



# Highland

MANUFACTURING

# INSTALLATION MANUAL



R A D C O FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS APPROVED  
07

1/13/2009

P.O. Box 427 – 1660 Rowe Ave., Worthington, MN 56187 (507)376-9460

# Using the Manual

This manual is organized into a series of steps that will take you through the entire installation process using only those pages required for the specific home being installed. First, review the entire manual, including the Introduction chapter. As you read it, identify sections of the manual that you will need; identify other documents or information you will need; construct lists of tools and materials required for your particular installation; and make sure you have everything you need before starting work.

After reviewing the entire manual, refer to the sequence of installation steps in the table below. Identify the pathway for your installation and follow the arrows downward. Select either **Single Section Home** or a **Multi-Section Home** and choose the column corresponding to the home's foundation type, either **Pier and Ground Anchor** or **Load-Bearing Perimeter Wall** (see **Definitions**, p. 5). Then complete the work in each of the sections starting with **Getting Started**.

If using an alternative (proprietary) foundation system, the installation process will change from that described in this manual. Consult the system manufacturer directions for instructions. See page 7 for alternative foundation system criteria.

SINGLE SECTION HOME		MULTI-SECTION HOME	
Pier and Ground Anchor	Load-Bearing Perimeter Wall	Pier and Ground Anchor	Load-Bearing Perimeter Wall
Getting Started (p. 9) ▼			
Prepare the Site (p. 14) ▼			
Install Footings (p. 20 ) ▼	Construct Foundation (p. 35) ▼	Install Footings (p. 20 ) ▼	Construct Foundation (p. 35) ▼
Set the Home (p. 37) ▼	Connect Utilities (p. 87) ▼	Set the Home (p. 37) ▼	Complete Roof and Exterior Walls (p. 55) ▼
Install Stabilizing System (p. 71) ▼	Prepare Appliances and Equipment (p. 96) ▼	Complete Multi-Section Set (p. 44) ▼	Connect Crossovers (p. 59) ▼
Connect Utilities (p. 87) ▼	Complete Under the Home and Site Built Structures (p. 106) ▼	Complete Roof and Exterior Walls (p. 55) ▼	Complete Interior (p. 69) ▼
Prepare Appliances and Equipment (p. 96) ▼	Prepare Home for Occupancy (p. 109) ▼	Connect Crossovers (p. 59) ▼	Connect Utilities (p. 87) ▼
Complete Under the Home and Site Built Structures (p. 106) ▼	Complete Installation Checklist (p. 110)	Complete Interior (p. 69) ▼	Prepare Appliances and Equipment (p. 96) ▼
Prepare Home for Occupancy (p. 109) ▼		Install Stabilizing System (p. 71) ▼	Complete Under the Home and Site Built Structures (p. 106) ▼
Complete Installation Checklist (p. 110)		Connect Utilities (p. 87) ▼	Prepare Home for Occupancy (p. 109) ▼
		Prepare Appliances and Equipment (p. 96) ▼	Complete Installation Checklist (p. 110)
		Complete Under the Home and Site Built Structures (p. 106) ▼	
		Prepare Home for Occupancy (p. 109) ▼	
		Complete Installation Checklist (p. 110)	

## Disclaimer

The Manufactured Housing Research Alliance, its members, consultants, contractors and representatives make no representations, warranty or guarantee, express or implied, as to the accuracy or appropriateness of any materials or information in this manual for use in a specific



1/13/2009

December 31, 2008

home, nor assume any liability for the use of the information, methods, or materials contained herein, or for damages arising from any such use.

Copyright © 2008 Manufactured Housing Research Alliance

ISSN 1529-3424

December 31, 2008



R A D C O FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS 07 APPROVED  
1/13/2009

# Introduction

This installation manual contains instructions that must be followed for the proper installation of the home. It complies with the HUD Model Manufactured Home Installation Standards. Please read all instructions and any other documents (including addendum pages and supplements) that may apply to the specific home prior to commencing site work or installation.

This installation manual covers permits and site work through final inspection of the installation. It covers both single and multi-section homes installed over pier and anchor, load bearing crawl space walls and basement foundations. It contains instructions, including specifications and procedures, for the set and hookup of manufactured homes to be used as single-family dwellings.

The importance of correct installation cannot be over-emphasized. Correct installation is absolutely essential to homeowner satisfaction and the structural integrity of the home. All instructions must be followed to provide the customer with a safe, quality home.

No manual can cover all circumstances that may exist for certain home designs or building sites. For questions, further clarification, or if you encounter conditions at the site or in the design of the home or its foundation not covered by this manual, please contact Highland Mfg. Co. (see **Resources**, p. 4), a registered engineer, or registered architect.

Supplemental addendum pages may be included with this manual. Supplements include requirements not covered in this manual or that supercede the manual instructions.

Once the home installation is complete, leave this manual with the home.

## IMPORTANT NOTICES

- Highland Mfg. Co. is not responsible for installation or for the materials supplied by the set-up crew at the time of installation. The installer may be responsible for any deviations from the installation instructions of this manual.
- To keep the home in compliance with its warranty, the home installation must follow the procedures described in this manual or other procedures approved by Highland Mfg. Co. Deviation from the instructions in this manual may void the home's warranty. Any alterations or changes to the home shall be approved by a registered engineer or registered architect and may still be subject to warranty violations.
- When an installer does not provide support and anchorage in accordance with the approved manufacturer's installation instructions, or encounters site conditions (such as areas that are subject to flood damage or high seismic risk) or other conditions that prevent the use of the instructions provided in this manual, the installer must obtain special site-specific instructions or use a design approved by a registered engineer or registered architect.
- The installer must possess a valid installation license as a manufactured home installer.
- If the installer identifies failures of the home to comply with the Federal Manufactured Home Construction and Safety Standards (the HUD Code), the installer must notify the Highland Mfg. Co. and retailer.

