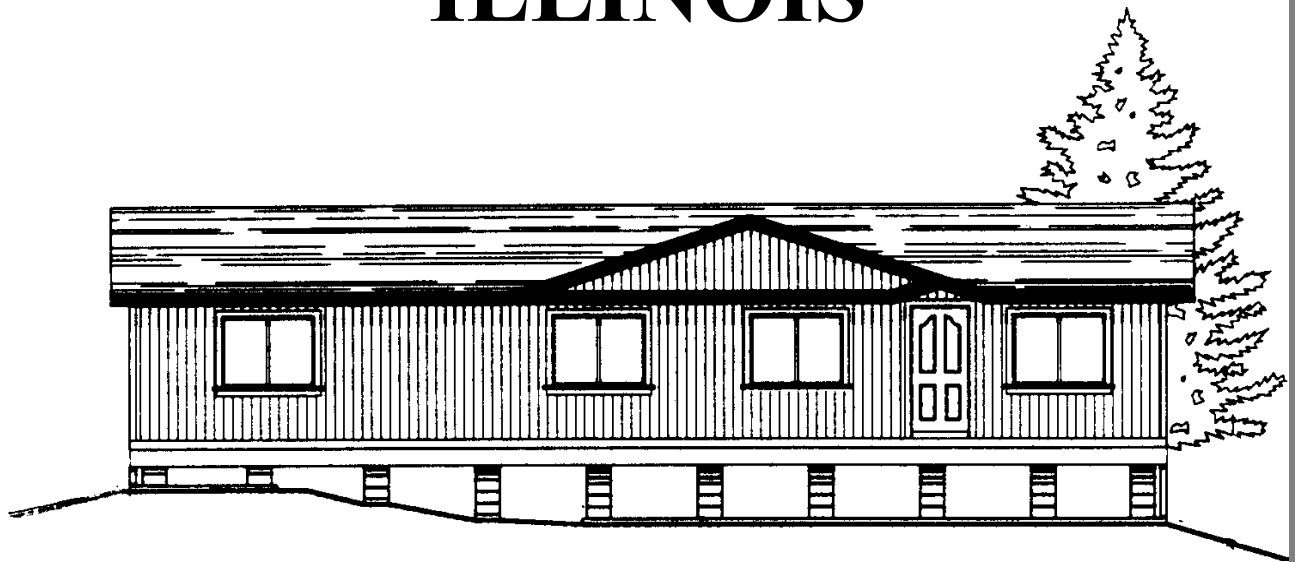


# GUIDELINES FOR INSTALLING MANUFACTURED HOMES IN ILLINOIS



2000

9/00

## INTRODUCTION

The construction of all manufactured homes after June 1976 have been regulated by the U.S. Department of Housing and Urban Development as authorized by the National Manufactured Home Construction and Safety Standard Act of 1974 (42 U.S.C. 5401). While these standards only apply to the construction of the homes at the factory, they do require the manufacturer to provide detailed installation instructions.

Unlike many states, at the present time there are no statewide requirements in Illinois for the entire installation of manufactured homes. There are, however, state requirements pertaining to the anchoring of the homes through the Illinois Mobile Home Tiedown Act, and the water and sewer connections are regulated by the Illinois Plumbing Code. The installer also must be aware of local building code requirements that may pertain to the installation of the home. There are license requirements on the state level requiring a licensed plumber or apprentice plumber to connect the plumbing to these homes and a requirement for a roofer's license for any person doing roofing. Many local jurisdictions also require licensed electricians and mechanical contractors.

In an effort to assure proper installation of the more than 4,000 manufactured homes installed in Illinois annually, the Illinois Department of Public Health and the Illinois Manufactured Housing Association have worked jointly on two aspects. The first is a voluntary certification of installers of manufactured homes. At the present time, there are no specific license or certification requirements for the installers of manufactured homes in Illinois. In 1995, training classes were initiated. More than 550 individuals have successfully completed the course and exam as of September 2000 and are certified manufactured home installers. Additional classes will be offered and educational information will be provided periodically to the certified installers.

The second aspect of the program to assure proper installation of the homes is the development of guidelines to assist the installers. **The enclosed information does not replace the manufacturer's instructions but rather is intended to be used for those installations where the manufacturer's installation instructions are not available. Failure to follow the manufacturer's instructions may void the warranty of the home.** It is also important that all instructions for equipment such as anchors, air conditioners and furnaces be read and followed.

The installer or homeowner is advised to obtain all required permits and approvals from state and local jurisdictions prior to installing the home.

The enclosed procedures pertain to the installation of a "manufactured home," which is defined as a "structure, transportable in one or more sections, which, in the traveling mode, is eight body feet or more in width or forty body feet or more in length, or, when erected on site is three hundred twenty or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein." These structures previously were known as "mobile homes." (This document does not pertain to the installation of "modular homes." The construction and installation of modular homes is regulated by the Illinois Department of Public Health.) State and local jurisdictions are prohibited from imposing any construction requirements for the portion of the manufactured home built at the factory that exceeds the federal standards.

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## 1. SITE LOCATION

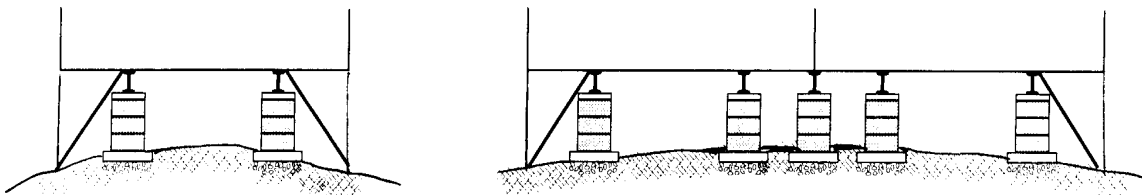
The portion of the lot used for the placement of the manufactured home should be firm, undisturbed soil or compacted fill. It should be tested for its load bearing capacity and graded to prevent surface water or drainage runoff from accumulating under the home. The ground should be sloped a minimum of ½ inch per foot at least six feet away from the perimeter of the home. (See Figure 1-1.)

The property shall be zoned for manufactured homes and the home shall be placed to meet all the required distance separations. If the home is placed in a community subject to licensure by the Illinois Department of Public Health, there must be a 10 foot separation between other homes and five feet from the park property line. The home must be at least 10 feet from any street or alley. The Department also has established minimum sizes for the site depending on when the park was constructed. Contact the Department at 217-782-5830 if there are questions.

All decayable material such as grass, twigs, and wood scraps shall be removed from under the home.

A six-mil polyethylene vapor barrier, secured and extending to the dimensions of the home, should be placed on the ground underneath the manufactured home before the perimeter enclosure is installed, unless the home is placed on a poured concrete slab.

**Figure 1-1**  
**Site Preparation**



Slope ground ½ inch per foot for a minimum of 6 feet from the perimeter of the home.

## 2. FOUNDATION SYSTEMS

The foundation system for the manufactured home should be designed to support all normal anticipated loads during all types of weather conditions at the specific location.

### A. Load Requirements

The first step in designing a foundation is to determine the weight it should support. This is the actual weight of the empty home, called the dead weight, plus the anticipated weight of the occupants and furniture, known as the live floor weight, plus the live roof weight, which is the weight of anticipated snow. On homes manufactured after 1976, this information is to be included on the data plate in the home. In Illinois, manufacturers must design the roof system to withstand a minimum of 20 pounds per square foot. The live floor load is a minimum of 40 pounds per square foot. The only other weight is that of the home. A typical value is 20 pounds per square foot, resulting in a total design weight of 80 pounds per square foot, which is the minimum design load for a home in Illinois.

### B. Soil Capacity

The next step in the design of a foundation system is to determine the load bearing capacity (expressed in pounds per square foot) of the ground where the home will be located. Soils with less bearing capacity will require a larger footing to distribute a specific load. Table 2-1 contains the allowable pressures of various soil categories. A pocket penetrometer, which is a small hand-held device, can also be used to determine the load capacity of the soil.

**Table 2-1**  
**SOIL PRESSURE**

<u>Soil Type</u>	<u>Allowable Pressure (lbs/sq. ft.)</u>
Hard Pan or Rock	4,000 and up
Gravel or Sandy Gravel	2,000
Sandy or Silty Sand	1,500
Clay or Silty Clay	1,000
Peat or Uncompacted Fill	Special Analysis Required

### C. Support System Types

The third step is to determine the type of support system for the home. There are two basic categories and many different types in each category.

1. The first category is a floating support system. This system does not extend below the frost depth. Consequently, when the soil freezes in the winter, because of the moisture in the ground, it expands and causes the foundation to rise or “heave.” After the soil thaws, the home will settle back to near the original elevation. This movement can cause severe damage if proper precautions are not taken. It is important that the entire home changes elevation uniformly and the anchoring system is designed to allow for this movement. Examples of floating support systems are shown in Figure 2-1. These include concrete runners under each I-beam, a concrete pad under the entire home and individual concrete footings, all of which are a minimum of 3½ inches thick and at ground elevation.
2. The second category of support system extends below the frost depth so it is not affected by freezing conditions. Figure 2-2 illustrates different types of these systems, which include piers placed on individual footings, runners under the I-beams, runners perpendicular to the I-beam and a perimeter support system. A perimeter support system in which the home is placed on a basement or crawl space should be designed in accordance with the International Code Council’s publication the *International One and Two Family Dwelling Code (1998 edition)*. Copies of that code can be purchased from the Building Officials and Code Administrators International, telephone number 708-799-2300.

The actual frost depth in Illinois varies from 24 inches in the southern part of the state to more than 40 inches in northern areas. Check with the local building department or utility company if you are not aware of the design depth in your area.

### D. Footings

Footings a minimum of 3½ inches in depth should be placed on undisturbed soil or compacted rock. Runners and pads constitute footings. When runners or pads are not used, it is necessary to determine the minimum dimensions of these footings. Use Tables 2-2 to determine the area in square inches of this footing based on the width of the home, the roof design loads, the soil type and the spacing you chose for the piers. Table 2-3 converts this area into common dimensions for the footing. (See Appendix A for a sample footing design.)

Footings may consist of precast or poured-in-place concrete at least 3½ inches thick with a 28-day compressive strength of 3,000 pounds per square inch. Pressure treated wood having a 0.60 retention in accordance with AWPA C22 Standard may also be used. Footings must be level and support devices should not overlap the footings.

**Table 2-2**

<b>FOOTING AREAS REQUIRED FOR SOIL BEARING CAPACITY DESIGN ROOF LOAD 20 POUNDS PER SQUARE FOOT</b>									
Section Width (feet)									
	12	14	16	12	14	16	12	14	16
Support Spacing (feet)									
	6	6	6	8	8	8	10	10	10
Support Loading (pounds per pier)									
	3200	3700	4250	4250	4950	5650	5300	6150	7050
Soil Bearing Capacity (lbs/ft <sup>2</sup> )	Footing Area (square inches)								
1000	461	533	612	612	713	814	763	886	1015
1500	307	355	408	408	475	542	509	590	677
2000	230	266	306	306	356	407	382	443	508
3000	154	178	204	204	238	271	254	295	338
4000	144	144	153	153	178	203	191	221	254

**Table 2-3**

<b>FOOTING AREAS REQUIRED FOR SOIL BEARING CAPACITY DESIGN ROOF LOAD 30 POUNDS PER SQUARE FOOT</b>									
Section Width (feet)									
	12	14	16	12	14	16	12	14	16
Support Spacing (feet)									
	6	6	6	8	8	8	10	10	10
Support Loading (pounds per pier)									
	3550	4150	4750	4750	5550	6350	5950	6950	7950
Soil Bearing Capacity (lbs/ft <sup>2</sup> )	Footing Area (square inches)								
1000	511	598	684	684	799	914	857	1001	1145
1500	341	398	456	456	533	610	571	667	763
2000	256	299	342	342	400	457	428	500	572
3000	170	199	228	228	266	305	286	334	382
4000	144	148	171	171	200	229	214	250	286



**Table 2-4**

<b>FOOTING AREAS REQUIRED FOR SOIL BEARING CAPACITY DESIGN ROOF LOAD 40 POUNDS PER SQUARE FOOT</b>									
Section Width (feet)									
	12	14	16	12	14	16	12	14	16
Support Spacing (feet)									
	6	6	6	8	8	8	10	10	10
Support Loading (pounds per pier)									
	3950	4650	5300	5300	6150	7050	6600	7700	8800*
Soil Bearing Capacity (lbs/ft <sup>2</sup> )	Footing Area (square inches)								
1000	569	670	763	763	886	1015	950	1109	1267
1500	379	446	509	509	590	677	634	739	845
2000	284	335	382	382	443	508	475	554	634
3000	190	223	254	254	295	338	317	370	422
4000	144	167	191	191	221	254	238	277	317

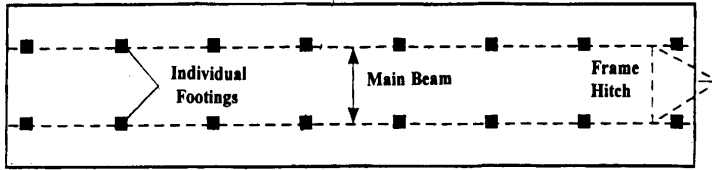
- a) First footing centered within 2 feet from end of home.
- b) Individual supports, concrete 8"x8"x16" blocks, shall **NOT** support loads greater than **8,000 pounds for a single stack and 14,000 pounds for a double stack pier.**

**Table 2-5  
Common Footing Size**

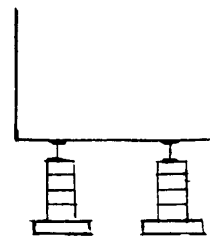
<u>Footing Size</u>	<u>Area (sq. in.)</u>
24x18	432
24x20	480
24x24	576
24x32	768
24x36	864
24x48	1152
30x36	1080
32x44	1408
18 inch diameter	255
24 inch diameter	452
30 inch diameter	707
36 inch diameter	1018

Figure 2-1  
FLOATING SUPPORT SYSTEMS

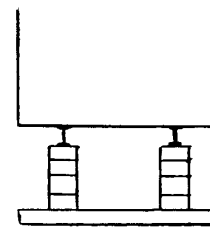
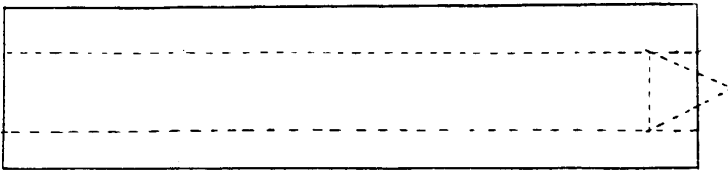
Top View



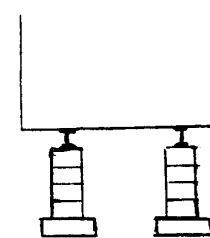
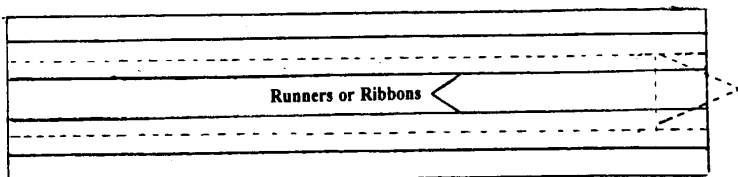
End View



**Individual Footings**



**Concrete Pad Under Entire Home**



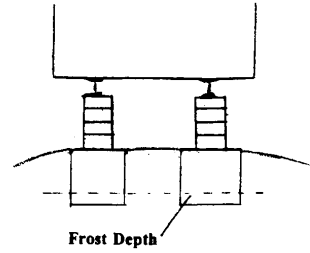
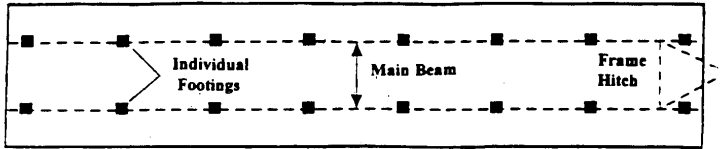
**Concrete Runners or Ribbons**

Figure 2-2

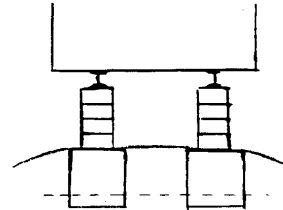
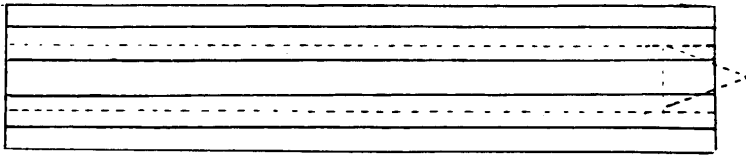
BELOW FROST DEPTH SUPPORT SYSTEMS

Top View

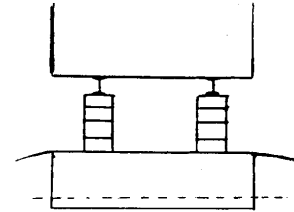
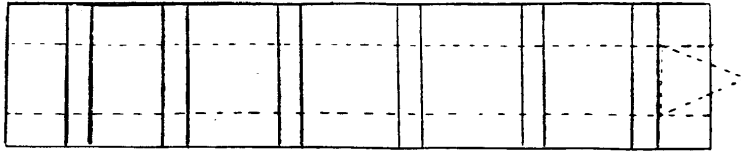
End View



