
USACE / NAVFAC / AFCEC / NASA UFGS-03 11 19.00 10 (May 2014)

Preparing Activity: USACE Superseding
UFGS-03 11 19.00 10 (February 2012)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2018

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DIVISION 03 - CONCRETE

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05/14

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INSULATING CONCRETE FORMING
05/14

NOTE: This guide specification covers the requirements for Insulating Concrete Forming (ICF).

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

NOTE: This guide specification will normally be used in conjunction with the following Sections as applicable to the project:
Section 03 15 00.00 10 CONCRETE ACCESSORIES
Section 03 20 00.00 10 CONCRETE REINFORCING
Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE
Section 03 30 00 CAST-IN-PLACE CONCRETE

ICFs are used as stay-in-place forms for structural concrete, load-bearing and nonload-bearing walls, below grade and above grade walls. The forms remain in place after placement and curing of concrete and must be protected by approved interior and exterior finish materials.

The three most common systems are FLAT (ICF panels

create a uniformly thick concrete wall), GRID (ICF panels create a waffle pattern of circular vertical and horizontal concrete elements), and POST-AND-BEAM (ICF panels create discrete circular columns and beams). This guide specification is written for FLAT ICF wall systems based upon ASTM E2643. However, an option is provided in the Paragraph "ICF Manufacturer Qualification" for the manufacturer to certify code compliance via either ICC-ES Evaluation Report or certification showing conformance to ASTM E2634.

ICF products are manufactured using Expanded Polystyrene (EPS) panels. However, Extruded Polystyrene (XPS) panels are permissible if the ICF wall system meets the requirements of ASTM E2634.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

| | |
|----------|--|
| ACI 117 | (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary |
| ACI 301 | (2016) Specifications for Structural Concrete |
| ACI 305R | (2010) Guide to Hot Weather Concreting |
| ACI 306R | (2016) Guide to Cold Weather Concreting |
| ACI 318 | (2014; Errata 1-2 2014; Errata 3-5 2015; |

Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

ASTM INTERNATIONAL (ASTM)

| | |
|-------------------|---|
| ASTM C177 | (2013) Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus |
| ASTM C203 | (2005; R 2012) Breaking Load and Flexural Properties of Block-Type Thermal Insulation |
| ASTM C518 | (2017) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| ASTM C578 | (2017a) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM D1621 | (2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics |
| ASTM D1622/D1622M | (2014) Apparent Density of Rigid Cellular Plastics |
| ASTM D7611/D7611M | (2013; E 2014) Standard Practice for Coding Plastic Manufactured Articles for Resin Identification |
| ASTM E119 | (2016a) Standard Test Methods for Fire Tests of Building Construction and Materials |
| ASTM E2129 | (2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products |
| ASTM E2634 | (2017) Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems |
| ASTM E84 | (2018) Standard Test Method for Surface Burning Characteristics of Building Materials |
| ASTM E90 | (2009) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements |

U.S. GREEN BUILDING COUNCIL (USGBC)

| | |
|-----------|---|
| LEED BD+C | (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC) |
|-----------|---|

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Insulating Concrete Form; G[, [_____]]
Local/Regional Materials; LEED BD+C
Environmental Data
Accessories

SD-04 Samples

Mock-Up Installation of ICF; G[, [_____]]

SD-06 Test Reports

ICC ES Evaluation Report

SD-07 Certificates

3rd Party Agency Certification

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Plastic Identification

1.3 QUALITY ASSURANCE

1.3.1 Insulation Concrete Form (ICF) Manufacturer Qualification

Manufacturer who has been successfully producing ICF products for a period of not less than 5 years and who has experience similar to this project in size, scope and complexity. Manufacturer must have an ICC-ES Evaluation Report or certification showing conformance to ASTM E2634 as evidence that the Insulating Concrete Forming (ICF) units are code-compliant.

1.3.2 Installer Qualification

Installer must be trained by the ICF manufacturer or an ICF Technical Advisor to ensure product is installed in accordance with the manufacturer's published installation instructions. Installer must have experience in ICF wall systems and successfully completed at least [three] [_____] projects that are similar to this project in size, scope and complexity.

1.3.3 Pre-Installation Meetings

NOTE: When the construction consist largely of Insulating Concrete Forming, it is suggested that a pre-installation meeting be required. Otherwise, if the construction is primarily another building material the pre-installation meeting may be omitted.

Prior to commencement of ICF installation and associated work, conduct a meeting at project site with the Contracting Officer, ICF manufacturer's representative, and trades responsible for installing forms, concrete, and reinforcement.