## SAFETY

There are potential hazards associated with the installation of a manufactured home. Home installers are licensed, and as experienced professionals, should recognize these hazards, be qualified to work with them, and be capable of providing safe work practices and equipment that minimize the risks of injury.

Only qualified persons should install a manufactured home. As qualified professionals in the field of manufactured home installation, installers are the experts and must be aware of the hazards and conditions faced. Warnings are published throughout this manual as reminders. These reminders may not cover all hazards, all potential hazards, or all possible consequences of improper or unsafe installation practices.

Construction crews should be trained in the skills required and be supervised by experienced personnel. Installers should regularly inspect work performed by crews and subcontractors.

Obey OSHA regulations, particularly those related to home construction, such as Title 29 Code of Regulations Part 1926. For copies of OSHA regulations, call (202) 512-1800 or visit [www.osha.gov](http://www.osha.gov) on the web.

## RESOURCES

**Manufacturer contact information:**



December 31, 2008

Highland Mfg. Co.  
 P.O. Box 427 – 1660 Rowe Ave.  
 Worthington, MN. 56187  
 Telephone: (507)376-9460  
 Fax: (507)376-5915

### Office of Regulatory Affairs and Manufactured Housing

US Department of Housing and Urban Development  
 451 Seventh Street, SW, Room 9164  
 Washington, DC 20410-8000  
 Telephone: (202) 708-6423 or (800) 927-2891  
 FAX: (202) 708-4213

### State Administrative Agencies

A list of SAAs may be found on the web at [www.hud.gov](http://www.hud.gov) or by contacting the Office of Regulatory Affairs and Manufactured Housing.

## FEDERAL PREEMPTION

This home was engineered, constructed, and inspected in conformance with the Federal Manufactured Home Construction and Safety Standards of the US Department of Housing and Urban Development (24 CFR Part 3280, commonly referred to as the “HUD Code”) in effect on the date of manufacture. These Standards set forth minimum requirements for the design and construction of manufactured homes designed to be used as dwellings.

Individual states, counties and cities shall have no authority to establish standards regarding the construction or safety of a manufactured home. A metal certification label is affixed to each section of the home to certify that it has been constructed and inspected to comply with these Standards. The design plans and in-plant construction of all homes are inspected by independent third party agencies to assure compliance with the Standards.

The installation of the home and any alterations made to the home shall conform to the requirements of the Federal Manufactured Home Construction and Safety Standards and the HUD Model Manufactured Home Installation Standards. These installation instructions are minimum requirements. Applicable local or state laws may have more stringent installation requirements than outlined in this manual and must be followed. Consult with the local authority having jurisdiction (LAHJ) for regulations that may require licenses and/or permits or which may affect procedures described in this manual.

## DEFINITIONS

**ANCHOR ASSEMBLY.** Any device or other means designed to transfer loads to the ground.

**ANCHORING EQUIPMENT.** Ties, straps, cables, turnbuckles, chains, and other approved components, including tensioning devices that are used to secure a manufactured home to anchor assemblies.

**ANCHORING SYSTEM.** A combination of anchoring equipment and anchor assemblies that will, when properly designed and installed, resist the uplift, overturning, and lateral forces on the manufactured home.

**BASEMENT.** A load-bearing perimeter wall foundation that includes habitable space (finished or unfinished, heated or unheated) partly or completely below grade.

**CRAWLSPACE.** The space underneath the home’s floor system, enclosed with either load- or non-load bearing perimeter walls. The ground may be covered with a concrete slab or by a plastic ground cover. Crawlspace walls must be vented.

**CROSSOVERS.** Utility interconnections between sections of multi-section homes, including heating and cooling ducts, electrical circuits, and water pipes, drain plumbing, and gas lines.

**DATA PLATE.** An information sheet located at the main electrical panel, in the utility room, in a bedroom closet, or in a cabinet in the kitchen. It contains a unique identification number and identifies the wind zone, roof load zone, and climatic zone for which the home was constructed.

**DIAGONAL TIE.** A tie intended to resist horizontal or shear forces, but which may resist vertical, uplift, and overturning forces.