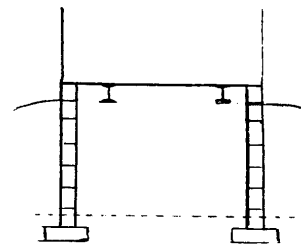
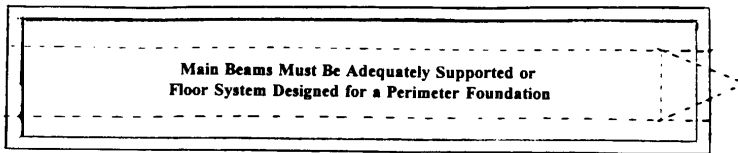
**Individual Pier Footings**



**Parallel Runner Footings**



**Perpendicular Runner Footings**



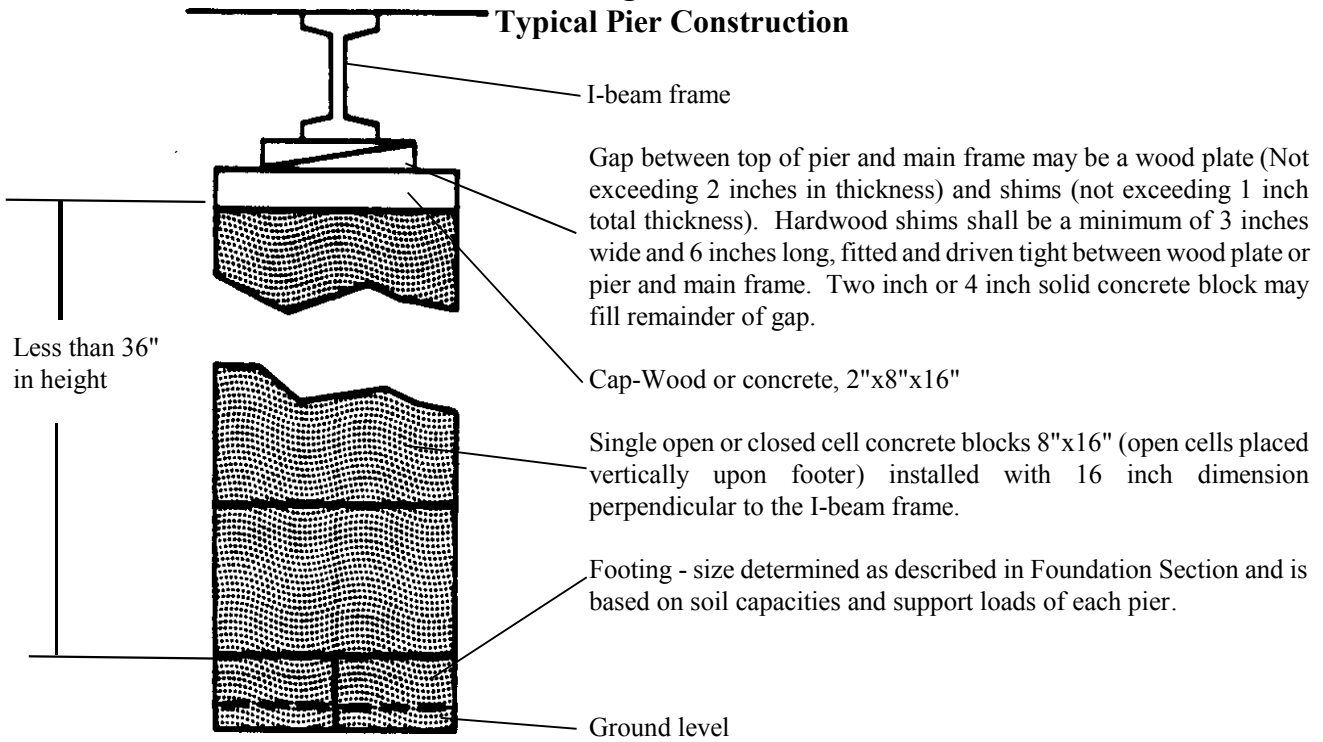
**Perimeter Foundation with Footings**

## E. Piers

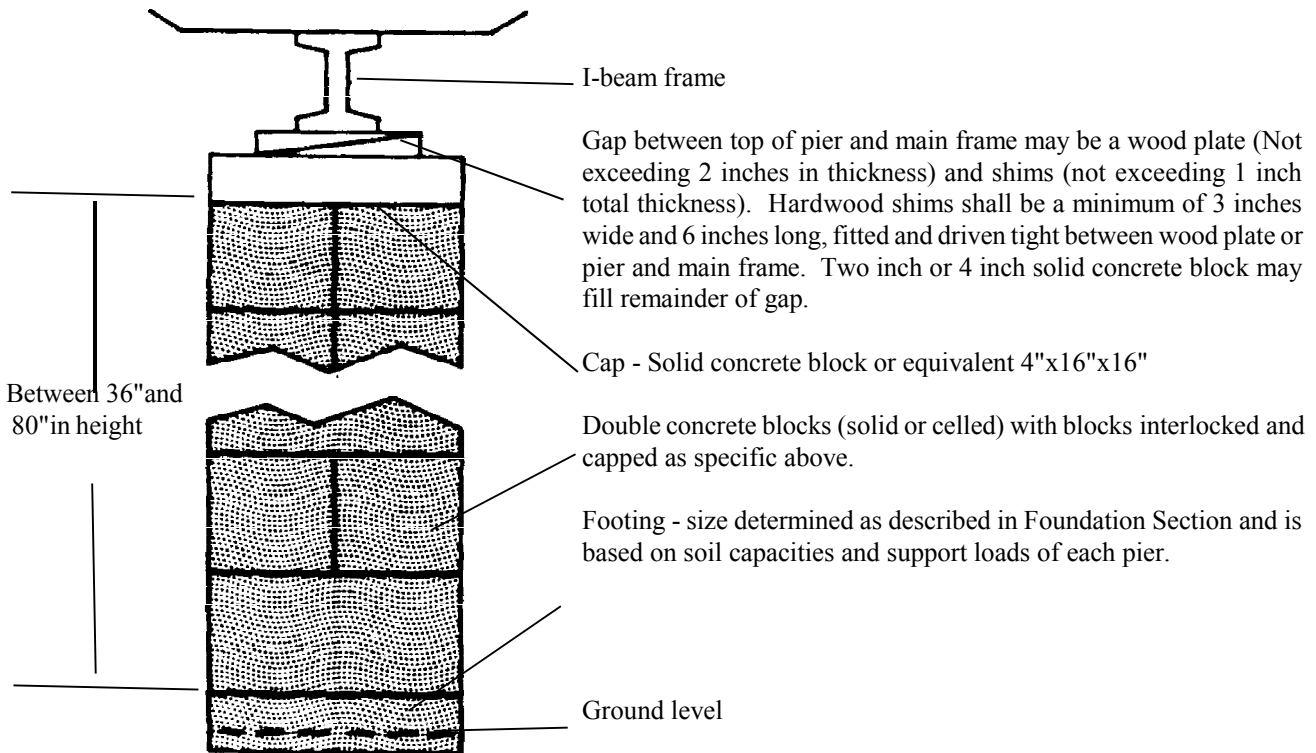
In order to properly support the home, the piers should be of the proper type, size, location and spacing.

1. Piers may be concrete blocks, pressure treated wood or adjustable metal or concrete devices approved and listed for the required load capacities.
2. Non-mortared concrete blocks conforming to ASTM C-90 Type N with a nominal size of 8 inches by 8 inches by 16 inches shall be installed with the 16 inch dimension perpendicular to the main frame (I-beam), the open cells vertical, stacked level. A 2 or 4 inch thick 8 inch by 16 inch solid concrete cap block that conforms to ASTM C-145 Type N shall be placed on the top of each stack. The vertical load shall not exceed 8,000 pounds per single stack and 14,000 pounds for a double stack . The blocks should be stacked on a solid base pad in accordance with the soil bearing capacity (see soil type and Table 2-2). A wood plate not exceeding 2 inches thick and 2 shims not exceeding 1 inch total thickness should be used to fill any gap between the concrete cap and main frame. Hardwood shims should be a minimum of 3 inches wide and 6 inches long fitted tight between cap or wood plate and main frame. (See Figure 2-4.)
3. A minimum clearance of 12 inches should be provided between the ground and the bottoms of the frame. If piers exceed 36 inches in height (more than four 8x8x16 blocks), they shall be double blocked as shown in Figure 2-5. If the height exceeds 80 inches, or 10 blocks, the pier should be double blocked and mortared with rebar as shown in Figure 2-6. If the home is placed in an area subject to flooding, consult an engineer to design a support and anchoring system that will resist flood forces. The Federal Emergency Management Agency has information that also may assist in the design. (See Section 10.)
4. In addition to the piers under the main I-beam of the home, piers should be placed under openings in the perimeter walls and center-mating wall openings greater than four feet. (See Table 2-5 and Figure 2-7.)

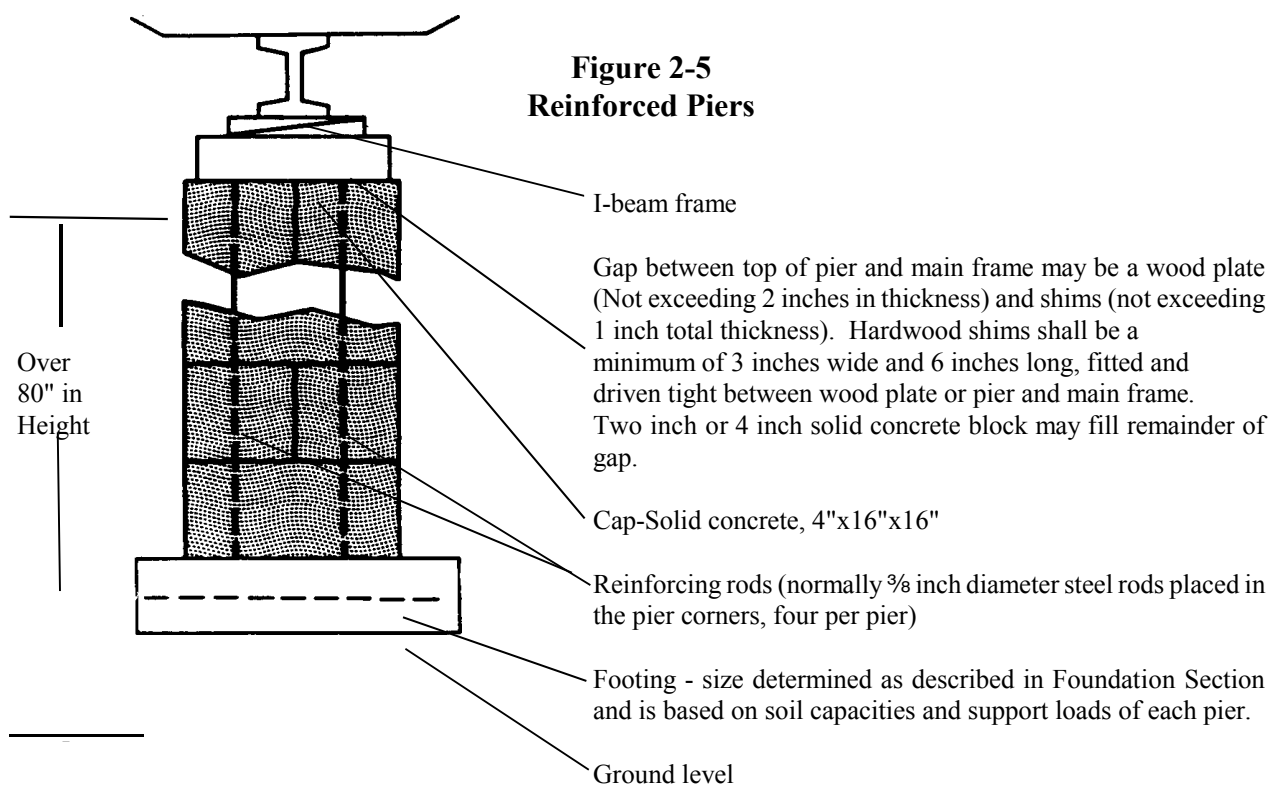
**Figure 2-3**  
**Typical Pier Construction**



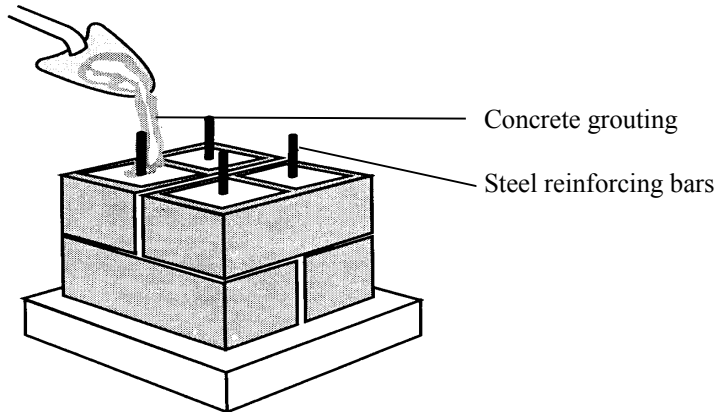
**Figure 2-4**  
**Double Block Pier Construction**



**Figure 2-5  
Reinforced Piers**



Footing placed on firm undisturbed soil or on controlled fill free of grass and organic materials compacted to a minimum load-bearing capacity of 1000 pounds per square foot.



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

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**Table 2-6**

	Roof Live Load (psf)	<b>PIER LOAD AND MINIMUM PIER CAPACITY FOR 12 FOOT WIDE SECTION (pounds)</b>						
		Mating/Perimeter Wall Opening (feet)						
		5	10	15	20	25	30	35
	20	900	1800	2600	3500	4400	5300	6100
	30	1200	2300	3500	4700	5800	7000	8200*
	40	1500	2900	4400	5800	7300	8800*	10200*
Soil Bearing Capacity (psf)	Footing Area (square inches)							
1000	20	144	259	374	504	634	763	878
	30	173	331	504	677	835	1008	1181
	40	216	417	634	835	1051	1267	1469
1500	20	144	173	250	336	422	509	586
	30	144	221	336	451	557	672	787
	40	144	278	422	557	701	845	979
2000	20	144	144	187	252	317	382	439
	30	144	166	252	338	418	504	590
	40	144	209	317	418	526	634	734
3000	20	144	144	144	168	211	254	293
	30	144	144	168	226	278	336	394
	40	144	144	211	278	350	422	490
4000	20	144	144	144	144	191	191	220
	30	144	144	144	169	209	252	295
	40	144	144	158	209	263	317	367

\* Individual supports shall **NOT** support loads greater than **8000 for a single stack of 8"x8"x16" stack of blocks, 14000 pounds for a double stack.**

**Table 2-7**

	Roof Live Load (psf)	<b>PIER LOAD AND MINIMUM PIER CAPACITY FOR 14 FOOT WIDE SECTION (pounds)</b>						
		Mating/Perimeter Wall Opening (feet)						
		5	10	15	20	25	30	35
	20	1000	2000	3000	4100	5100	6100	7100
	30	1400	2700	4100	5400	6800	8100*	9500*
	40	1700	3400	5100	6800	8400*	10100*	11800*
Soil Bearing Capacity (psf)	Footing Area (square inches)							
1000	20	144	288	432	590	734	878	1022
	30	202	389	590	778	979	1166	1368
	40	245	490	734	979	1210	1454	1699
1500	20	144	192	288	394	490	586	682
	30	144	259	394	518	653	778	912
	40	163	326	490	653	806	970	1133
2000	20	144	144	216	295	367	439	511
	30	144	194	295	389	490	583	684
	40	144	245	367	490	605	727	850
3000	20	144	144	144	197	245	293	341
	30	144	144	197	260	326	389	456
	40	144	163	245	326	403	485	566
4000	20	144	144	144	148	184	220	256
	30	144	144	148	194	245	292	342
	40	144	144	184	245	302	364	425

\* Individual supports shall **NOT** support loads greater than **8000 for a single stack of 8"x8"x16" stack of blocks, 14000 pounds for a double stack.**

