2021 INTERNATIONAL CODE COUNCIL® CONFERENCE AND HEARINGS

Off-site Construction and Building Official Responsibility

David A. Tompos, President, ICC NTA

ICC INTERNATIONAL CODE COUNCIL®

Meet the Presenter

- David A. Tompos
- President ICC NTA, LLC.
- 25+ years experience in off-site construction
- LEED Accredited Professional BD+C
- ICC Commercial Inspector (all disciplines)
- ICC Residential Inspector (all disciplines)
- ICC Building Plans Examiner

What is Off-Site?

What is Off-Site Construction?

- **OFF-SITE CONSTRUCTION.** A home, building, component or panelized system which is wholly or in substantial part fabricated or assembled on a separate building site and has been manufactured in such a manner that all parts or processes cannot be inspected at the installation site without disassembly, damage to, or destruction thereof.

What is Off-Site?

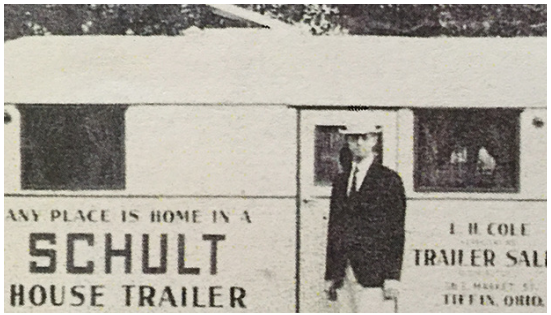
Open Construction

Closed Construction

History

- 1600s – First off-site construction came to America from England.
- 1800s – Modular homes were built in New York and sent to California during the Gold Rush.
- 1897 - E.F. Hodgson opened a manufacturing plant in Dover, Massachusetts.
- 1908 – 1939 Sear Roebuck sold over 75,000 homes.

History



- 1934 – Schult Mobile Homes opened one of the first housing factories in the country.
- 1963 – 13.5% of all new housing starts were mobile homes
- 1971 – Walt Disney's Contemporary Resort
- 1976 – Federal Manufactured Housing standards introduced to regulate construction

History

- 1990s and 2000s brought in a new generation of architects looking for efficiency and sustainability.
- In 1996 25% of all single-family homes built were manufactured homes.

History

- 2016 – Marriott builds its first modular hotel in California
- 2018 – CitizenM builds its first modular hotel in New York
- 2021 - Elon Musk buys a $50k Modular Tiny Home

Modular Construction

- **Modular Structure** means any structure built for use of occupancy by person or property, whether or not designed to be placed on a permanent foundation. Modular structures include factory-built buildings and subassemblies for manufactured residential and commercial units, modular homes and pre-manufactured homes.

Residential Modular Construction

- Built to state and/or local codes (IRC)
- 1-2% of the single-family market.
- 1% of Multi-family

Commercial Modular Construction

- Nonresidential factory-built building components and structures designed to meet all applicable State and local codes

Relocatable Buildings

Permanent Modular construction

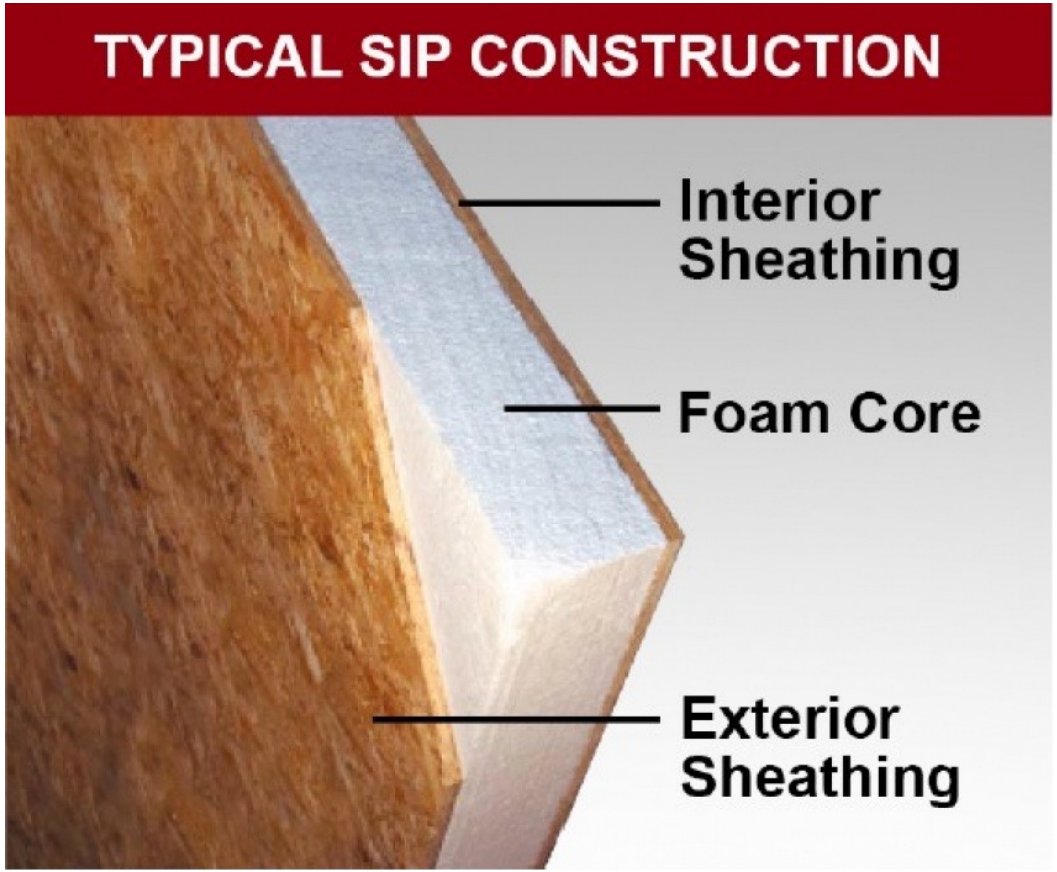
Volumetric Modular Pods

Panelized

- A panelized building system incorporates construction techniques that use advanced technology, quality materials and a controlled work environment to build energy-efficient homes in less time.

Structurally Insulated Panels

- SIP Panels
- The panels consist of an insulating foam core sandwiched between two structural facings, typically oriented strand board (OSB)



Recycled Shipping Containers

Many Uses of Shipping Containers

Residential Homes
- Single family and Multi-story

Homeless Shelters
Office Buildings
Medical Buildings
Emergency Hospitals
Apartments/Student Housing
Hotels
Schools
Restaurants/Cafés/Bars
Workshops
Stores
Portable Restrooms
Disaster Shelters

Manufactured Housing

- Manufactured home: A structure, transportable in one or more sections, which in the traveling mode is 8 body feet or more in width or 40 body feet or more in length, or which when erected on site is 320 or more square fee, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes plumbing, heating, air-conditioning, and electrical systems contained in the structure.

Manufactured Housing

- Currently 6.9 million manufactured homes across the country
- Regulated by HUD
- Built to 24 CFR Part 3280 – Manufactured Home Construction and Safety Standards
- The price per square foot for a manufactured home is about $50, compared to $114 for a site-built home (excluding land)

Tiny Homes

- Appendix Q of the IRC defines TINY HOUSE as “a dwelling that is 400 square feet (37 m^2) or less in floor area excluding lofts.”
- ANSI A119.5 Park Model Recreational Vehicle Standard
- NFPA 1192 Standard for RVs

Park Models

ANSI A119.5 Park Model Recreational Vehicle Standard

RVs

- NFPA 1192 Standard for RVs (2021 Edition)

Benefits

- **Faster Completion Time**
  - A home's construction time can be reduced because the site work portion in the field and the actual construction on the home's modules are being done separately, but simultaneously.
  - Initial testing of many of a home's system (plumbing and electrical) is being done prior to delivery to the site.
  - Weather is virtually eliminated as a delay because of the work in being done indoors.
  - modular construction an average 25 to 50 percent time savings over traditional construction.

Benefits

- **Reduced Costs**
  - Labor costs are reduced because of lost productivity due to weather.
  - Much of the rework is eliminated due to issues at the site.
  - Modular construction can cut costs by 20-30 percent. A shorter build time saves money on overall construction.

Benefits

- **Better for the environment**
  - Factory production is designed to minimize, reused, or eliminate waste
  - Recent reporting from the Waste & Resources Action Program (WRAP) shows that a 90-percent waste reduction can be achieved by increasing the use of off-site construction.
  - Less wasted work time because of the concentration of many homes being constructed in one locations versus spreading resources across scattered lots for typical custom home construction.
  - Less pollution – Since most materials are delivered to the factory, modular construction means fewer trucks at the project site. Fewer vehicles mean less air and noise pollution.

Benefits

- **Higher Quality**
  - Consistent processes
  - Continuous inspection
  - Trained and consistent workforce
  - Easier quality control – The modular method of “in-house” design and production helps designers, engineers, and builders spot problems early on.

Benefits

- **Worker Safety**
  - Works have a much more predictable and consistent work environment.
  - Multi-story buildings are built with modules on the ground floor of a factory virtually eliminating fall hazards.
  - Safety equipment is required in the factory and is monitored and enforced

Challenges

- The payment schedule required for modular projects requires capital earlier in the project than in traditional construction because manufacturers require up-front capital so they can procure all materials and begin producing a design.
- While modular projects must be built to the same local code as traditional construction, there may be some regulatory overlap because state and local authorities may impose additional requirements for approval and transportation.
- For manufactured housing, zoning requirements and traditional financing is a challenge

Fixing the Construction Industry's Skilled Labor Shortage

Fayola Powell | Aug 16, 2018 | Share:

Price increases signal costly construction

By: Nate Beck, nbeck@dailyreporter.com April 10, 2018 1:17 pm

nstruction materials prices continued to climb in
er goods could send construction costs
Bureau of Labor Statistics da
nt from the same time
, and are up s

ABC: Construction Materials Costs Increase
st Pace Since 20

ane Hedmond

e Construction Labor Shortage: Where Did All the Skilled
abor Go?

tradesmen_blog03

Contractors of America revealed that nearly 80 percent of construction businesses are having a hard time finding qualified skilled labor. Beginnin
labor shortage is now in full bl

The reality is that while the bu
growth could be even faster if
with Bloomberg Business, an e
shortage issue wasn't present

Did All the Skilled

On the surface, the numbers
plenty of workers looking for
Additionally, there are about
2006. When looking at the n
to fill the openings, right?

The problem is that if there

According to Bureau of Labo
143,000 vacant constructio
its members were experienc

A recently released survey by the Associated General
isolated pockets when home construction bottomed out in 2011, the

THE CIVIC REPORT

Where Are All the Builders?

Construction costs are climbing and production is lagging, in part because t
aren't enough workers to go around.

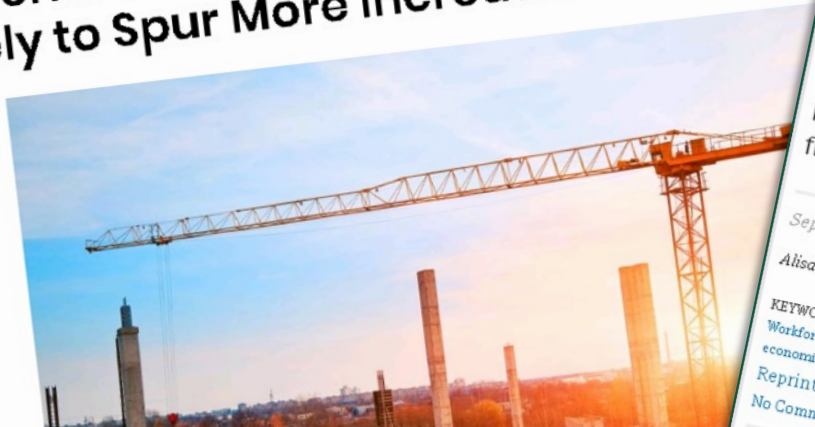
By Andrew Soergel Senior Reporter June 15, 2018, at 6:00 a.m.

lders have been looking to fill an average of nearly 225,000 construction jobs

WILLIAMSON/THE WASHINGTON POST/GE

Your Business

Material and Construction Costs Up; Tariffs Likely to Spur More Increases



Workforce

Construction Worker Shortage Continues To Grow

In Autodesk-AGC study, four of five contractors report tough time finding qualified workers

September 4, 2018

Alisa Zevin

KEYWORDS AGC / Construction Workforce / Ken Simonson, AGC economist

Reprints

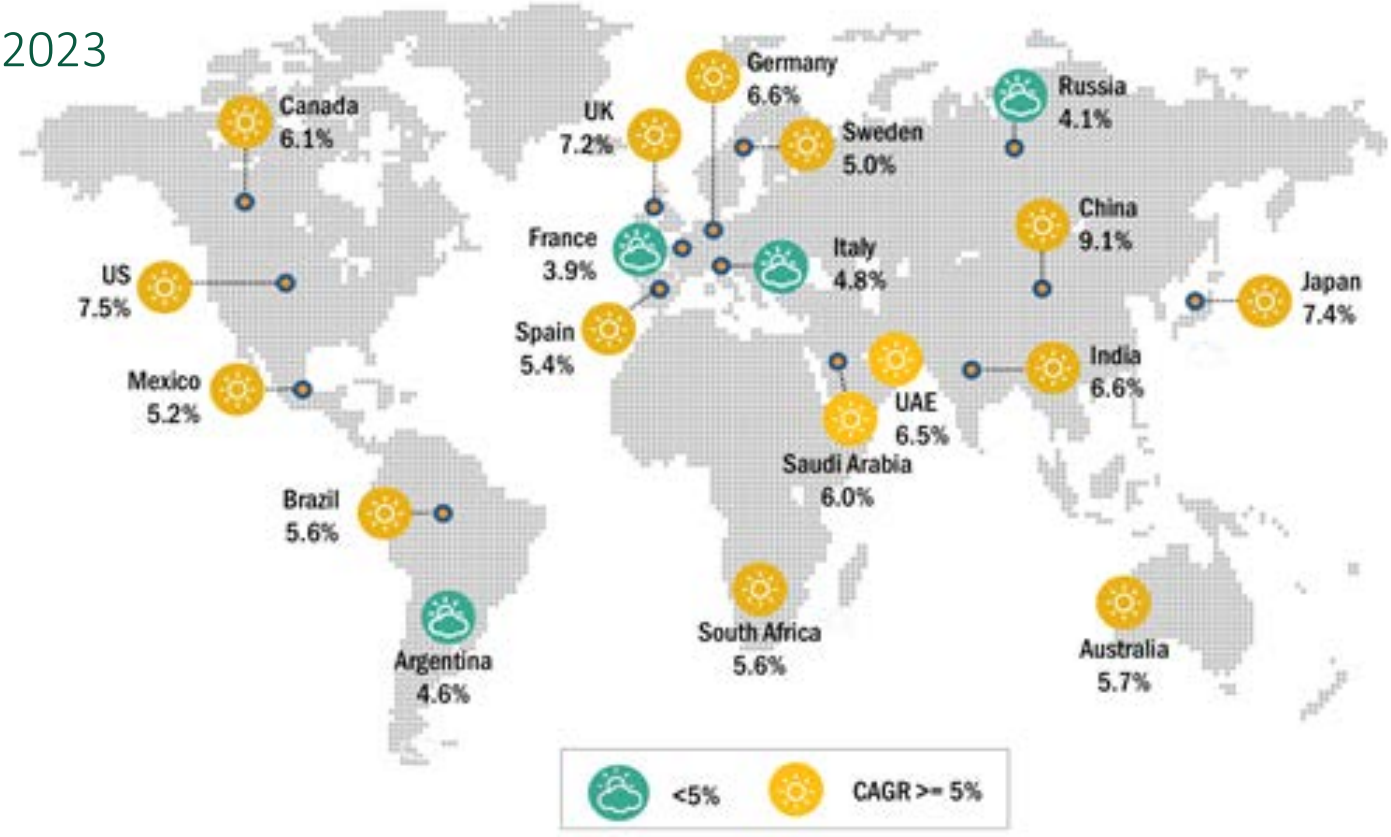
No Comments

The U.S. construction industry's labor shortage continues to worsen in 2018, according to the recently released Autodesk-Associated General Contractors of America (AGC) Construction Workforce Shortage Survey. Among 2,500 contractors surveyed, 80% report qualified workers,