**FOOTING.** That portion of the support system that transmits loads directly to the soil.

**GROUND ANCHOR.** A specific anchoring assembly device designed to transfer home loads to the ground.



FEDERAL MANUFACTURED  
 HOUSING CONSTRUCTION  
 & SAFETY STANDARDS  
 07  
 1/13/2009  
 APPROVED

- H-BEAM.** Steel H-beams are often used to support a home over a basement or crawlspace. They span across the foundation from sidewall to sidewall, typically with an intermediate support pier and footing (typically in the center point resulting in a line of piers under the centerline of a double section home).
- INFORMATION PACKET.** A set of important documents provided with the home including warranties, information on high wind coverage, and other features of the specific home.
- INSTALLATION LICENSE.** The proof that an installer meets the requirements for installing manufactured homes under the HUD-administered installation program.
- LABELED.** Equipment or materials to which has been attached a label, symbol, or other identifying mark of a certified testing laboratory, inspection agency, or other an organization concerned with product evaluation. The label indicates compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.
- LISTED OR CERTIFIED.** Included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.
- LOAD-BEARING PERIMETER WALL FOUNDATION.** A support system for the home whereby the home is mechanically fastened to a structural wall(s) that transfers gravity, lateral, and uplift loads to the ground.
- LOCAL AUTHORITY HAVING JURISDICTION (LAHJ).** The state, city, county, municipality, utility, or organization that has local responsibilities that must be complied with during the installation of a manufactured home.
- MUST.** Indicates a mandatory requirement.
- N/A.** Indicates not applicable.
- PIER.** That portion of the support system between the footing and the manufactured home, exclusive of shims. Types of piers include, but are not limited to: (1) manufactured steel stands; (2) pressure-treated wood; (3) manufactured concrete stands; (4) concrete blocks; and (5) portions of foundation walls.
- PIER AND GROUND ANCHOR FOUNDATION.** A support system for the home that employs piers under the chassis and other locations to support gravity loads and employs ground anchors and tie downs (the stabilizing system) to resist lateral and uplift loads.
- PERIMETER BLOCKING.** Regularly spaced piers supporting the sidewalls and marriage line of the home. Some homes require perimeter blocking in addition to supports under the home's frame.
- QUALIFIED.** Has the necessary knowledge and skills gained from experience and training that will allow performance of the job safely, competently, and in accordance with all applicable codes, standards, rules, and regulations. Meets all necessary qualification tests including any license and certification requirements that may be in effect in the area where the home will be installed.
- RAMADA.** Any freestanding roof or shade structure, installed or erected over a manufactured home or any portion thereof.
- SHOULD.** Indicates a recommendation that is strongly advised but not mandatory.
- SHALL.** Indicates a mandatory requirement.
- SITE FOR A MANUFACTURED HOME.** A designated parcel of land designed for the accommodation of one manufactured home, its accessory buildings or structures, and accessory equipment, for the exclusive use of the occupants of the home.
- SKIRTING.** A weather-resistant material used to enclose the perimeter, under the living area of the home, from the bottom of the manufactured home to grade.
- STABILIZING SYSTEM.** All components of the anchoring and support systems, such as piers, footings, ties, anchoring equipment, anchoring assemblies, or any other equipment, materials and methods of construction, that support and secure the manufactured home to the ground.
- SUPPORT SYSTEM.** Pilings, columns, a combination of footings, piers, foundation walls, caps, and shims and any combination thereof that will, when properly installed, support and secure the manufactured home to the ground.
- TIE.** Straps, cable, or securing devices used to connect the manufactured home to anchoring assemblies.
- UTILITY CONNECTION.** The connection of the manufactured home to utilities that include, but are not limited to, electricity, water, sewer, gas, or fuel oil.



FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS  
 07  
 1/13/2009

December 31, 2008

**VERTICAL TIE.** A tie intended to resist uplifting and overturning forces.

**WIND ZONE.** The areas designated on the Basic Wind Zone Map, as further defined by the Manufactured Home Construction and Safety Standards.

## ENGINEER'S STAMP

Certain pages of this manual display the seal of a registered engineer. Federal guidelines only require the seal from one state to be displayed, but the details herein apply to all states.

## SYMBOLS USED IN THE MANUAL



This icon indicates an important warning. It is critical to heed these warnings.



This icon indicates a recommended best practice. While not required, following these practices will result in a superior installation, reducing the chance that cosmetic or durability related complaints might arise.

## ABBREVIATIONS

<b>ABS</b>	Acrylonitrile Butadiene Styrene	<b>max.</b>	Maximum
<b>ANSI</b>	American National Standards Institute	<b>MHCSS</b>	Manufactured Home Construction and Safety Standards
<b>APA</b>	American Plywood Association	<b>min.</b>	Minimum
<b>ASTM</b>	American Society for Testing and Materials	<b>mph</b>	Mile(s) per hour
<b>AWPA</b>	American Wood Preservers Association	<b>NEC</b>	National Electric Code
<b>CFM</b>	Cubic feet per minute	<b>NFIP</b>	National Flood Insurance Program
<b>CFR</b>	Code of Federal Regulations	<b>NFPA</b>	National Fire Protection Association
<b>DWV</b>	Drain, Waste, Vent	<b>o.c.</b>	On center
<b>EMT</b>	Electrical metallic tubing	<b>OSHA</b>	Occupational Safety and Health Administration
<b>FEMA</b>	Federal Emergency Management Agency	<b>oz</b>	Ounce(s)
<b>ft</b>	Foot/feet	<b>p.</b>	Page
<b>ga</b>	Gauge	<b>psf</b>	Pounds per square foot
<b>HUD</b>	US Department of Housing and Urban Development	<b>psi</b>	Pounds per square inch
<b>in</b>	Inch(es)	<b>SAA</b>	State Administrative Agency
<b>LAHJ</b>	Local Authority Having Jurisdiction	<b>sq ft</b>	Square foot/feet
<b>lb(s)</b>	Pound(s)		

## ALTERNATIVE FOUNDATION SYSTEMS

Alternative foundation systems or designs are permitted if they are approved by the Local Authority Having Jurisdiction (LAHJ) and a recognized HUD Third Party Agency, and are in accordance with either of the following:

- Systems or designs are manufactured and installed in accordance with their listings by a nationally recognized testing agency based on a nationally recognized testing protocol; or
- System designs are prepared by a registered engineer or a registered architect or tested and certified by a registered engineer or registered architect in accordance with acceptable engineering practice and are



manufactured and installed so as not to take the home out of compliance with the Manufactured Home Construction and Safety Standards.

## DISPLAY AND STORAGE OF THE HOME

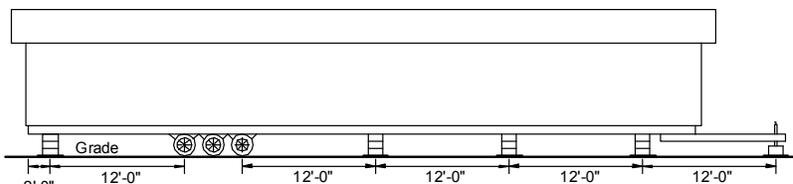
### WEATHER PROTECTION

If the installation is not started immediately upon delivery of the home, the retailer and/or installer has the responsibility to ensure the exterior weather protection covering of marriage walls and the roof of homes with hinged roofs has not been damaged during shipment. Inspect the home immediately upon the delivery and frequently during storage. Promptly repair tears in the home closure materials to prevent damage from the elements. Inspect and repair roof shingles and siding as needed.