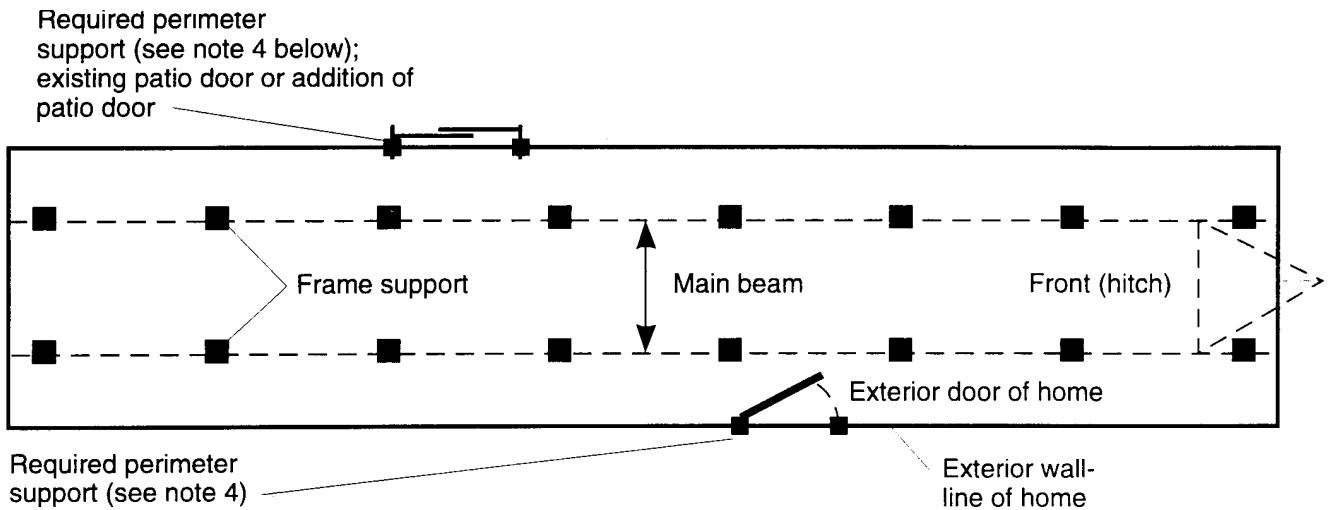


**Table 2-8**

	Roof Live Load (psf)	<b>PIER LOAD AND MINIMUM PIER CAPACITY FOR 16 FOOT WIDE SECTION (pounds)</b>						
		Mating/Perimeter Wall Opening (feet)						
		5	10	15	20	25	30	35
	20	1200	2300	3500	4700	5800	7000	8100*
	30	1600	3100	4700	6200	7800	9300*	10900*
	40	1900	3800	5800	7500	9700*	11600*	13600*
Soil Bearing Capacity (psf)	Footing Area (square inches)							
1000	20	173	331	504	677	835	1008	1166
	30	230	446	677	893	1123	1339	1570
	40	274	547	835	1080	1397	1670	1958
1500	20	144	221	336	451	557	672	778
	30	154	298	451	595	749	893	1046
	40	182	365	557	720	931	1114	1306
2000	20	144	165	252	338	418	504	583
	30	144	223	338	446	562	670	785
	40	144	144	418	540	698	835	979
3000	20	144	144	168	226	278	336	389
	30	144	149	226	298	374	446	523
	40	144	182	278	360	466	557	653
4000	20	144	144	144	169	209	252	292
	30	144	144	169	223	281	335	392
	40	144	144	209	270	349	418	490

\* Individual supports shall **NOT** support loads greater than **8000 for a single stack of 8"x8"x16" stack of blocks, 14000 pounds for a double stack.**

**Figure 2-6  
Typical Blocking Diagram - Single Section Home**



Note (applies to both single and double section homes)

1. See Table 2-2, 2-3 or 2-4 for required pier capacity and spacing.
2. See Table 2-5 for footing size requirements.
3. Piers shall be located 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 .

**Figure 2-7  
Typical Blocking Diagram - Double Section Home**

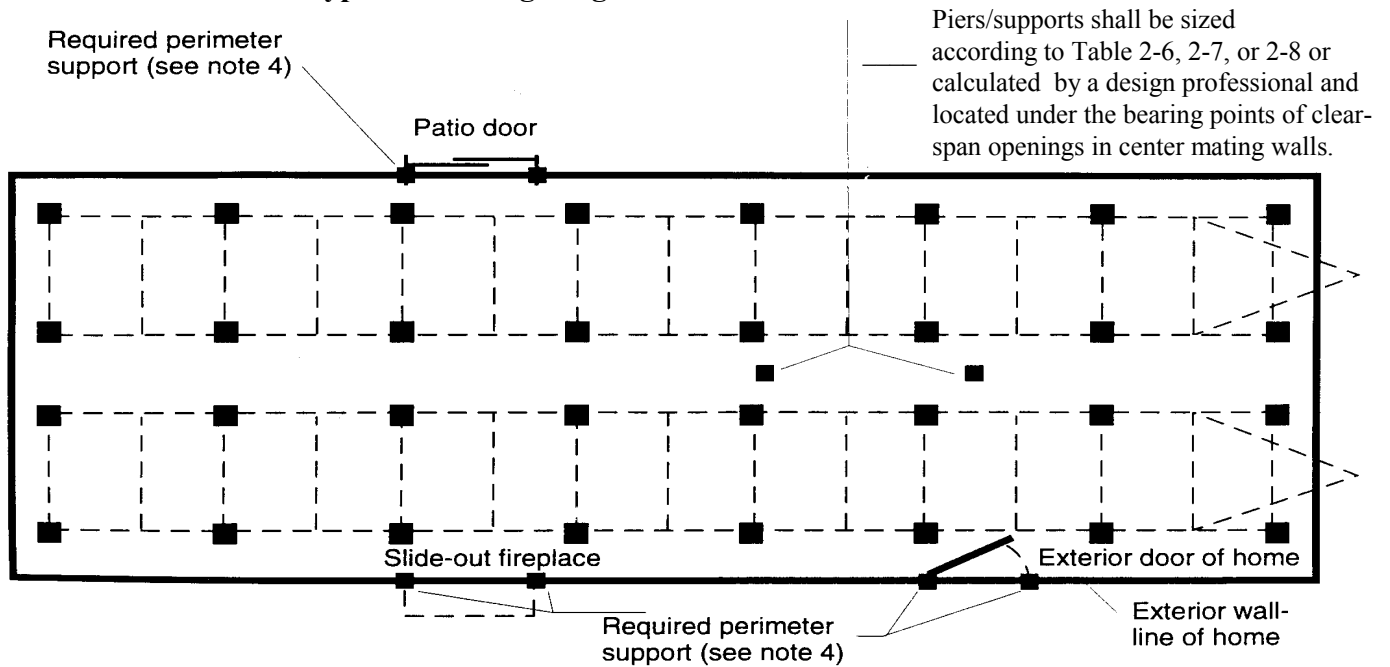
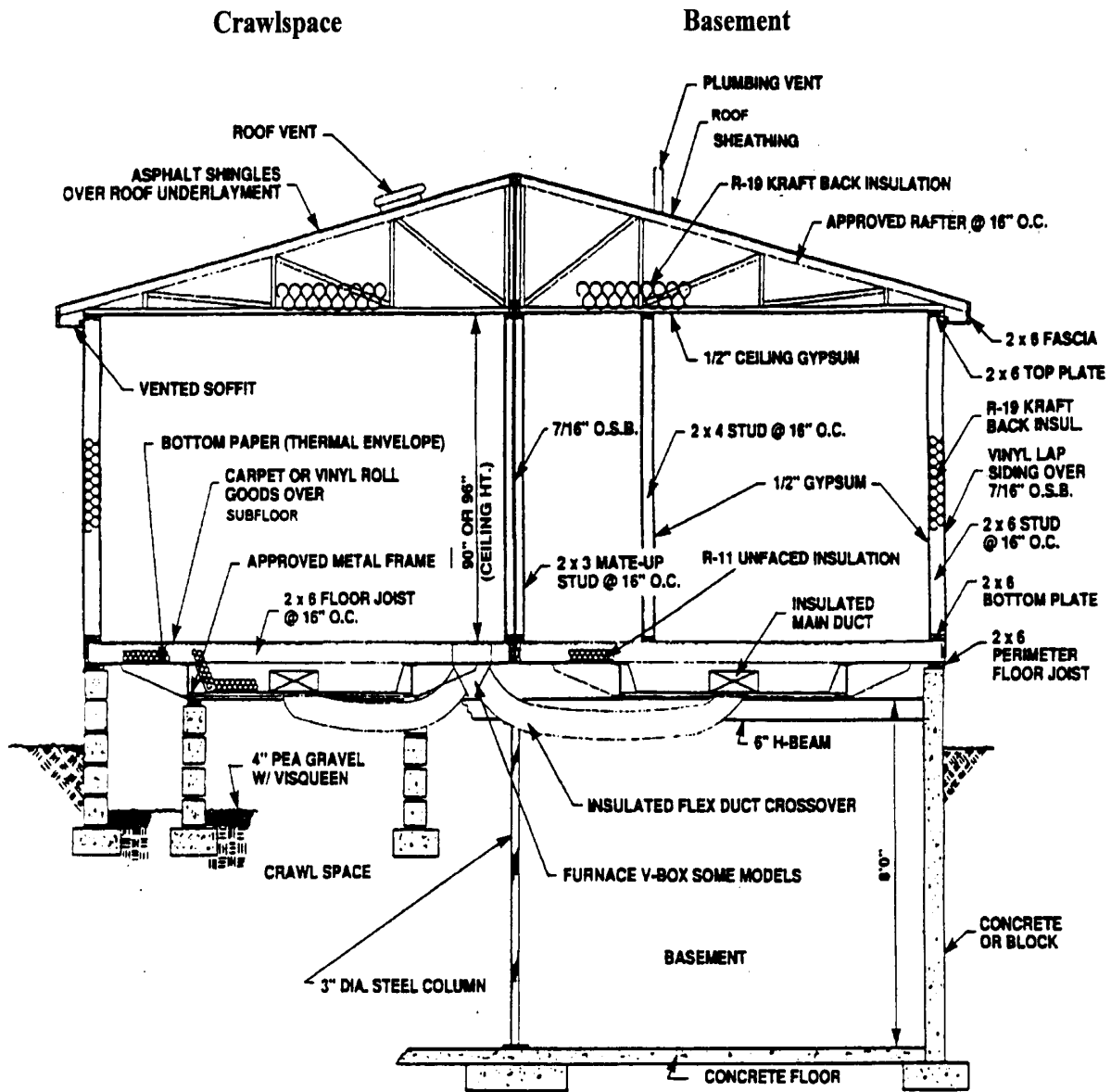


Figure 2-8  
 Typical Cross-section And Foundation of a Manufactured Home Placed on a Permanent Foundation



### 3. STRUCTURAL CONNECTIONS, SEALING AND PATCHING

Multi-section manufactured homes should be secured to immobilize each section, allow for the transfer of required loads, and protect interior and enclosed spaces.

#### Ridge Beam Connections

Ridge beams of multi-section manufactured homes should be secured together according to Table 3-1 or –

- (1) With ½ inch diameter carriage bolts spaced at a maximum of 48 inches on center at 90 degrees. (See Figure 3-1.);
- (2) With ¾ inch diameter lag screws with full penetration, with washers, staggered and spaced equally along the length of the ridge beam at a maximum of 24 inches on center at 45 degrees maximum angle (See Figure 3-1.);
- (3) With 4 inch by 10 inch by 18 gauge galvanized metal straps spaced equally along the length of the ridge at a maximum of 48 inches on center and fastened with ten 10d nails or equal on each end (See Figure 3-2.);
- (4) When a ridge beam center line support is located on one section (side) only, eight ½ inch diameter bolts with washers spaced 4 inches on center, installed at 90 degrees and centered over the support should secure the two ridge beams together (See Figure 3-3.);
- (5) All ridge beam bolt or lag screws should be installed in an area where there is solid ridge beam material between the multi-sections. Ridge beams should be pre-drilled for lag screws and bolts.

**Table 3-1  
Multi-Section Fastening Schedule**

CONNECTOR LOCATION	FASTENER SIZE	FASTENER ANGLE	FASTENER SPACING
Roof ridge beam connection	½ inch carriage bolts	90 degrees	48 inches on center
Roof ridge beam connection	¾ inch lag screws with washers	45 degrees or less	24 inches on center
Roof rafter connection	4 inch by 10 inch 18 gauge straps with 10-10d nails	90 degrees	48 inches on center
Floor rim joist connection	¾ inch lag screws with washers	45 degrees or less	32 inches on center
Floor connection	Marriage clips	90 degrees	Where installed

Figure 3-1

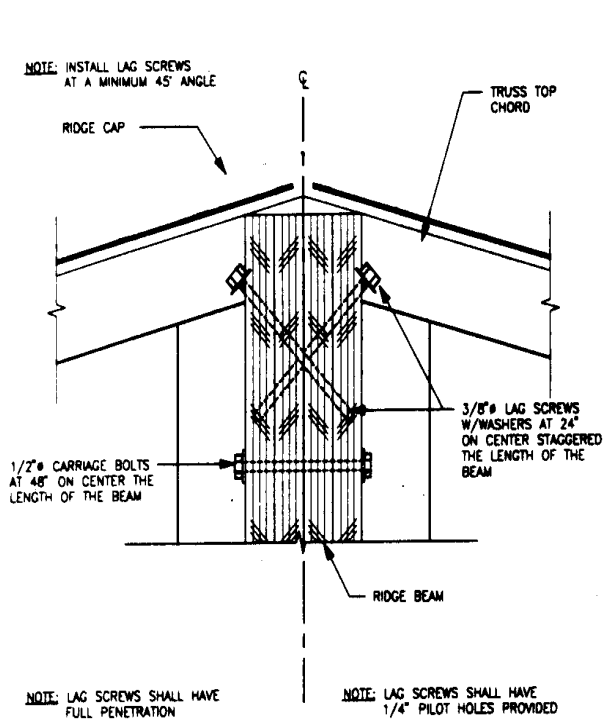


Figure 3-2

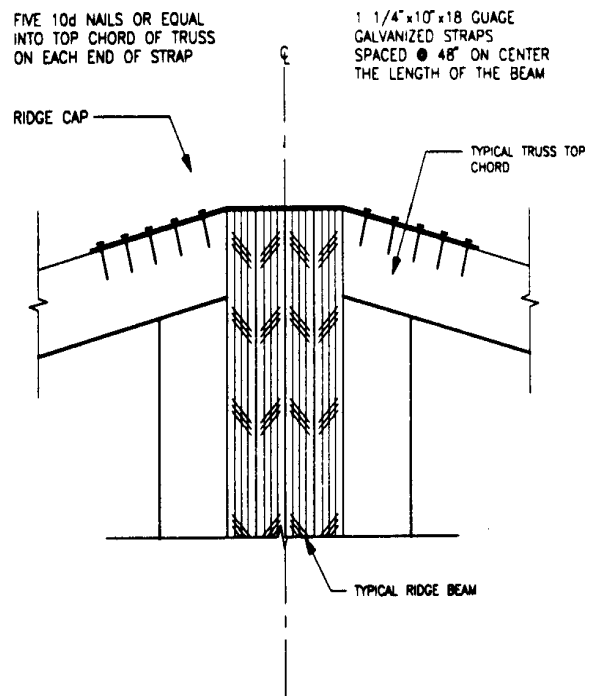
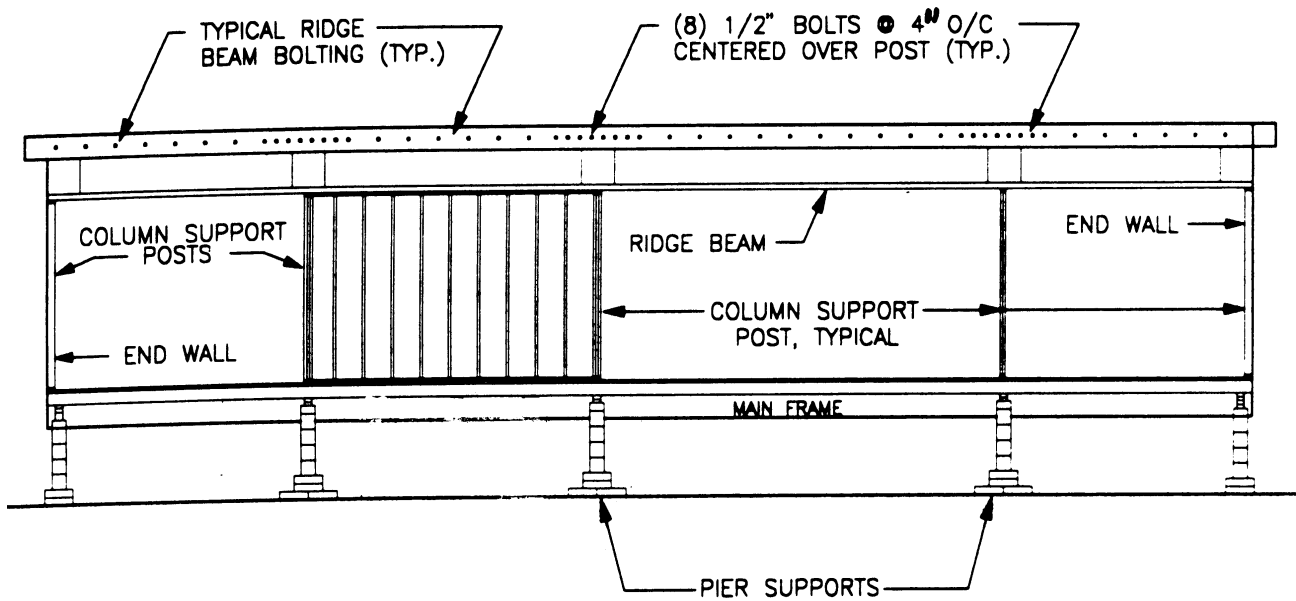


Figure 3-3

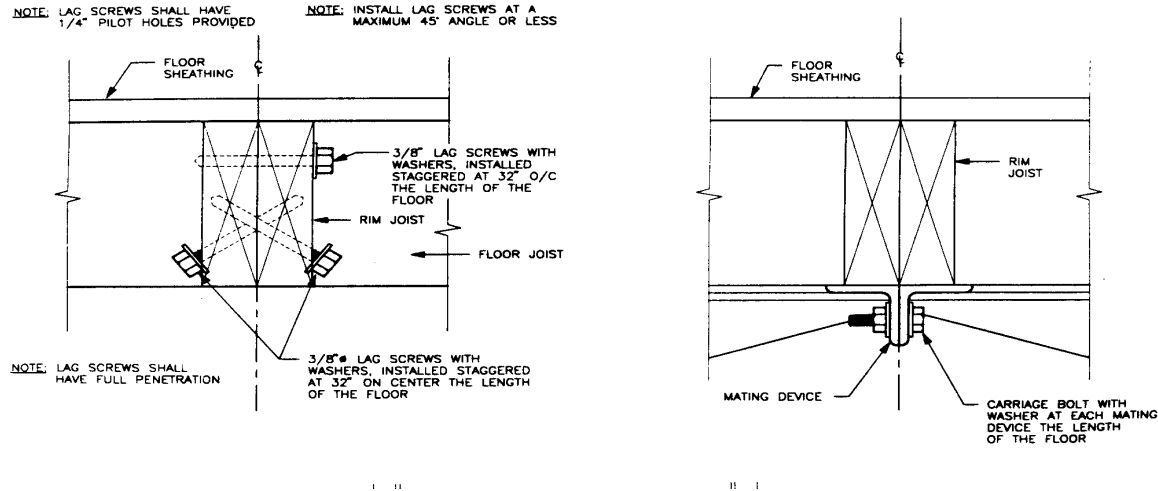


## Floor Connections

Floors of multi-section homes should be secured together according to Table 3-1 (Figure 3-4.) or with the manufacturer's installed mating devices bolted together with appropriately sized bolts and washers. (See Figure 3-5.)

