Equivalent Thermal Resistance Constructions

C. Florida Energy Code Compliance with AERCON

In a separate study performed by the Florida Solar Energy Center, the Energy Performance Index (EPI) according to Method A of the Florida Energy Code was calculated for an actual building in Central Florida. To meet the thermal efficiency requirements of that code, the EPI must not exceed a value of 100. The lower the EPI for a building, the more energy efficient and, therefore, the lower the energy costs for heating and cooling.

This study calculated the EPI for a building which utilized 8-inch thick AERCON block for the exterior walls. It also calculated the EPI for the same building, substituting R-11 wood frame exterior walls and then substituting standard concrete block exterior walls with R-5 additional insulation. All other components of the building were held constant for the study. The results of the calculation are shown in Table 3.

As shown by this EPI calculation, the AERCON walls clearly provide the most energy efficient walls!

As an additional comparison, the Florida Solar Energy Center calculated the EPI for the same three wall constructions, shown in Figure A, assuming the minimum code allowance on residential construction for ceiling insulation, air conditioning efficiency (SEER), and single pane windows. In each case the building was rotated in increments of 45 degrees to examine all possible building orientations.

The resulting EPI values indicate that a house built with AERCON walls complies with the code regardless of the building orientation. The other wall systems would fail to comply with the Florida Energy Code.

Table 3
Energy Performance Index (EPI)

AERCON	Wood Frame Wall	Standard Concrete Block
84.40	91.85	89.71