### SUPPORTING A HOME FOR DISPLAY

When a new or used manufactured home is to be displayed at a retail location, temporarily block and support the home. Set up single-section homes with single block piers spaced no further apart than 12 feet o.c. beneath each I-beam. The tire and axle system may be used as one of these required supports, and the hitch jack may be used as another. Locate the first pier no further than two feet from the rear end of the home (**Figure 1**). Place additional piers along the perimeter on either side of openings greater than four feet (i.e. sliding glass doors, bay windows, etc.).

For multi-section homes, locate additional piers along the marriage line under support columns. These locations will be marked by Highland Mfg. Co.



**Figure 1.** Supporting a home for display

For all homes, place footings below each pier. Footings may be placed directly on the surface grade without excavation and may be ABS pads, 2 x 10 by 16 inch long pressure treated lumber or 16" x 16" by 4 inch thick concrete pads.

### SUPPORTING A HOME FOR STORAGE

To prevent damage to homes being stored but not on display (i.e. people shall not be permitted inside the home) for a period exceeding 30 days, locate piers below each I-beam no further than two feet from each end of the home and at the approximate center between the tire and axle system and pier at hitch end of home.



December 31, 2008

# Getting Started

This chapter covers a few steps that, taken now, will avoid problems later in the installation process.

## Follow the Steps below:

- ▼ STEP 1. LOCATE THE DATA PLATE (p. 9)
- ▼ STEP 2. CONFIRM WIND ZONE (p. 9)
- ▼ STEP 3. CONFIRM THERMAL ZONE (p. 10)
- ▼ STEP 4. CONFIRM ROOF-LOAD ZONE (p. 11)
- ▼ STEP 5. CHECK LOCAL CODES AND SECURE PERMITS (p. 13)

## STEP 1. LOCATE THE DATA PLATE

Locate the data plate inside the home (**Figure 2**), typically inside the Master Bedroom closet.

Figure 2. Sample data plate

The information on the data plate will be used to verify that the home was designed for the proper location.

## STEP 2. CONFIRM WIND ZONE

From **Table 1**, identify the wind zone for the home. Verify that the home conforms to the following rules and any special requirements determined by the LAHJ.

- No home may be located in a higher wind zone than that indicated on the data plate. (Example: a home designed for Wind Zone II cannot be placed in Wind Zone III.)
- A home may be located in a lower wind zone than that indicated on the data plate. (Example: a home designed for Wind Zone II can be placed in either Wind Zone II or I.)
- Homes located within 1,500 feet of the coastline in Wind Zones II and III must be designed to withstand exposure 'D' conditions. This will be indicated on the data plate.

If the home does not conform to these rules, contact the Highland Mfg. Co.



**Site appropriateness.** If the site is not accessible, not appropriate for the planned support system or cannot be properly graded, notify the purchaser, the retailer and HUD, with the reasons why the site is unsuitable. Do not install the home until all issues are remedied.

FEDERAL MANUFACTURED  
 HOUSING CONSTRUCTION  
 & SAFETY STANDARDS  
 07  
 1/13/2009  
 APPROVED



immediately.

**TABLE 1. WIND ZONE BY LOCALITY**

300.010

<b>Wind Zone I</b>	
All areas except those areas listed below as being within Wind Zone II or III	
<b>Wind Zone II</b>	
Alabama	Counties of Baldwin and Mobile
Florida	All counties except those listed below as within Wind Zone III
Georgia	Counties of Bryan, Camden, Chatham, Glynn, Liberty, McIntosh
Louisiana	Parishes of Acadia, Allen, Ascension, Assumption, Calcasieu, Cameron, East Baton Rouge, East Feliciana, Evangeline, Iberia, Iberville, Jefferson Davis, Lafayette, Livingston, Pointe Coupee, St. Helena, St. James, St. John the Baptist, St. Landry, St. Martin, St. Tammany, Tangipahoa, Vermillion, Washington, West Baton Rouge, and West Feliciana
Maine	Counties of Hancock and Washington
Massachusetts	Counties of Barnstable, Bristol, Dukes, Nantucket, and Plymouth
Mississippi	Counties of George, Hancock, Harrison, Jackson, Pearl River, and Stone
North Carolina	Counties of Beaufort, Brunswick, Camden, Chowan, Columbus, Craven, Currituck, Jones, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington
South Carolina	Counties of Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, Jasper, and Williamsburg
Texas	Counties of Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, Orange, Refugio, San Patricio, and Willacy
Virginia	Cities of Chesapeake, Norfolk, Portsmouth, Princess Anne, and Virginia Beach
<b>Wind Zone III</b>	
Hawaii	Entire state
Alaska	Coastal regions (as determined by the 90 mph isotach on the ANSI/ASCE 7-88 map)
Florida	Counties of Broward, Charlotte, Collier, Dade, Franklin, Gulf, Hendry, Lee, Martin, Manatee, Monroe, Palm Beach, Pinellas, and Sarasota
Louisiana	Parishes of Jefferson, La Fourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. Mary, and Terrebonne
North Carolina	Counties of Carteret, Dare, and Hyde
Other	All regions of the U.S. Territories of American Samoa, Guam, Northern Mariana Islands, Puerto Rico, Trust Territory of the Pacific Islands, and the United States Virgin Islands

### STEP 3. CONFIRM THERMAL ZONE

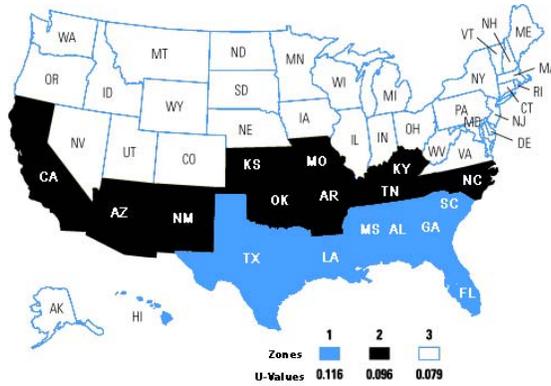
From **Table 2**, identify the thermal (UO) zone for the home. Verify that the home conforms to the following rules.