**Figure 3-4**

**Figure 3-5**  
**Floor Connections**



## Lag Screws

Lag screws, when used, should be provided with 1/4 inch pilot holes and be installed to provide full penetration of the lag screw into both beams or joists.

## Sealing

During installation, joints between all multi-section homes should be cleaned and shimmed where the gap exceeds 1/2 inch top or bottom; then sealed with a weather-stripping gasket material to limit heat loss and prevent air, moisture and other damaging infiltration. The gasket material should be durable, non-porous caulking, closed cell foam, urethane or sill seal. Caulking, if used, should be capable of compressing and stretching. Sill seal, if used, should be a minimum of 5 1/2 inches wide and attached with fasteners staggered at 6 inches on center.

## Patching

All cuts, holes or tears in the bottom board or floor insulation including but not limited to areas around structural connections and plumbing, mechanical and heating equipment penetrations should be adequately repaired to prevent the entrance of rodents, to limit heat loss and to prevent air, moisture and other damaging infiltration.

#### 4. ANCHORING OF THE HOME

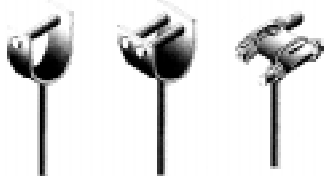
The Illinois Mobile Home Tiedown Act requires all manufactured homes that are moved or set up on site after January 1, 1980, to be tied down in accordance with rules promulgated by the Illinois Department of Public Health. It is the homeowner's responsibility to ensure that the home is tied down within 30 days after the home is installed. There are no mandatory requirements for the installers of anchoring equipment but the Department recommends that a certified manufactured home installer be used. Homeowners may do their own installation. Anyone who installs tiedown equipment must comply with the requirements of the Manufactured Home Tiedown Code.

Only equipment approved by the Department can be used. You may contact the Department at 217-782-5830 for a list of approved equipment. The equipment manufacturer must provide instructions with all equipment. These instructions, in addition to the installation instructions provided by the home manufacturer, must be followed.

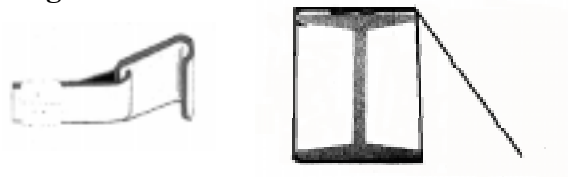
There are two types of anchors: ground anchors and concrete anchors. Ground anchors are rated for different types of soils. The proper anchor must be used for the specific soil type. For ground anchors, the use of a shear device (plate or concrete cylinder) must be utilized if the anchor is not installed in line with the direction of intended resistance. Locate all underground utilities before installing ground anchors. You should call JULIE (800-892-0123) 48 hours prior to installation for assistance in locating underground utilities. Provisions should be taken to protect the home from damage by frost heave if the foundation system for the home does not extend below the frost depth.

When installing concrete anchors, the minimum distance from the edge of the concrete and the size and condition of the concrete specified by the manufacturer are important. Concrete anchors must be provided with adequate concrete to resist the required minimum forces established in the Manufactured Home Tiedown Code. An anchor designed to withstand a pull of 4725 pounds must be imbedded in 4725 pounds (1.16 cubic yards) of concrete.

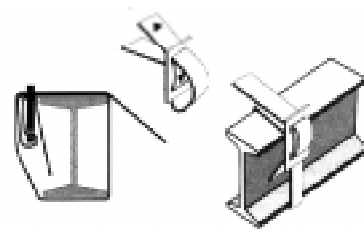
**Figure 4-1  
Anchor Equipment**



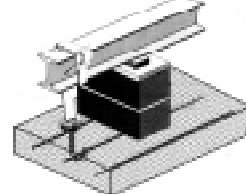
**Single and Double-Headed Anchors**



**Frame Hook Clamp with Strap Tie**



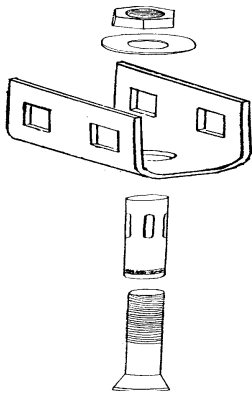
**Strap with Buckle Frame Tie**



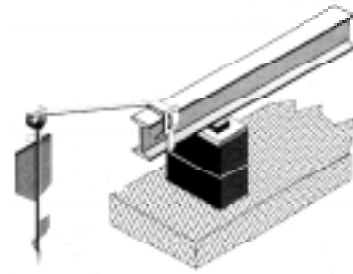
**Concrete Anchor with Strap and Buckle Tie**

(Note that the installation shown does not resist the horizontal wind forces)

**Figure 4-1  
Anchor Equipment**



**Expansion Bolt Concrete Anchor**

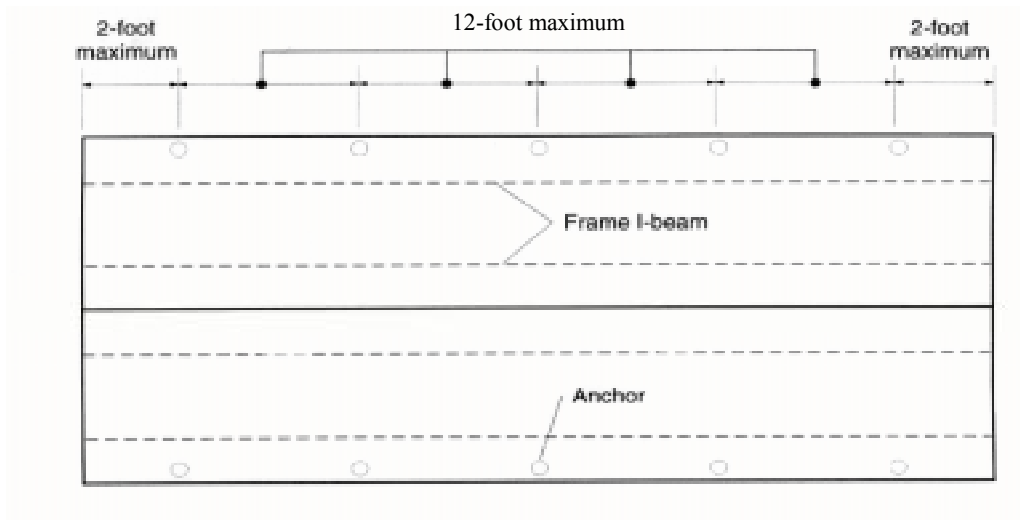


**Ground Anchor with Stabilizer Plate  
Strap with Frame Buckle Tie**

**Figure 4-2  
Anchor Spacing**

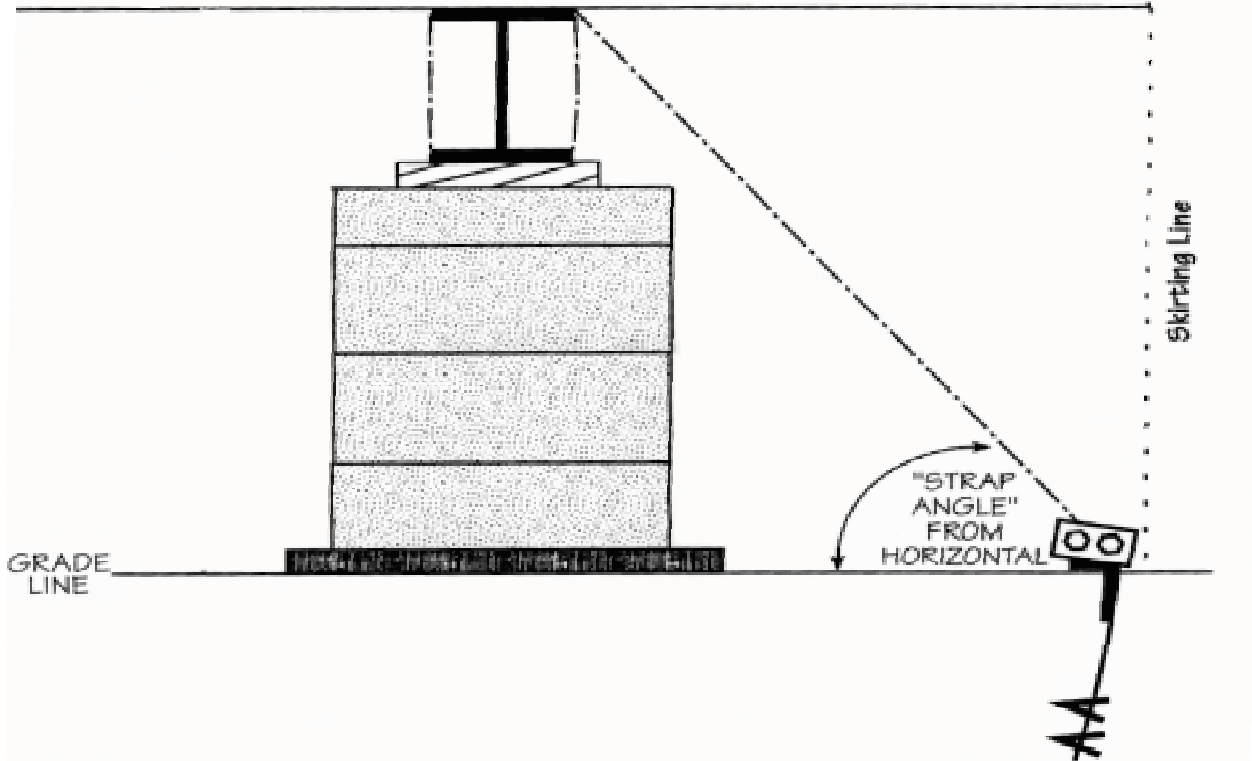
(Note: This spacing shown also applies to single section homes)

Anchors must be located within 2 feet from the ends of the home and spaced a maximum 12 feet along the length of the home.





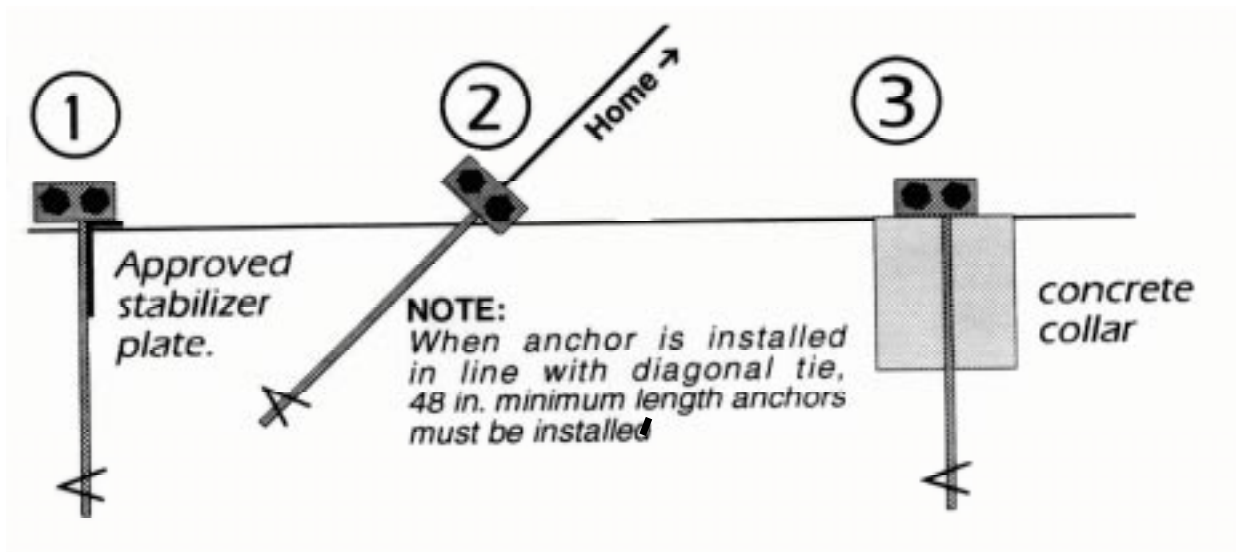
**Figure 4-3  
Tie Strap Angle**



The angle formed between the tie and the ground shall be between 40 and 50 degrees. If this angle exceeds 50 degrees when the tie is connected to the nearest I-beam, a tie shall connect from an anchor to both I-beams of the unit.

**Figure 4-4  
Stabilizing Methods**

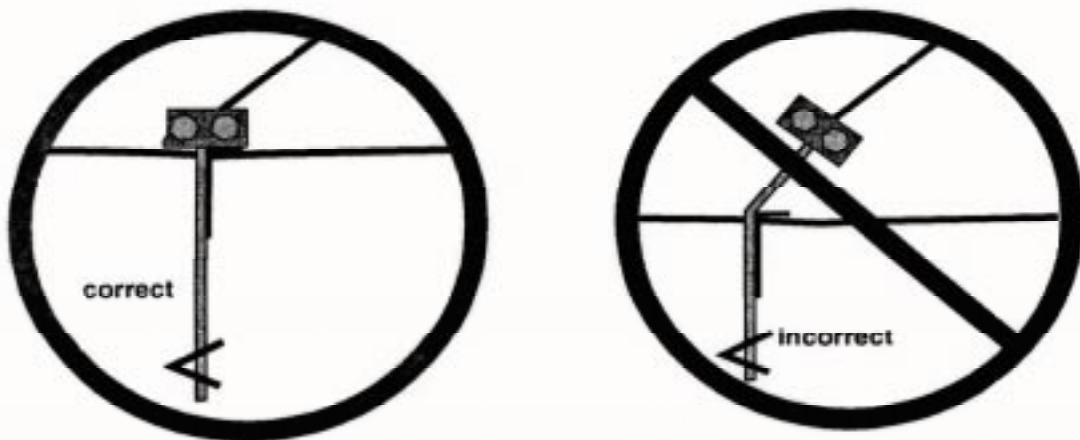
All ground anchors must be stabilized as per one of the methods shown below.



**Figure 4-5**  
**General Anchoring Information**



**WARNING:** Rock anchors can fail under high wind loads if they are not installed into solid rock. Rock surface must be within 1" of the rock anchor tension head in order to prevent failure. Rock anchor drive rods must be installed in accordance with manufacturer's instructions.



**WARNING:** Ground anchors can fail under high wind loads if they are not installed to their full depth, resulting in severe damage to the home.

