

# American National Standard — Manufactured Home Installations

## 1 Introduction, applicability, and organization of standard

### 1.1 Scope

This standard covers the installation of manufactured homes, wherever located, whenever the manufacturer's installation instructions are not available. Included are requirements for manufactured home sites and set-ups.

### 1.2 Intended usage of manufactured homes covered under this standard

The provisions of this standard are intended to apply to manufactured homes (single-section, multisection, or expandable types) for use as single-family dwellings.

NOTE 1 – The Federal Manufactured Home Construction and Safety Standards (MHCSS) cover one-family occupancies only. This standard makes no provisions for other residential occupancies.

NOTE 2 – This standard does not apply to manufactured homes used for other than dwelling purposes.

NOTE 3 – The provisions of this standard shall not apply to recreational vehicles as defined in the National Fire Protection Association (NFPA) 501C, Standard for Recreational Vehicles, or to park trailers as defined in the ANSI A119.5, Standards for Park Trailers.

#### 1.2.1 Types of manufactured homes covered

The manufactured homes covered under this standard are manufactured homes complying with the U.S. Department of Housing and Urban Development (HUD)'s MHCSS Program, as set forth in 24 C.F.R., Parts 3280, 3282, and 3283, as mandated in the United States of America and manufactured homes built prior to June 15, 1976, including those complying with the Standard for Mobile Homes, NFPA 501B/ANSI A119.1 edition, in effect at the time of

manufacture.

NOTE – The Federal standards, regulations, and requirements for manufactured housing, as authorized by 42.U.S.C.5401 et seq., are as follows:

\*Part 3280 – MHCSS

\*Part 3282 – Manufactured Home Procedural and Enforcement Regulations

\*Part 3283 – Manufactured Home Consumer Manual Requirements

Hereafter, throughout sections three through eight of this document, "manufactured home" will be used interchangeably with "home."

#### 1.2.2 Applicability

This standard is designed to be adopted by authorities having jurisdiction over and responsible for the safety and health of manufactured home users. It is intended to apply to all home installations, whether at new or existing manufactured home sites.

While this standard provides useful technical data for improvements to existing sites falling within its scope, and such use is encouraged, it is not intended to be applied retroactively to existing sites except where the authority having jurisdiction considers such application essential for the safety and health of the occupants or users of the sites. This standard shall not be construed as relieving the installer of a manufactured home of the responsibility for compliance with the codes and regulations established by the authorities having jurisdiction.

#### 1.2.3 Organization of standard

This standard consists of eight sections, generally divided by the kinds of work involved in properly setting up a home.

#### 1.2.4 Use of this standard

This standard contains instructions, including specifications and procedures, for installation

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and hook-up of a manufactured home. It has been written in an objective and easy-to-understand manner so that it can be understood by those who lack extensive technical training. It discusses the installation of the home from preparation of the site through final inspection. It includes many tables and figures giving important data for proper installation.

Careful adherence to this standard by the home owner and installation crew, and consultation with a registered engineer in those unusual circumstances it does not cover, will help ensure the home owner of a well-built, safe, and affordable home for many years to come.

### 1.3 Preinstallation considerations

Prior to locating or relocating a manufactured home, the authority having jurisdiction shall be contacted for installation procedures.

Some jurisdictions require licensed or registered installers. Many jurisdictions require permits to be obtained prior to the installation of such items as blocking, anchoring, and electrical and sewer or water connections or both. Inspections will be required in conjunction with permits to help ensure a correct and safe installation of the manufactured home, with notification to the jurisdiction at different times during the installation.

For private property, installation zoning or development covenants may apply and should also be taken into consideration.

#### 1.3.1 Alterations

Prior to altering a home, i.e., modifying the electrical, plumbing, or heating or cooling systems; adding a room, carport, or garage; or making major repairs such as replacing a roof, be sure to contact the authority having jurisdiction. A plan approval and permit may be required.

#### 1.3.2 Safety

Only trained crews should install the home. Installers should follow the safety instructions provided in this standard.

### 1.3.3 Support

Manufactured homes weigh several tons. Installers should use enough temporary blocking to support the home during installation. No one should be allowed under the home unless it is securely in place, even if it is not moving.

### 1.4 Consumer information card

The distributor or dealer of the manufactured home shall fill out the *consumer information card* and return it to the home's manufacturer, so that the consumer may be notified of revised instructions or new products.

## 2 Definitions

**accessory building or structure, manufactured home:** A building or structure that is an addition to or supplements the facilities provided by a manufactured home. Examples are: awnings, garages, storage structures, carports, fences, windbreaks, or porches.

**anchoring equipment:** Straps, cables, turnbuckles, and chains, including tensioning devices, that are used with ties to secure a manufactured home to ground anchors.

**anchoring system:** A combination of ties, anchoring equipment, and ground anchors that will, when properly designed and installed, resist the overturning of the home or sideways movement caused by wind.

**approved:** Acceptable to the authority having jurisdiction.

**NOTE** – NCSBCS and ANSI do not approve, inspect, or certify any installations, procedures, equipment, or material, nor do they approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NCSBCS/ANSI or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listing or labeling practices of an organization concerned

with product evaluations that is in a position to determine compliance with appropriate standards for current production of listed items.

**authority having jurisdiction:** The organization, office, or individual responsible for approving plans, equipment, an installation, or an alteration procedure.

**awning:** A shade structure supported by posts or columns and entirely or partially supported by a manufactured home installed, erected, or used on a manufactured home site.

**baling:** A method of "wrapping" a cross section (roof, walls, and floor) and the main frame (chassis) of a manufactured home with straps.

**cabana:** A room enclosure erected or constructed adjacent to a manufactured home for residential use by the occupant of the manufactured home.

**carport:** An awning or shade structure for a vehicle(s) that is freestanding and not attached to a manufactured home.

**construction alteration:** The replacement, addition, modification, or removal of any equipment or installation that may affect the originally approved design of construction, plumbing, heating, cooling, fuel-burning, or electrical systems.

**diagonal tie:** A tie intended to resist horizontal or shear forces and to resist vertical, uplift, and overturning forces.

**dwelling unit:** One or more habitable rooms that are designed to be occupied by one family, with facilities for living, sleeping, cooking, eating, and sanitation.

**frame, main:** That part of the structural system that is normally used to transmit accumulative design loads to the support system.

**footing:** That part of the support system that sits directly on the ground at, below, or partly below grade to support the piers.

**foundation, manufactured home:** A site-built or site-assembled system of stabilizing devices that

is:

- Capable of transferring design dead loads and lateral and vertical live loads, as required by the Manufactured Home Procedural and Enforcement Regulations, and other design loads unique to local home sites that result from wind, seismic, and water conditions, or that are imposed by or upon the structure, into the underlying soil or bedrock without failure;

- Placed at an adequate depth, or otherwise adequately designed, to prevent frost damage in areas that are susceptible to frost;

- Constructed of materials acceptable to the authority having jurisdiction.

**garage:** A freestanding structure located on a manufactured home site and designed for the storage of motor vehicles.

**gas supply connector, manufactured home:** A listed connector designed for connecting the manufactured home to the gas supply source.

**ground anchor:** A device placed at the manufactured home stand designed to transfer home anchoring loads to the ground.

**habitable room:** A room or enclosed floor space arranged for living, eating, food preparation, or sleeping purposes, not including bathrooms, toilet compartments, laundries, pantries, foyers, hallways, and other accessory spaces.