- No home may be located in an area with a higher thermal zone number than that indicated on the data plate. (Example: a home designed for Thermal Zone 2 cannot be placed in Thermal Zone 3.)
- A home may be located in a lower thermal zone than that indicated on the data plate. (Example: a home designed for Thermal Zone 2 may be placed in either Thermal Zone 2 or 1.)
- In no case may a home designated for installation in the "Humid & Fringe Climate," as identified on the data plate, be located outside of this region (**Table 2**).

If the home does not conform to these rules, contact the Highland Mfg. Co. immediately.



**Figure 3. Thermal (UO) zone map**



**TABLE 2. HUMID AND FRINGE CLIMATE ZONES**

Humid and Fringe Climate Zone	
Alabama	Counties of Baldwin, Barbour, Bullock, Butler, Choctaw, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Escambia, Geneva, Henry, Houston, Lowndes, Marengo, Mobile, Monroe, Montgomery, Pike, Washington, and Wilcox
Florida	All counties and locations
Georgia	Counties of Appling, Atkinson, Bacon, Baker, Ben Hill, Berrien, Brantley, Brooks, Bryan, Calhoun, Camden, Charlton, Chatham, Clay, Clinch, Coffee, Colquitt, Cook, Crisp, Decatur, Dougherty, Early, Echols, Effingham, Evans, Glynn, Grady, Irwin, Jeff Davis, Lanier, Lee, Liberty, Long, Lowndes, McIntosh, Miller, Mitchell, Pierce, Quitman, Randolph, Seminole, Tattall, Terrell, Thomas, Tift, Turner, Ware, Wayne, and Worth
Hawaii	All counties and locations
Louisiana	All counties and locations
Mississippi	Counties of Adams, Amite, Claiborne, Clarke, Copiah, Covington, Forrest, Franklin, George, Greene, Hancock, Harrison, Hinds, Issaquena, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Lamar, Lawrence, Lincoln, Marion, Pearl River, Perry, Pike, Rankin, Simpson, Smith, Stone, Walthall, Warren, Wayne, and Wilkinson
North Carolina	Counties of Brunswick, Carteret, Columbus, New Hanover, Onslow, and Pender
South Carolina	Counties of Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, and Horry
Texas	Counties of Anderson, Angelina, Aransas, Atascosa, Austin, Bastrop, Bee, Bexar, Brazoria, Brooks, Burleson, Caldwell, Calhoun, Cameron, Camp, Cass, Chambers, Cherokee, Colorado, Comal, De Witt, Dimmit, Duval, Falls, Fayette, Fort Bend, Franklin, Freestone, Frio, Galveston, Goliad, Gonzales, Gregg, Grimes, Guadalupe, Hardin, Harris, Harrison, Hays, Henderson, Hidalgo, Hopkins, Houston, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Karnes, Kaufman, Kennedy, Kinney, Kleberg, La Salle, Lavaca, Lee, Leon, Liberty, Limestone, Live Oak, Madison, Marion, Matagorda, Maverick, McMullen, Medina, Milam, Montgomery, Morris, Nacogdoches, Navarro, Newton, Nueces, Orange, Panola, Polk, Rains, Refugio, Robertson, Rusk, Sabine, San Augustine, San Jacinto, San Patricio, Shelby, Smith, Starr, Titus, Travis, Trinity, Tyler, Upshur, Uvalde, Val Verde, Van Zandt, Victoria, Walker, Waller, Washington, Webb, Wharton, Willacy, Williamson, Wilson, Wood, Zapata, and Zavala

## STEP 4. CONFIRM ROOF LOAD ZONE

From **Table 3**, identify the Roof Load Zone for the home. Verify that the home conforms to the following rules.

- No home may be placed in an area with a higher roof load than that indicated on the data plate. (Example: a home designed for the South (20 psf) Roof Load Zone cannot be placed in the Middle (30 psf) Roof Load Zone).
- A home may be located in an area with a lower roof load than that indicated on the data plate. (Example: a home designed for the Middle (30 psf) Roof Load Zone may be placed in the South (20 psf) Roof Load Zone).
- There are special high roof load areas (primarily in mountains) not shown on the map. Contact the LAHJ or SAA for information about these areas. The home's data plate will indicate if the home has been designed for one of these high roof load areas.
- Ramadas may be used in areas with roof live loads greater than 40 psf. Ramadas are to be self-supporting, except that any connection to the home

FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS  
 APPROVED  
 07  
 1/13/2009



must be for weatherproofing only.