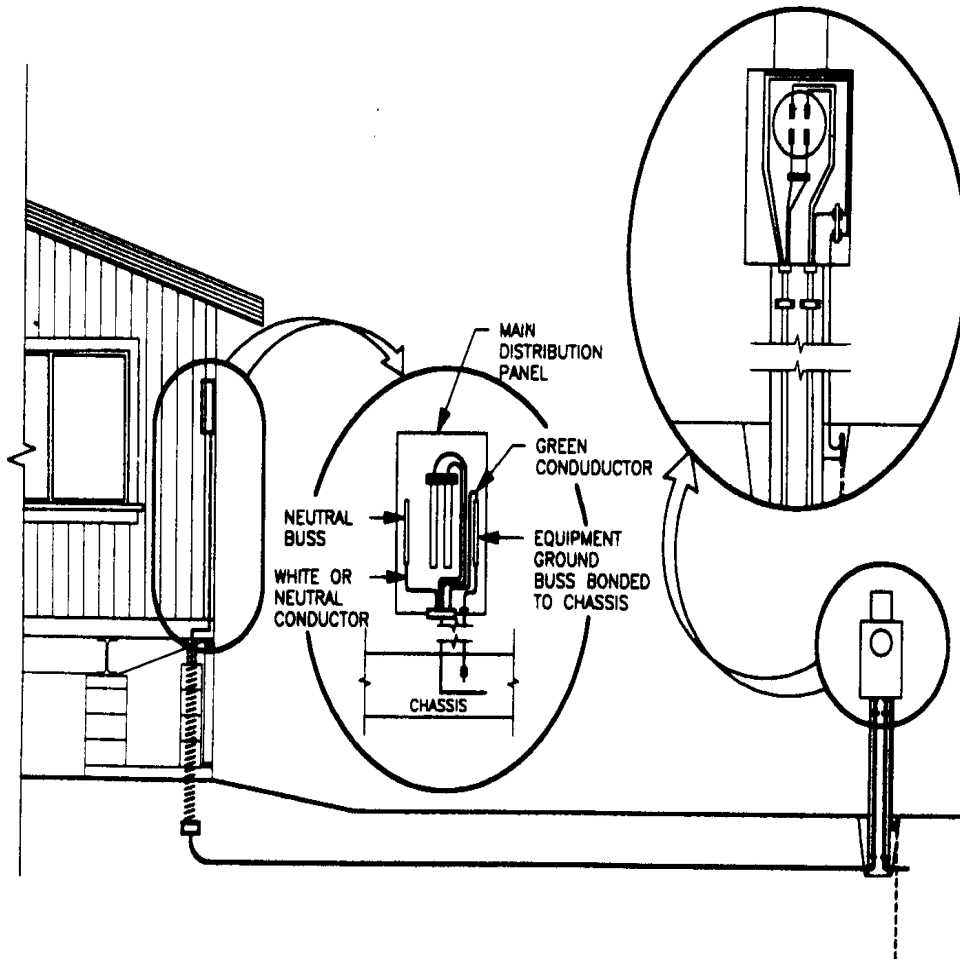


**WARNING:** Frame tie connections must come off the "top" of the frame in order to prevent frame damage and to keep the tie from disconnecting from the I-beam if loosened.

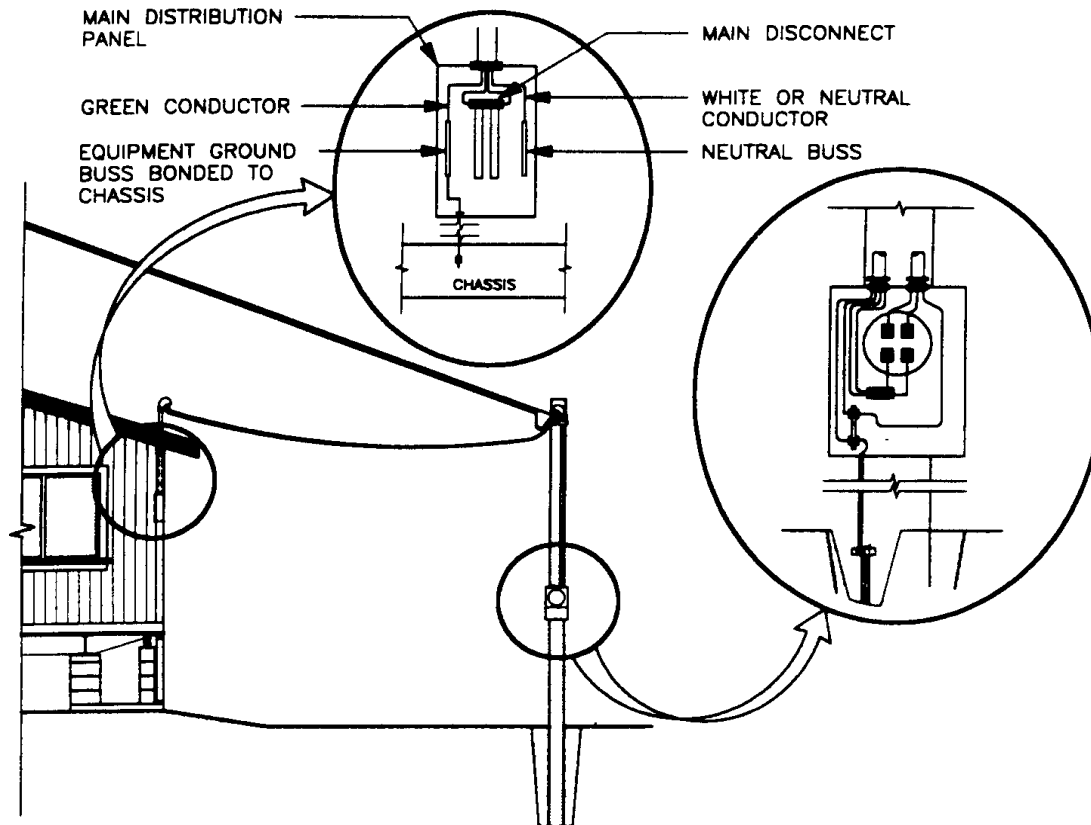
## 5. ELECTRICAL

An adequate power supply must be available at the site. An inadequate supply may result in improper operation and possible damage to motors and appliances. It may also increase the electricity costs. The current rating in amperes of the home can be found on the tag located on the outside next to the feeder or service entrance, and also on the electrical distribution panel. All wiring must be in accordance with the National Electrical Code. Figure 5-1 shows typical main components of the electrical system.

**Figure 5-1**  
**Underground Feed**  
**Typical Electrical Systems**



**Figure 5-2  
Overhead Feed  
Typical Electrical Systems (Continued)**



The home is designed for connection to an electrical wiring system rated at 120/240 volts AC. Proper and safe connection depends on the type of supply system with which the home is equipped. The connection to the home is a feeder (unless it is equipped with a factory-installed service master base) requiring wiring at the site. The following paragraphs describe the wiring and grounding of electrical feeders.

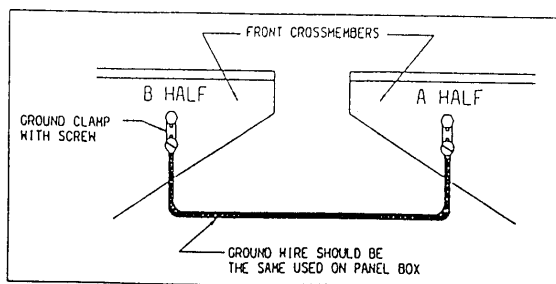
The main breaker and the label on the electrical distribution panel give the feeder current capacity in amperes. Using this information, determine the required feeder size from Table 5-1. These sizes are based on an ambient temperature of 75 degrees Fahrenheit and do not take voltage drop into consideration. Feeders require four insulated conductors, one of which must be an equipment-grounding conductor, and must be approved for the intended use (above or below ground installation).

Homes equipped with overhead (mast weatherhead) feeder entrances contain the necessary conduit to the electrical distribution panel. However, you must install four feeder conductors (not provided) on site.

Homes with an under the floor entrance come with a permanently attached conduit raceway that runs from the electrical distribution panel and terminates under the floor. Install an approved conduit fitting or junction box at the termination point.

The home must be properly grounded to protect the occupants. The only safe and approved method of grounding the feeder-connected home is through the grounding bar in the electrical distribution panel. This bar grounds all noncurrent-carrying metal parts of the electrical system at a single point. The grounding conductor of the power supply feeder cable connects the grounding bar to an electrical ground. Follow the feeder connection procedures described to achieve proper grounding. (Exception: Homes with a factory-installed service meter base must be grounded differently. Refer to the specific manufacturer's instructions.) Isolate (insulate) the grounded circuit conductor (neutral or white wire) from the grounding conductors (green wires) and from equipment enclosures and other grounded parts. Isolate (insulate) the neutral circuit terminals in the distribution panel board and in ranges, clothes dryers, and counter-mounted cooking units from the equipment enclosures. Bonding screws, straps or buses in the distribution panel board or in appliances should have been removed and discarded at the manufacturing facility. You may provide the required continuity of ground between sections of multi-section homes through a metallic roof or siding, or by bolting outriggers together. When the outriggers or other overlapping metal joints of adjoining sections are not bolted together on houses with shingled roofs and non-metallic siding, install a ground wire connection between the metal frame members. This bonding connection is commonly made with a #8AWG bare copper wire or other connection between the parts (see Figure 5-2.), using the approved lugs with bolts, star washers and nuts, or self-tapping screws that are shipped with the home.

**Figure 5-3**  
**Multi-section Home Grounding**



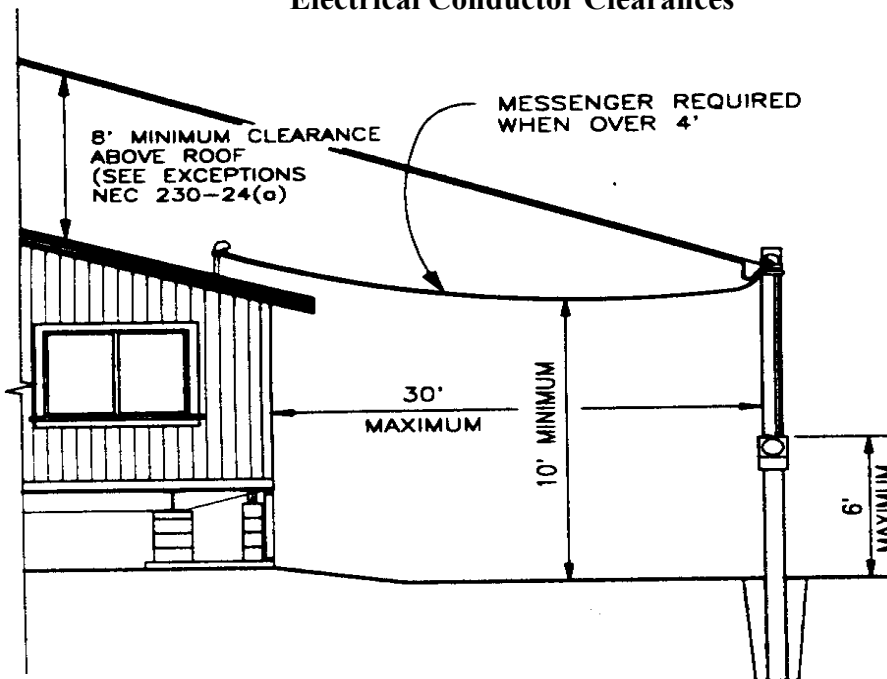
Grounding to a rod, a water pipe, or through the home's hitch caster will not satisfy the important grounding requirement. Never use the neutral conductor of the feeder cable as a ground wire. **Do not ground the neutral bar in the electrical distribution panel.**

Connections should be made only by a qualified electrician or certified manufactured home installer using one of the following methods:

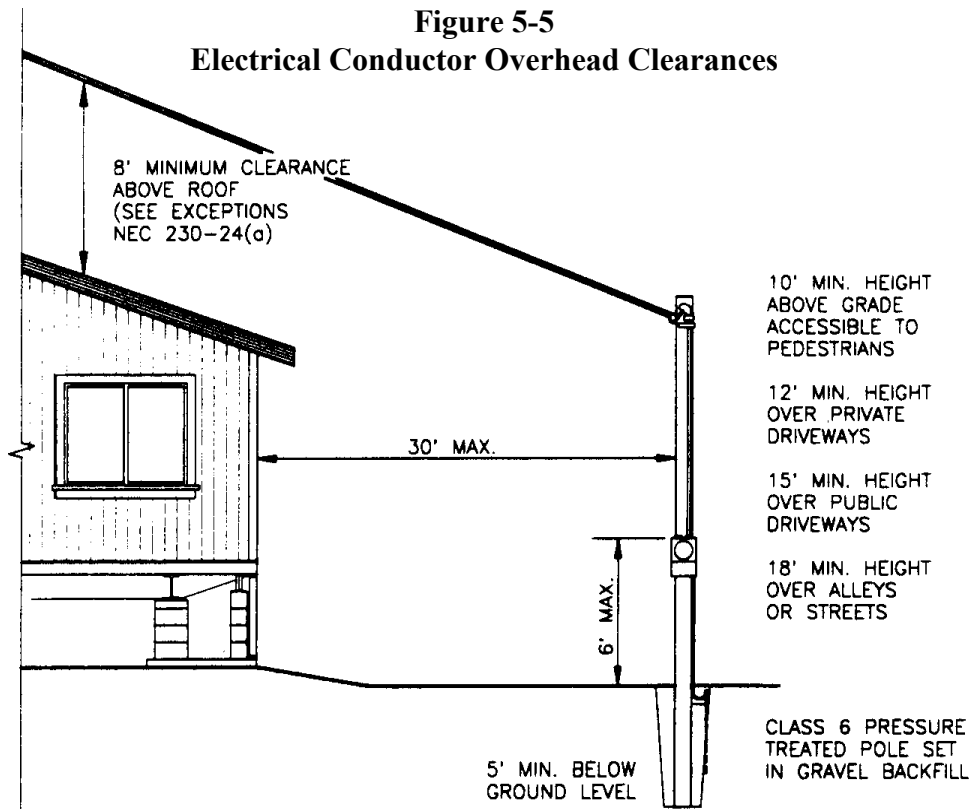
1. Older homes may be equipped with a permanently-connected 50-ampere feeder chord stored under the floor. If so, it is ready to be plugged into a 50-ampere, 3 pole, 4 wire, 120/240 volt grounding service receptacle after the electrical tests have been completed. Unless the home is equipped for only 50-ampere service, do not attempt to use a feeder chord or "pigtail" connection. Connect homes equipped for 100 ampere in accordance with the National Electrical Code.

2. The routing, connection and support of the service drop must meet local codes. Homes equipped this way contain all necessary conduit to the electrical distribution panel. However, the four feeder conductors (not provided) must be installed on site. If the masthead is located above the roof overhang, allow a minimum clearance of 8 feet above all roof points over which the conductors pass. There are two exceptions to this rule (See Figures 5-4 and 5-5): (1) The vertical clearance may be reduced to 3 feet if the roof has a minimum slope of 4 in 12; and (2) The vertical clearance may be reduced to 18 inches if no more than 4 feet of service drop conductors pass above the roof overhang, and if they terminate at a through-the-roof raceway or approved support. A minimum clearance must also be provided from the final grade to the service-drop conductors. This measurement may vary from 10 feet to 18 feet, depending on the type of traffic anticipated below the service drop (refer to the National Electrical Code (NEC)). Unless impractical, locate service heads above the point of attachment of the service drop conductors and make them rain-tight. If individual conductors do not extend downward, form drip loops. (See Figures 5-4 and 5-5.)

**Figure 5-4**  
**Electrical Conductor Clearances**

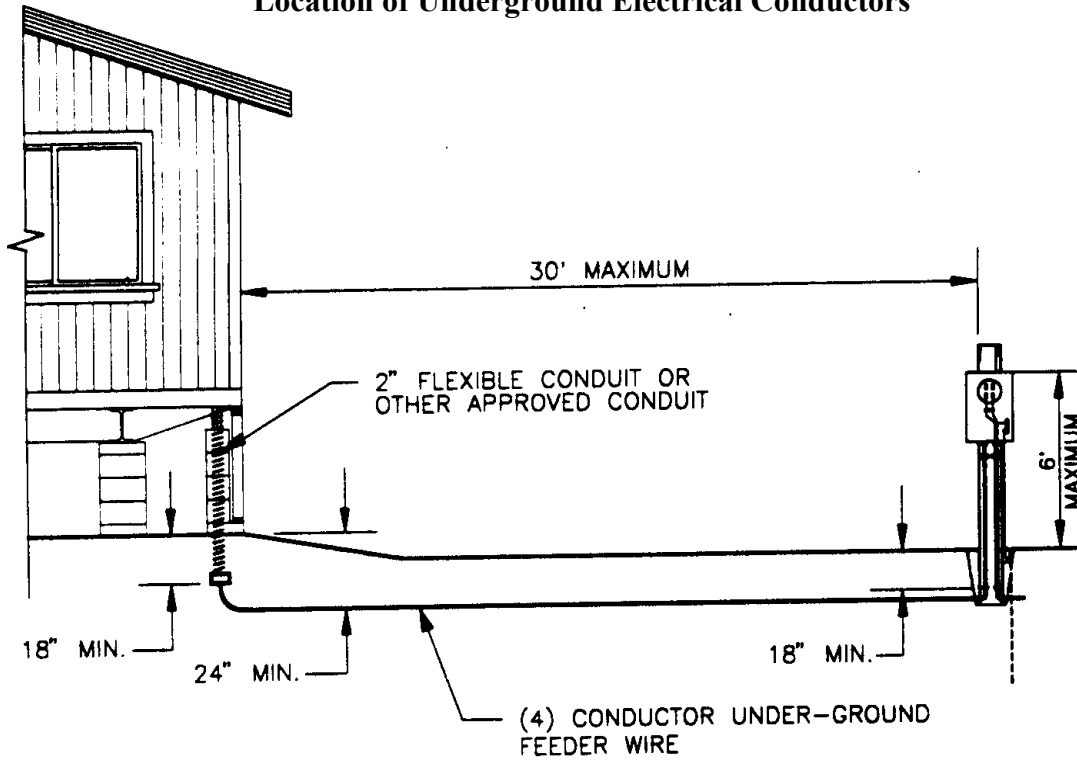


**Figure 5-5  
Electrical Conductor Overhead Clearances**



3. A raceway from the main panel board to the underside of the home allows for installing an approved junction box or fitting, which must be used to connect it to the supply raceway. Install properly-sized conductors from the main power supply to the panelboard. Refer to Table 5-1 for the conductor and junction box requirements. The homeowner or installer must provide the supply connection including the four feeder conductors, junction box and raceway connectors. Protect conductors emerging from the ground from a minimum of 18 inches below grade to 8 feet above grade, or to a point of entrance to the home. The distance measured from the top surface of a buried cable, conduit, or raceway to the finished grade must meet the minimum burial requirements outlined in the National Electrical Code. Use a moisture-proof bushing at the end of the conduit from which the buried cable emerges. (See Figure 5-6.)