Trends

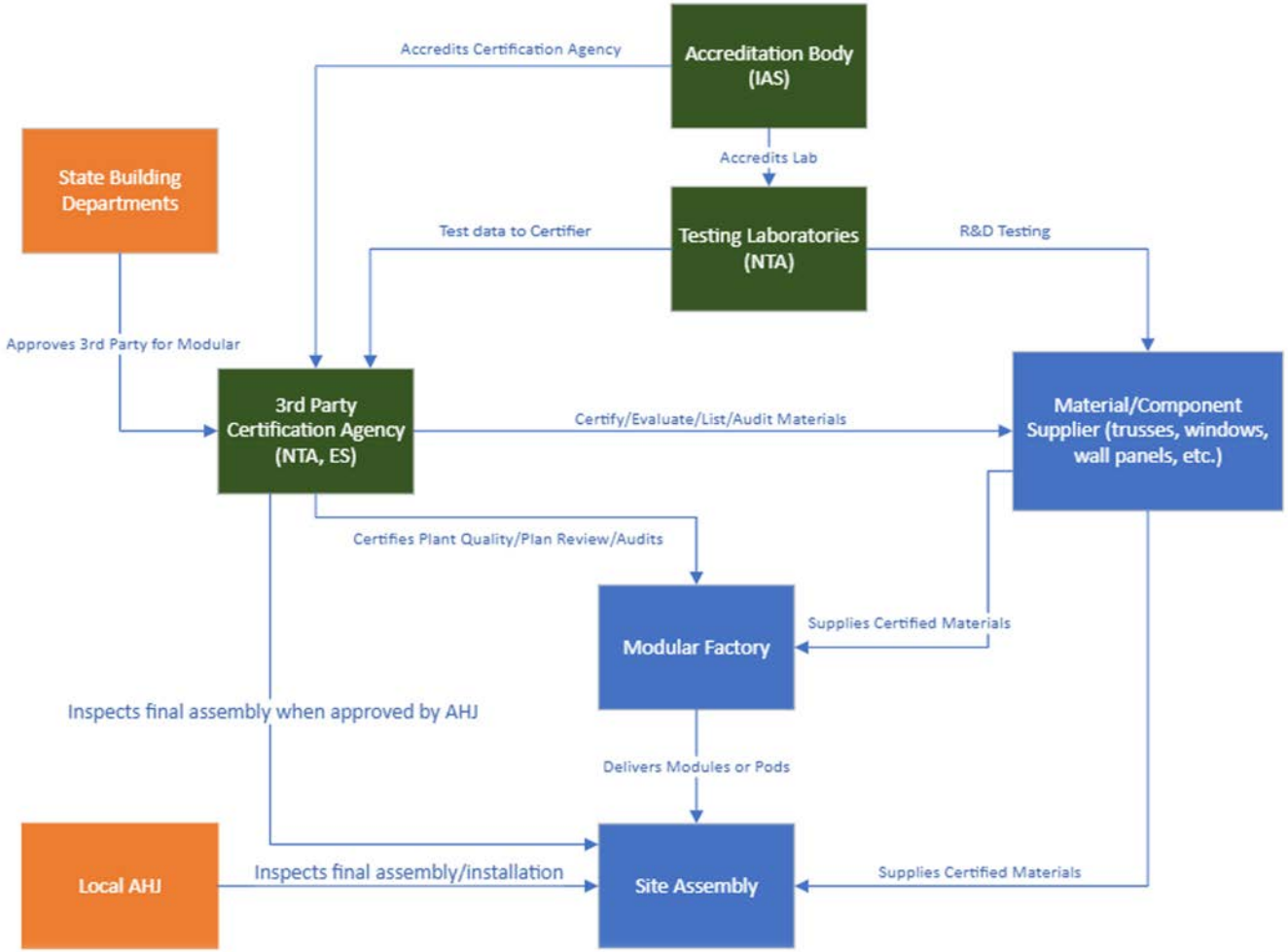
Projected growth to 2023

- Source: Markets and Markets
- CAGR = Compound Annual Growth Rate

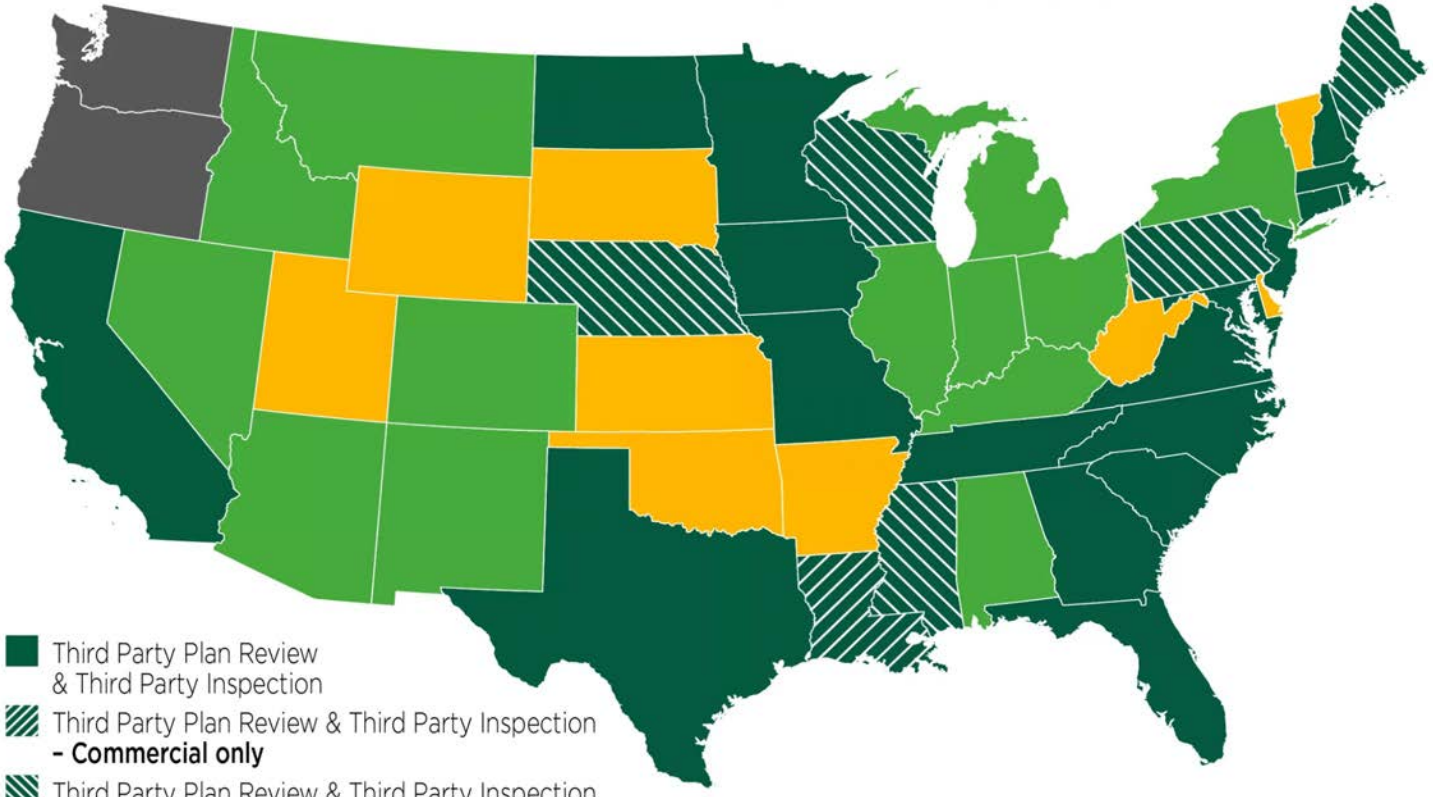


Off-site Construction Regulations

Off-Site Construction Regulatory Process



PLAN REVIEW INSPECTION JURISDICTIONS



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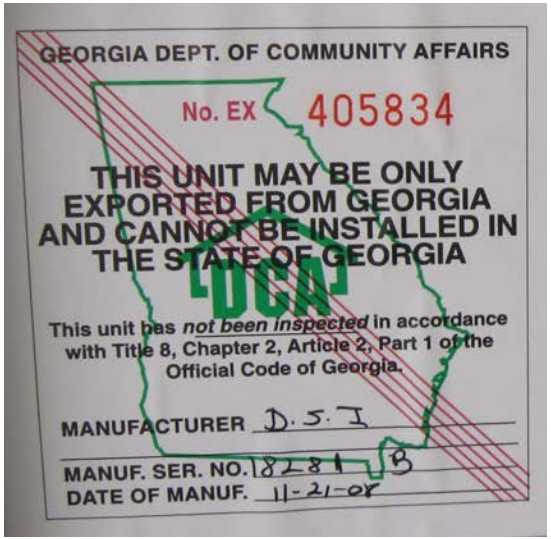
Modular Insignias

- A label on each unit signifies to the local building official that the unit has been constructed under a state sanctioned modular program
- Labels generate revenue for the State.

Colorado State Modular Code Label



Quality Assurance Program

- Production process (station by station)
- Inspection process
- Control of design documents
- Training
- Material control
- Internal auditing
- Testing

Common Challenges

- Material Standards and Listings
- Design and Installation
- Plan Submission Format
- Quality Assurance Manuals
- Time Zone/language and/or Terminology Barriers

Recycled Shipping Containers

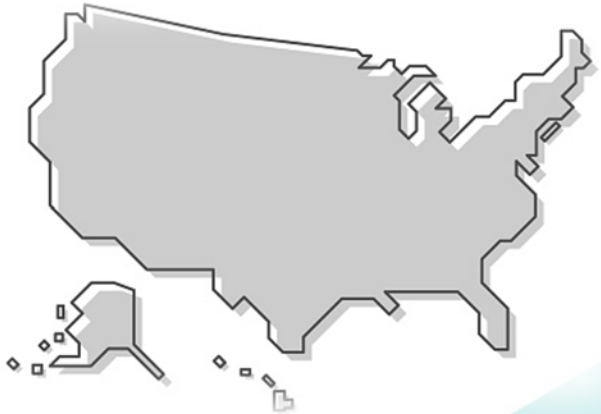
AC 462 Introduced by ICC-ES

- February 2016
- Established criteria and protocol for evaluating the reuse of shipping containers as a source of ***building product/material*** and not the final building itself
- For any new building constructed using shipping containers as part or the whole building
- Intent is to Evaluate the quality control procedures to establish and verify
  - Dimensions
  - Chemical/Physical properties of steel components
  - Evaluate the steel components for design in accordance with provisions of the code
- *Intended to provide information and recommendations to those involved in the use of containers as buildings or structures*

States Requiring AC 462 for Containers

Arizona - unless tested for steel
California
Colorado
Delaware
Florida
Georgia
Idaho - AC 462 or Steel testing
Illinois - Based on Local requirements
Louisiana
Maryland – over 400 square foot otherwise local
Minnesota
Mississippi – When under the ICC 500
New Hampshire
New Jersey
New Mexico
New York – with PE Certification (alternate Steel Testing)

- North Dakota
- Oregon
- South Carolina
- Tennessee
- Texas
- Washington
- West Virginia – Local Requirements



ICC G5-2019
Guideline for the Safe Use of ISO Containers

As with all ICC Guidelines, this guideline is not intended to be a regulatory document but rather a non-mandatory document that provides useful information for the industry, design professionals and code

IBC Standards

Current Code Requirements

Under the current code (2018 edition) shipping containers may be used as building components subject to the alternative building material requirements of the IBC (Section 104.11). Because approval procedures vary from location to location, developers and builders should consult local government authorities to gain an understanding of the state and local laws and regulations as well the required technical submissions for development review and approval.

The 2021 International Building Code includes provisions for the use of shipping containers as a building material based on approved code change – G151-18

3115.1 General

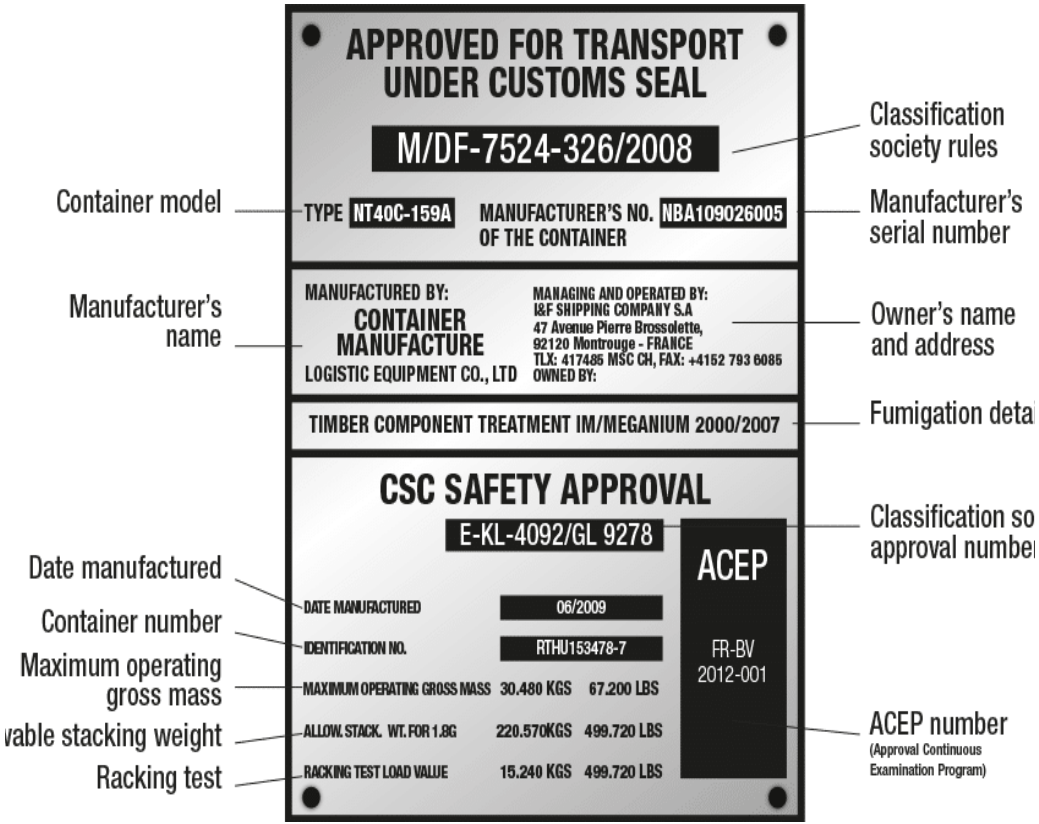
The provisions of Section 3115 and other applicable sections of this code shall apply to *intermodal shipping containers* that are repurposed for use as buildings or structures, or as a part of buildings or structures.