**installation:** Assembly, at the site of occupancy, of all portions of the manufactured home, connection of the home to existing utility connections, and installation of support or anchoring systems.

**installation alteration:** The replacement, addition, modification, or removal of any components of the required ground support or ground anchoring systems.

**installation instructions:** Instructions provided by the manufacturer, which accompany each manufactured home and detail the manufacturer's requirements for ground support, anchoring systems, and other work completed

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on site.

**labeled:** Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction; that is concerned with product evaluation; that maintains periodic inspection of production of labeled equipment or materials; and that provides labels, the use of which indicates a manufacturer's compliance with appropriate standards or performance in a specified manner.

**listed:** Equipment or materials included in a list that is published by an organization acceptable to the authority having jurisdiction; that is concerned with product evaluation; that maintains periodic inspection of production of listed equipment or materials; and that produces listings that state either that the equipment or materials meet appropriate standards or have been tested and found suitable for use in a specified manner.

NOTE – The means for identifying listed equipment may vary among organizations that are concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should use the system employed by the listing organization to identify a listed product.

**manufactured home:** A structure, transportable in one or more sections that, in its traveling mode, is 8 body feet or more in width or 40 body feet or more in length, or, when erected on site, is 320 or more square feet; that is built on a permanent chassis; that is designed to be used as a dwelling; that may or may not have a permanent foundation; that is connected to the required utilities; and that contains the plumbing, heating, air conditioning, and electrical systems; except that such term shall include any structure that meets the size requirements and for which the manufacturer has voluntarily filed a certification required by the Secretary of HUD; and that complies with the MHCSS.

NOTE – This definition should not be interpreted to include any types of recreational vehicles (including so-called "park models" or travel trailers) that may equal or exceed the body length or width

specified herein.

**noncompliance:** Failure of a manufactured home to comply with the MHCSS that does not constitute a defect, serious defect, or imminent safety hazard.

**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, the following:

- manufactured steel stands;
- pressure-treated wood;
- manufactured concrete stands;
- concrete blocks.

**porch:** An outside walking area with a floor that is elevated more than 8 inches above grade.

**ramada:** Any freestanding roof or shade structure installed or erected above a manufactured home or any portion thereof.

**shall:** Indicates a mandatory requirement.

**should:** Indicates a recommendation or that which is advised but not required.

**site, 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 space from the bottom of the manufactured home to grade.

**stabilizing devices:** All components of the anchoring and support systems, such as piers, footings, ties, anchoring equipment, ground anchors, or any other materials and methods of construction that support and secure the manufactured home to the ground.

**stand, manufactured home:** That area of a manufactured home site that has been reserved for the placement of a manufactured home.

**structure:** That which is built or constructed, an edifice or building of any kind, or any piece of work artificially built up or composed of parts

joined together in some definite manner.

**support system:** A combination of footings, piers, and shims that will, when properly installed, support the manufactured home.

**tie:** See anchoring equipment.

**utility connections:** The connection of the manufactured home to existing utilities that include, but are not limited to, electricity, water, sewer, gas, or fuel oil.

**vertical tie:** A tie intended to resist uplifting and overturning forces.

### 3 Site preparation

#### 3.1 Location and layout

##### 3.1.1 Use of zone maps

A home is designed for certain weather conditions and roof loads [see zone maps near main electrical panel and in figures 3-1(a), (b), and (c)]. Do not site or relocate a home in a zone requiring greater wind, roof load, or heating or cooling capabilities than those for which it was designed.

##### 3.1.2 Access for transporter

Before attempting to move a home, ensure that the transportation equipment and home can be routed to the installation site. Special transportation permits may be required from state, county, or city officials.

##### 3.1.3 Encroachments and setback distances

Local laws regarding encroachments in streets, yards, and courts shall be obeyed, and permissible setback distances from property lines and public roads shall be met.

##### 3.1.4 Fire separation distance

The distance a home must be sited from other structures depends on its fire resistance rating and on local requirements. Contact the home's manufacturer or the inspection agency identified on the data plate for fire-resistance rating

information.

#### 3.1.5 Issuance of permits

Ensure that all necessary local permits have been obtained and fees paid.

### 3.2 Soil conditions

#### 3.2.1 Requirements

To help prevent settling or sagging, site the home on firm, undisturbed soil or fill compacted to at least 90 percent of its maximum relative density. Installation on loose, uncompacted fill may invalidate the home's limited warranty.

#### 3.2.2 Bearing capacity

Test the bearing capacity of the soil in accordance with 3.2.3 before designing the foundation. If the soil cannot be tested, but its type can be identified, use the foundation bearing pressures shown in table 3-1 as a guide. If you cannot identify the soil, use a bearing capacity of 1,000 pounds per square foot. Under unusual conditions, or if the soil appears to be composed of peat or uncompacted fill, consult a local geologist, engineer, or architect.

#### 3.2.3 Soil-bearing testing methods and equipment

Use a pocket penetrometer or other methods acceptable to the local jurisdiction having authority.

### 3.3 Removal of organic material

Removal of all decayable material, such as grass, roots, twigs, and wood scraps, from beneath the home is required in areas where footings are to be placed, to minimize settling of footings and insect damage. Remove shrubs and overhanging branches from the immediate vicinity of the home site to prevent windstorm damage.

### 3.4 Drainage

#### 3.4.1 Purpose

Proper drainage prevents water build-up under the home, which may cause shifting or settling of the foundation, dampness in the home, damage to siding and bottom board, buckling of walls and floors, and problems with the operation of doors and windows.

#### 3.4.2 Elimination of depressions

Grade the home site to permit water to drain from under the home (see figure 3-2).

#### 3.4.3 Drainage structures

Depending on the local landscape, ditches and culverts may be needed to drain surface runoff. If so, consult a registered engineer.

#### 3.4.4 Gutters and downspouts

When gutters and downspouts are installed, direct the run off away from the home.

### 3.5 Ground moisture control

#### 3.5.1 Vapor retarder

If the space under the home is to be enclosed with skirting or other material, a vapor retarder that keeps ground moisture out of the home shall be installed .

#### 3.5.2 Acceptable types of ground cover

Use a minimum of six-mil polyethylene sheeting or its equivalent.

#### 3.5.3 Proper installation

Cover the entire area under the home with the sheeting and overlap it at least 12 inches at all joints. Where soil and frost conditions permit placement of footings at grade level, place the sheeting directly beneath the footings.

## 4 Foundations

NOTE - This section only covers foundations.

Installation procedures and methods for securing the home to its foundations are discussed in 5.

### 4.1 Piers

#### 4.1.1 Importance

Proper pier installation is the most important part of home installation. Incorrect size, location, or spacing of piers may cause serious structural damage to the home. It is important to install piers around the perimeter as required. Failure to do so may lead to sagging floors, walls, and roofs (see 4.1.5.3).

#### 4.1.2 Acceptable types

Piers may be concrete blocks, pressure-treated wood having 0.60 retention in accordance with American Wood Preservers Association (AWPA) C22 Standard, or adjustable metal or concrete piers (see figure 4-1). Manufactured piers shall be listed or labeled for the required load capacity.

#### 4.1.3 Design requirements

##### 4.1.3.1 Load-bearing capacity

The load that each pier must carry depends on such factors as the dimensions of the home, the roof live load, the spacing of the piers, and the way the piers are used to support the home. Center beam/marriage wall blocking is required for multisection homes.