**Figure 5-6**  
**Location of Underground Electrical Conductors**



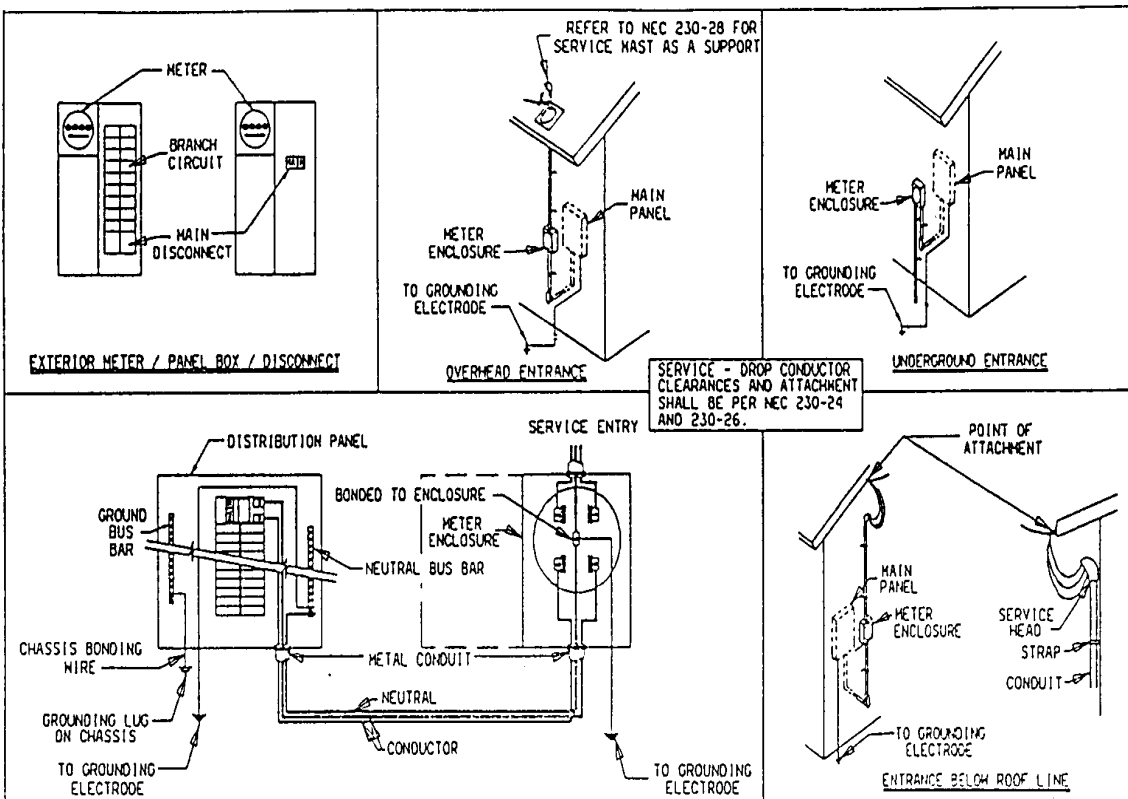
**Table 5-1**

<b>ELECTRICAL FEEDER and EQUIPMENT SIZES</b>									
Feeder and Main Breaker Sizes	Minimum Size of Junction Box	Conduit (inches)	Conductors (Red or Black) (AWG)		Neutral (White) (AWG)		Grounding (Bare or Green) (AWG)		Chassis Bond (Bare or Green) (AWG)
			Copper	Aluminum	Copper	Aluminum	Copper	Aluminum	Copper Only
100 amp	10x10x4	1¼	3	2	3	2	6	4	8
150 amp	10x12x4	1½	1	2/0	2	1/0	6	4	8
200 amp	12x12x4	2	2/0	4/0	1	2/0	6	4	8



4. When a factory-installed service meter base is provided for homes to be installed on a permanent perimeter foundation, either an overhead or underground entrance may be provided. The exterior equipment and enclosure must be weatherproof, and conductors must be suitable for use in wet locations. When a meter base is installed on the home, a main bonding jumper is is to be installed to connect the equipment-grounding conductor and the service-equipment enclosure to the grounded conductor of the system within the service equipment. The main bonding jumper may be a wire, a bus or a screw. A grounding electrode conductor shall be used to connect the equipment-grounding conductors, the service-equipment enclosures and the grounded service conductor to the grounding electrode as shown in Figure 5-7. The homeowner must provide the grounding electrode conductor(s), which should be a # 4 (minimum) copper in one piece (not spliced). The grounding electrode should be an 8-foot length of 1/2 inch diameter copper rod or 3/4 inch galvanized steel pipe. Drive the entire length of the rod into the ground at least 12 inches below the surface and 2 feet from the foundation, or bury it horizontally in a 2 1/2 foot deep trench. Connect the grounding conductor wire to the grounding electrode with a grounding clamp, and cover with 12 inches of earth. For added protection, homes with metal frames or siding should be connected to the earth by means of additional bonding-jumper ground-fault return paths to underground metallic water pipes, ground-rings, additional ground rods, etc., to protect the buildup of hazardous voltage.

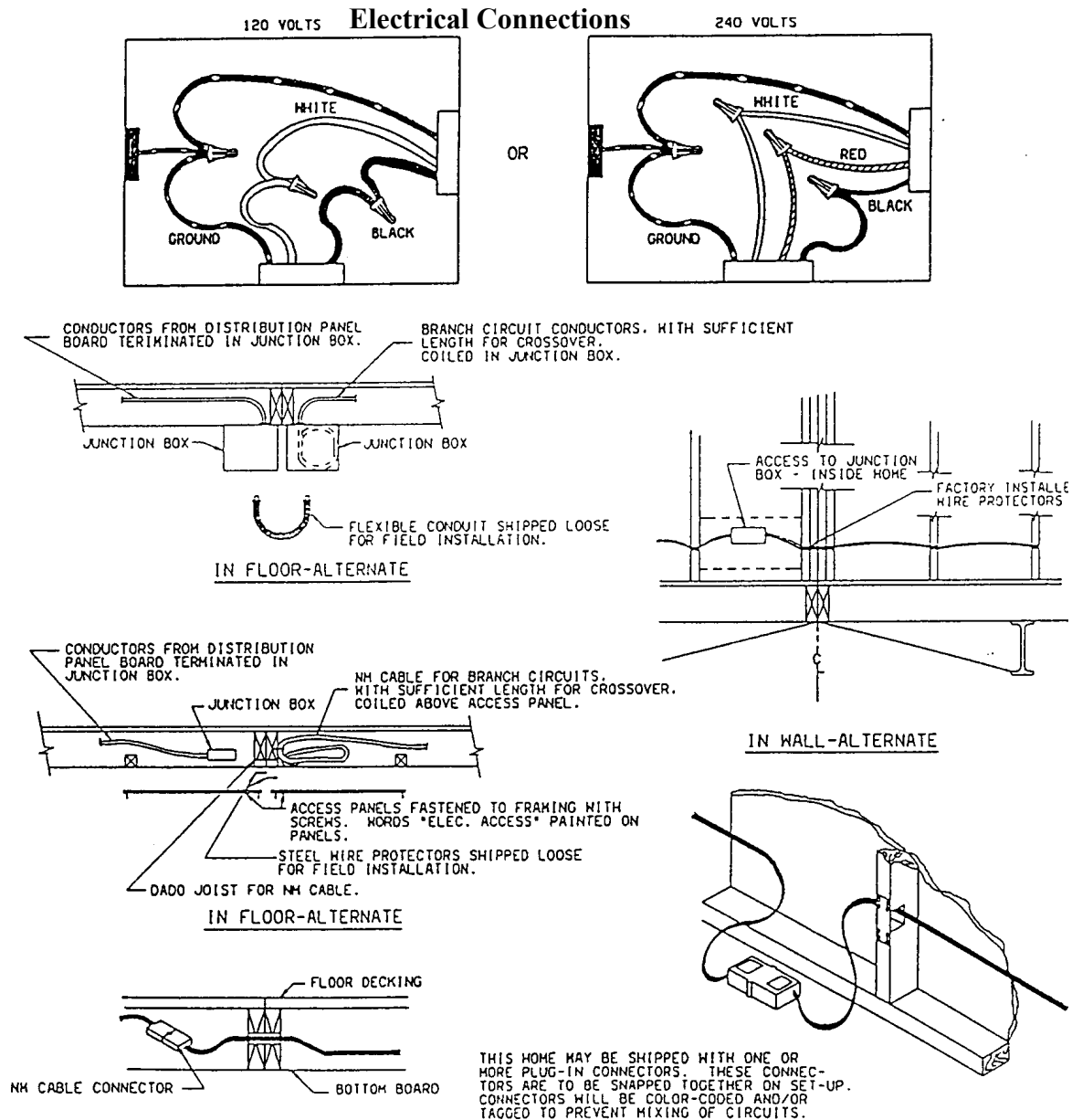
**Figure 5-7**  
**Installation of Factory Installed Meter Bases**



**CAUTION: THESE DIAGRAMS APPLY ONLY TO FACTORY INSTALLED METER BASES FOR HOMES TO BE PLACED ON PERMANENT PERIMETER FOUNDATIONS**

5. For multi-section homes, refer to Figure 5-8 for typical crossover wiring connections (located along the centerline between the sections). Crossover locations can be distinguished by metal junction boxes or access cover panels. Remove these panels and connect the enclosed wires as illustrated in Figure 5-8. Some crossover connectors plug together and do not require junction boxes. When the mating section contains a bathroom that requires ground fault circuit interruptor (GFCI) protection for the receptacle, it is important that the bathroom circuit wiring be connected to the proper GFCI protected circuit in the power supply panel. Bonding between the sections of a home with metal siding or metal roof is provided by the overlapping metal joints fastened with metal screws. Bonding between sections of a home with non-metallic siding and a non-metallic roof must be accomplished at set-up by connecting a #8 AWG bare copper wire between the metal frame members using the approved grounding lugs with bolts, star washers, and nuts or self-tapping screws that are shipped with the home. (Refer to Figure 5-2.)

**Figure 5-8**



Conduct the following tests before any electrical power is supplied to the home:

1. Conduct a continuity test by placing all branch circuit breakers and switches controlling individual outlets in the "on" position. The test should give no evidence of a connection between any of the supply conductors (including the neutral) and the grounding circuit. You may use a flashlight continuity tester.
2. Using a continuity tester, test noncurrent-carrying metal parts to assure continuity to ground. The following parts should be checked:
  - \*appliance enclosures, including fans
  - \*fixture enclosures and canopies
  - \*metal siding and roofs
  - \*metal water supply and gas lines
  - \*metal ducts (except foil covered insulated ducts)
  - \*the home's frame

On multi-section homes, perform this test only after completing all electrical and bonding connections between the sections. **NOTE:** Grounding is not required on the metal inlet of plastic water system or on plumbing fixtures such as tubs, faucets, shower risers and metal sinks when they are connected only to plastic water and drain piping.

Conduct the following three tests after turning on the main circuit breaker and each individual circuit breaker. **CAUTION:** Allow the water heater to fill completely before activating the water heater circuit. Failure to do so will cause the water heater elements to burn out. Replacement of the elements is not covered by the warranty.

1. With the receptacle and lighting circuits energized, check the polarity and grounding of each 120-volt receptacle and light socket using a polarity tester capable of determining an incorrect wiring configuration. A conversion device may be required to test various fixture bulb sizes and outlet configurations. Investigate any indication of reversed polarity, open grounds or shorts, and correct them.
2. Make certain that all receptacles requiring GFCI protection are in fact on the correct circuit(s). Check each ground fault interrupter device by pushing the test button to determine if the power route to the receptacle has been interrupted, or follow the manufacturer's instructions. Replace any GFCI that does not operate properly.
3. Check all light fixtures by placing a bulb in the socket and turning the switch on and off. Using a pigtail light, check all 240 volt receptacles to determine if both legs of the circuit are powered. Check all 120 volt receptacles to be sure that each is operational. Switched receptacles require the switch to be turned on and off. It is not necessary to check appliances, but their power sources must be assured. Failure of any electrical wiring or fixtures requires repair and retesting.

**REMINDER-** Consult your local code for any additional requirements of the local building

authority.

## 6. PLUMBING

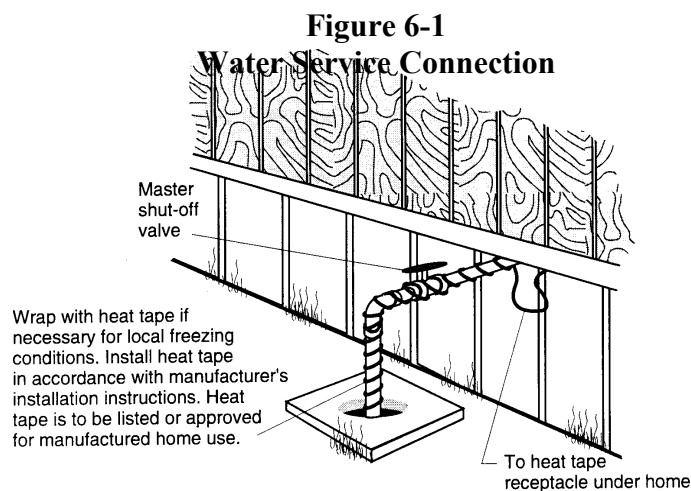
As specified by the Illinois Plumbing License Law (225 ILCS 320 et seq.), all plumbing installed in Illinois shall be done by an Illinois licensed plumber or the owner or occupant of the homes and shall comply with the Illinois Plumbing Code. Be advised that a person who installs plumbing and is not licensed or is not the owner or occupant of the home can be fined up to \$5,000 in accordance with the provisions of Illinois Plumbing License Law and Plumbers Licensing Code. A copy of the Illinois Plumbing License Law, Plumbers Licensing Code and the Illinois Plumbing Code can be obtained by sending a \$40 check payable to the Illinois Department of Public Health, Plumbing Program, 828 S. Second St., Springfield, IL 62704. Publications from the Department of Public Health are also available on the internet at <www.idph.state.il.us.>.

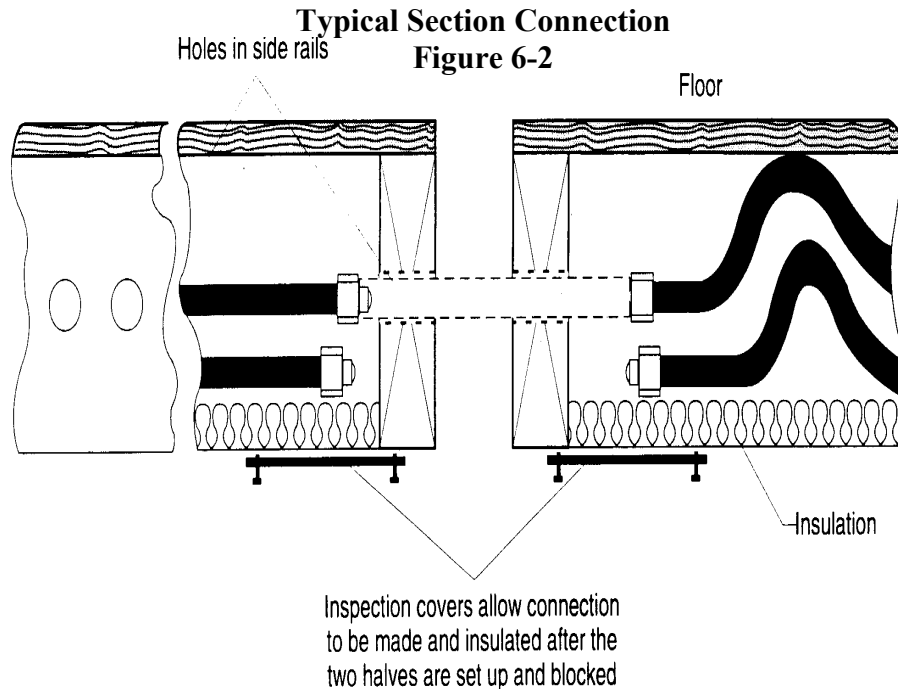
### Water System

All premises intended for human habitation or occupancy shall be provided with a potable water supply. The water shall be sufficient in volume and at pressure adequate to enable plumbing fixtures to function properly and without undue noise under normal conditions of use. Water supply materials to the home shall meet the material specification for water service pipe and piping above the ground shall meet the specifications for water distribution piping as listed in Table A of the Illinois Plumbing Code (Appendix A). Each home shall be supplied with a minimum  $\frac{3}{4}$  inch inside diameter service rated a minimum of 160 pounds per square inch (psi).