Convention for Safe Containers (CSC) sets international standards in two areas:

- Design type approval to ensure that new containers are designed and built to meet the dimensional and strength requirements established by the International Standards Organization (ISO).

- Safety inspections to ensure that containers are maintained in safe condition during their operating lives.

Data Plates



- The information contained on the data plate includes, but not limited to, the following:
  - Manufacturer's name or identification number
  - Date manufactured
  - Safety approval number
  - Identification number
  - Maximum operating gross mass or weight (kg)(lbs.)
  - Allowable stacking load for 1.8G (kg)(lbs.)
  - Transverse racking test force (Newtons)
  - Valid maintenance examination date
  - Classification Society

Remote Virtual Inspections

New Standards for Off-Site Construction

- Off-Site Construction Standards
  - ICC/MBI Standard 1200: Planning, Design, Fabrication and Assembly
  - ICC/MBI Standard 1205: Inspection and Regulatory Compliance
- Developed by the ICC/MBI Off-Site and Modular Construction Standard Consensus Committee (IS-OSMC)
- Anticipated Publication Date: September 16th
  - Available for adoption and use by jurisdictions throughout the United States in conjunction with the model building code for the finished construction.

ICC/MBI 1200 – Standard for Off-Site Construction

Planning, Design, Fabrication and Assembly

"…provide minimum requirements to safeguard the public health, safety, general welfare and address societal and industry challenges in multiple facets of the off-site construction process including: planning, designing, fabricating, transporting and assembling…"

This Standard includes componentized, panelized and modularized elements and will not apply to HUD Manufactured Housing.

ICC/MBI 1200 – Standard for Off-Site Construction

- Provides planning and preparation requirements for:
  - The role of the architect/modular manufacturer/construction manager/general contractor;
  - Location of plant vs. construction site;
  - A controlled manufacturing environment;
  - Supply chain integration;
  - The fabrication process and on-site assembly.

ICC/MBI 1200 – Standard for Off-Site Construction

- Table of Contents
  - Chapter 1: Application & Administration
  - Chapter 2: Definitions
  - Chapter 3: Design
  - Chapter 4: Special Requirements Based on Product Type
  - Chapter 5: Manufacturing Plant
  - Chapter 6: Fabrication
  - Chapter 7: Transportation and Storage
  - Chapter 8: On-site Installation
  - Chapter 9: Referenced Standards

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 1: Application & Administration
  - Administrative Provisions
    - Purpose
    - Scope
    - Provisions for Compliance
    - Compliance Alternative
    - Referenced Standards
  - General Requirements
    - Planning Considerations
      - AHJ, Manufacturing process, transportation, installation sequencing, cranes, responsibilities
    - AHJ Requirements (state programs where exist)
    - Responsible Parties Identification

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 1: Application & Administration
  - Submittal Documents
    - General requirements
      - Delineation of off-site/on-site elements
      - Key plan
      - Mate lines
      - Component specifications
    - Non-site-specific buildings
    - Panelized systems
  - Inspections
    - In-plant
    - On-site
      - Inter-connections

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Acronyms/Abbreviations
  - Definitions
    - ASSEMBLY. A collection of modular components assembled into a whole or partial module or modular building.
    - AUTHORITY HAVING JURISDICTION (AHJ). Organization, political subdivision, office or individual charged with the responsibility of administering and enforcing the provisions of the applicable building code. The authority having jurisdiction shall include a state agency or local building department.

Photo credit: Volumetric Building Companies, Philadelphia, PA

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Definitions
    - COMPLIANCE ASSURANCE PROGRAM. Procedures that state the guiding principles and define the framework for ensuring that construction documents approved by a design review agency, or that modular buildings inspected by a third-party inspection agency, comply with the applicable building codes.
    - DATA PLATE. A plate attached by the manufacturer or installer, to a modular building, or modular component that contains identifying information allowing code officials or end users to determine if the structure is suitable for installation in their jurisdiction, location, or project.

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Definitions
    - DECAL. The approved form of certification issued by the authority having jurisdiction, to be permanently attached to the modular building, modular component or panelized system indicating that it has been constructed to meet or exceed the applicable building code requirements.
    - THIRD PARTY REVIEW AGENCY. An organization, private or public, determined by the authority having jurisdiction to be qualified by reason of facilities, personnel, experience, and demonstrated reliability to review the design package and certify compliance to the applicable building codes.

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Definitions
    - INSIGNIA. The approved form of certification issued by the authority having jurisdiction to the manufacturer to be attached to the modular building, modular component or panelized system indicating that it has been constructed to meet or exceed the applicable building code requirements.
    - INSTALLATION. The assembly of a modular building, modular component or panelized system on site and the process of affixing the modular building, modular component or panelized system to land, a foundation, footings or an existing building

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Definitions
    - MODULAR COMPONENT. A sub-assembly, subsystem, or combination of elements, including panelized systems, building shells or bathroom pods, for use as a part of a modular building that is not structurally independent, but is a part of structural, plumbing, mechanical, electrical, fire protection, or other systems affecting life safety.
    - MODULE. A three-dimensional, volumetric section of a modular building designed and approved to be transported as a single section independent of other sections, to a site for on-site construction.

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 2: Definitions
  - Definitions
    - PANELIZED SYSTEM. Wall, roof or floor components that are constructed at a location other than the building site in a manner that prevents the construction from being inspected at the building site without disassembly, damage or destruction thereof.
    - THIRD-PARTY INSPECTION AGENCY. An approved person or entity determined by this standard or applicable states statutory requirements to be qualified by reason of facilities, personnel, experience, demonstrated reliability, and independence of judgment to inspect industrialized housing, buildings, and portions thereof for compliance with the construction documents, compliance control program, and applicable codes.

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 3: Design
  - Fire and Smoke Protection Features
    - Construction Documents
    - Inspections
    - Secondary Attachments to Structural Members
  - Mechanical/Electrical/Plumbing/Fire Protection Systems
    - Application
    - Construction Documents

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 3: Design
  - Exterior Walls
    - System continuity
    - Control layers
    - Insulation
  - Structural Design
    - Tolerances in Panelized

Photo credit: Volumetric Building Companies, Philadelphia, PA

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 4: Special Requirements Based on Product Type
  - Modules
    - Structural (stiffness, interconnections, diaphragm and sheer walls)

Photo credit: Volumetric Building Companies, Philadelphia, PA

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 5: Manufacturing Plant
  - Location (not on-site)
  - QA/QC Plan --> 1205, availability
  - QA/QC Process
    - Personnel
    - Frequency
    - Records
  - Inspection
    - Availability
    - Notification
  - Sustainability
    - Materials Protection

Photo Credit: Durabuilt Homes and Modular Mobilization Coalition by Heather Wallace

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 6: Fabrication
  - Volumetric Construction
    - Structural identification
  - Deformation Compatibility
    - ASCE 7
  - Temporary Supports and Shoring
  - Off-site storage
    - Stacking
    - Weather Protection

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 7: Transportation and Storage
  - Transportation Permitting/Route/Weight
  - Methods of Transport
    - Integrated chassis/trailer/other
  - Loading and Unloading
  - On-site storage
    - Stacking
    - Weather and Mechanical Protection
    - Staging

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 8: On-Site Installation
  - Foundation (loads)
  - Installation Tolerances (ISO 6707-1)
  - Connections
    - Manufacturer's Instructions
      - Structural strength & rigidity
      - Envelope (air barrier, vapor barrier, insulation, sheathing. . .)
      - Ducts, pipes, wires
      - Fire separations, blocking
      - Foundation loads and anchorage
      - Foundation support
      - Services
      - Other

ICC/MBI 1200 – Standard for Off-Site Construction

- Chapter 9: Referenced Standards
  - ASCE 7
  - IBC
  - IRC
  - ICC Guideline 5
  - ICC/MBI 1205
  - ISO 6707-1
  - NFPA 221

Photo credit: Volumetric Building Companies, Philadelphia, PA

ICC/MBI 1205 - Standard for Off-Site Construction

Inspection and Regulatory Compliance

"…provide minimum requirements to safeguard the public health, safety, general welfare and address societal and industry challenges for the inspection and regulatory compliance of off-site and modular construction."

This Standard includes componentized, panelized and modularized elements and will not apply to HUD Manufactured Housing.

ICC/MBI 1205 - Standard for Off-Site Construction

- Inspection and Regulatory Compliance
- Includes compliances requirements for:
  - Permitting;
  - In-plant and on-site final inspections;
  - Third party inspections;
  - The role of Industrialized Building Departments, state modular programs and the Authority Having Jurisdiction.

ICC/MBI 1205 - Standard for Off-Site Construction

- Table of Contents
  - Chapter 1: Application & Administration
  - Chapter 2: Definitions
  - Chapter 3: Plan Approvals and Inspection Procedures
  - Chapter 4: Third Party Review and Inspection Agencies
  - Chapter 5: Requirements for Compliance Assurance Programs
  - Chapter 6: Authority Having Jurisdiction
  - Chapter 7: Insignia and Data Plates
  - Chapter 8: Referenced Standards

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 1: Application & Administration
  - General Requirements
    - Planning Considerations
    - Duties and responsibilities of building officials
      - Display proper labels
      - Undamaged
      - Installation
      - Certificate of occupancy
      - Report violations to state (if applicable)

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 1: Application & Administration
  - General Requirements
    - Responsible Parties
      - Registered design professional;
      - Manufacturer
      - Assembly
      - Constructor of On-Site Elements
    - Submittal Documents

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 1: Application & Administration
  - General Requirements
    - Inspections
      - In-plant
      - On-site
        - Manufacturer's installation instructions and construction documents
- Chapter 2: Definitions

Photo Credit: Arris Manufacturing by Heather Wallace

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - Document requirements
    - Plans, specs, test results, evaluations, manufacturer instruction. . .
    - Signature and seal
    - Structural calcs
    - Manufacturer info
    - Cover sheet
    - Layout and sequencing
  - Remote Virtual Inspections

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - General Building and Architectural
    - Table (use and occupancy, type of construction, area, occupants, height, fire rating, structural design loads)
    - Floor plans, elevations, cross sections
    - Attic access, ventilation
    - Envelope and interior wall info
    - Window and door schedule

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - Accessibility
  - Fire Safety
    - Protection features
    - Rated assemblies
    - Life safety plan
    - Flame spread, draft stops, opening protectives
    - Fire protection systems

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - Plumbing and Gas Systems
    - Drawings & details
  - Electrical Systems
    - Load calculations
    - Disconnects
    - Locations
    - Lighting plan

Photo credit: Volumetric Building Companies, Philadelphia, PA

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - Energy Conservation
  - Structure
    - Load listings
    - Engineering analysis, Design calculations
    - Material specs
    - Details of structural elements
    - Blocking plan
    - Foundation plan

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 3: Plan Approvals and Inspection Procedures
  - Connections
    - On-site details
    - Manufacturer's instructions
  - Inspection Procedures
    - In-plant (third party requirements)
      - Each module/panel in a phase of construction

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 4: Third Party Review and Inspection Agencies
  - AHJ approval
    - Name, address
    - Disciplines
    - Key personnel
    - Experience
    - Accreditation (ISO 17065 or 17020 by 17011 body)
    - Registered design professional certifications/professional license/certification

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 4: Third Party Review and Inspection Agencies
  - AHJ approval
    - Statements
      - Independence
      - Plan review
      - Plant certification
      - Inspection conduct/frequency
    - Inspection reports
    - Label control
    - Insurance

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 4: Third Party Review and Inspection Agencies
  - Performance Evaluation of Evaluation Agencies
  - Quality Assurance Personnel
    - Administrator
    - Supervisor

Photo Credit: Durabuilt Homes and Modular Mobilization Coalition by Heather Wallace

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 5: Requirements for Compliance Assurance Program
  - Quality Assurance Manual
    - Permission for inspection
    - Org chart and key personnel
    - Plant layout (station by station)
    - Inspection procedures
    - Checklists/training/auditing
    - Construction document approval process

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 5: Requirements for Compliance Assurance Program
  - Quality Assurance Manual
    - Manufacturing records
    - Serial numbering
    - Testing and inspection equipment
    - Module storage
    - Packing for shipping
    - Forms

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 5: Requirements for Compliance Assurance Program
  - Materials Control
    - Inspection procedure
    - Protection of materials
    - Rejected materials
  - Certification Labels

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 6: Authority Having Jurisdiction
  - Manufacturer Registration
    - Each facility
    - Report changes
  - List of approved third-party inspection agencies
  - Right of entry

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 7: Third Party Insignia, Identification and Data Plates
  - Insignia
    - third party + certification label number
    - Permanently affixed
    - Agency controlled
  - Data plate
    - Manufacturer info
    - Codes/loads/special conditions/special instructions
  - Records retention

ICC/MBI 1205 - Standard for Off-Site Construction

- Chapter 8: Referenced Standards
  - IBC
  - IRC
  - ISO 17011
  - ISO 17020
  - ISO 17065

Photo credit: Volumetric Building Companies, Philadelphia, PA

Code Council Resources (www.iccsafe.org/offsite)

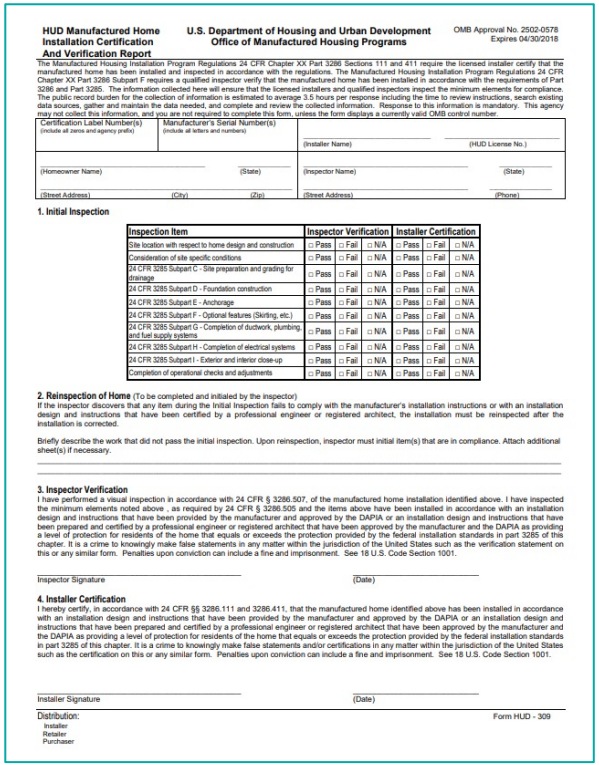
- Guideline 5-2019 Guideline for the Safe Use of ISO Intermodal Shipping Containers Repurposed as Buildings and Building Components
- ICC/MBI 1210 - Standard for Off-Site Construction: Mechanical, Electrical, Plumbing Systems, Energy Efficiency and Water Conservation (in development)
- FAQs on Off-Site Construction
- Learning Center Specialty Catalog on Off-Site Construction
- Digital Codes Premium Off-Site Resources (forthcoming)
- Conformity Assessment Services from ICC-ES, IAS, NTA
- Education Courses for Standards 1200 and 1205 coming soon.