See tables 4-1 and 4-2 for pier capacities. These tables shall be used when the manufacturer's installation instructions are not available. Manufactured piers must be rated at least to these capacities, and locally constructed piers must be designed to transmit these loads safely (see 4.1.3.2).

##### 4.1.3.2 Configuration

Figure 4-1 shows the recommended arrangement of concrete block piers constructed on site. Load-bearing (not decorative) concrete blocks should have dimensions of at least 8 inches x 8 inches x 16 inches. They must be stacked with their hollow cells aligned vertically. When piers are constructed of blocks stacked

side by side, each layer should be at right angles to the previous one (see figure 4-1).

Cap hollow block piers as shown in figure 4-1 to distribute the structural load evenly across them. Caps may be of solid masonry of at least 4 inches nominal thickness or hardwood at least 2 inches nominal thickness, or of steel (see figure 4-1). All caps shall be of the same length and width as the piers upon which they rest. Avoid using plywood, as it may lead to unwanted settling.

Use 4-inch x 6-inch hardwood shims to level the home and fill any gaps between the base of the I-beam and the top of the pier cap. Always use shims in pairs (see figure 4-1). Drive them in tightly so that they do not occupy more than 1 inch of vertical space. Use hardwood plates no thicker than 2 inches to fill in any remaining vertical gaps.

Select manufactured pier heights so that the adjustable risers do not extend more than 3 inches when finally positioned.

All piers must rest on footings (see 4.2) that extend below the frost line (see 4.2.2 for exceptions to placement) and are placed on either undisturbed soil or compacted fill.

#### **4.1.3.3 Clearance under homes**

A minimum clearance of 12 inches shall be maintained beneath the lowest member of the main frame (I-beam or channel beam) in the area of utility connections. No more than 25 percent of the lowest member of the main frame of the home shall be less than 12 inches above grade.

### **4.1.4 Design procedures**

#### **4.1.4.1 Piers less than 36 inches high**

Piers less than 36 inches high may be constructed of single, open, or closed-cell concrete blocks, 8 inches x 8 inches x 16 inches. Install them so that the long sides are at right angles to the supported I-beam (see figure 4-1). Position open cells at right angles to the footers. Horizontal offsets should not exceed 1/2 inch top to bottom. Mortar will not normally be required. Manufactured piers

should be listed and labeled.

#### **4.1.4.2 Piers 36 inches to 80 inches high and corner piers**

Construct all piers between 36 inches and 80 inches high and all corner piers over three blocks high out of double, interlocked concrete blocks (see figure 4-1). Mortar will not normally be required.

#### **4.1.4.3 Piers over 80 inches high**

Where permitted by local codes, lay blocks in concrete mortar with steel reinforcing bars inserted in the block cells and fill the cells with concrete. Where such construction is not permitted by local codes, piers over 80 inches high shall be designed by a registered engineer.

#### **4.1.4.4 Elevated homes**

When more than one-fourth of the area of a home is installed so that the bottom of the main-frame members are more than 3 feet above ground level, the home stabilizing devices shall be designed by a qualified engineer and be approved prior to installation by the authority having jurisdiction.

### **4.1.5 Location and spacing**

The location and spacing of piers depend upon the dimensions and weight of the home, the roof load zone, the type of construction (single- or multisection), and such other factors as the location of doors or other openings. In general, locate piers no more than 2 feet from either end and not more than 8 feet center-to-center under the main rails.

#### **4.1.5.1 Single-section homes**

Figure 4-2 shows the recommended location and spacing of piers for a single-section home when the manufacturer's installation instructions are not available.

#### **4.1.5.2 Multisection homes**

Figure 4-3 shows the recommended location and spacing of piers for a multisection home when the manufacturer's installation instructions

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are not available.

### **4.1.5.3 Perimeter blocking**

Place piers on both sides of side wall exterior doors and any other side wall openings greater than 4 feet (such as entry and sliding glass doors); under porch posts, fireplaces, and wood stoves; and under the locations where heavy pieces of furniture, such as pianos, organs, waterbeds, etc., are expected to be placed.

## **4.2 Footings**

Footings shall be placed a minimum of 4 inches below grade in undisturbed soil. Support every pier with a properly designed footing (see 4.2.1.1).

### **4.2.1 Acceptable types of footings**

#### **4.2.1.1 Concrete**

Footings may consist of precast or poured-in-place concrete, pads, slabs, or ribbons at least 3 1/2-inches thick, with a 28-day compressive strength of at least 3,000 pounds per square inch.

#### **4.2.1.2 Pressure-treated permanent wood**

Two layers of nominal 2-inch thick pressure-treated wood having 0.60 retention in accordance with AWPA C22 Standard, with the long dimensions of the second layer placed perpendicular to that of the first, may also be used.

#### **4.2.1.3 Other materials**

Other materials approved for footings may be used when approved by local authorities if they provide equal load-bearing capacity and resistance to decay. Examples include:

- 1/2 inch maximum crushed stone;
- 3/8 inch or 3/4 inch graduated gravel;
- coarse sand, with grains no smaller than 1/16 inch, placed so it provides a soil-bearing capacity of at least 3,000 pounds per square foot.

## **4.2.2 Placement in freezing climates**

### **4.2.2.1 Conventional footings**

In areas subject to ground frost heave, place footings below the frost line. Consult local authorities to determine the depth of the frost line. In the absence of a local code, use the frost penetration map provided in figure 4-4 as a guide.

### **4.2.2.2 Floating slab systems**

When properly designed by a registered professional engineer, a "floating slab system" may be used above the frost line. The design shall accommodate the anchorage requirements identified in 5.

### **4.2.2.3 Insulated foundations**

Footings may also be placed above the frost line when the home is provided with a perimeter foundation or skirting having insulation properties sufficient to prevent freezing of the soil under or adjacent to every load-bearing component of the foundation and acceptable for this purpose to the authority having jurisdiction. Useful design guidelines may be found in the references found in Annex F. Insulation systems should be compatible with the requirement to cross-ventilate the entire space under the home.

### **4.2.3 Proper sizing of footings**

Proper sizing of footings depends upon the load-carrying capacity of both the piers and the soil. See table 4-3 for recommended footing sizes.

## **4.3 Permanent foundations**

Check local building codes and regulations and consult a registered engineer when the home is to be sited on a permanent foundation (such as a full basement, crawl space, or load-bearing perimeter foundation). To obtain a permanent foundation design that meets most local codes, write to the manufacturer of the home. Useful ideas and design guidelines can also be found in reference publications, such as those listed in Annex F.

#### 4.4 Special considerations

Also see 5.5.3.

##### 4.4.1 Areas prone to flooding

Special elevations and anchoring techniques are required when locating a home in an area prone to flooding. Consult an engineer and the local building official to make sure that home design and construction conform to applicable federal, state, and local codes and regulations. The Federal Emergency Management Agency (FEMA) publication listed in Annex F contains design and construction recommendations for elevated foundations as well as for connections and anchoring systems that will allow the foundation system to resist flood forces.

##### 4.4.2 Severe wind areas

Special foundation and anchoring techniques are required when locating a home in a severe wind area is unavoidable. Consult a registered engineer. The HUD foundations design guide listed in Annex F contains recommendations for designing foundations and anchoring systems. Do not place the home in a more severe wind zone than the one indicated on the data plate posted in the home.

##### 4.4.3 Special snow load conditions

Homes designed for and located in heavy snowfall areas or that are subjected to other extreme loading conditions may require special piers or footings. Check with the local authority having jurisdiction.