300.012

**TABLE 3. ROOF LOADS BY LOCALITY**

<b>North (40 psf roof load)</b>	
Alaska	All counties
Maine	Counties of Aroostook, Piscataquis, Somerset, Penobscot, Waldo, Knox, Hancock, Washington
<b>Middle (30 psf roof load)</b>	
Colorado	All counties
Idaho	All counties
Iowa	Counties of: Buena Vista, Butler, Calhoun, Cerro Gordo, Cherokee, Chickasaw, Clay, Dickinson, Emmet, Floyd, Franklin, Hamilton, Hancock, Hardin, Howard, Humboldt, Ida, Kossuth, Lyon, Mitchell, O'Brien, Osceola, Palo Alto, Plymouth, Pocahontas, Sac, Sioux, Webster, Winnebago, Worth, Wright
Maine	Counties of Androscoggin, Cumberland, Franklin, Kanabec, Lincoln, Oxford, Sagadahoc, York
Massachusetts	County of Essex
Michigan	Counties of Alger, Alcona, Alpena, Antrim, Baraga, Benzie, Charlevoix, Cheboygan, Chippewa, Crawford, Delta, Dickson, Emmet, Gogebic, Grand Traverse, Houghton, Iron, Kalkaska, Keweenaw, Leelanau, Luce, Mackinac, Marquette, Menominee, Missaukee, Montmorency, Ogemaw, Ontonagon, Oscoda, Otsego, Presque Isle, Roscommon, Schoolcraft, Wexford
Minnesota	Counties of Aitkin, Anoka, Benton, Blue Earth, Brown, Cass, Carlton, Carver, Chippewa, Chisago, Cook, Cottonwood, Crow Wing, Dakota, Dodge, Douglas, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Hubbard, Itasca, Isanti, Jackson, Kandiyohi, Kanabec, Koochiching, Lac qui Parle, Lake, Le Sueur, Lincoln, Lyon, McLeod, Meeker, Morrison, Millie Lacs, Mower, Martin, Murray, Nicollet, Nobles, Olmsted, Pipestone, Pine, Pope, Ramsey, Redwood, Renville, Rice, Rock, St. Louis, Sibley, Scott, Steele, Sherburne, Swift, Stearns, Stevens, Todd, Wadena, Wright, Washington, Wabasha, Winona, Waseca, Watonwan, Yellow Medicine
Montana	All Counties
New Hampshire	All Counties
New York	Counties of Cayuga, Clinton, Essex, Erie, Franklin, Fulton, Genesee, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, St. Lawrence, Saratoga, Schenectady, Seneca, Warren, Washington, Wayne, Wyoming, Yates
South Dakota	Counties of Brookings, Clay, Codington, Deuel, Grant, Hamlin, Hanson, Hutchinson, Kingsbury, Lake, Lincoln, McCook, Miner, Minnehaha, Moody, Turner, Union, Yankee
Utah	All Counties
Vermont	Counties of Addison, Caledonia, Chittenden, Essex, Franklin, Grand Isle, Lamoille, Orange, Orleans, Rutland, Washington, Windsor
Wisconsin	Counties of Ashland, Bayfield, Barron, Buffalo, Burnett, Clark, Chippewa, Door, Douglas, Dunn, Eau Claire, Florence, Forest, Iron, Jackson, Langlade, Lincoln, Marathon, Marinette, Menominee, Oconto, Oneida, Pepin, Pierce, Polk, Price, Rusk, St. Croix, Sawyer, Taylor, Trempealeau, Vilas, Washburn
Wyoming	All Counties
<b>South (20 psf roof load)</b>	
Other	The states and counties not listed for the Middle or North roof load zone above are deemed to be within the South roof load zone.

Is the data plate present and the home placed in the appropriate wind, thermal, and roof load zones?

- ▶ **YES**, go to **STEP 5, CHECK LOCAL CODES AND SECURE PERMITS**, (p. 13).
- ▶ **NO**, Stop installation activities and notify the home retailer, purchaser and HUD.



## STEP 5. CHECK LOCAL CODES AND SECURE PERMITS

Local regulations may set conditions for the siting and installation of a manufactured home. Consult the LAHJ, state manufactured housing association, and the state SAA (See **Resources**, p. 4) for the specific local requirements, including:

- Building codes that may affect the construction of site built structures and infrastructure.
- Local requirements regulating the installation of manufactured homes.
- Setback requirements for property lines, streets, yards, and courts.
- Fire separation distances.
- Development covenants for the specific property.
- The locations of flood hazard areas and any special foundation requirements for homes installed in those areas.
- In some areas, building permits are required to install manufactured homes. Prior to making any alteration to the site and the home, contact the LAHJ to determine if plan approval and permits are required.



### Areas subject to flooding.

The foundation specifications contained in this manual are NOT intended to address flood loads. If the home is in the flood plain, consult a registered engineer.

▶ go to **Prepare the Site** (p. 13)

## Prepare the Site

A properly prepared site is critical to a good quality installation and the long term structural stability of the home.

This chapter explains the process of planning the site, evaluating the soil, and preparing the site for construction of the home's support system.

### Follow the Steps below:

- ▼ **STEP 1. PLAN SITE ACCESS** (p. 14)
- ▼ **STEP 2. DETERMINE HOME LOCATION AND LAYOUT** (p. 14)
- ▼ **STEP 3. CLEAR AND GRADE THE SITE** (p. 15)
- ▼ **STEP 4. DETERMINE SOIL CONDITIONS** (p. 15)
- ▼ **STEP 5. DETERMINE SOIL BEARING CAPACITY AND FROST LINE** (p. 15)
- ▼ **STEP 6. DETERMINE GROUND ANCHOR HOLDING CAPACITY** (p. 16)

### STEP 1. PLAN SITE ACCESS

Planning the route to the site is typically the responsibility of the retailer or transportation company. Whoever is responsible must secure state permits from the states through which the home will pass.

In planning the route, avoid obstructions that might interfere with the passage of the home, such as low hanging wires and trees, low overpasses, and bridges not suitable for the load. Contact the utility company if wires need to be moved. Do not allow branches, bushes, or other foliage to scrape against the home as the home is moved to the site. Avoid ditches, berms, steep slopes, and soft ground. Identify and fill any holes and soft spots into which the transporter's wheels may sink. Avoid moving over steep changes in grade (20 degrees or more).

If required, provide for home storage and staging areas on the site. Plan the delivery and staging of home sections and materials so that after all deliveries are complete, home sections and materials can be accessed for use and installed in the appropriate sequence. Orient home sections so they do not have to be rotated or excessively maneuvered during the installation process. Plan for temporary needs, such as dumpsters, portable toilets, crew parking, delivery vehicle drop-offs and concrete mixer deliveries.

Before moving the manufactured home to the site, inform the LAHJ and make sure the site is prepared and utilities are available.

### STEP 2. DETERMINE HOME LOCATION AND LAYOUT

The home location may have already been determined by others. If not, plan the home location and layout in compliance with the regulations researched in **Getting Started, STEP 5. CHECK LOCAL CODES AND SECURE PERMITS** (p. 9). Contact utilities for locations of existing infrastructure, such as underground cables, pipes, and electrical lines. When planning the site improvements, consider the following:

- The home location should be level.
- Avoid contact with large trees, steep slopes, poorly drained areas, and potential flood zones.
- Preserve trees and shrubs for shade, visual screens, and windbreaks.