Adopting ICC/MBI 1200 & 1205

- Being considered for incorporation in 2024 IBC.
- Jurisdictions can adopt now as stand-alone effort or part of code adoption.
- Incorporate into Building Code & Residential Code:
  - IBC Section 429 (new)
  - IRC Section 301.1.5 (new)
- Salt Lake City, UT adopted March 2021

Manufactured Housing Installation
What building officials need to know

Manufactured Housing Installation



HUD Manufactured Home Installation Certification And Verification Report

U.S. Department of Housing and Urban Development
Office of Manufactured Housing Programs

OMB Approval No. 2502-0578
Expires 04/30/2018

The Manufactured Housing Installation Program Regulations 24 CFR Chapter XX Part 3286 Sections 111 and 411 require the licensed installer certify that the manufactured home has been installed and inspected in accordance with the regulations. The Manufactured Housing Installation Program Regulations 24 CFR Chapter XX Part 3286 Subpart F requires a qualified inspector verify that the manufactured home has been installed in accordance with the requirements of Part 3286 and Part 3285. The information collected here will ensure that the licensed installers and qualified inspectors inspect the minimum elements for compliance. The public reporting burden for the collection of information is estimated to average 3.5 hours per response including the time to review instructions, search existing data sources, gather and maintain the data needed, and complete and review the collected information. Response to this information is mandatory. This agency may not collect this information, and you are not required to complete this form, unless the form displays a currently valid OMB control number.

Certification Label Number(s) (include all zeros and agency prefix)	Manufacturer's Serial Number(s) (include all letters and numbers)	(Installer Name)	(HUD License No.)
(Homeowner Name)	(State)	(Inspector Name)	(State)
(Street Address) (City) (Zip)		(Street Address)	(Phone)

1. Initial Inspection

Inspection Item	Inspector Verification	Installer Certification
Site location with respect to home design and construction	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
Consideration of site specific conditions	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart C - Site preparation and grading for drainage	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart D - Foundation construction	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart E - Anchorage	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart F - Optional features (Skirting, etc.)	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart G - Completion of ductwork, plumbing, and fuel supply systems	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart H - Completion of electrical systems	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
24 CFR 3285 Subpart I - Exterior and interior close-up	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A
Completion of operational checks and adjustments	□ Pass □ Fail □ N/A	□ Pass □ Fail □ N/A

2. Reinspection of Home (To be completed and initialed by the inspector)
If the inspector discovers that any item during the Initial Inspection fails to comply with the manufacturer's installation instructions or with an installation design and instructions that have been certified by a professional engineer or registered architect, the installation must be reinspected after the installation is corrected.

Briefly describe the work that did not pass the initial inspection. Upon reinspection, inspector must initial item(s) that are in compliance. Attach additional sheet(s) if necessary.

3. Inspector Verification
I have performed a visual inspection in accordance with 24 CFR § 3286.507, of the manufactured home installation identified above. I have inspected the minimum elements noted above , as required by 24 CFR § 3286.505 and the items above have been installed in accordance with an installation design and instructions that have been provided by the manufacturer and approved by the DAPIA or an installation design and instructions that have been prepared and certified by a professional engineer or registered architect that have been approved by the manufacturer and the DAPIA as providing a level of protection for residents of the home that equals or exceeds the protection provided by the federal installation standards in part 3285 of this chapter. It is a crime to knowingly make false statements in any matter within the jurisdiction of the United States such as the verification statement on this or any similar form. Penalties upon conviction can include a fine and imprisonment. See 18 U.S. Code Section 1001.

Inspector Signature (Date)

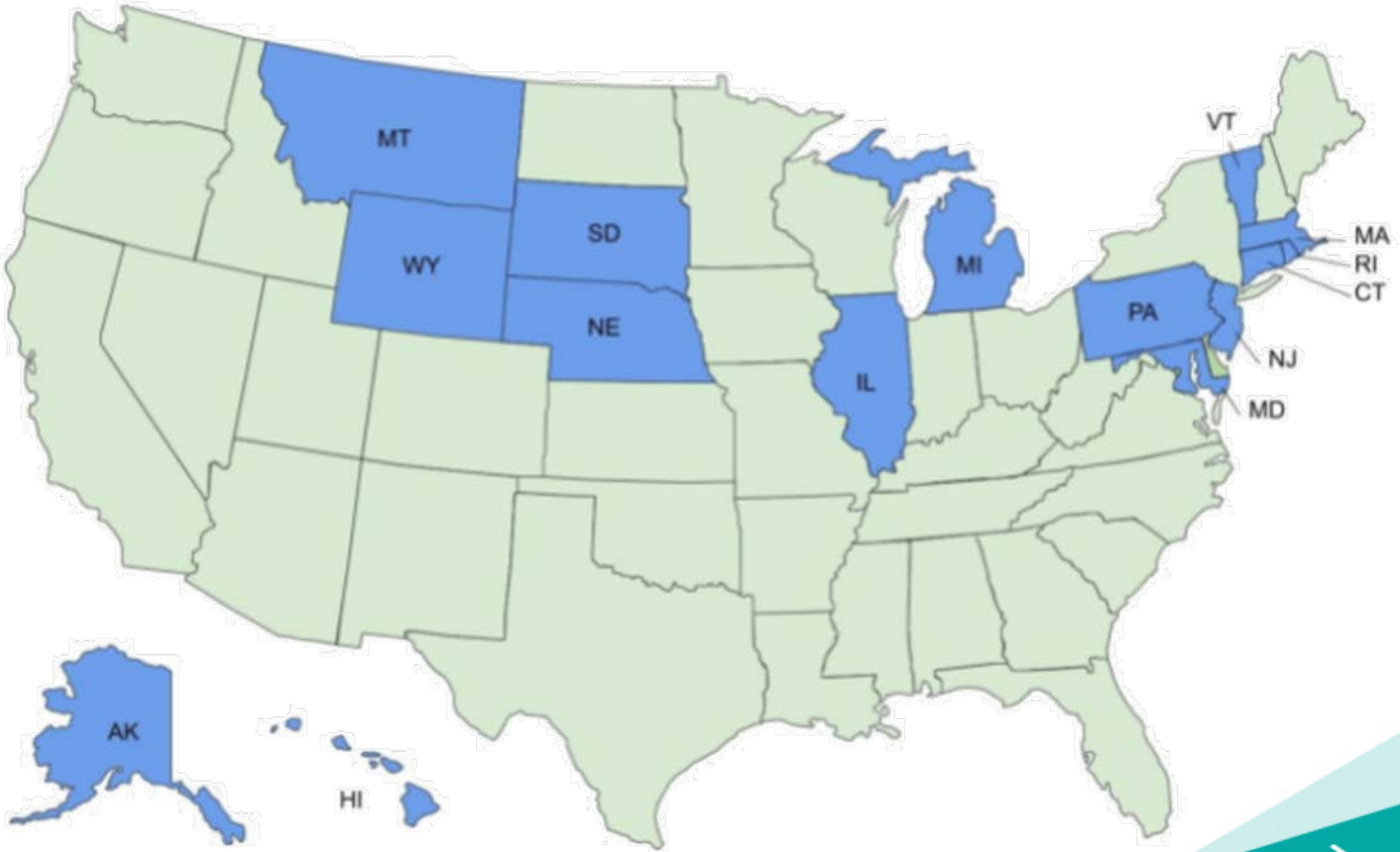
4. Installer Certification
I hereby certify, in accordance with 24 CFR §§ 3286.111 and 3286.411, that the manufactured home identified above has been installed in accordance with an installation design and instructions that have been provided by the manufacturer and approved by the DAPIA or an installation design and instructions that have been prepared and certified by a professional engineer or registered architect that have been approved by the manufacturer and the DAPIA as providing a level of protection for residents of the home that equals or exceeds the protection provided by the federal installation standards in part 3285 of this chapter. It is a crime to knowingly make false statements and/or certifications in any matter within the jurisdiction of the United States such as the certification on this or any similar form. Penalties upon conviction can include a fine and imprisonment. See 18 U.S. Code Section 1001.

Installer Signature (Date)

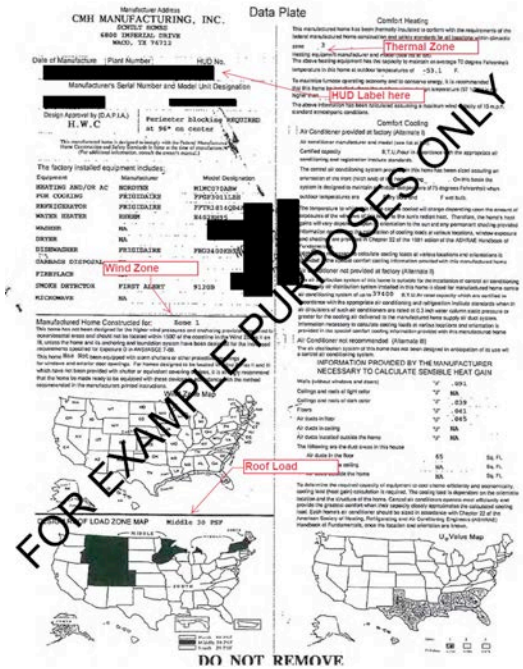
Distribution:
Installer
Retailer
Purchaser

Form HUD - 309

HUD-Administered Installation States

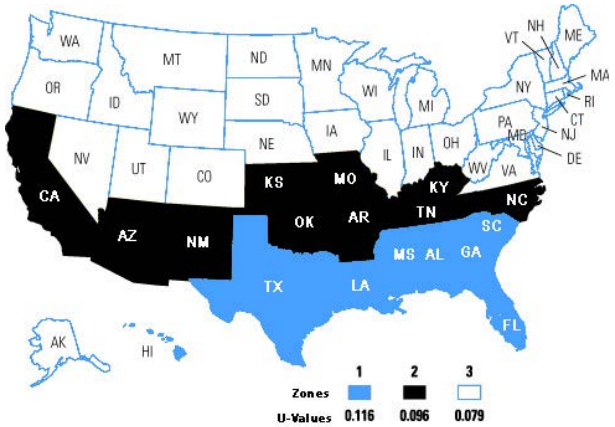


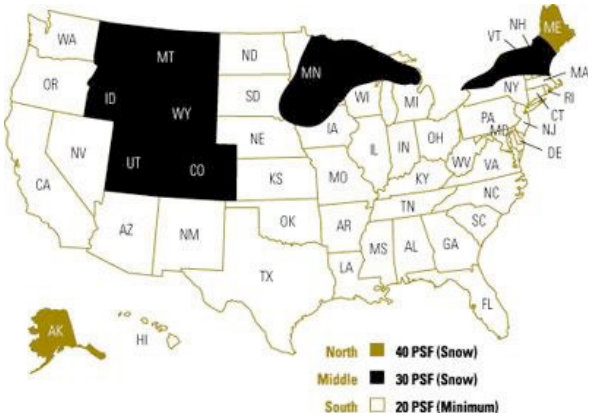
Manufactured Housing Installation



Manufactured Housing Installation

- Uo Value Zone
- Roof Load Zone
- Wind Zone





Manufactured Housing Installation

3285.203 Site Drainage. ½” per foot for 10 feet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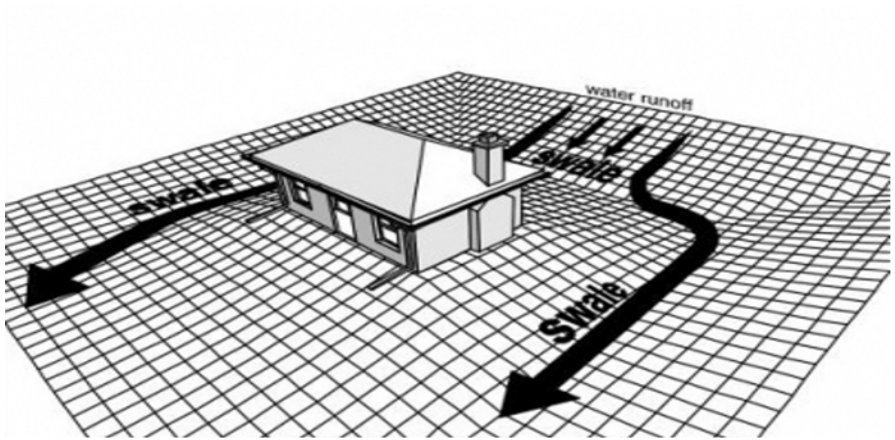
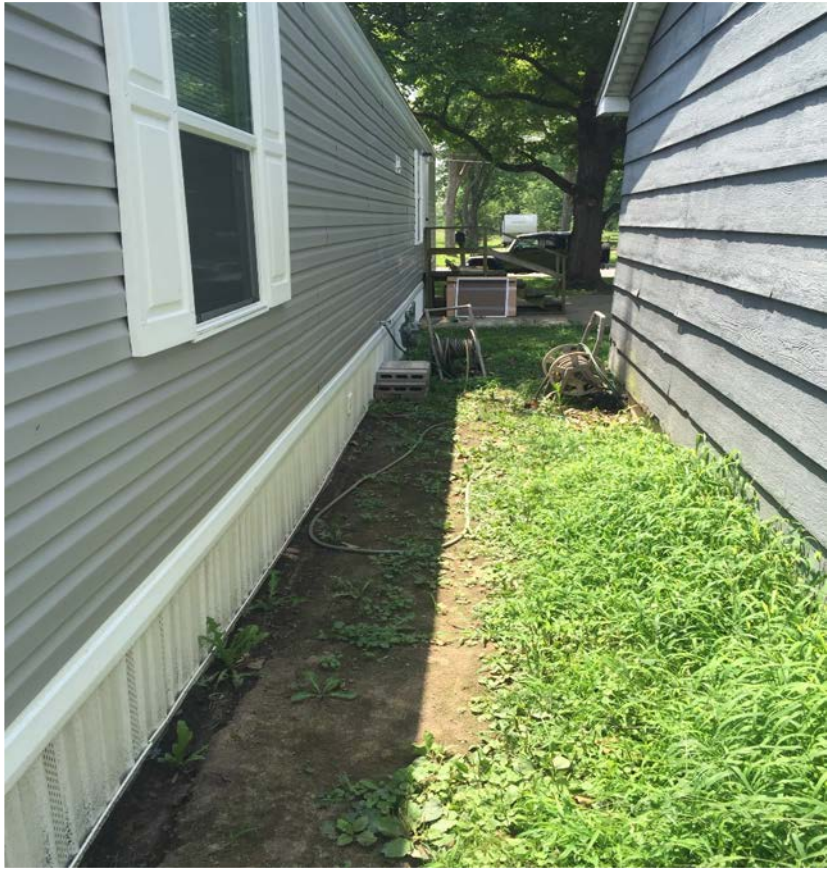





3285.203 Site Drainage. ½” per foot for 10 feet

3285.201 Soil Conditions

- Must be on firm, undisturbed soil or fill compacted to at least 90 percent of its maximum relative density.