#### 4.5 Important reference documents

See Annex F.

### 5 Installation procedures

#### 5.1 Moving manufactured home to location

The following items shall be completed or verified before placing the manufactured home:

- The site is properly prepared (see 3).
- All footing work necessary for setting the

home is completed.

- Utilities are available.
- Any trenching, for crossover drain lines or for wheels that will be left in place, is complete.
- Items that could be difficult to install after the home is sited (such as anchors and ground moisture retarders), are in their proper locations.

**CAUTION:** *The home weighs several tons. Use adequate temporary support blocking to safeguard workers.*

#### 5.2 Positioning home

The home shall be installed and leveled by qualified installation personnel who are acceptable to the authority having jurisdiction.

#### 5.3 Interconnection of multisection homes

The following items shall be completed during the interconnection of multisection homes when the manufacturer's installation instructions are not available.

- Provide an air infiltration barrier on the mating edges of the floor, end walls, and ceilings.
- Fasten the roof at the ridge with #10 x 4-inch wood screws, at a minimum, at 12-inch, on-center, staggered intervals. Secure end walls with #10 x 4-inch wood screws, at a minimum, at 6-inch, on-center, staggered intervals. Fasten floors together at the mating line with #10 x 4-inch wood screws, at a minimum, at 12-inch, on-center, staggered intervals.
- Mating walls shall be firestopped in accordance with the MHCSS.

**Table 5-1 – Normal Home Installations  
(Single- Or Multisection Homes)**

**Types Of Foundation Systems –  
Main Components**

**Piers–Ground anchors:**

The manufactured home rests on piers of concrete block; formed-in-place concrete; permanent wood; or steel pedestals on permanent wood, crushed stone, or concrete footers. The ground anchors in the soil are angled to the resist straps or embedded in dead-men in the soil. Straps are tied to the frame, with or without over-the-top straps.

**Concrete slab or continuous footings:**

The manufactured home rests on a concrete slab or ribbons of concrete. The straps are tied between the frame and the perimeter footers or concrete slab.

**Pile/post system:**

The manufactured home rests on piles or posts placed sufficiently deep in the ground to resist all wind, snow, and earthquake forces. Straps fasten the home to the piles or posts or to caps placed thereon.

**Concrete, concrete block, or wood-  
foundation, load-bearing, perimeter walls:**

The manufactured home rests on exterior load-bearing walls that sit on concrete or gravel footings. Straps fasten the home to the walls to resist all external forces.

**5.4 Cross-over connections for multisection  
manufactured homes**

**5.4.1 Utility cross-overs**

Connect water, drainage, gas, electricity, and telephone utility cross-overs. The correct procedures are outlined in 8.

**5.4.2 Duct-work cross-overs.** Clamp the flexible air conditioning or heating ducts or both to the sleeves projecting through the bottom covering, seal the ducts' adjustable collars with several wrappings of duct tape, and suspend/support them above the ground (see figure 5-1).

**5.5 Anchoring instructions**

After blocking and leveling, the installer should secure the manufactured home against the wind, unless the jurisdiction permits otherwise. The type of installation is the determining factor in deciding how this should be done, as is described in the following sections.

**5.5.1 Normal installations**

Table 5-1 summarizes and defines the types of normal installations. The pier-and-ground-anchor system, as provided in this standard, is most common. When using another type of installation, consult a registered engineer.

NOTE – The anchoring or foundation system shall be capable of meeting the loads required by the MHCSS.

**5.5.1.1 Number and location of anchors**

Select the number and location of straps and anchors from the chart and diagram in figure 5-2. Use either the single- or the double-strap method. Use only approved ground anchors capable of resisting at least the minimum loads given in the chart for the method selected.

**5.5.1.2 Installation of anchors**

The following is one example: Install the anchors at the locations selected from figure 5-2 when the home manufacturer's installation instructions are not available. Follow the anchor manufacturer's instructions. Use single-headed anchors at all "frame-tie-only" locations when using the single-strap method, and double-headed anchors when employing the double-strap method. Install single- or double-headed anchors at all over-the-roof-tie locations. When using a single strap, line up the shaft of each anchor with its strap (see figure 5-3). When connecting more than one strap to a single anchor, line the shaft of the anchor with the results achieved by calculating the combined forces (see figures 5.4). The ground anchors must be sized for the direction of the load and the type of soil. (See figures 5.3 and 5.4 for additional information on the installation of anchors and tiedowns.)

### 5.5.2 Over-the-roof straps

If over-the-roof straps are provided with the home, they must be reinstalled.

### 5.5.3 Severe climatic conditions

#### 5.5.3.1 Freezing climates

Be sure anchor augers are installed below the frost line. During periods of frost heave, be prepared to lessen tension on the straps.

#### 5.5.3.2 Severe wind zones

Before a home is installed in a severe wind zone or is located within 1,500 feet of a coastline in Wind Zones II or III, seek the advice of an engineer. Have engineered drawings showing foundation, connection, and anchorage details approved by local authorities. Design guidelines may be found in HUD's permanent foundations guidebook referenced in Annex F. Homes destined for severe wind areas in Zone I shall be designed and installed for Zone II conditions (see figure 3-1).

#### 5.5.3.3 Areas prone to flooding

Foundation considerations are discussed in 4.4.1 and the FEMA document referenced in Annex F. Unconventional anchorage and tie-downs often are needed in designing and constructing the special elevated foundations required in areas prone to flooding. Consult an engineer and the local building official for guidance.

## 5.6 Installation of on-site structures

Design all buildings and structures to support all of their own live and dead loads. Provide fire separation, as state or local ordinances require, for occupancy.

### 5.6.1 Expanding rooms

Install expanding rooms in accordance with the manufacturer's instructions. When the manufacturer's instructions are not available, perimeter blocking shall be installed in accordance with table 4-1; ground anchors shall be installed in accordance with figure 5-2.

### 5.6.2 Garages and carports

A garage or carport must be installed according to the manufacturer's instructions and to all applicable local codes. The garage or carport must be supported independently of the factory-built portion of the manufactured home. Electrical circuits in a garage shall be provided with ground-fault circuit protection.

### 5.6.3 Porches

Site-constructed porches must be constructed and inspected according to applicable building codes.

### 5.6.4 Steps, stairways, and landings

Steps, stairways, and landings must be constructed and inspected according to applicable building codes.

## 6 Installation of optional features

NOTE – Where applicable, and specific to manufacturer's product.

### 6.1 Hinged roofs and eaves

If the home has a hinged roof or eave(s), caution must be taken.

#### 6.1.1 Moving the home

Plan to move the home without dismantling it, if possible.

#### 6.1.2 Hinged roofs or eaves

If a hinged roof or eave must be dismantled, obtain professional assistance to ensure that no damage is done in the process.

#### 6.1.3 Reinstalling dismantled roofs or eaves

When reinstalling dismantled roofs or eaves, particular care should be taken to ensure that all vent stacks, furnaces, water heaters, ventilation systems, fireplaces, and wood stoves are properly installed in accordance with listed appliance manufacturers' instructions.

## 6.2 Garden and bay windows

If the home is supplied with a garden or bay window that was dismantled or removed for transportation, it must be reinstalled to resist the elements and be supported as required.

## 6.3 Awnings and ramadas

Choose only freestanding products with support columns.