The distribution piping shall be adequately supported. Plastic piping shall be supported with approved materials at 4 foot intervals. Galvanized piping shall be supported with ferrous supports at 8 feet intervals. Copper piping shall be supported at 8 foot intervals and the supports shall be of material which will not react with the copper piping material.

Precautions should be taken by the homeowner to prevent water lines from freezing. Listed heat tapes shall be installed according to instructions provided. (See Figure 6-1.)





### Sewer Drain System

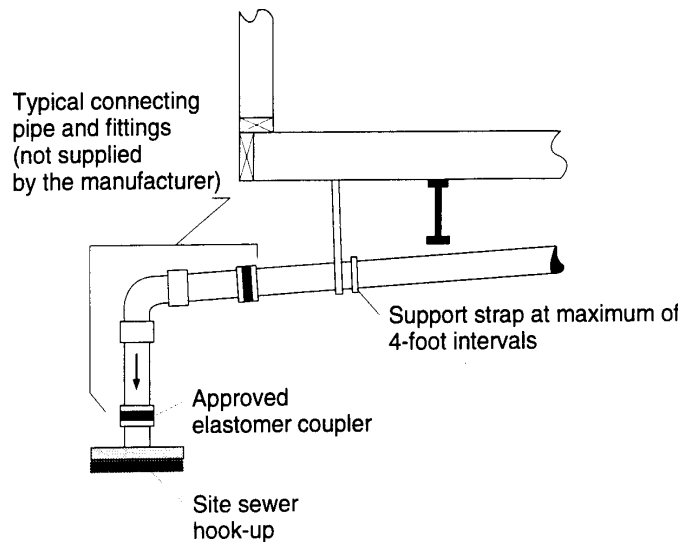
Each home shall be provided with an approved sewage disposal system. The sewage drain system materials for above and below ground piping for a distance 5 feet from the perimeter of the home, shall be rated for building drain material as listed in Table A of the Illinois Plumbing Code (Appendix A). Different types of plastic drainage pipe shall not be glued together but instead shall be connected with approved adapters.

Each plumbing fixture connected to the sanitary drainage system shall be equipped with a liquid seal-trap. The trap seals shall be provided with adequate venting so that there will be no danger of siphonage, aspiration or forcing of the trap seals under conditions of ordinary use. Full size cleanouts shall also be provided for the drainage system at changes in direction greater than 60 degrees and at 50 foot intervals in order to clean out any stoppages in the system.

The sanitary drainage system under the home shall be adequately supported with approved materials and properly sloped to drain. Plastic piping shall be supported at not more than 4 feet intervals, at the ends of branches and at changes of direction or elevation. Trap arms in excess of 3 feet shall be supported as close as possible to the trap. Copper and galvanized piping shall be supported with the same support requirements as the water system. Drain lines 3 inches and less inside diameter shall be sloped at least a  $\frac{1}{4}$  inch per foot and drain lines larger than 3 inches inside diameter shall be sloped at least  $\frac{1}{8}$  inch per foot. If the sewer drain is to discharge to an existing sewer riser at the

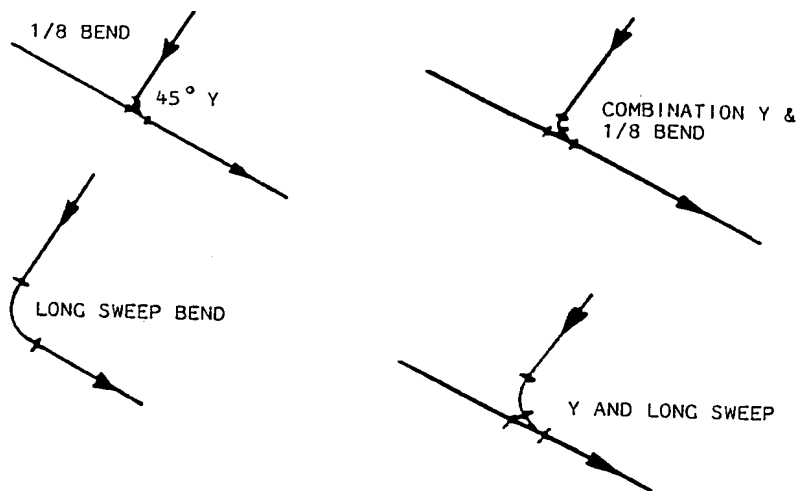
site, the drain pipe shall extend into the sewer riser and be sealed to be odor and water tight. (See Figure 6-2.) All vent piping shall be sloped at least 1/8 inch per foot back to the drainage system.

**Figure 6-2**  
**Drainage Connection**

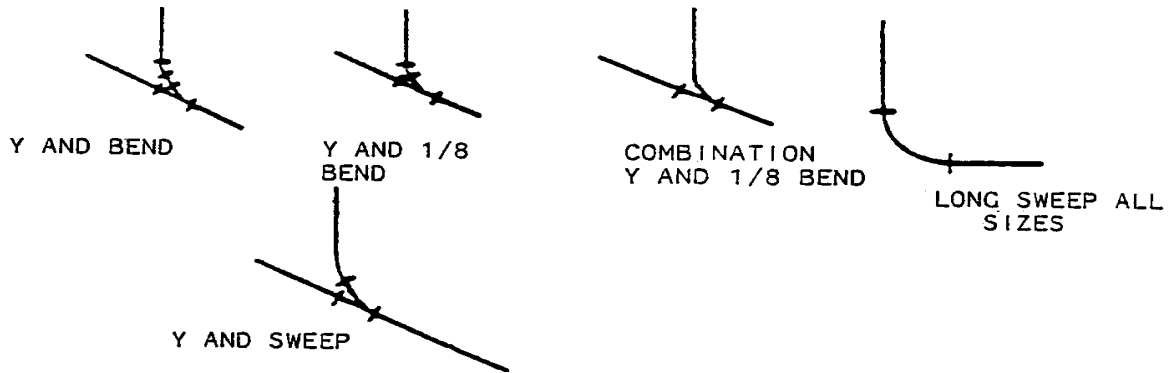


Changes in direction for the drainage system shall be done with appropriate directional fittings as indicated in Figures 6-3, 4 and 5. Single and double sanitary tees and short sweep quarter bends shall be used in drainage lines only where the direction of flow is from the horizontal to the vertical. (See Figure 6-3.)

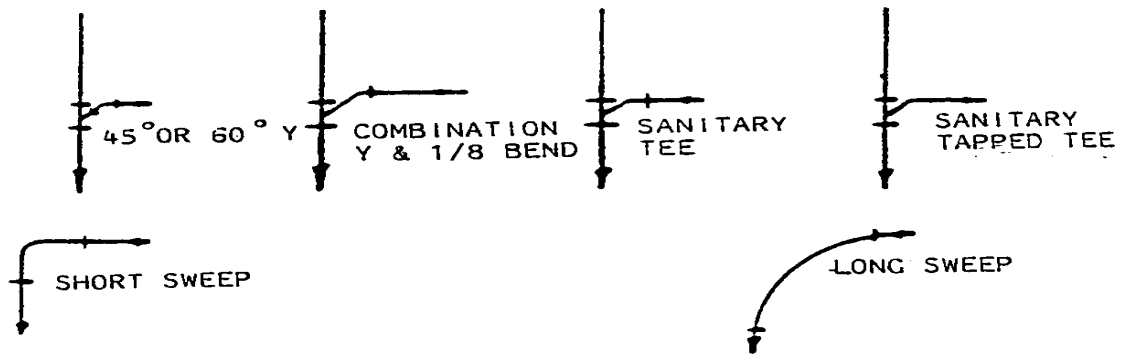
**Figure 6-3**  
**Direction Drainage Fittings**  
**Horizontal to Horizontal Change of Direction**



**Figure 6-4**  
**Direction Drainage Fittings**  
**Vertical to Horizontal Change of Direction**



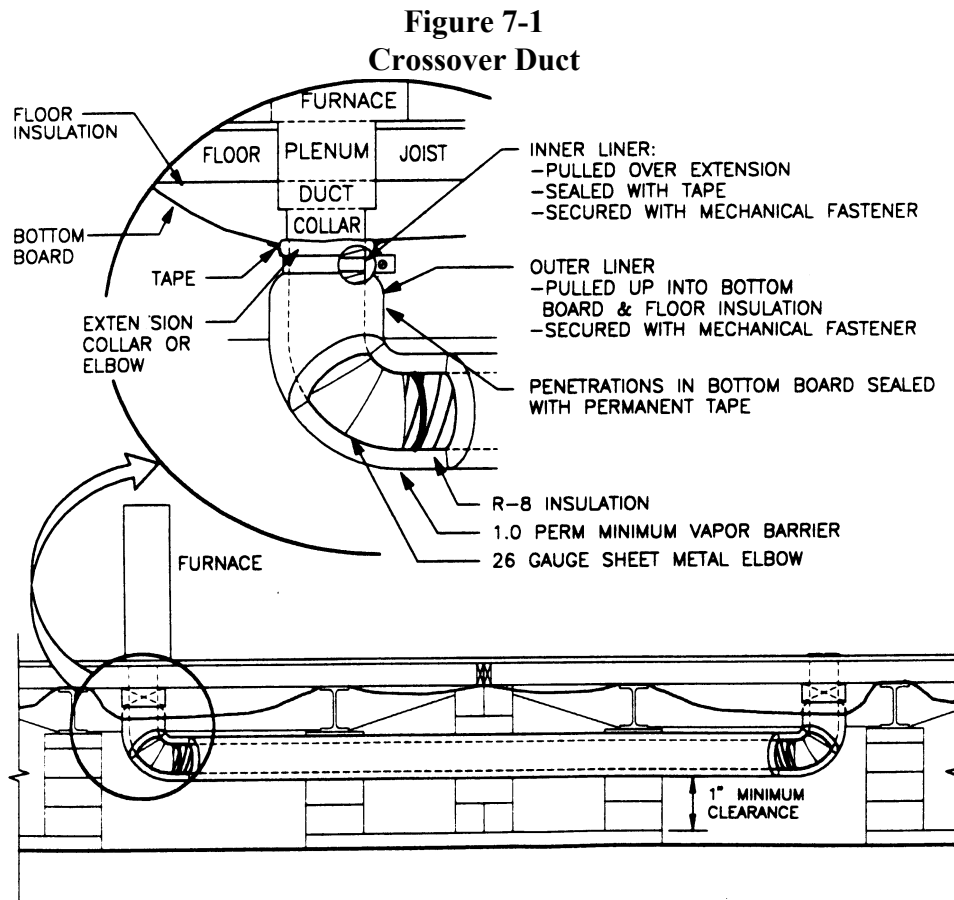
**Figure 6-5**  
**Direction Drainage Fittings**  
**Horizontal to Vertical Change of Direction**



## 7. HEATING AND AIR CONDITIONING

Most homes are provided with both heating and air conditioning systems. All onsite installations shall meet the manufacturer's specifications, comply with local code, and be performed by qualified personnel.

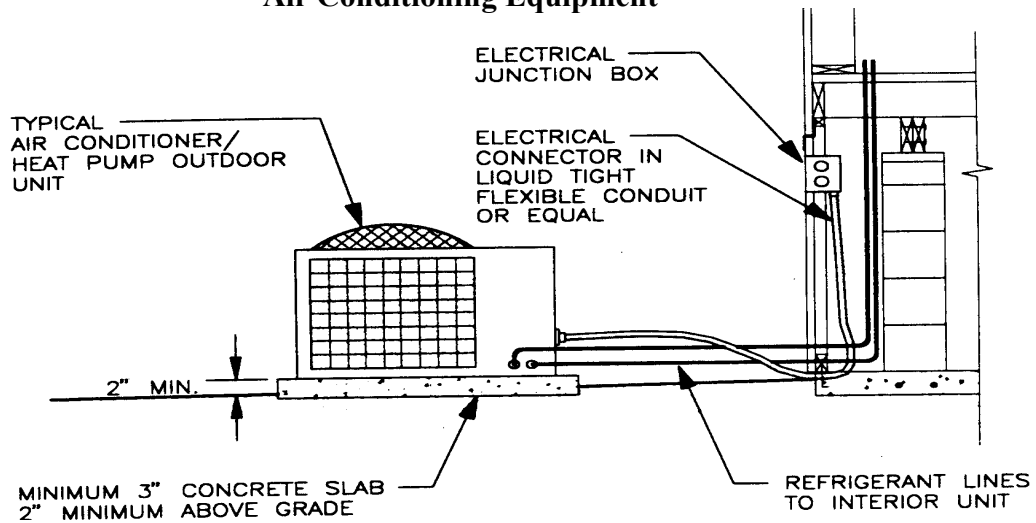
The heating systems are provided for most homes with the duct systems installed. On site installation consists of connecting the cross over duct for multi-section homes. The crossover ducts should be adequately supported above ground, properly sealed to prevent air leaks and properly cut to length to avoid kinks. (See Figure 7-1.)



Air conditioning equipment must be installed in accordance with the manufacturer's specifications and comply with local codes. The maximum electrical full load ampere draw for the desired air conditioning unit must not exceed the circuit rating shown. Any field installed wiring beyond the junction box must include a fused disconnect located within sight of the condensing unit (See Figure 7-2.). The maximum fuse size is marked on the condenser data plate. Charging of the air conditioning equipment must be performed by qualified personnel. Condensation from the air conditioning equipment must drain to a properly trapped and vented drain and not underneath the home.

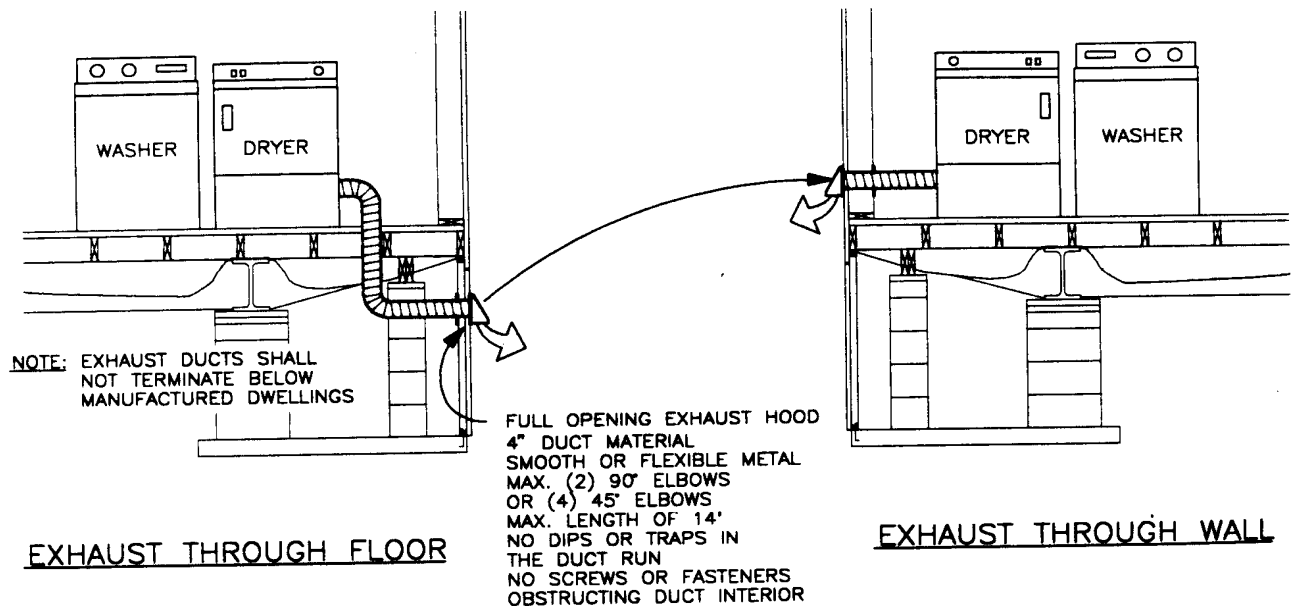


**Figure 7-2**  
**Air Conditioning Equipment**



Clothes dryer vents must exhaust outside the exterior of the home, or any perimeter foundation or skirting. Do not let the exhaust system end under the home where excess moisture or flammable material can accumulate. The exhaust duct must be adequately supported and sealed. The installation of the duct should be in accordance with the manufacturer's instructions (See Figure 7-3.).