- All organic material such as grass, roots, twigs, and wood scraps must be removed in areas where footings are to be placed.

3285.204 Ground moisture control

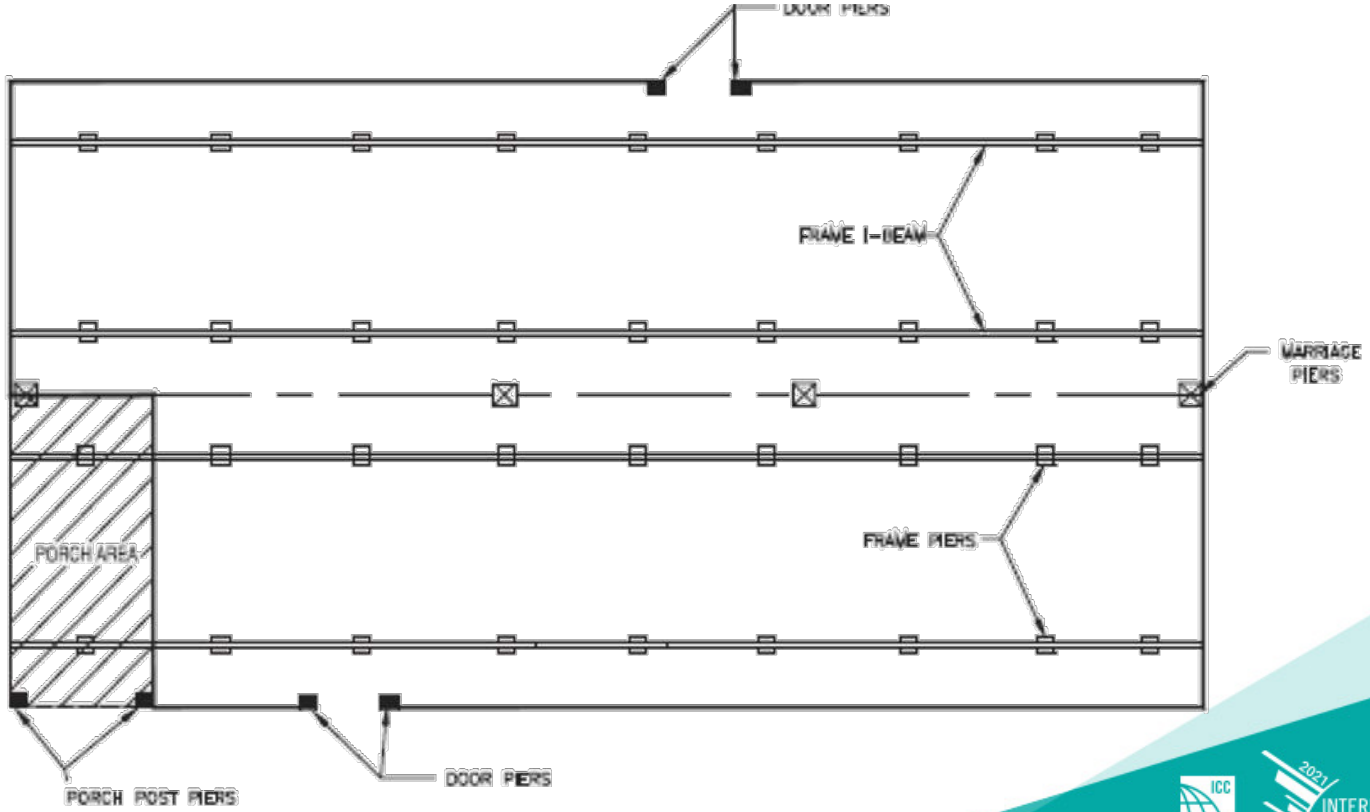
Void or tears in the vapor retarder must be repaired. 12” overlap.

Vapor retarder is required even with a slab. Best practice is under the slab, but above the slab is acceptable.

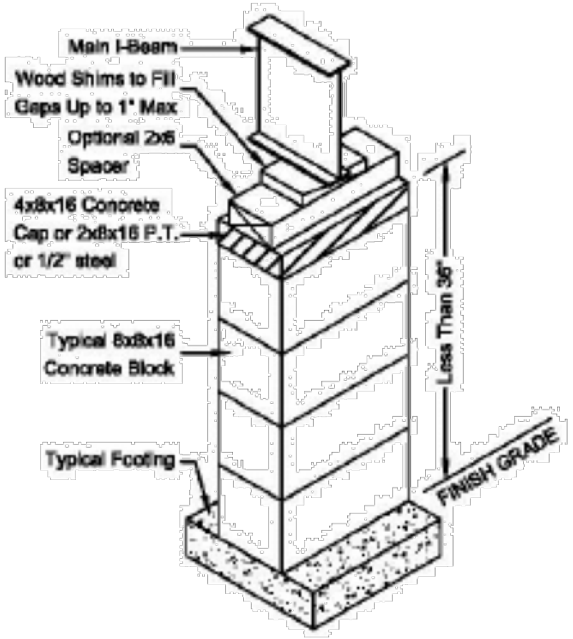
3285.305 Clearance under homes.

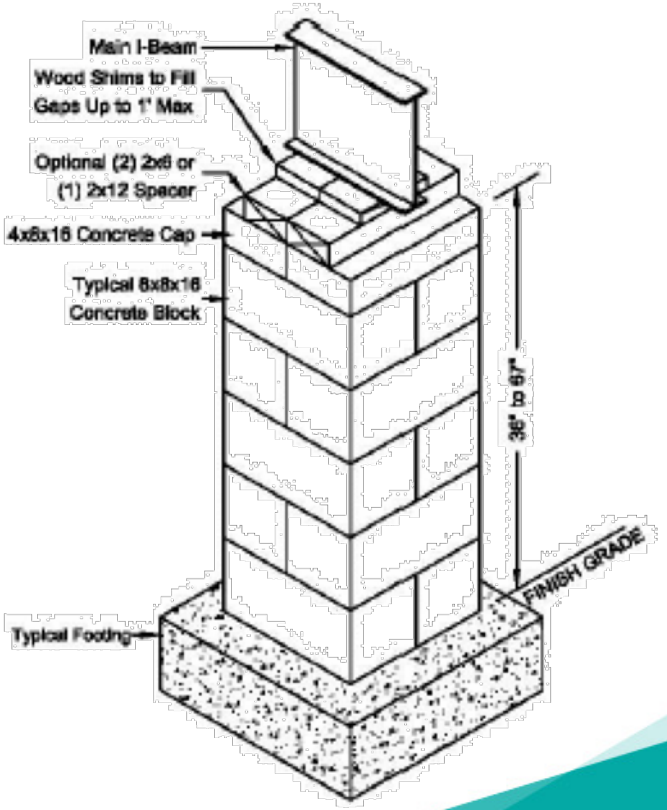
- A minimum clearance of 12 inches must be maintained between the lowest member of the main frame and the grade under all areas of the home