## 6.4 Miscellaneous lights and fixtures

Some exterior lights, ceiling fans and chain-hung fixtures may not yet be installed when the home is delivered. All of these fixtures must be grounded by a fixture-grounding screw or by a fixture-grounding wire. For chain-hung fixtures, use both of these methods. When fixtures are mounted on combustible surfaces such as hardboard, install a noncombustible ring to completely cover the combustible surface exposed between the fixture canopy and the wiring outlet box. If siding has not been installed at a fixture location, remove the outlet box and install the siding with a hole for the outlet box. Then reinstall the outlet box and proceed as for other fixtures, which shall be installed according to their listings.

### 6.4.1 Exterior lights

Remove the junction box covers and make wire-to-wire connections, using wire nuts. General practice is to connect wires black-to-black, white-to-white, and ground-to-ground. Push the wires into the box and secure the light fixture to the junction box. Caulk around the base of the light fixture to ensure a water-tight seal to the side wall. Install the light bulb and attach the globe, as in figure 6-1.

### 6.4.2 Ceiling fans

To reduce the risk of injury, install ceiling fans with the trailing edges of the blades at least 6 feet 4 inches above the floor. Connect the wiring, as shown in figure 6-2, and follow the manufacturer's instructions, as in shown in figure 6-2.

## 6.5 Ventilation options

Follow the component manufacturer's instructions (see, for example, figure 6-3.)

## 6.6 Optional panels, siding, and moulding

If the home is equipped with optional panels, siding, or moulding, refer to figure 6-4 for the proper installation procedures.

## 6.7 Exterior coverings

Install exterior coverings (stucco, plywood, vinyl, or hardboard exterior siding; shingled or tiled roofs; etc.) according to the product manufacturer's instructions. Do not cover the home's label (the "HUD" label) when applying any exterior coverings:

### 6.8 Skirting

Skirting, if used, shall be of durable materials suitable for exterior exposures. Skirting must not be attached in a manner that can cause water to be trapped between the siding or trim to which it is attached. The skirting should be recessed under the siding or trim. Most local codes do not permit wood, including lumber and all wood siding used for skirting, to be used within 6 inches of the ground unless it is pressure treated to prevent decay and termite infestations.

Ventilation shall be provided for the crawl space at a minimum of one square foot of free area for every 150 square feet of the home's floor area. Ventilation openings shall be placed at or near each corner of the home and as high as practicable. Openings shall be located to provide cross-ventilation on at least two opposite sides.

Except in arid regions with dry soil conditions, a uniform 6-mil polyethylene sheet material or other acceptable vapor barrier material should be installed on the ground surface beneath the home to further reduce moisture. Where an acceptable ground vapor barrier is installed and one such ventilation opening is within 3 feet of each corner of the home, the total area of ventilation openings may be reduced to one square foot for every 1,500 square feet of the

home's floor area. Where local codes have minimum ventilation requirements for crawl spaces, these requirements shall apply to homes with skirting and continuous foundations.

Access opening(s) not less than 18 inches in any dimension and not less than three square feet in area shall be provided and shall be located so that any water supply and sewer drain connections located under the home are accessible for inspections.

Dryer vents, air conditioning condensation drains, and combustion air inlets must pass through the skirting to the outside.

## 6.9 Telephone and cable TV

**CAUTION:** *Careless installation of telephone and cable television lines may be hazardous. Failure to follow these instructions may result in serious personal injury or death.* The walls and floors of the home contain electrical circuits, plumbing, and duct work. Avoid contact with these systems when drilling through and placing cables within these cavities. Only trained professionals should handle such work.

## 6.10 Joints and seams

Where appropriate, weatherproof all joints and seams that were disturbed during relocation of the home.

## 7 Preparation of appliances

### 7.1 Clothes dryer vent

The clothes dryer must exhaust to the exterior of the home, or beyond any perimeter skirting installed around it, as shown in figure 7-1. **IMPORTANT:** *Do NOT let the exhaust system end under the home, where excess moisture or flammable material can accumulate.* (Follow the dryer manufacturer's instructions for installing the exhaust system.)

### 7.2 Comfort cooling systems

**IMPORTANT:** *Before installing a comfort cooling system, check the home's data plate to assure that the home has been designed for*

*the installation of central air conditioning. Only qualified personnel may install a comfort cooling system not provided with the home.* Follow the product manufacturer's installation instructions and conform to all local codes.

### 7.2.1 Air conditioners

An installed central air conditioning system must not exceed the rating shown on the home's compliance certificate.

The home's electrical distribution panel may contain optional factory-installed circuits for air conditioning. The maximum full-load ampere draw for the desired air conditioning unit must not exceed the circuit rating shown. **IMPORTANT:** *Electrical circuits within the home may not have been sized for the additional load of non-factory-installed air conditioning, and a separate, outside electrical supply may have to be provided.*

"A"-coil air conditioning units must be compatible and listed for use with the furnace in the home. Follow the air conditioner manufacturer's instructions. Direct all condensation beyond the perimeter of the home by means specified by the equipment manufacturer.

### 7.2.2 Heat pumps

Install heat pumps according to the heat pump manufacturer's instructions.

### 7.2.3 Evaporative coolers

Install a roof-mounted cooler by following the appliance manufacturer's instructions. Before installing a roof-mounted cooler, be sure that the roof will support the weight of the cooler. A rigid base must be provided to evenly distribute the cooler's weight over several rafters.

## 7.3 Fireplace and wood-stove chimneys and air inlets

Fireplaces and wood stoves require on-site installation of additional section(s) of approved, listed chimney pipe, a spark arrestor, and a rain-cap assembly (see figure 7-2.). Fireplace and wood-stove chimneys and air inlets shall be

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installed in accordance with their listings. All fireplaces and wood stoves installed shall be listed for use in manufactured housing. For field installation, approval from the manufacturer and the authority having jurisdiction shall be required to ensure compliance with the required standards.

### 7.3.1 Minimum extensions above roof

To ensure sufficient draft for proper operation, extend the finished chimney at least 3 feet above the highest point at which it penetrates the roof and at least 2 feet higher than any building or other obstruction located within a horizontal distance of 10 feet. If there are obstructions on the site that extend higher than the home's roof peak and are within 10 feet of the chimney, the installer may have to provide an additional section of chimney pipe, if required to do so by local codes.

### 7.3.2 Required components

The required components of a correctly-installed chimney are as shown in figure 7-2.

### 7.3.3 Combustion air duct inlets

Combustion air-intake ducts end just below the bottom covering of the floor. The ducts must be extended to the outside when the home has a basement or crawlspace. If the added ducts are not supplied, they may be purchased at a hardware store. The fireplace manufacturer's instructions for installing combustion air ducts can be found in the fireplace/stove or with the chimney parts. Do not allow the combustion air inlet to drop material from the hearth to the area beneath the home. Locate the inlet damper above the expected snow level, as shown in figure 7-2.

### 7.4 Range, cook-top, and oven venting

**IMPORTANT:** *If the home is equipped with a combination range (cook-top)/grill or oven that contains its own exhaust system, the vent must exhaust to the exterior of the home. If perimeter skirting is installed, the vent must exhaust through the skirting.*

## 8 Utility-system connection and testing

### 8.1 Proper procedures

Consult local, county, or state authorities before connecting any utilities. Only qualified service personnel, familiar with local codes and licensed where required, should make utility connections and conduct tests.