**Site Preparation.** The home manufacturer has no control over the site planning and installation of the home unless the manufacturer is responsible for the home's installation. Final responsibility for site preparation, including soil stability and frost heave control, lies with the installer. An improperly prepared site may result in the denial of a foundation-related warranty claim.



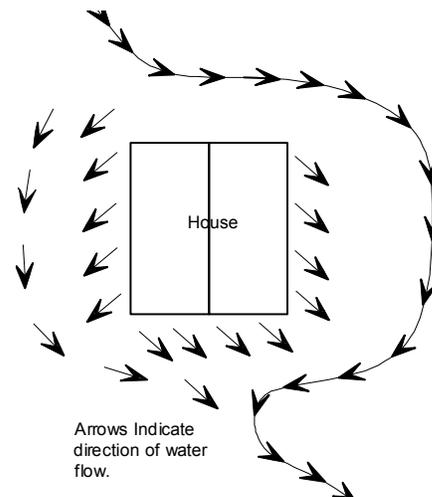
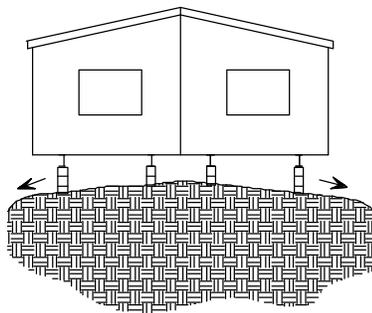
**Fire separation.** Comply with any LAHJ fire separation requirements or the requirements NFPA 501A, 2003 edition (Chapter 6).

- Plan the driveway, parking areas, septic, well, other structures, and utility lines.
- Consider future additions, such as screen rooms, porches, and awnings.

### STEP 3. CLEAR AND GRADE THE SITE

Trim overhanging foliage considering future growth, potential storms, swaying in wind and snow/ice-weighted branches. Remove organic material such as vegetation, wood, roots, twigs, dead branches, grass, and brush from directly under the home. Remove any debris that could become termite infested from the site and surrounding area. Remove all other debris from the home location, including roots from beneath footing locations. Properly dispose of all items.

Crown the site (**Figure 4**) away from the foundation for the first ten feet with a minimum slope of 1/2 inch per foot. Where property lines, walls, slopes, or other physical conditions prohibit this slope, provide the site with drains, swales, or grading to drain water away from the structure. Any fill required to grade the site should be inorganic "controlled fill" applied in a maximum of four inch layers, compacted between each layer to at least 90% of its maximum relative density. Direct runoff away from the site using ditches and berms (**Figure 5**). If the home will have skirting, start grading from two feet in from the edge of the home.



Grade the ground so that water under porches, decks, and recessed entries flows away from the home. If proper grading is not possible, use other methods such as a drain tile and automatic sump pump system to remove any water that may collect under the home.

The home is suitable for the installation of gutters and downspouts. When gutters and downspouts are installed, direct runoff away from the home.

### STEP 4. DETERMINE SOIL CONDITIONS

Examine the soil type under the proposed home location to make sure it is suitable for placement of a home. The design of the home's support system, including footing/pier spacing and size, will in part be determined by the bearing capacity of the soil, and if ground anchors are used, by the soil's withdrawal strength.

The soil under every portion of the support system must meet the following criteria:

- The soil must be firm and undisturbed (not previously excavated) or fill compacted to at least 90% of its maximum relative density. Uncompacted



**Site drainage.** Moisture under the home can result in structural damage to the floor system and other parts of the home. Failure to provide adequate slope/drainage can result in moisture-related problems such as mold, mildew, and erosion.

**Figure 4.** Crown the soil under the home to prevent water ponding

**Figure 5.** Direct runoff away from the home



**Soil.** Inadequate soil bearing capacity or a support system mismatched to the soil characteristics can result in excessive or

FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS APPROVED  
 R A D C O  
 07

1/13/2009



will settle over time, causing the home to shift and become unlevel.

- Fill must not contain large debris. This too will settle over time.
- The soil must not be comprised of organic clays or peat. Organic material can decay, causing settlement, and also may harbor pests that can infest the home.
- The water table must be below the lowest level of the planned support system/foundation. A soil's bearing capacity can be greatly reduced when it is saturated with water. Note that water tables may vary with seasonal or climactic conditions. Consult a geologist or the LAHJ if you are unsure of the water table level.
- The soil must not be a highly expansive type. Expansive soils can expand when they become saturated with water, causing the home to shift and become unlevel. If soils are expansive, contact a registered engineer, or registered architect to assist with the design of the foundation system.

### Does the soil meet these criteria?

- ▶ **YES**, go to **STEP 5, DETERMINE SOIL BEARING CAPACITY AND FROST LINE**, (p. 16).
- ▶ **NO**, Consult a registered engineer, registered architect, or geologist to determine a suitable soil bearing capacity.

## STEP 5. DETERMINE SOIL-BEARING CAPACITY AND FROST LINE

The soil under a home must be capable of withstanding the loads imposed by the weight of the home, its support system and furnishings, as well as any loads imposed by wind, snow, or other climactic conditions.

### SOIL-BEARING CAPACITY

Determine the soil-bearing capacity in pounds per square foot (psf) before designing a support system. The higher the capacity (psf), the more weight the soil can hold without unduly compressing. As the soil-bearing capacity increases, footings can be reduced in size or spaced farther apart.