Foundation System

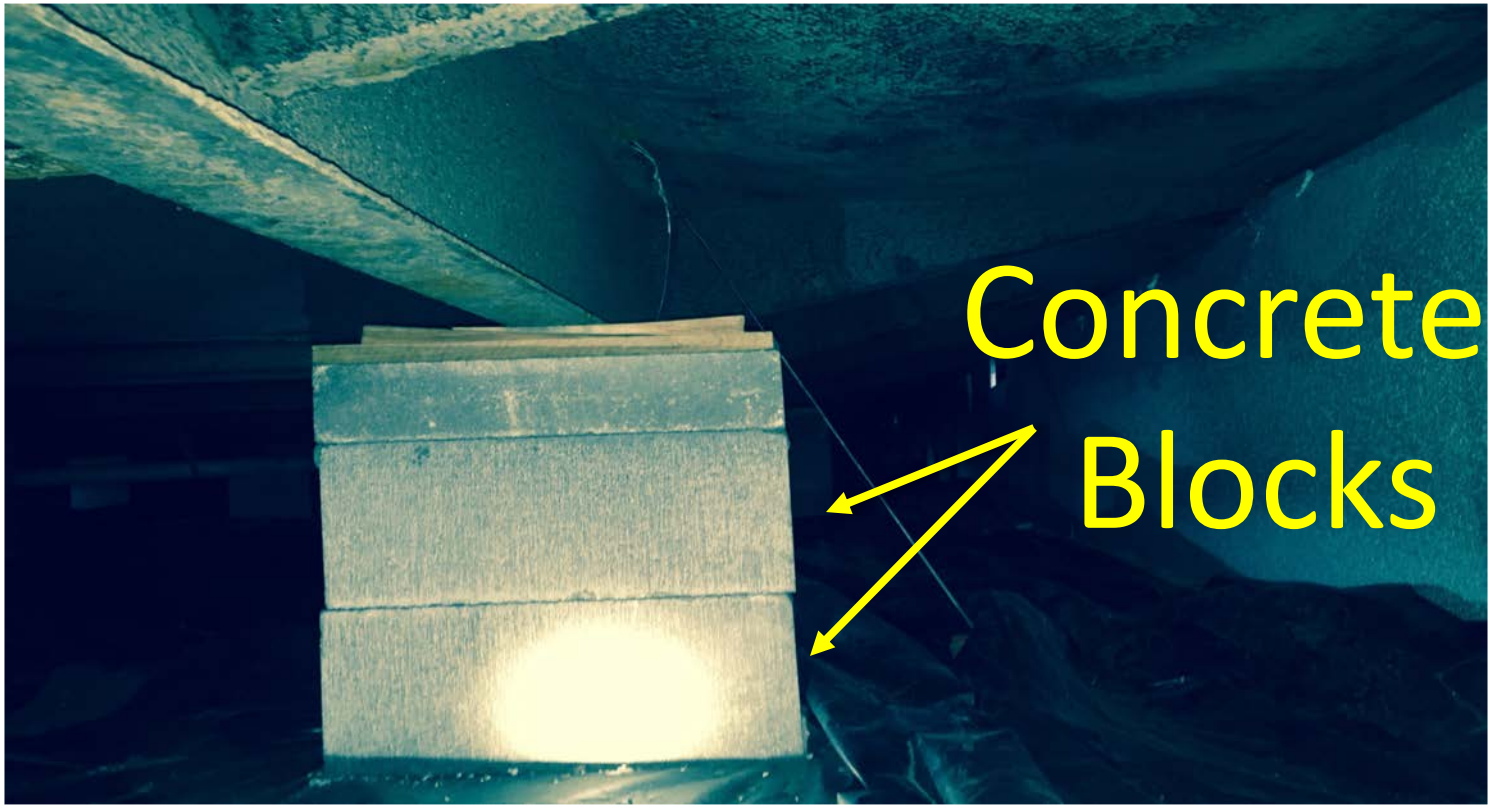


Concrete block piers

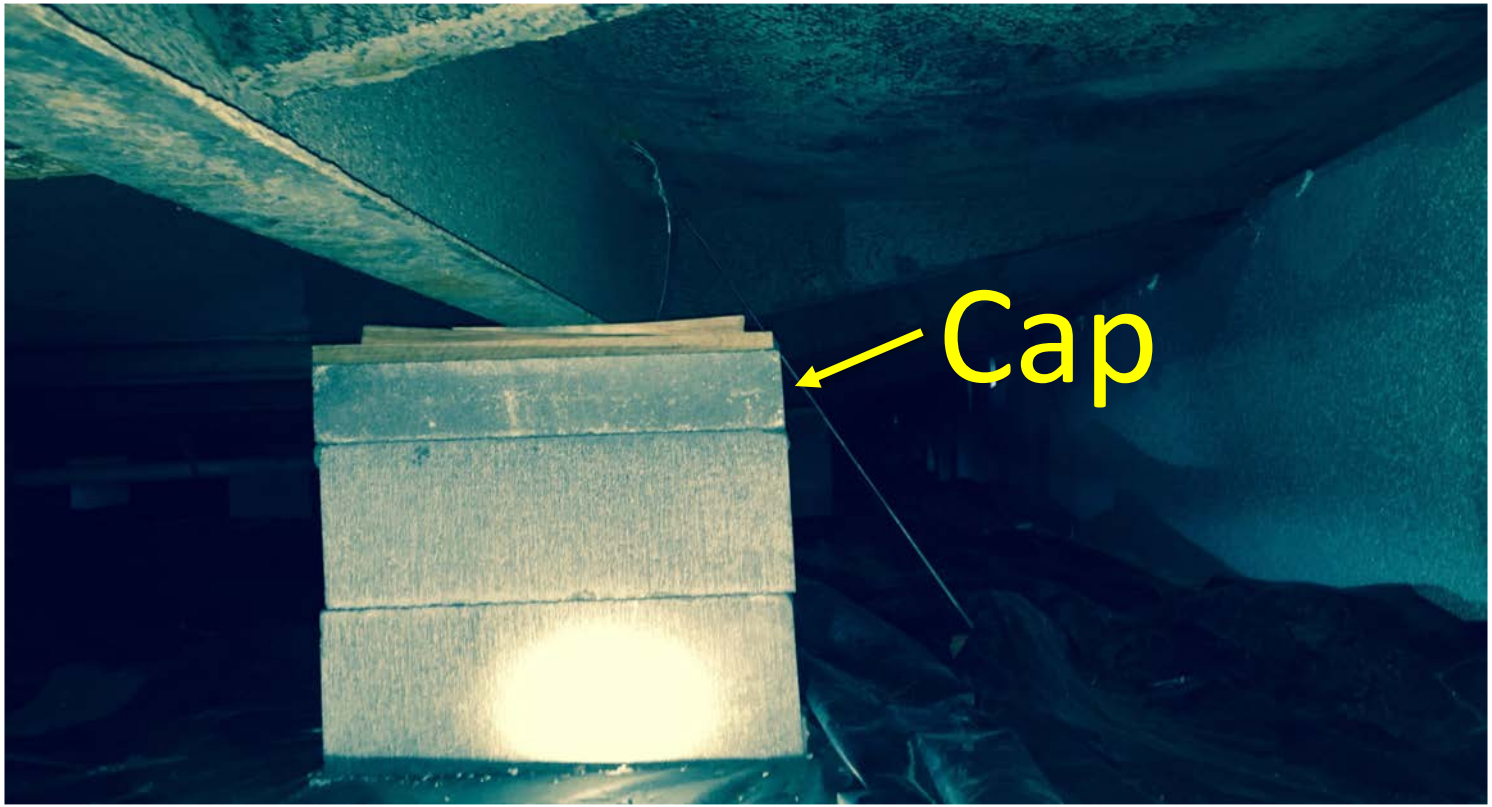




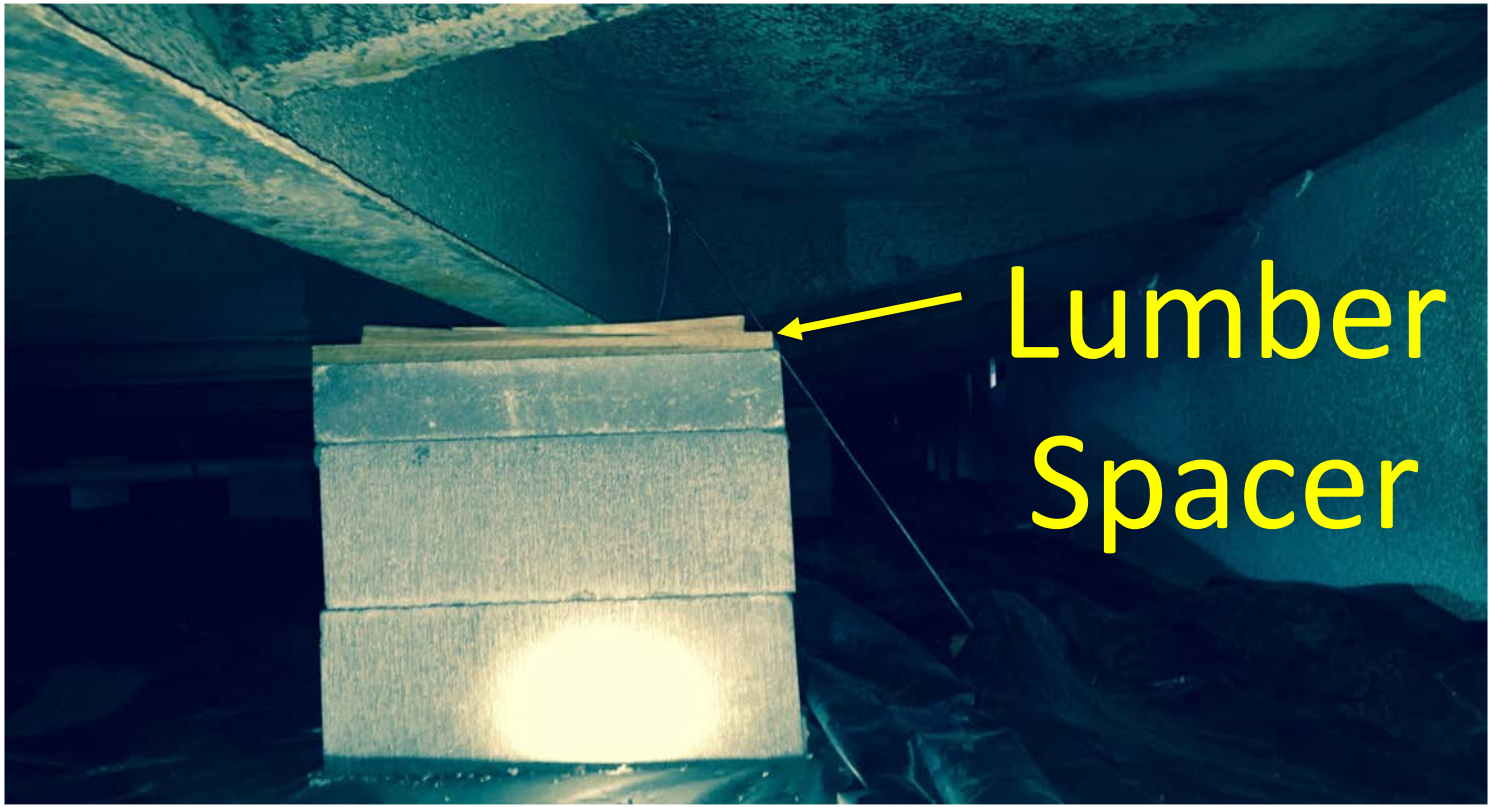
3285.303 Pier construction



3285.303 Pier construction



3285.303 Pier construction



3285.303 Pier construction

3285.303 Pier construction

Caps must be one of the following

1. 4”x8”x16” concrete solid block.
2. 2”x8”x16” Hardwood or P.T. Lumber.
3. ½”x8”x16” Steel plate w/ corrosion protection.
4. Other listed material.

3285.303 Pier construction

To fill the gap above the cap you may use the following:

1. 4”x8”x16” Concrete Block
2. 3”x8”x16” Concrete Block
3. 2”x8”x16” Concrete Block
4. Hardwood or P.T. Lumber no thicker than 2”
5. Other listed material.
6. Shims used in pairs no more than one inch in height.


3285.307 Perimeter support piers
Typically found missing on block perimeter walls

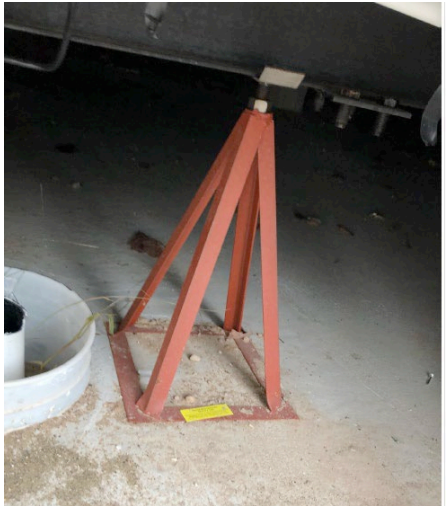

3285.307 Perimeter support piers
Missing Caps and no bearing.

BLOCK

Unlisted/unlabeled piers and caps

3285.308 Manufactured piers

- Must be listed and labeled.
- Provided with protection against weather deterioration and corrosion at least equivalent to that provided by a costing of zinc on steel of .30 oz./ft.^{2}



Foundation Construction

24 CFR 3285 Subpart D

- Piers

LOAD ON FRAME SUPPORTS FOR HOMES NOT REQUIRING PERIMETER BLOCKING — lbs.

Maximum support spacing	Roof load zone and max. section width										
	20 PSF Live Load				30 PSF Live Load				40 PSF Live Load		
	12 Wide	14 Wide	16 Wide	18 Wide	12 Wide	14 Wide	16 Wide	18 Wide	12 Wide	14 Wide	16 Wide
4 ft	2490	2820	3140	3600	2810	3170	3520	4030	3120	3520	3900
6 ft	3730	4230	4710	5400	4210	4760	5270	6040	4680	5280	5840
8 ft	4980	5640	6270	7200	5610	6340	7030	8060	6240	7040	7790
10 ft	6220	7040	7840	-	7010	7920	8790	-	7800	8800	9730

Foundation Construction

FOOTING DIMENSIONS

Soil Bearing Capacity	Minimum Footing Area (sq. in.)	Minimum Footing Dimensions (in)	Equivalent Footing Dia. (in)	8 in. x 16 in. pier (single-stack blocks)		16 in. x 16 in. pier (double-stack blocks) (Minimum Dia. Is 32")	
				Unreinforced Cast-in-Place min. thickness (in.)	Maximum Footing Capac-ity (lbs)	Unreinforced Cast-in-Place min. thickness (in.)	Maximum Footing Ca-pacity (lbs)
1000	256	16 x 16	18	6	1640	6	1640
	384	24 x 16	23	6	2460	6	2460
	576	24 x 24	28	8	3600	6	3700
	1024	32 x 32	36	12	6040	8	6400
	1296	36 x 36	41	14	7420	10	7870
	2304	48 x 48	54	20	8000	16	12800
1500	256	16 x 16	18	6	2530	6	2530
	384	24 x 16	23	6	3800	6	3800
	576	24 x 24	28	8	5600	6	5700
	1024	32 x 32	36	12	8000	8	9950
	1296	36 x 36	41	-	-	10	12370
	2304	48 x 48	54	-	-	16	16000
2000	256	16 x 16	18	6	3420	6	3420
	384	24 x 16	23	6	5130	6	5130
	576	24 x 24	28	8	7600	6	7700
	1024	32 x 32	36	12	8000	8	13510
	1296	36 x 36	41	-	-	10	16000
	-	-	-	-	-	-	-

Install Footings

TABLE 10. FOOTING DIMENSIONS

Pier Capacity (Lbs)	Soil Bearing Capacity (PSF) Required Footing Area (square inches)					
	1000	1500	2000	2500	3000	4000
1000	144	128	128	128	128	128
1200	173	128	128	128	128	128
1400	202	134	128	128	128	128
1600	230	154	128	128	128	128
1800	259	173	130	128	128	128
2000	288	192	144	128	128	128
2200	317	211	158	128	128	128
2400	346	230	173	138	128	128
2600	374	250	187	150	128	128
2800	403	269	202	161	134	128
3000	432	288	216	173	144	128
3100	446	298	223	179	149	128
3200	461	307	230	184	154	128
3300	475	317	238	190	158	128
3400	490	326	245	196	163	128
3500	504	336	252	202	168	128
3600	518	346	259	207	173	130
3700	533	355	266	213	178	133

Note:

To calculate a square or rectangular footer:

Length (in) x Width (in) = Area

Example:

16 in x 20 in = 320 sq. inches

To calculate a round footer:

3.14 x .25 x Diameter (in) x Diameter (in) = Area

Example: For a 22" diameter footing

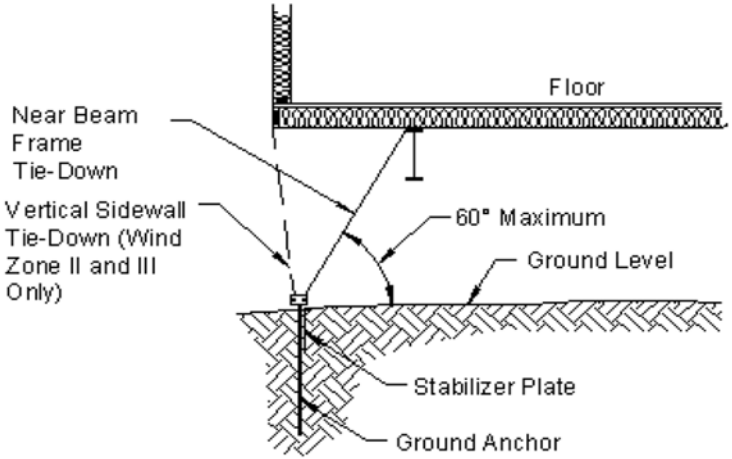
3.14 x .25 x 22 in x 22 in = 380 sq. inches

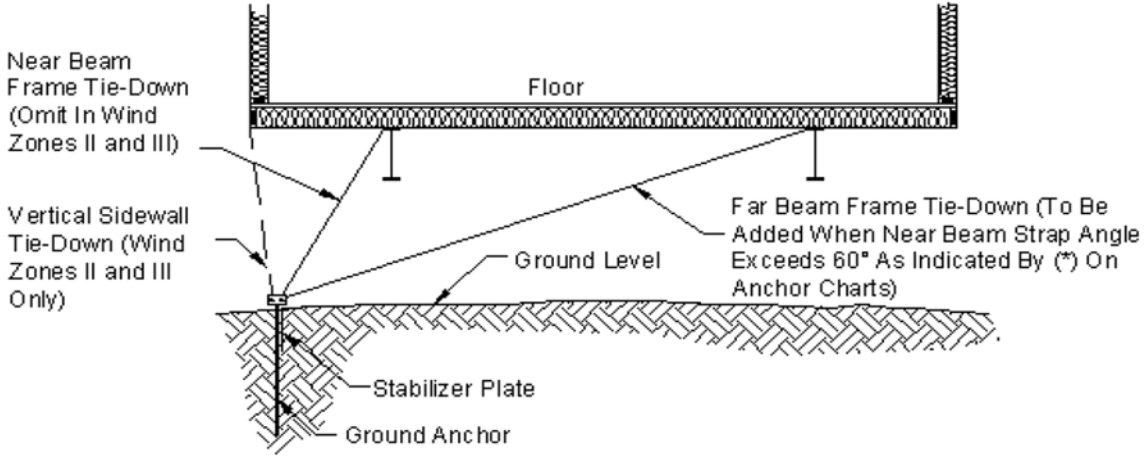
Anchorage

WIND ZONE I SIDEWALL FRAME ANCHOR MAXIMUM SPACING

Floor width	Max. Sidewall height	Height from Ground to Top of Pier	Roof Slope Maximum 4.35/12 (20 degrees)			
			Single Section		Multi-Section	
			Beam Spacing 80" – 82"	Beam Spacing 96" – 99.5"	Beam Spacing 80" – 82"	Beam Spacing 96" – 99.5"
12 Wide	96"	12" to 20"	9' – 09"	* 10' – 11"	9" – 09"	* 13' – 05"
		21" to 36"	* 10' – 03"	* 11' – 08"	* 13' – 05"	* 13' – 05"
		37" to 52"	* 10' – 10"	* 12' – 01"	* 13' – 03"	* 13' – 05"
		53" to 67"	* 11' – 04"	* 12' – 04"	* 12' – 05"	* 12' – 09"
	108"	12" to 20"	8' – 10"	* 9' – 07"	8' – 10"	* 12' – 01"
		21" to 36"	* 8' – 11"	*10' – 04"	*12' – 00"	* 12' – 01"
		37" to 52"	* 9' – 06"	* 10' – 08"	* 11' – 11"	* 12' – 01"
		53" to 67"	* 9' – 10"	* 10' – 11"	* 11' – 02"	* 11 – 06"
	120"	12" to 20"	8' – 00"	* 8' – 06"	8' – 00"	* 10' – 09"
		21" to 36"	* 7' – 10"	* 9' – 02"	* 10' – 07"	* 10' – 09"
		37" to 52"	* 8' – 05"	* 9' – 07"	* 10' – 08"	* 10' – 09"
		53" to 67"	* 8' – 05"	* 9' – 10"	* 10' – 02"	* 10' – 05"
14 Wide	96"	12" to 20"	11' – 07"	9' – 10"	11' – 07"	9' – 10"
		21" to 36"	9' – 04"	* 10' – 11"	9' – 04"	* 13' – 05"
		37" to 52"	* 10' – 03"	* 11' – 06"	* 13' – 05"	* 13' – 05"
		53" to 67"	* 10' – 09"	* 11' – 10"	* 12' – 09"	* 13' – 01"
	108"	12" to 20"	10' – 05"	8' – 10"	10' – 05"	8' – 10"
		21" to 36"	8' – 04"	* 9' – 06"	8' – 04"	* 12' – 01"
		37" to 52"	* 8 – 11"	* 10' – 01"	*12' – 01"	*12' – 01"
		53" to 67"	*9' – 05"	*10' – 05"	* 11' – 06"	*11' – 09"
	120"	12" to 20"	9' – 06"	8' – 00"	9' – 06"	8' – 00"
		21" to 36"	7' – 07"	* 8' – 05"	7' – 07"	* 11' – 00"
		37" to 52"	* 7' – 10"	* 8' – 11"	* 11' – 00"	* 11' – 00"
		53" to 67"	* 8' – 03"	* 9' – 03"	* 10' – 05"	* 10' – 08"