### 8.2 Water supply

#### 8.2.1 Maximum supply pressure and reduction

The water systems of the home were designed for a maximum inlet pressure of 80 pounds per square inch. **IMPORTANT:** *If the home is located in a water district where the local water supply pressure exceeds 80 pounds per square inch, install a pressure-reducing valve.*

#### 8.2.2 Connection procedures

##### 8.2.2.2 Mandatory shut-off valve

Install an accessible shut-off valve between the water supply and the inlet, as shown in figure 8-1. It must be a full-flow gate or ball valve.

##### 8.2.2.3 Cross-overs

Multisection homes with plumbing in both sections require water-line cross-connections, as shown in figure 8-2. Remove the shipping caps from the water lines and install the cross-over connectors provided with the home. If freezing could occur, wrap water connectors with insulation.

#### 8.2.3 Freezing protection

##### 8.2.3.1 Necessity

In areas subjected to subfreezing temperatures, protect exposed sections of water-supply piping, shut-off valves, pressure reducers, and pipes in water-heater compartments with uninsulated doors, from freezing.

##### 8.2.3.2 Use of heat tapes

Heat tapes (either automatic or nonautomatic)

can protect exposed plumbing from freezing. **CAUTION:** *In order to reduce the risk of fire, use only heat tapes listed by a nationally recognized testing laboratory for use with manufactured homes, and install them only in accordance with the manufacturer's instructions.* Plug the 3-wire, grounded cord set of the heat tape into the outlet located under the home near the water supply inlet (figure 8.1).

#### 8.2.4 Testing procedures

Even though the water system was tested at the factory, it shall be rechecked for leaks at the installation site. The test shall be made by subjecting the system to air or water at 100 pounds per square inch for 15 minutes without loss of pressure.

### 8.3 Drainage system

#### 8.3.1 Assembly and support

If portions of the drainage system were shipped loose when the home was relocated, reinstall them in accordance with the MHCSS, Part 3280.608 (see figure 8-3).

#### 8.3.2 Proper slopes and connector sizes

Drain lines must slope at least 1/4 inch fall per foot of run unless otherwise noted on the schematic diagram (see figure 8-4). **EXCEPTION:** 1/8-inch fall per foot is allowed when a clean-out is installed at the upper end of the run. Connect the main drain line to the site's sewer hook-up, using an approved elastomer coupler (figure 8-5).

#### 8.3.3 Cross-overs

Connect multisection-home, drainage-line cross-overs as shown in figure 8-6.

#### 8.3.4 Testing procedures

Even though the drainage system was tested at the factory, it shall be rechecked for leaks after installation at the site. This shall be accomplished by capping the water line, filling it with water, and holding it 15 minutes.

### 8.4 Gas supply

#### 8.4.1 Type of gas system furnished with home

All gas-burning appliances, including the heating system, are equipped for either natural gas (NG) or liquified petroleum gas (LPG). A qualified service person must convert the appliances from one type of gas to the other, following the instructions provided by the manufacturer of each appliance.

#### 8.4.2 Orifices and regulators

**IMPORTANT:** *Special orifices and regulators are required for specific gases. See the instructions accompanying each gas-burning appliance for modification instructions. Before making any connections to the site supply, check the inlet orifices of all gas-burning appliances to ensure they are correctly set up for the type of gas to be supplied. Special attention should be given to homes sited at altitudes above 3,000 feet.*

#### 8.4.3 Proper supply pressure.

**IMPORTANT:** *The gas piping system in the home has been designed for a pressure that is not to exceed 14 inches of water column (8 ounces or 1/2 pound per square inch). If gas from any supply source exceeds, or may exceed, this pressure, a regulator must be installed. To operate gas-burning appliances safely and efficiently, do not exceed the design pressure limitations. For NG systems, the incoming gas pressure should remain between 6 inches and 8 inches of water column. For LPG systems, the pressure should register between 12 inches and 14 inches of water column.*

#### 8.4.4 Cross-overs

A gas cross-over may need to be installed in multisection homes. All cross-overs and fittings must be listed for exterior use and be of the same size as the main unit pipe. Do not use tools to connect or remove the flexible connector quick-disconnect.

#### 8.4.5 Testing procedures

Even though the gas system was tested at the factory, it shall be retested for leaks at the installation site by qualified personnel (see 8.4.3).

#### 8.4.6 Connection procedures

Inspect gas-burning appliance vents to ensure that they have been connected to the appliance, and ensure that roof jacks are installed and have not come loose during transit. **IMPORTANT:** *Have the gas system connected to the gas supply only by an authorized representative of the gas company.*

#### 8.4.7 Gas appliance start-up procedures

One at a time, open each equipment shut-off valve, light pilot lights, and adjust burners according to each appliance manufacturer's instructions. **IMPORTANT:** *Ensure that the water heater is filled with water before lighting the pilot light.* Check the operation of the furnace and water heater thermostats and set them to the desired temperatures.

#### 8.5 Heating oil systems

Homes equipped with oil-burning furnaces must have their oil supply tankage and piping installed on site. These items are not supplied by the manufacturer. Consult the oil-burning furnace manufacturer's instructions for proper pipe size and installation procedures. **IMPORTANT:** *All oil storage tanks and pipe installations must meet all applicable local regulations and should be made only by experienced, qualified personnel.*

##### 8.5.1 Tank installation requirements

Unless the home is installed in a community with a centralized oil distribution system, an oil storage tank must be installed outside the home. Locate the tank where it is accessible to service and supply and safe from fire and other hazards.

##### 8.5.2. Leak test procedure

Before operating the system, check for leaks in

the tank and supply piping. Fill the tank to capacity with fuel and examine all joints in the system for leakage.