1.3.4 Mock-Ups

NOTE: Complexity of work and scope of quality control should be carefully evaluated before requiring Contractor to construct a mock-up. Delete

paragraph if mock-up is not required.

Complete Mock-Up Installation of ICF with full-size erected assemblies with details including at least one window. Provide mock-up to establish that proposed materials and construction techniques provide acceptable visual effect. Use materials for mock-up that are proposed for actual construction and meet the following requirements:

- a. Locate mock-up installation in the location as directed by the Contracting Officer.
- b. Demonstrate the required concrete thickness, insulation and workmanship.
- c. Demonstrate window openings with sill, head and jambs.
- d. Do not proceed with the remaining work until mock-up is approved by the Contracting Officer.
- e. When directed, demolish and remove the mock-up from the site.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products in original factory packaging, bearing listing and labeling identification of product, manufacturer and lot number. Handle and store products in location to prevent physical damage and soiling. Ensure that UV protection is provided for material stored on site beyond 30 days.

1.5 FIELD/SITE CONDITIONS

Conform to ACI 305R and ACI 306R for hot and cold weather concreting requirements.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

NOTE: Using local materials can help minimize transportation impacts, including fossil fuel consumption, air pollution, and labor. Using materials harvested and manufactured within an 800 km 500 mile radius from the project site contributes to the following LEED credit: MR5. Coordinate with Section 01 33 29 SUSTAINABILITY REPORTING. Use second option if Contractor is choosing local products in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. First option shall not be used for USACE projects. Army projects shall include second option only if pursuing this LEED credit.

Include this submittal only if pursuing LEED credit MR5.

[Use materials or products extracted, harvested, or recovered, as well as manufactured, within a [800][_____] km [500][_____] mile radius from the

project site, if available from a minimum of three sources.] [See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total local material requirements. Insulating Concrete Forming materials may be locally available.] Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

1.6.2 Environmental Data

NOTE: ASTM E2129 provides for detailed documentation of the sustainability aspects of products used in the project. This level of detail may be useful to the Contractor, Government, building occupants, or the public in assessing the sustainability of these products.

Submit manufacturer's descriptive data. Documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project. [Submit Table 1 of ASTM E2129 for the following products: [____].]

1.6.3 Plastic Identification

NOTE: The marking system indicated below is intended to provide assistance in identification of products for making subsequent decisions as to handling, recycling, or disposal.

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D7611/D7611M. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual and in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

| | |
|--------|--|
| Type 1 | Polyethylene Terephthalate (PET, PETE) |
| Type 2 | High Density Polyethylene (HDPE) |
| Type 3 | Vinyl (Polyvinyl Chloride or PVC) |
| Type 4 | Low Density Polyethylene (LDPE) |
| Type 5 | Polypropylene (PP) |
| Type 6 | Polystyrene (PS) |

| | |
|--------|--|
| Type 7 | Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination. Provide the package make up. |
|--------|--|

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

NOTE: ICF products are manufactured using Expanded Polystyrene (EPS) panels. However, Extruded Polystyrene (XPS) panels are permissible if the ICF wall system meets the requirements of ASTM E2634.

The ICFwall system consists of two panels of molded expanded polystyrene (EPS) insulation connected by cross ties to act as permanent formwork for cast-in-place reinforced concrete beams, lintels, non-load-bearing walls, load-bearing walls, foundation walls, and retaining walls while provide insulating characteristics.

2.1.1 Design Requirements

Design, engineer, and construct the ICF wall system in accordance with the manufacturer's instructions for anticipated loads, lateral pressures, and stresses, and capable of withstanding the pressures resulting from placement and vibration of concrete. Monitor the adequacy of design and construction prior to and during concrete placement as part of the approved Quality Control Plan.

2.1.2 Performance Requirements

The Insulating Concrete Form (ICF) wall system must provide a minimum[100 mm 4 inches] [150 mm 6 inches] [200 mm 8 inches] [250 mm 10 inches] [305 mm 12 inches] nominal wall width; not less than 12 mm 1/2-inch less nor 6 mm 1/4-inch more than the nominal width indicated. Provide cross ties in the ICF wall system at 200 mm 8 in on center maximum with a tolerance of plus or minus 6 mm 1/4-inch. ICF wall system must have vertical fastening strips 25 mm 1 inch minimum flange width that align vertically within 12 mm 1/2-inch horizontally between stacked blocks or panels for the full height of the wall to fasten exterior and interior wall finishes. Vertical gap between fastening strips of stacked blocks or panels must not exceed 38 mm 1-1/2 inches. Space fastening strips at a maximum of 405 mm 16 inches on center horizontally with a tolerance of plus or minus 6 mm 1/4-inch. Wall system must provide accurate positioning of concrete reinforcing bars within the form cavity conforming to ACI 318. Submit manufacturer's literature describing product, materials, installation procedure and accessories.