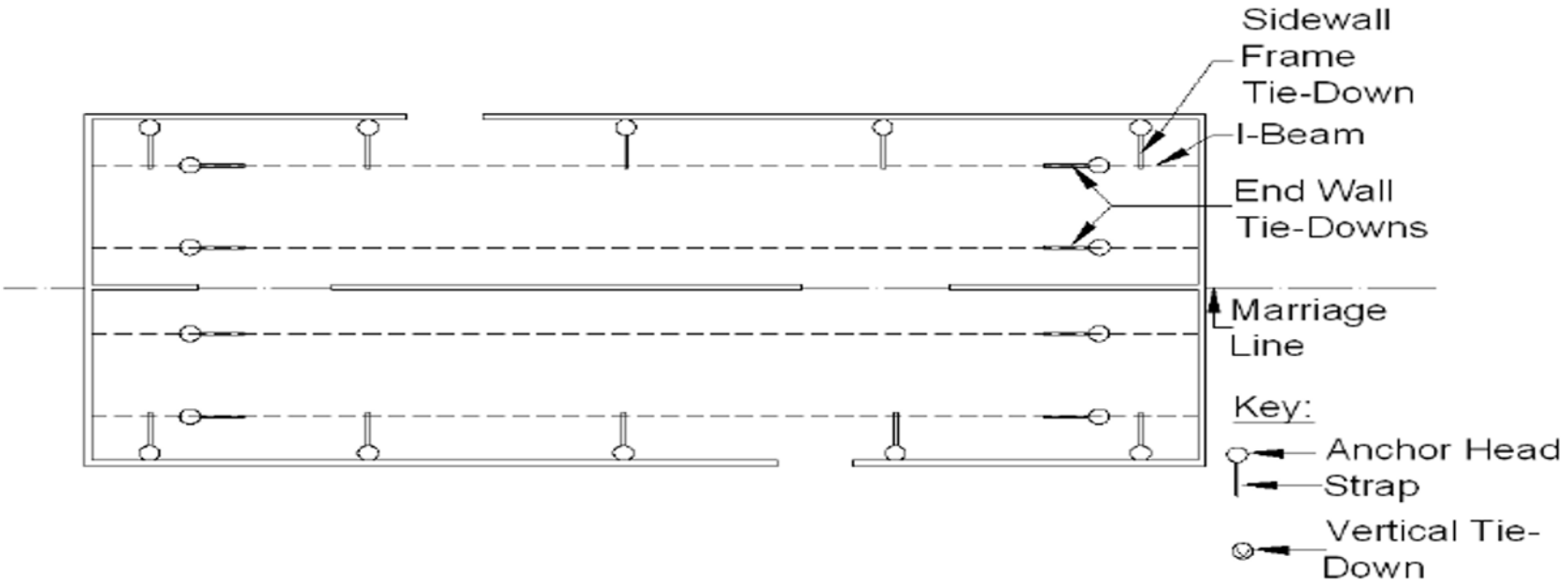
Anchorage



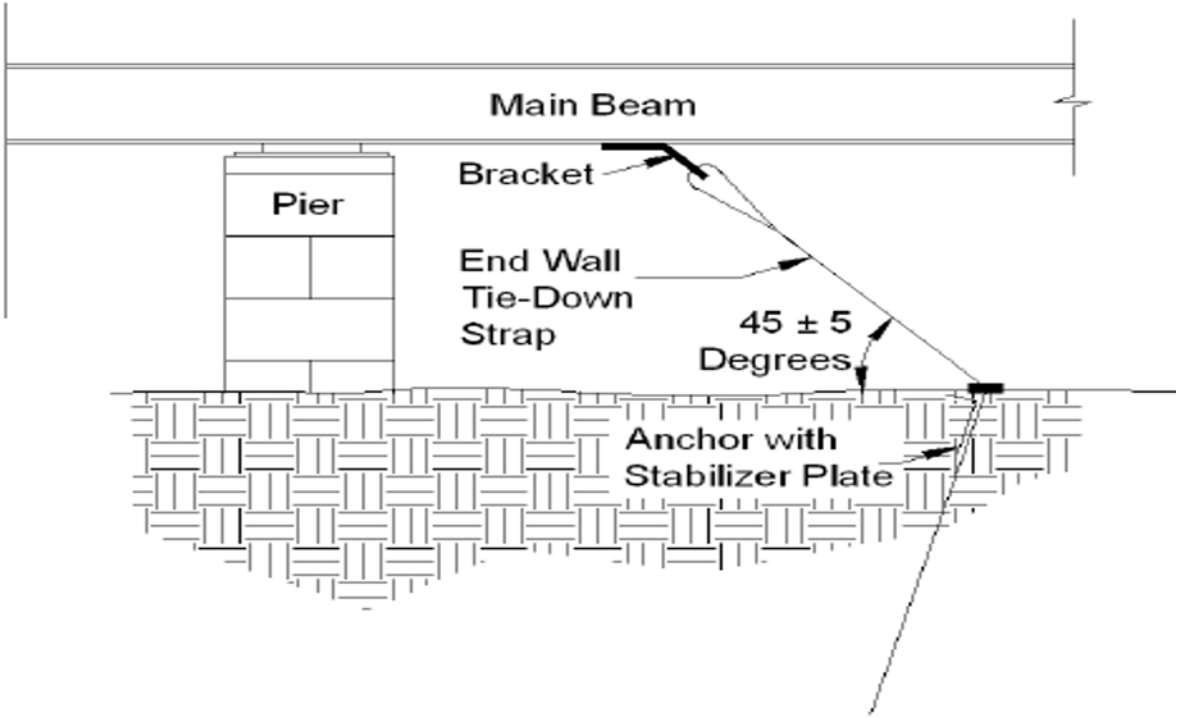


* Indicates a configuration that will require an additional strap connected to the far beam

End Wall Anchors



End Wall Anchors

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ASTM D3954


MMA 42

Alternative Anchoring Systems

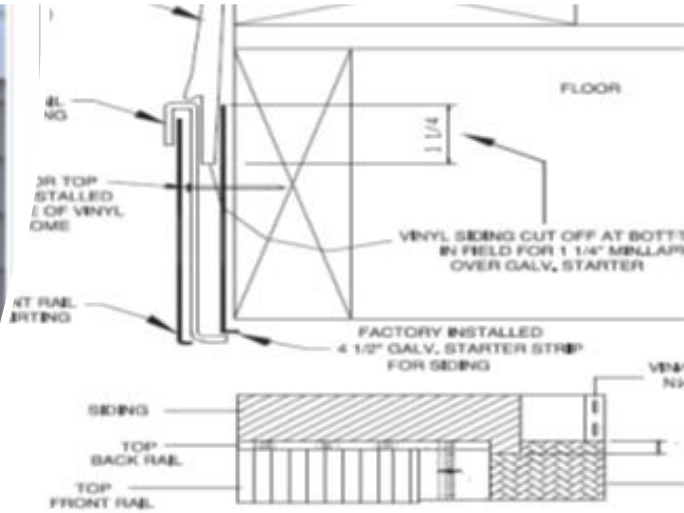
- Must be listed and labeled.
- Must be installed per manufactures installation instruction and must be approved for use in DAPIA manual.

3285.203(f) Gutters and downspouts.

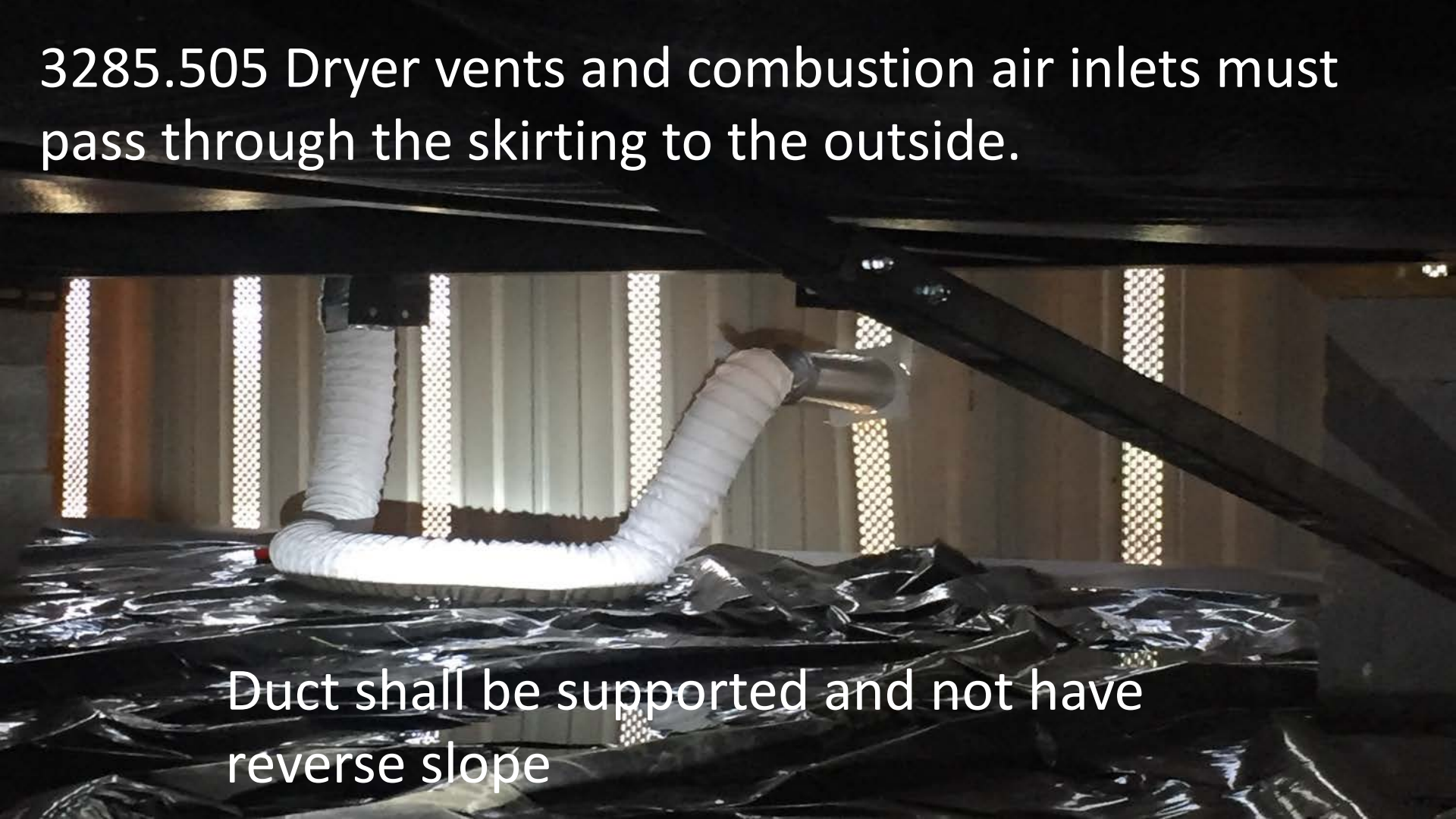
- If gutters and downspouts are installed, the water runoff must be directed away from the home.
- Not required to be installed.

3285.504 Skirting

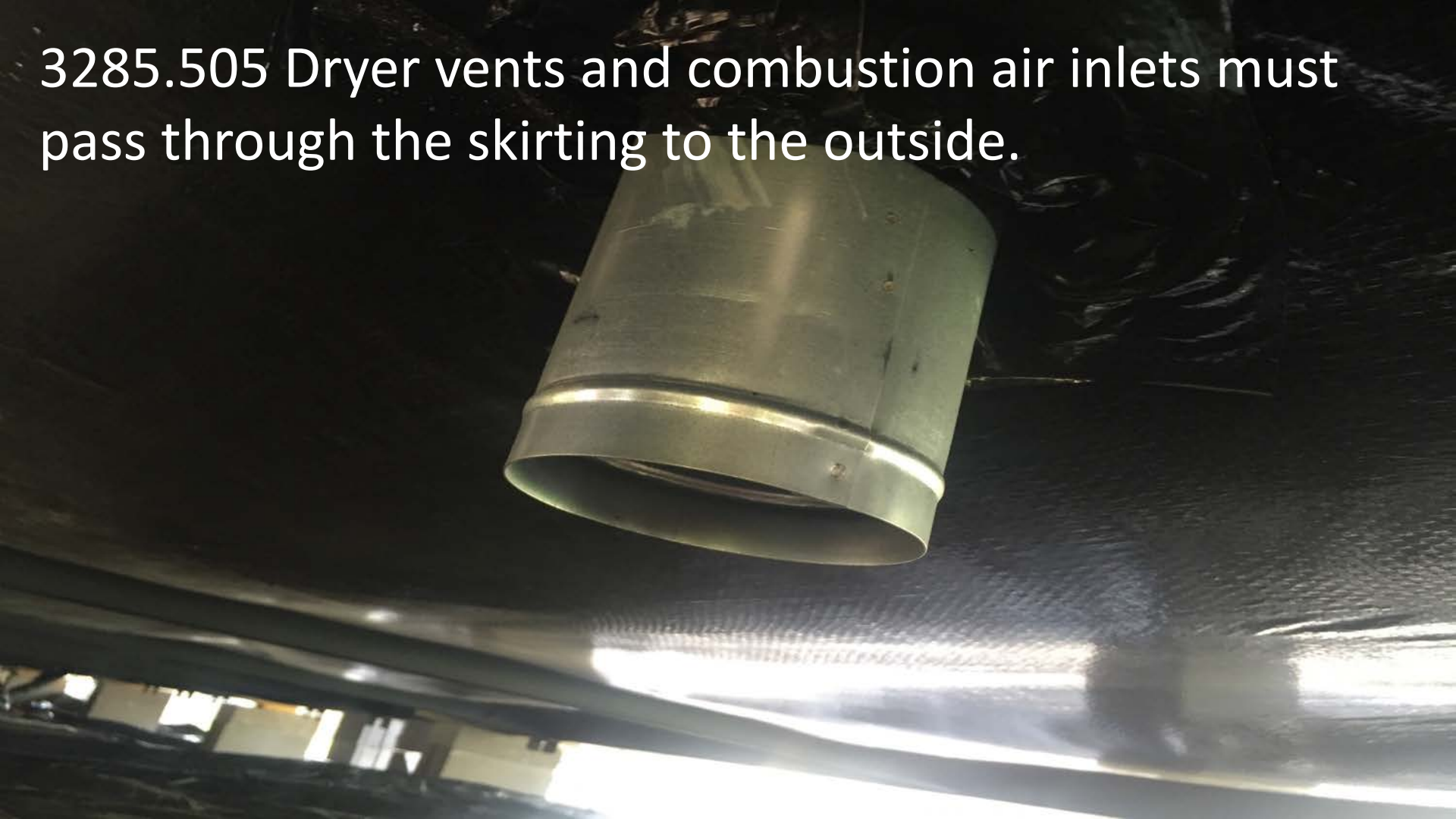
- Must be weather-resistant material
- Can not trap water behind siding or trim
- Must not impede the contraction and expansion of the homes exterior covering.