#### 8.6 Electricity

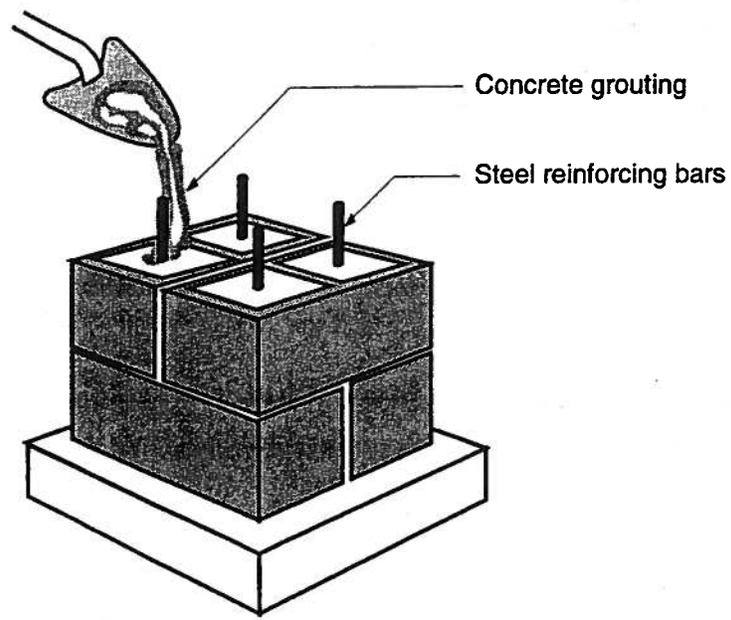
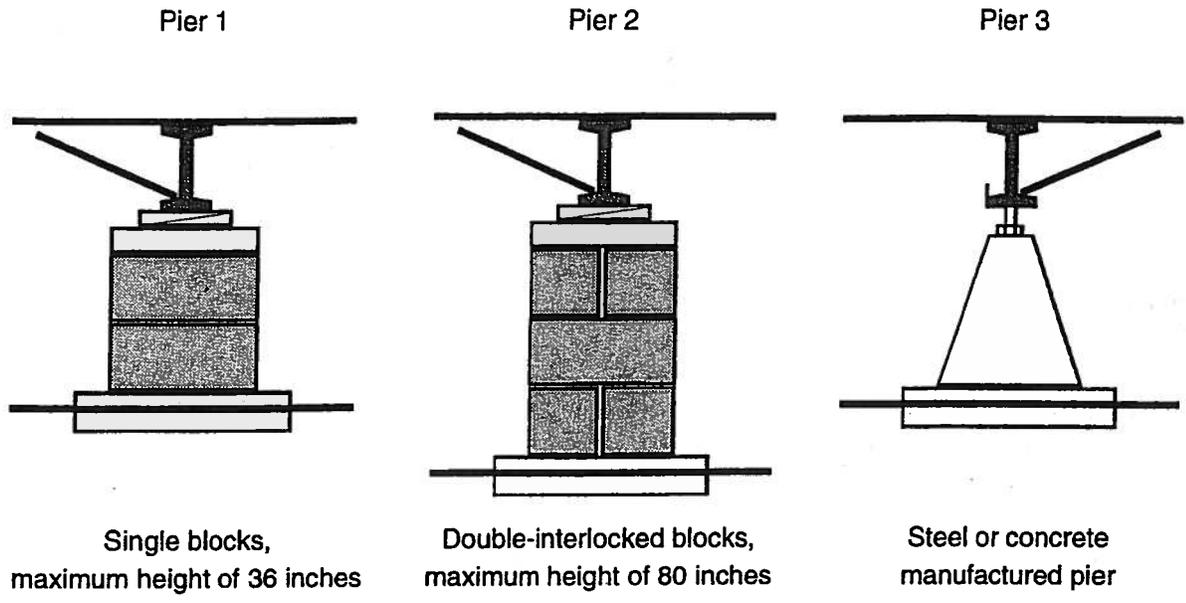
A large-enough power supply must be available at the site. An inadequate power supply may result in improper operation of, and possible damage to, motors and appliances. The current rating in amperes of the home can be found on the tag located outside, next to the feeder or service entrance, and also on the electrical distribution panel.

##### 8.6.1 Description and rating of house wiring

The home is designed for connection to an electrical wiring system rated at 120/240 volts AC. **IMPORTANT:** *Proper and safe connection depends on the type of supply system with which the home is equipped.*

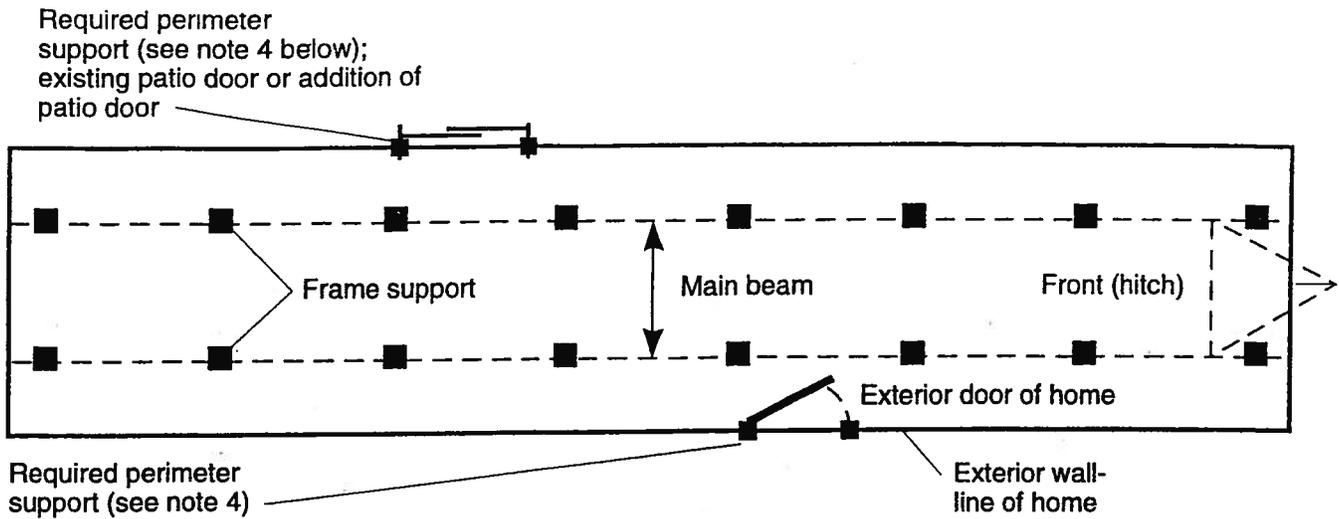
##### 8.6.2 Electrical equipment/ installations

All electrical equipment and installations shall be designed, constructed, and maintained in accordance with the applicable provisions of the MHCSS, the National Fire Protection Association (NFPA) 70, the National Electrical Code (NEC), or the local jurisdiction having authority, or all of the above.



For piers exceeding 80 inches in height, the concrete blocks should be filled with concrete grouting and steel reinforcing bars should be utilized.

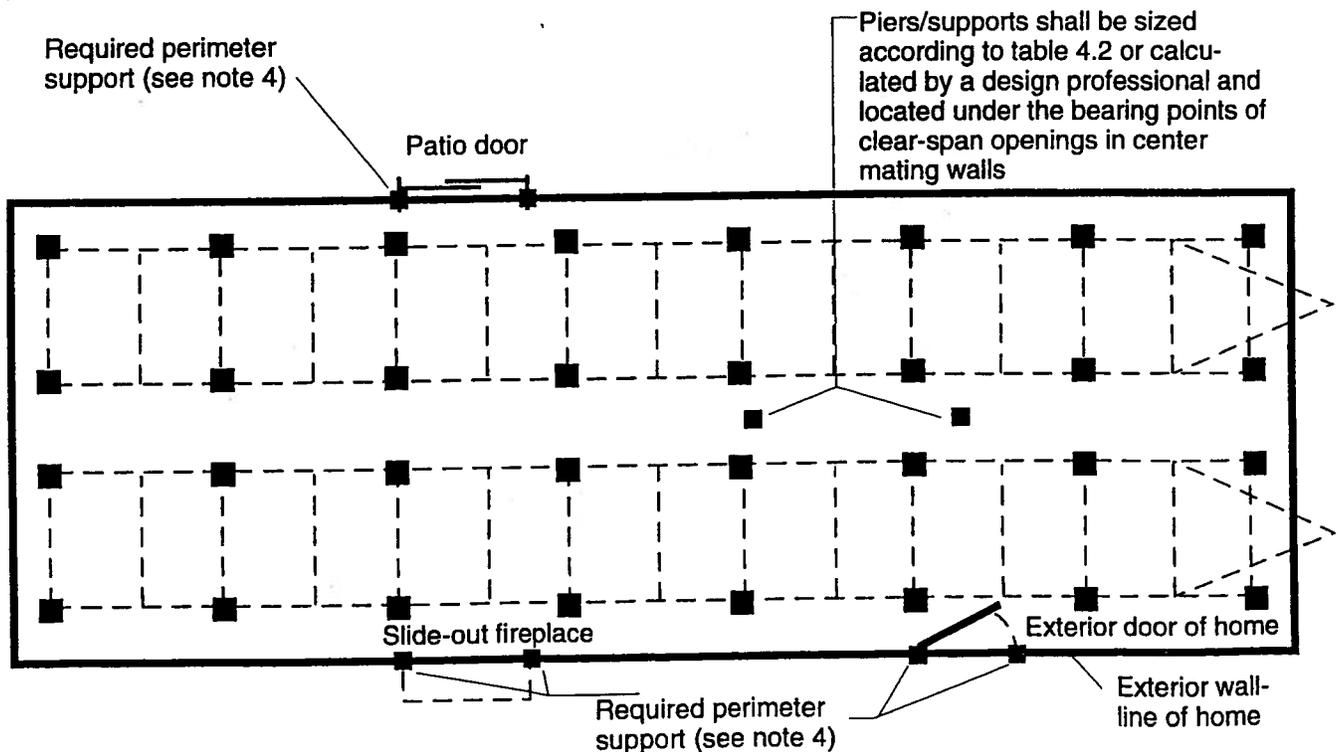
Figure 4-1 -- Typical footing and pier installation