2.2 MANUFACTURED UNITS

2.2.1 Description

The ICF wall system includes an expanded polystyrene forming unit used to construct a monolithic reinforced concrete wall. The forms remain in

place, providing a concrete wall to be finished with conventional interior and exterior wall coverings. Provide form unit types and sizes as determined by the ICF manufacturer to provide walls indicated. Provide form materials in accordance with the manufacturer, other specifications herein, and the following:

2.2.2 Performance/Design Criteria

NOTE: Some ICF's are available with a 45 mm 1-3/4 inch EPS option. These forms are an economical option for interior demising walls and environments where high thermal insulation values are not as important. The typical R-value of a 45 mm 1-3/4 inch EPS ICF is R-14. Also, ICF manufacturer's typically do not have all form types in every core thickness. Usually straight and 90 degree corner units are available in each core thickness.

STC 50 may not be attainable for a 100 mm 4 inch ICF wall system.

With the ICF wall system provide a minimum [100 mm 4 inch] [150 mm 6 inch] [200 mm 8 inch] [250 mm 10 inch] [305 mm 12 inch] concrete "flat" cross section. Use preformed forms with interlocking edges to facilitate course-to-course bonding to prevent uplift and lateral failure. Provide manufacturer form unit types for straight, 90 degree corners, 45 degree corners, brick ledges, and tapered top forms. ICF unit shall provide a minimum R-value of [R-22] [_____] as tested in accordance with Test Method ASTM C518/ASTM C177. EPS must provide a maximum vapor permeation of 0.09 perm-meter 3.5 perm-inch. Finish wall assembly shall have a minimum rating of Sound Transmission Class (STC) [50][_____] sound attenuation performance as tested in accordance with Test Method ASTM E90. The fire resistive-rated construction of the complete ICF wall assembly including EPS, cross tie material, and concrete must be in accordance with Test Methods ASTM E119.

Conform the Insulating Concrete Forming System to the following minimum requirements:

TABLE 1 - PROPERTIES

| Properties | ASTM Test | Value |
|----------------------|-------------------|---|
| Density | ASTM D1622/D1622M | 24 kg/m3 1.5 lbs/ft3 |
| Thermal Resistance | ASTM C177 | 0.275 m2.C/W per cm (min)4.0 F.ft2.h/Btu per in (min) |
| Compressive Strength | ASTM D1621 | 103 kPa15.0 psi |
| Flexural Strength | ASTM C203 | 276 kPa (min.)40.0 psi (min) |
| Flame Spread | ASTM E84 | 25 maximum |

2.3 MATERIALS

 NOTE: ICF products are manufactured using Expanded Polystyrene (EPS) panels. However, Extruded Polystyrene (XPS) panels are permissible if the ICF wall system meets the requirements of ASTM E2634.

Submit 3rd party agency certification stating that product supplied meets the requirements of ASTM E2634.

2.3.1 Expanded Polystyrene (EPS)

 NOTE: Some ICF Manufacturers have 50 mm 2 inches thick EPS panels for their 100 mm 4 inch wide ICF wall systems. Designer should confirm EPS panel thickness provides the appropriate R-value for this project. Some ICF's are available with a 45 mm 1-3/4 inch EPS option. These forms are an economical option for interior demising walls and environments where high thermal insulation values are not as important.

Expanded Polystyrene must conform to ASTM C578. Provide Type II EPS panels, Flame Resistant with [63 mm 2-1/2 inch][45 mm 1-3/4 inch][_____] thick minimum EPS panels.