3285.505 Dryer vents and combustion air inlets must pass through the skirting to the outside.

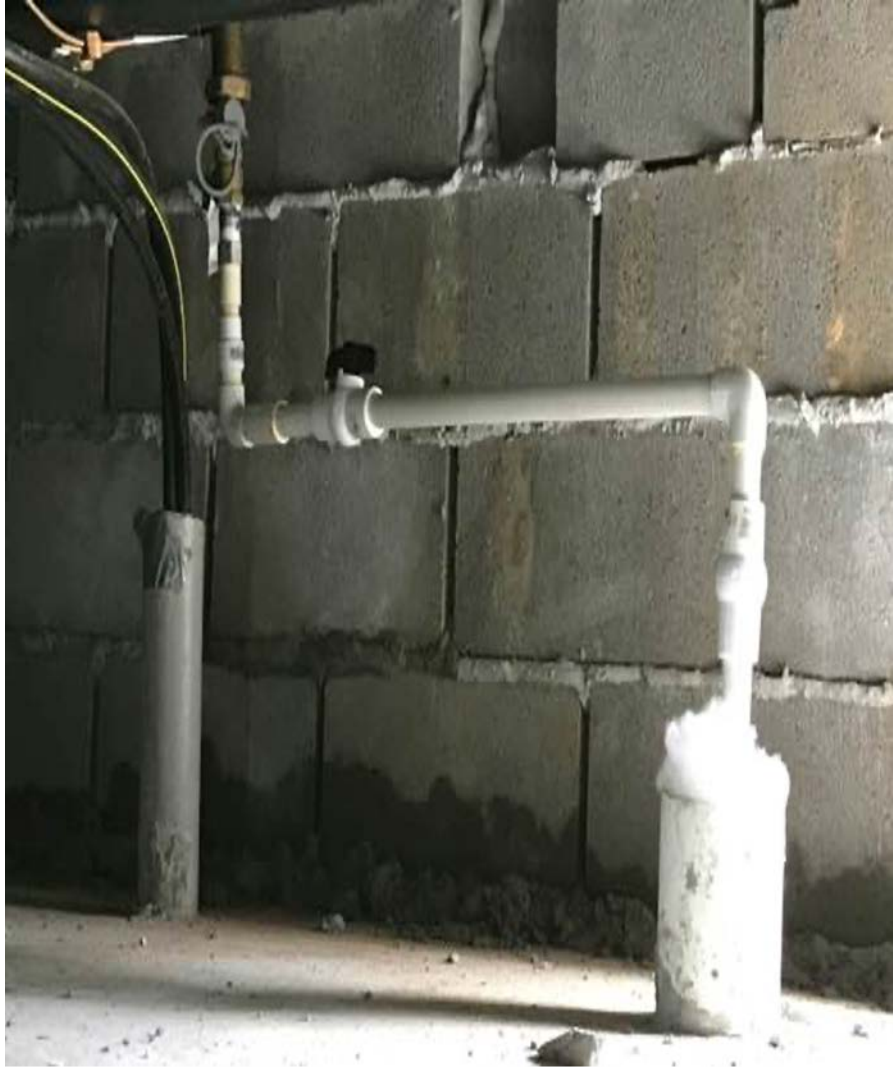


Duct shall be supported and not have reverse slope


3285.505 Dryer vents and combustion air inlets must pass through the skirting to the outside.

3285.603 Water Supply

1. Pipes must be insulated and use heat tape unless it is in an insulated foundation system.
2. A shutoff valve is mandatory.



3285.604 Drainage system

Drain lines shall have ¼” slope and support at 4ft oc.

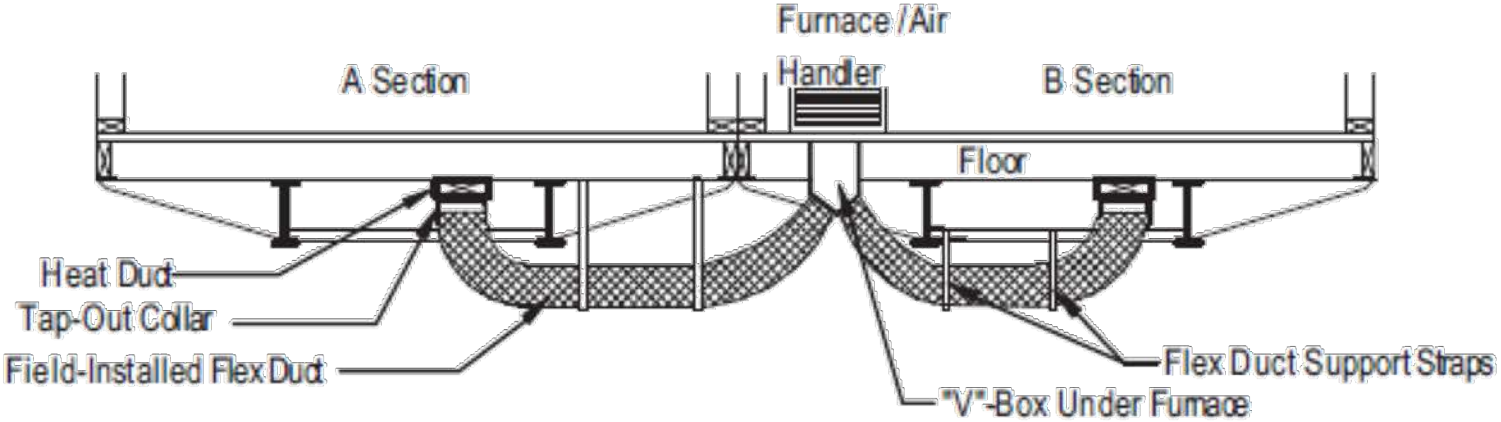
3285.604 Drainage system

AC condensate line shall be supported at 4ft oc without negative slope.

3285.604 Drainage system

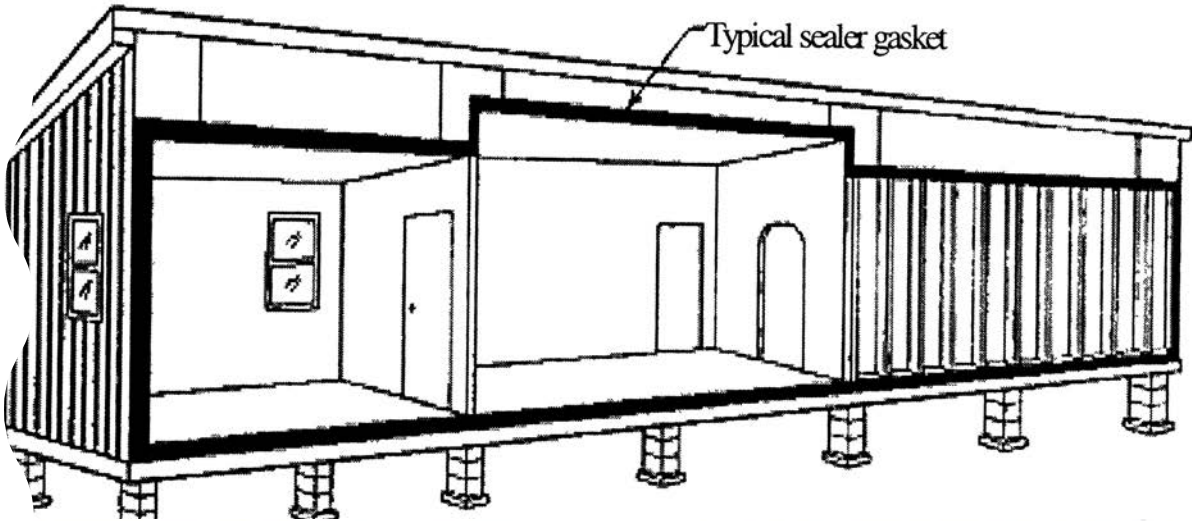
T&P Valve is required to extend to the exterior

3285.606 Ductwork Connection



Subpart I – Exterior and Interior Close-Up

- Siding installation
- Mate-line gasket
- Hinged roofs and eaves
- Interconnections
- Shipped-loose wall paneling

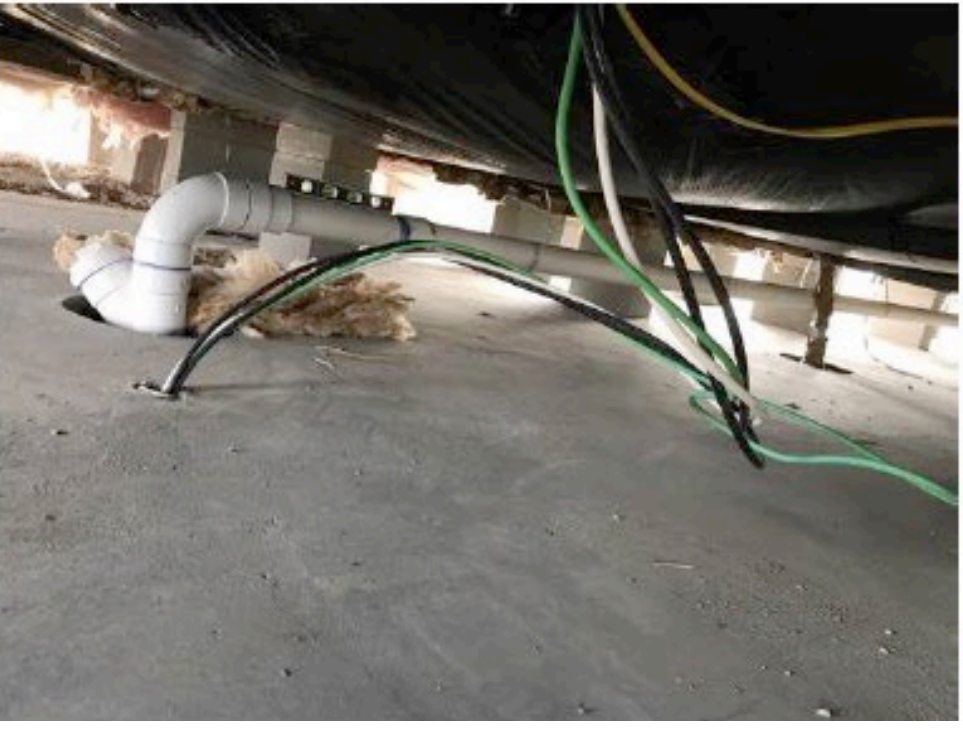


3280.801(d) Roof is free from physical damage, all shipping material is removed.

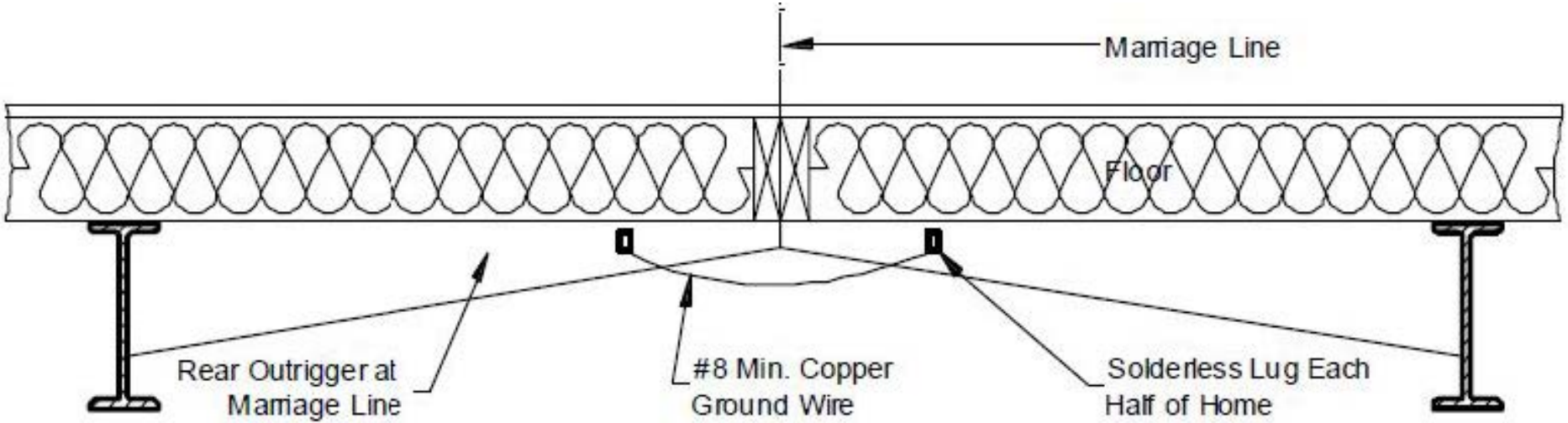
3285.804 Bottom board repair

3285.804 Bottom board repair

3280.808(k) Under-chassis line-voltage (120 volts nominal or higher) must be protected by conduit.



3280.809(d) The chassis of multiple section homes must be bonded with No. 8 minimum copper wire.



Porch Guards

- 3280.114(d) Guards. (1) Porches, balconies, or raised floor surfaces located more than 30 inches above the floor or grade below must have guards not less than 36 inches in height.
- Porch railing designs must be DAPIA approved.

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