11.0 MECHANICAL

FIGURE 11.01

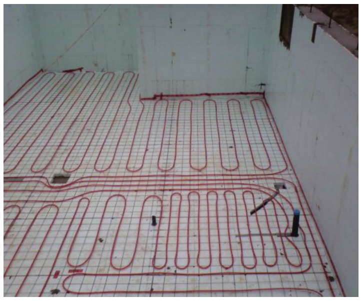

FIGURE 11.02

As with all buildings, the mechanical equipment installed must work efficiently with the type of structure being proposed. Inefficient equipment will result in poor performance of the structure and increased costs to the end user. When sizing any mechanical equipment it is beneficial to calculate, through engineered analysis, the required size of heating equipment along with the appropriate cooling equipment. Calculations should include the orientation of the structure to the prevailing winds, the amount of glazing within the building, floor areas to be heated or cooled, and finally the under slab insulation, type of wall insulation and roof insulation. All of these need to be calculated in order to effectively calculate the size of the mechanical system. According to the Portland Cement Association, most ICF Buildings fitted with a proper mechanical system will save an average of 44% on heating costs and 32% on air conditioning costs. When combined with other energy efficient building elements – some Nudura buildings have been recorded to save as much as 50% over conventionally constructed buildings of similar size in the same location.

When calculating the wall insulation, Nudura's EPS has an R-Value of 23.59 Btu/ (ft^2•hr•°F) (RSI 4.13 m^2•K/W) (U-Value 0.242 W/m^2• °K). This is based mainly upon the EPS foam, but when taking into consideration the solid mass of concrete sandwiched between the two 2 ⅝" (67 mm) thick panels, the overall performance of the wall assembly increases significantly depending upon geographical location. These performance values are available through ASHRAE 90.1 documents according to cities throughout North America. When trying to understand the overall performance of a wall section it is beneficial to know the difference in degree days for the region over a 12 month cycle. The lower the difference in the number of degree days in a 12 month cycle, the higher the overall performance of the wall. For example; if a structure was built in Southern Florida the difference in temperature change over 12 months might be 50°F (10°C), but in Northern Canada the temperature difference would be more like 90°F (33°C). This means that the overall wall performance will be reduced in Northern Canada due to increased temperature swing over the course of 12 months.

The other key component to consider is the amount of heat loss that normally occurs through a Nudura Integrated Building Technology wall. Under typical sustained Canadian winter conditions, the heat loss through a Nudura wall is about 3 Btu/hr/ft^2 (9.465 W/hr/m^2). Nudura's ceiling technology has a heat loss of 2 Btu/hr/ft^2 (6.31 W/hr/m^2).

The question then remains in mechanical design, what should the mechanical designer input as the design R Value when performing heat loss calculations for a Nudura Building? Though it will be higher than R22, the exact value cannot be calculated without the advice of an ICF experienced designer for your region. Nonetheless, experience has repeatedly shown that mechanical system designs that fail to adequately consider the thermal mass, continuous insulation, and air tightness properties of an ICF Assembly will generally perform much more in-efficiently than designs that do reflect the ICF's true thermal mass performance for a given geographic region.

For guidance on this subject, refer your mechanical designers to support resources available for mechanical designs for insulated concrete form buildings from the Portland Cement Association or the Cement Association of Canada at these links:

http://www.cement.org/
http://www.cement.ca/

There are also selected mechanical engineering and design firms throughout North America who do understand the science of thermal mass performance of ICF Technology and are producing energy efficient systems that have been properly integrated, with Nudura as the exterior envelope. Some companies even offer guarantees for mechanical performance of the building.

A properly designed mechanical system will ensure longer cycle times of operation for the mechanical equipment that assures more air exchange is occurring to properly ventilate the building. This is particularly important in the cooling cycle where adequate air exchange is necessary to assure that the full volume of air for the building is being passed through the system, so that condensation is not resulting on any surfaces in the building interior.

For some climatic zones, and because Nudura buildings are extremely airtight, the design of the mechanical system may involve use of a Heat Recovery (HRV) or Energy Recovery (ERV) Ventilation System. These systems cleverly use the ambient air from the building to help heat or cool any fresh air being supplied from the exterior. The added benefit is that these systems also balance the flow of ventilation air within the building to prevent back draft conflicts with other mechanical devices in the building, such as gas or oil fired furnaces, hot water heaters or even naturally vented fireplaces. A ventilation system is required, usually by code, to exchange air within a building and refresh it with clean, outside air. Typical air exchanges in a Nudura built structure should be roughly 1 per hour, but different building sizes will dictate the number of exchanges necessary for the structure.

Be sure to review these aspects of the system design with your mechanical contractor prior to their bid, to ensure that the mechanical system for your building is properly sized.

FIGURE 11.03