Insulated Concrete Foundation Systems
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Insulated concrete forms, also known as ICF’s, have become very popular over the past few years. When designed and installed correctly, the ICF foundation can provide a foundation that is strong, solid, and provides an amount of insulation, on both the inside and outside of the foundation, that exceeds the R values required per code for foundation walls. For those new to ICF construction, shop around. There are several manufacturer’s of ICF systems, and it is worthwhile looking at more than one manufacturer when choosing an ICF system for a construction project. As with many products, some ICF systems have features that others may not have. Depending on the complexity of the foundation being constructed, those extra features may be helpful. Researching the product, knowing the installation techniques, and knowing that technical assistance is available at a local level should all be factors in choosing an ICF foundation system. These are all important factors, especially for those new to ICF construction.

With the use of ICF systems on the rise, sections on ICF construction were added to the 2000 Michigan Residential Code (MRC), and remain the same in the 2003 MRC. Section R404.4 of the 2003 MRC requires that ICF foundation walls be designed and constructed to meet the requirements of Section R404.4 or in accordance with ACI 318. The requirements of Section R404.4 can only be applied however, when the foundation walls do not exceed the maximum sizes per Section R404.4.1. This section states that the foundation walls for buildings may not exceed 60 feet in plan dimensions and floors not greater than 32 feet or roofs not greater than 40 feet in clear span. Buildings can not exceed two stories in height above grade with each story not more than 10 feet in height. Walls exceeding these criteria would require approved engineering.

There are 3 types of ICF walls addressed in the 2003 MRC. These types include Flat ICF systems, Waffle-grid ICF systems and Screen-grid ICF systems. Each of these types have separate requirements for wall thickness and vertical reinforcement. Flat ICF walls may be a minimum of 5.5 inches thick. Waffle-grid and screen-grid ICF walls must be a minimum of 6 inches thick. The concrete used in these walls must meet the code requirements for minimum compressive strength and poured with a maximum slump of 6. The aggregate size can not exceed 3/4 inch in size. The ICF manufacturer’s specifications are the only exception to these code requirements. ICF manufacturer’s specifications are typically third party tested and approved to meet the requirements of the building code.

Proper placement of the vertical and horizontal rebar is extremely important to create a wall that will support all the loads placed on and against the wall area. Wall height, backfill height and soil types all play a part in determining the required vertical reinforcement required. The higher the wall and the backfill is, the more reinforcement will be required. The sizing of the rebar depends on the same variables as the spacing. Charts showing rebar spacing and sizes can be found in the 2003 MRC in tables R404.4(1) through (5). When an ICF wall requires vertical rebar, horizontal rebar is also required. When required, ICF foundation walls up to 8 feet in height require a minimum of one continuous #4 horizontal placed at 48 inches on center with one bar located within the top 12 inches of the wall story. ICF foundation walls greater than 8 feet in height per story require a minimum #4 rebar spaced 36 inches on center with the top bar located within 12 inches of the top of the wall story. Additional vertical reinforcement is required when the horizontal reinforcement is interrupted by wall openings. This additional vertical rebar must be placed within 12 inches of the opening edge and be sized the same as the vertical rebar placed in the rest of the wall.

ICF foundation walls must be covered on the interior and exterior sides. The foam plastic material used in ICF forms must meet the flame spread and smoke developed ratings of Section R314.1.1. This section requires a flame spread rating of not more than 75 and a smoke developed rating not to exceed 450. A thermal barrier must be provided to separate the foam from the interior space. This thermal barrier must meet a minimum 15 minute rating. ½ inch drywall can provide the required thermal barrier. Any other material used to provide the thermal barrier must meet or exceed the 15 minute rating. Should a material other than drywall be planned as a wall covering over the foam, confirmation as to the thermal protection capabilities will be needed. The exterior side of the ICF wall must be covered to prevent deterioration of the foam by exposure to sunlight. Several methods of covering are available including stucco type products, aluminum wrap, stone and masonry veneer, etc. Regardless of the material used, proper installation over the foam will be required.

There are several methods available to provide code compliant damproofing and waterproofing. Each ICF manufacturer has recommendations on damproofing for their ICF systems. Bituminous coatings, bituminous sheet goods, plastic dimple sheet goods, etc are all available as damproofing materials. Regardless of the damproofing method used, be sure that the material is compatible with the foam material. Test data and approved installation instructions should be available, and followed, for any method or material used. Just as with other foundation construction, ICF foundations also require foundation drainage. Foundation drainage for ICF’s is no different than what is typically required, drain tile and stone.

For those looking to continue upward and construct a home entirely out of an ICF system, it would be wise to look at Section R611 of the 2003 MRC. This section contains 32 pages of code requirements, diagrams and tables dealing with above-grade ICF construction.

Regardless of the ICF system used, The manufacturer’s installation instructions, as well as the code sections dealing with ICF construction must be followed. Failure to do so could result in structural failure of the foundation. For further information on ICF systems, contact your local ICF distributor. For further code information, contact your local Building Dept. The Building Dept. can, and should be your best source for up-to-date code information.

Building code information from the 2003 Michigan Residential Building Code