**Figure 4-2 -- Typical blocking diagram for single-section home when manufacturer's instructions are not available**

Note (applies to both figures 4-2 and 4-3) --

1. See table 4.1 for required pier capacity and spacing.
2. See table 4.3 and section 4.2 for footing requirements.
3. Piers shall be located at a maximum of 2 feet from both ends.
4. Place piers on both sides of entry doors and at any other openings greater than 4 feet in width, such as patio or atrium doors; under porch posts, fireplaces, and wood stoves; and under those places where heavy pieces of furniture such as pianos, organs, waterbeds, etc., may be placed.



**Figure 4-3 -- Typical blocking diagram for multisection home when manufacturer's installation instructions are not available**

Strap Method	Anchor Min. Ultimate Load Capacity	Maximum Anchor Spacing		
		Zone I	Zone II	Zone III
Single Strap	4725 lbs.	11' - 0"	6' - 0"	4' - 6"
Double Strap	4725 lbs. <sup>1</sup>	11' - 0" <sup>2</sup>	6' - 0" <sup>2</sup>	4' - 6" <sup>2</sup>

Note --

- 1 Unless listed/labeled for a higher capacity by the anchor manufacturer
- 2 Unless a greater spacing is specified by the anchor manufacturer
- 3 All homes located in Wind Zones II and III shall have a vertical tie installed at each diagonal tie location.

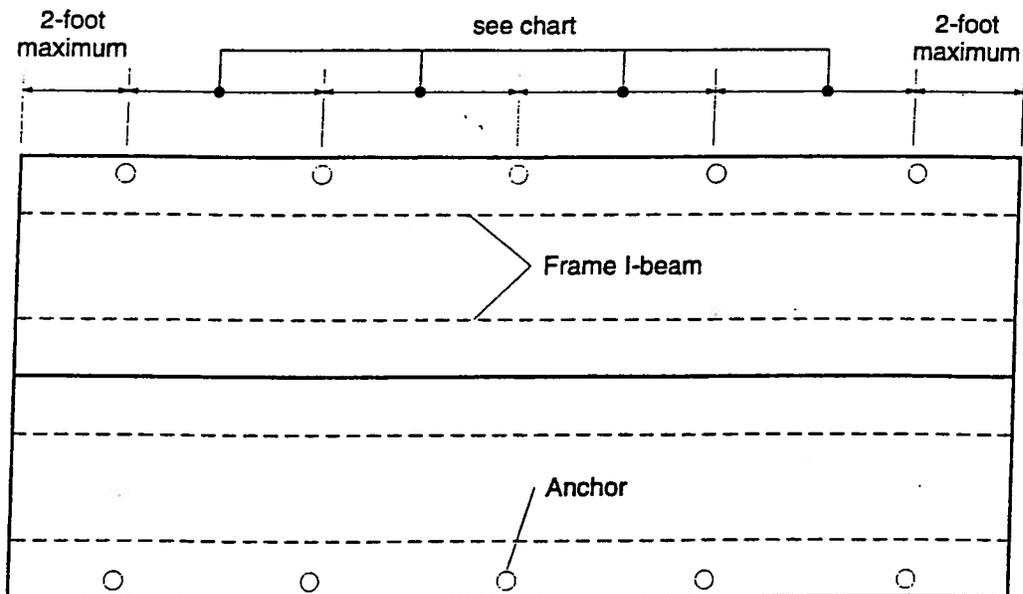
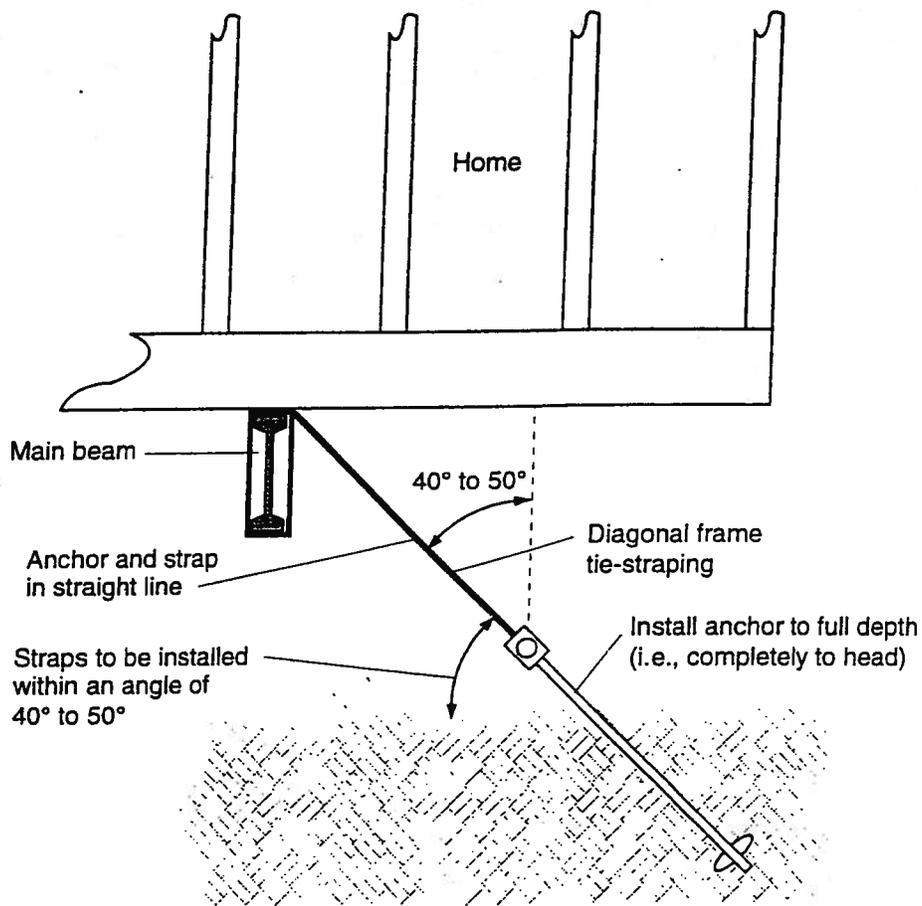


Figure 5-2 -- Number and location of straps and ground anchors

## Diagonal ties



Note --

1. All anchoring parts must be certified to a 4,725-pound capacity.
2. The ground anchors must be sized in accordance with the direction of the load and the type of soil.
3. The ground anchors' augers must be installed below the frost line.
4. Ground anchors may be installed vertically if either a 10-inch x 18-inch (at a minimum) concrete collar or an approved metal stabilizing device is installed.

Figure 5-3 -- Proper alignment of straps and anchors