2.3.2 Cross Ties and Fastening Strips

 NOTE: ICF Forms are widely available that include fastening strip recessed from 6 mm 1/4 inch up to 38 mm 1-1/2 inches below the outside surface of the EPS panels. The deeper recesses help facilitate the placement of electrical and plumbing utilities within the wall. 13 mm 1/2 inch recess appears to be standard for most ICF Manufacturers. Designer may include a range of recess depths, i.e., 13mm 1/2 inch to 38 mm 1-1/2 inches

Use plastic or metal cross ties spaced at 200 mm 8 inches on center maximum with a tolerance of plus or minus 6 mm 1/4-inch. Cross ties must allow for multiple reinforcement placement positions to meet the structural design. Provide fastening strips with 25 mm 1 inch minimum flange width that align vertically within 12 mm 1/2-inch horizontally between stacked blocks or panels for the full height of the wall to fasten exterior and interior wall finishes. Vertical gap between fastening strips of stacked blocks or panels must not exceed 38 mm 1-1/2 inches. Space fastening strips at a maximum of 4056 mm 16 inches on center horizontally with a tolerance of plus or minus 6 mm 1/4-inch. Recess the fastening strips [6 mm 1/4 inch][13 mm 1/2 inch][38 mm 1-1/2 inches][_____] below the outside surface of the panels. Clearly mark the flanges on the surface of the EPS panels.

Provide a fastening strip in the corners of corner forms.

2.4 ACCESSORIES

2.4.1 Bracing, Scaffolding, and Wall Alignment

Support ICF wall system prior to the attachment of permanent structural elements to protect the ICF components from damage during construction.

2.4.2 Door and Window Bucks

Use extruded vinyl, pressure treated wood, or metal buck material to frame door and window openings.

2.4.3 Waterproofing

Waterproofing material must be compatible with EPS system and as specified in Section [07 13 53 ELASTOMERIC SHEET WATERPROOFING] [07 14 00 FLUID-APPLIED WATERPROOFING]

2.4.4 Fasteners

Fasteners of interior and exterior wall finishes to ICF wall system must conform to ASTM E2634. Use corrosion-resistant fasteners of sufficient length to penetrate the flanges of the fastening strips.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that footings and slabs are installed level and true to the structural design. Ensure dimensions and steel reinforcement are as indicated.

3.2 PREPARATION

Clean top of footings and slabs of all foreign substances, frost, ice, and standing or running water prior to starting installation of ICF wall system. Use methods and materials approved by ICF manufacturer.

3.3 INSTALLATION

Install ICF wall system in accordance with the manufacturer's installation and technical manual; submit a copy of the manual. In accordance with ACI 301, provide bracing and shoring to ensure stability of formwork to prevent overstressing of ICF units due to construction loads. Install ICF wall system in running bond pattern. Anchor formwork to supporting surfaces to prevent lateral movement of the ICF units during concrete placement. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work before concrete placement. Align fastener strips to facilitate interior and exterior wall finishes. Install concrete reinforcement according to the structural drawings at all walls, lintels, beams, and around openings. Install window and door bucks at each location where an opening is required. Install the first ICF course on the footing in accordance with the manufacturer's instructions to ensure that base of wall does not become misaligned during concrete placement. Install alignment bracing around the entire wall of the structure to ensure the ICF wall system is straight and plumb before and during concrete placement.

3.3.1 ICF Wall System Length

Within plus or minus 4.2 mm per m 0.05 inches per foot of the intended length.

3.3.2 ICF Wall System Height

Within plus or minus 1.6 mmm per m 0.06 inches per foot of the intended height.

3.4 CONCRETE PLACEMENT

NOTE: Designer should indicate on the drawings location of construction joints and provide the necessary details, including any required dowels or keyways. Refer to ACI 318 for additional information for construction joints in structural members.

Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures. If concrete cannot be placed in continuous pour, provide construction joints [as indicated] [as approved by the Designer of Record] [as on the approved concrete placement plan]. Consolidate placed concrete in accordance with the manufacturer's instructions. Where no guidance is provided, consolidate placed concrete with mechanical vibrating equipment conforming to ACI 301. Variations from plumb and designated building lines cannot exceed the tolerances specified in ACI 117.

3.5 FIELD QUALITY CONTROL

The ICF manufacturer's representative or technical advisor must provide on-site training to installer to ensure familiarity of ICF manufacturer's installation procedures and technical manual. Inspect erected formwork, reinforcement placement, door and window opening construction, concrete placement, and alignment and bracing system to ensure that work is in accordance with drawings. Installer to ensure that the cast-in-place concrete walls are level, plumb, square, and straight and that all dimensions conform to the drawings and are within required tolerances. Notify the Contracting Officer in writing of defective forms within 7 working days of the date of ICF inspection.

3.6 CLEANING

Clean formed cavities, within ICF units, of debris and foreign matter prior to concrete placement. Clean up and properly dispose of all debris remaining on job site related to the installation of the ICF wall system, recycling materials as required.

3.7 PROTECTION

Provide temporary coverage of installation of ICF wall system to reduce exposure to ultraviolet light should final finish application be delayed longer than 60 days.

-- End of Section --