Use one or more of the following methods to determine the site's soil bearing capacity:

- **Test the soil.** Hire a registered geologist, registered engineer, or registered architect to determine the soil classification and maximum allowable soil bearing capacity by testing the soil in accordance with generally accepted engineering practice.
- **Obtain soil records.** The local office of the U.S. Department of Agriculture's Natural Resources Conservation Service ([www.soils.usda.gov](http://www.soils.usda.gov)) and/or the LAHJ may have test results and/or soil analyses on file for the area.
- **Conduct a pocket penetrometer test.** Use a pocket penetrometer to estimate allowable soil-bearing capacity as follows:
  1. Select a location that will be under a footing.
  2. Clear an area of a minimum of one square foot at least four inches deep or to the depth of the bottom of the planned footing.
  3. Using the instructions provided with the pocket penetrometer, take at least five readings.
  4. Discard the high and low readings and average the remaining readings. Round this result down to the nearest soil-bearing value shown in the right column of **Table 4**.
  5. Confirm that the rounded result matches the soil description on **Table 4**.
- **Determine soil-bearing value by visual examination.** If one of the options above is not available, the values on **Table 4** can be used to establish soil-

differential settlement of the home, which can cause the home to go out of level, resulting in jammed doors and windows, cracks in finishes and ruptured plumbing connections.



### Soil bearing capacity.

Support systems on soils with bearing capacities less than 1,000 psf must be designed by a registered engineer or registered architect and approved by the LAHJ.

### Limitations of pocket penetrometers.

Pocket penetrometers do not work on sand or gravel. Use **Table 4** to determine allowable pressure for these types of soils. If you encounter a layer of gravel, test the soil under the gravel. Do not put the penetrometer on stones larger than its tip as this will provide an inaccurate reading.



1/13/2009

December 31, 2008

bearing capacity by visual examination. This method provides lower capacity values than the options above. Accurate soil identification typically requires special training or expertise. An engineer or building code official may be able to assist in classifying the soil found on the site.

300.017



R A D C O FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS 07 APPROVED  
1/13/2009

**TABLE 4. SOIL-BEARING CAPACITY BY SOIL TYPE**

Soil Type (and classification)	Allowable Pressure (psf)
Rock or hard pan (class 1)	4,000
Sandy gravel and gravel; very dense and/or cemented sands; course gravel/cobbles; preloaded silts, clays and coral (class 2)	2,000
Sand; silty sand; clayey sand; silty gravel; medium dense course sands; sandy gravel; very stiff silt, sand clays (class 3)	1,500
Clay, sandy clay, silty clay, clayey silt (classes 4A and 4B)	1,000
Uncompacted fill, peat, organic clays (class 5)	Professional testing required

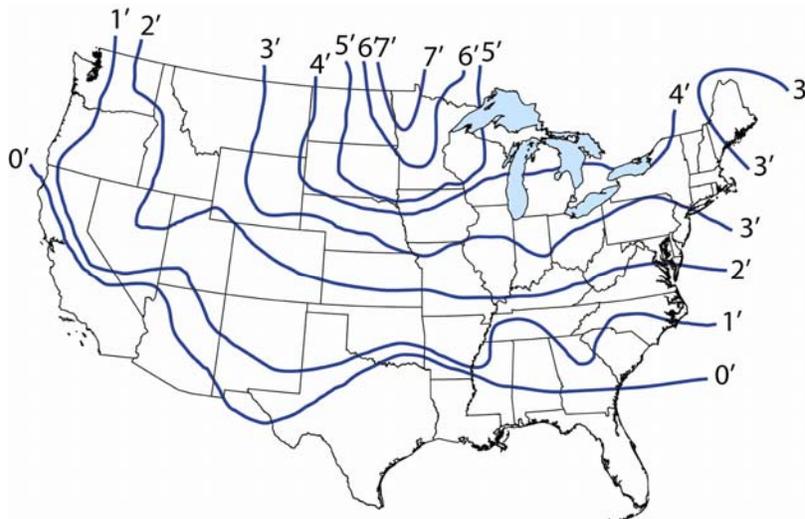
Note to table: No allowances made for overburden pressure, embedment depth, water table height, or settlement problems.

- **Use default capacity.** Use an allowable pressure of 1,500 psf, unless site-specific information requires the use of lower values based on soil classification and type according to **Table 4**.

Note that soil types may vary across a home site. In this case, the soil with the lowest bearing capacity should be assumed when designing the support system. Keep a record of the soil-bearing capacity value; it will be used later to design the home's support system.

**FROST LINE**

In climates subject to ground freezing, consult the LAHJ, a registered engineer, or registered architect to determine the depth of the frost line. **Figure 6** may be used as a guideline when there is no specific local determination. Keep a record of the frost depth; it will be used later to design the home's support system.



**Figure 6.** Average frost penetration depth (in feet)

Will this installation use auger-type ground anchors?

- ▶ **YES, go to STEP 6, DETERMINE GROUND ANCHOR HOLDING CAPACITY, (p. 18).**
- ▶ **NO, go to Construct Foundation, (p. 35).**

**STEP 6. DETERMINE GROUND ANCHOR HOLDING**



**Torque Probe.** Before using the torque probe, check with the utility companies



FEDERAL MANUFACTURED HOUSING CONSTRUCTION & SAFETY STANDARDS  
 07  
 APPROVED

1/13/2009

December 31, 2008

## CAPACITY

When using auger-type ground anchors to tie down the home, first, use a torque probe to determine the anchor-holding strength of the soil on the site.

Use a torque probe with a shaft of sufficient length to test the soil at the depth of the anchor helical plate. Augur the probe into the ground, and following the probe manufacturer's instructions, take the torque wrench reading in the area where the anchors will be installed and at the depth of the anchor helix. If the soil varies in consistency across the site, then use the lowest reading. Based on this reading, consult the anchor manufacturer's charts to select the anchor type(s).

300.019

for the location of underground cables or pipes to avoid contact with the probe shaft.

What type of support system will this installation use?

- ▶ For pier and ground anchor, go to **Install Footings**, (p. 25)
- ▶ For load-bearing perimeter wall, go to **Construct Foundation**, (p. 35)