**Figure 7-1**  
**Dryer Duct Exhaust**

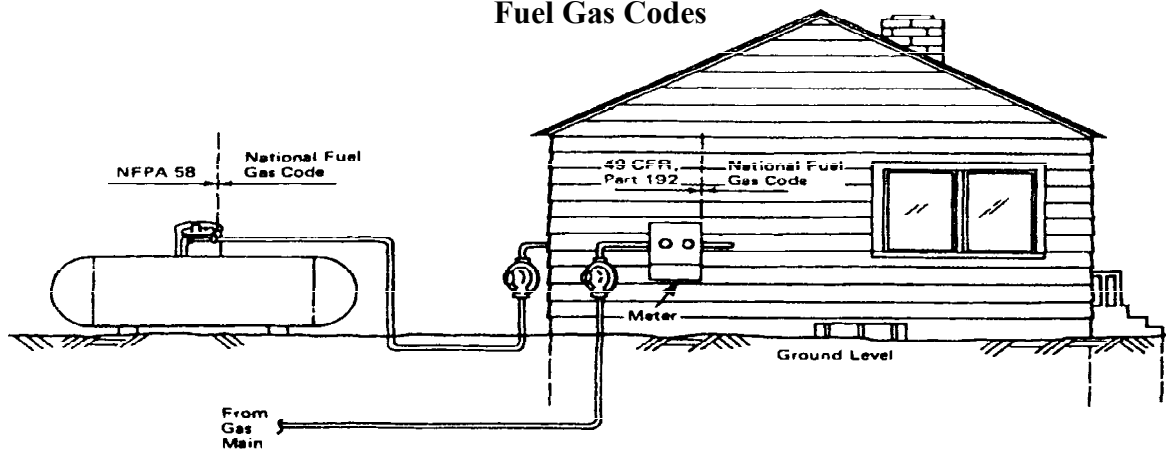


## 8. NATURAL AND LIQUEFIED PETROLEUM GAS INSTALLATION

### Natural Gas

There are three codes affecting the operation of natural gas facilities in manufactured homes. The Pipeline Safety Regulations administered by the U.S. Department of Transportation for the pipeline to the meter, the National Fuel Gas Code written by the National Fire Protection Association for the piping from the meter to underneath the home and the Code of Federal Regulation, Housing and Urban Development for the appliance installation, operation and venting in the home. (See Figure 8-1.)

**Figure 8-1**  
**Fuel Gas Codes**



Natural gas piping must be of approved materials. Plastic piping approved for natural gas, ASTM 2513, must be installed below ground level, except that it may terminate above ground if:

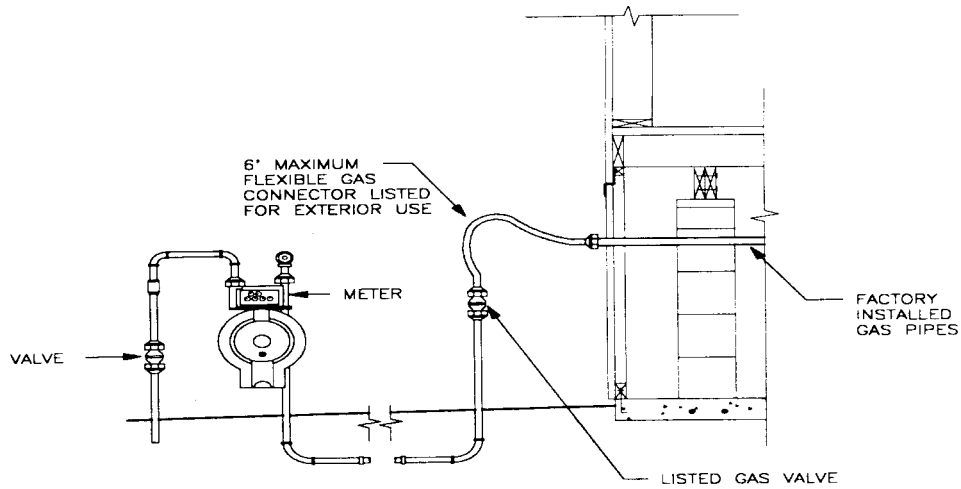
- 1) The above ground part of the plastic service line is protected against deterioration and external damage; and
- 2) The plastic service line is not used to support external loads.

Plastic pipe, tubing and fittings shall be joined in accordance with manufacturer's instructions. An electrically continuous corrosion resistant tracer wire (Minimum 14 AWG) or tape shall be buried with the plastic pipe to facilitate locating. Metallic pipe shall be at least standard weight, Schedule 40. Copper and brass pipe shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 standard cubic feet of gas. Metallic tubing such as seamless copper (ASTM A254), aluminum alloy or steel tubing (ASTM A539) shall be permitted to be used with gas not corrosive to such material. All piping under the home must be supported with appropriate hangers spaced at 6 foot intervals for 1 inch diameter or less pipe and at 10 foot intervals for piping 1¼ inch or more pipe in diameter. Defects in pipe, tubing or fittings shall not be repaired. When defective pipe, tubing or fittings are located in a system, the defective material shall be replaced. Gas piping in contact with earth or other material that could corrode the piping shall be protected against corrosion in approved manner.

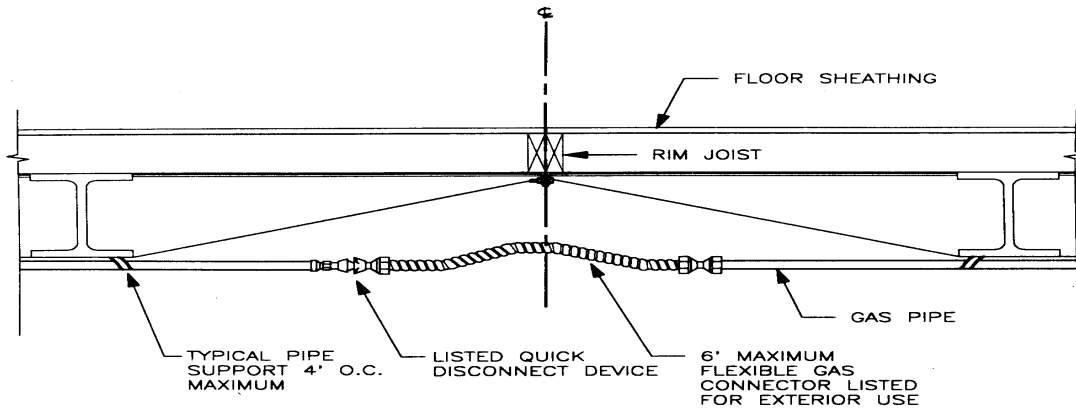
Meters and regulators must be installed in a readily accessible location and be protected from

corrosion and other damage. Each service line must have a service line valve located upstream of the regulator or meter. Each buried main must be installed with at least 24 inches of cover and service lines with at least 18 inches of cover. The service line cover can be reduced to 12 inches if external damage to the pipe is not likely to result. The gas piping system must be tested for leaks prior to occupancy of the home. (See Figures 8-2 and 8-3.)

**Figure 8-2  
Gas Meter Location**



**Figure 8-3  
Gas Connections**



## Liquefied Petroleum Gas (LP)

Liquefied petroleum (LP) gas containers must be approved for the intended use and properly located in accordance with Standard for the Storage and Handling of Liquefied Petroleum Gases, National Fire Protection Association (NFPA 58). See Table 3-2.2.2 and the following Figures 8-3, 8-4 and 8-5 from NFPA 58 for proper location of LP gas containers.

**Table 3-2.2.2**

Water Capacity Per Container Gallons (m <sup>3</sup> )	Minimum Distances		
	Mounded or Underground Containers [Note (d)]	Aboveground Containers [Note (f)]	Between Containers [Note (e)]
Less than 125 (0.5) [Note (a)]	10 ft (3 m)	None [Note (b)]	None
125 to 250 (0.5 to 1.0)	10 ft (3 m)	10 ft (3 m)	None
251 to 500 (1.0 + to 1.9)	10 ft (3 m)	10 ft (3 m)	3 ft (1 m)
501 to 2,000 (1.9 + to 7.6)	10 ft (3 m)	25 ft (7.6 m) [Note (c)]	3 ft (1 m)
2,001 to 30,000 (7.6 + to 114)	50 ft (15 m)	50 ft (15 m)	5 ft (1.5 m)
30,001 to 70,000 (114 + to 265)	50 ft (15 m)	75 ft (23 m)	} $\frac{1}{4}$ of sum of diameters of adja- cent containers)
70,001 to 90,000 (265 + to 341)	50 ft (15 m)	100 ft (30 m)	
90,001 to 120,000 (341 + to 454)	50 ft (15 m)	125 ft (38 m)	
120,001 to 200,000 (454 to 757)		200 ft (61 m)	
200,001 to 1,000,000 (757 to 3 785)		300 ft (91 m)	
Over 1,000,000 (3 785)		400 ft (122 m)	

**Notes to Table 3-2.2.2**

Note (a): At a consumer site, if the aggregate water capacity of a multicontainer installation comprised of individual containers having a water capacity of less than 125 gal (0.5 m<sup>3</sup>) is 501 gal (1.9 + m<sup>3</sup>) or more, the minimum distance shall comply with the appropriate portion of this table, applying the aggregate capacity rather than the capacity per container. If more than one such installation is made, each installation shall be separated from any other installation by at least 25 ft (7.6 m). Do not apply the MINIMUM DISTANCES BETWEEN CONTAINERS to such installations.

Note (b): The following shall apply to aboveground containers installed alongside of buildings:

1. DOT specification containers shall be located and installed so that the discharge from the container pressure relief device is at least 3 ft (1 m) horizontally away from any building opening that is below the level of such discharge, and shall not be beneath any building unless this space is well ventilated to the outside and is not enclosed for more than 50 percent of its perimeter. The discharge from container pressure relief devices shall be located not less than 5 ft (1.5 m) in any direction away from any exterior source of ignition, openings into direct-vent (sealed combustion system) appliances, or mechanical ventilation air intakes.
2. ASME containers shall be located and installed so that the discharge from the container pressure relief device is at least 5 ft (1.5 m) horizontally away from any building opening that is below the level of such discharge, and not less than 10 ft (3 m) in any direction away from any exterior source of ignition, openings into direct-vent (sealed combustion system) appliances, or mechanical ventilation air intakes.
3. The filling connection and the vent from liquid level gauges on either DOT or ASME containers filled at the point of installation shall be not

less than 10 ft (3 m) in any direction away from any exterior source of ignition, openings into direct-vent (sealed combustion system) appliances, or mechanical ventilation air intakes.

Note (c): This distance may be reduced to not less than 10 ft (3 m) for a single container of 1,200 gal (4.5 m<sup>3</sup>) water capacity or less provided such container is at least 25 ft (7.6 m) from any other L.P.-Gas container of more than 125 gal (0.5 m<sup>3</sup>) water capacity.

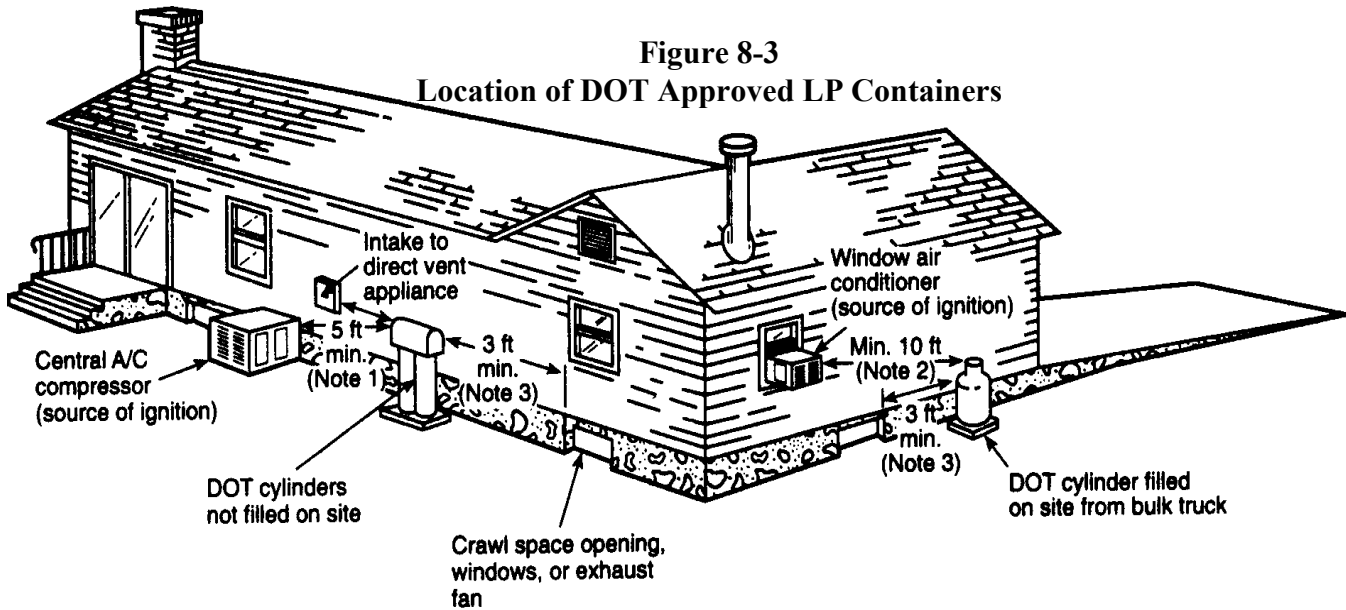
Note (d): Minimum distances for underground containers shall be measured from the pressure relief device and filling or liquid level gauge vent connection at the container, except that no part of an underground container shall be less than 10 ft (3 m) from a building or line of adjoining property that may be built upon.

Note (e): Where underground multicontainer installations are made of individual containers having a water capacity of 125 gal (0.5 m<sup>3</sup>) or more, such containers shall be installed so as to permit access at their ends or sides to facilitate working with cranes or hoists.

Note (f): In applying the distance between buildings and ASME containers of 125 gal (0.5 m<sup>3</sup>) or more water capacity, a minimum of 50 percent of this horizontal distance shall also apply to all portions of the building that project more than 5 ft (1.5 m) from the building wall and that are higher than the relief valve discharge outlet. This horizontal distance shall be measured from a point determined by projecting the outside edge of such overhanging structure vertically downward to grade or other level upon which the container is installed. Under no conditions shall distances to the building wall be less than those specified in Table 3-2.2.2.

Exception to Note (f): Not applicable to installations in which overhanging structure is 50 ft (15 m) or more above the relief valve discharge outlet.

**Figure 8-3**  
**Location of DOT Approved LP Containers**



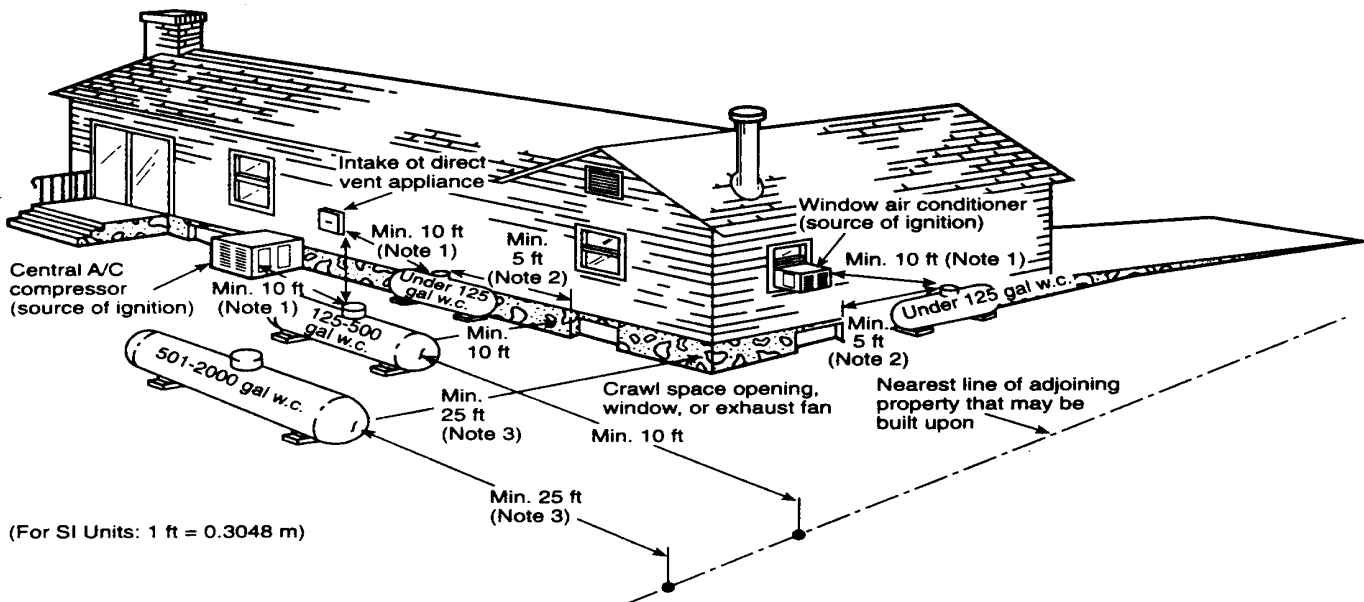
Note 1: 5-ft minimum from relief valve in any direction away from any exterior source of ignition, openings into direct vent appliances, or mechanical ventilation air intakes. Refer to Note (b) (1) under Table 3-2.2.2.

Note 2: If the DOT cylinder is filled on site from a bulk truck, the filling connection and vent valve must be at least 10 ft from any exterior source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes. Refer to Note (b) (3) under Table 3-2.2.2.

(For SI units: 1 ft = 0.3048 m)

Note 3: Refer to Note (b) (1) under Table 3-2.2.2.

**Figure 8-4**  
**Location of ASME Approved LP Containers**



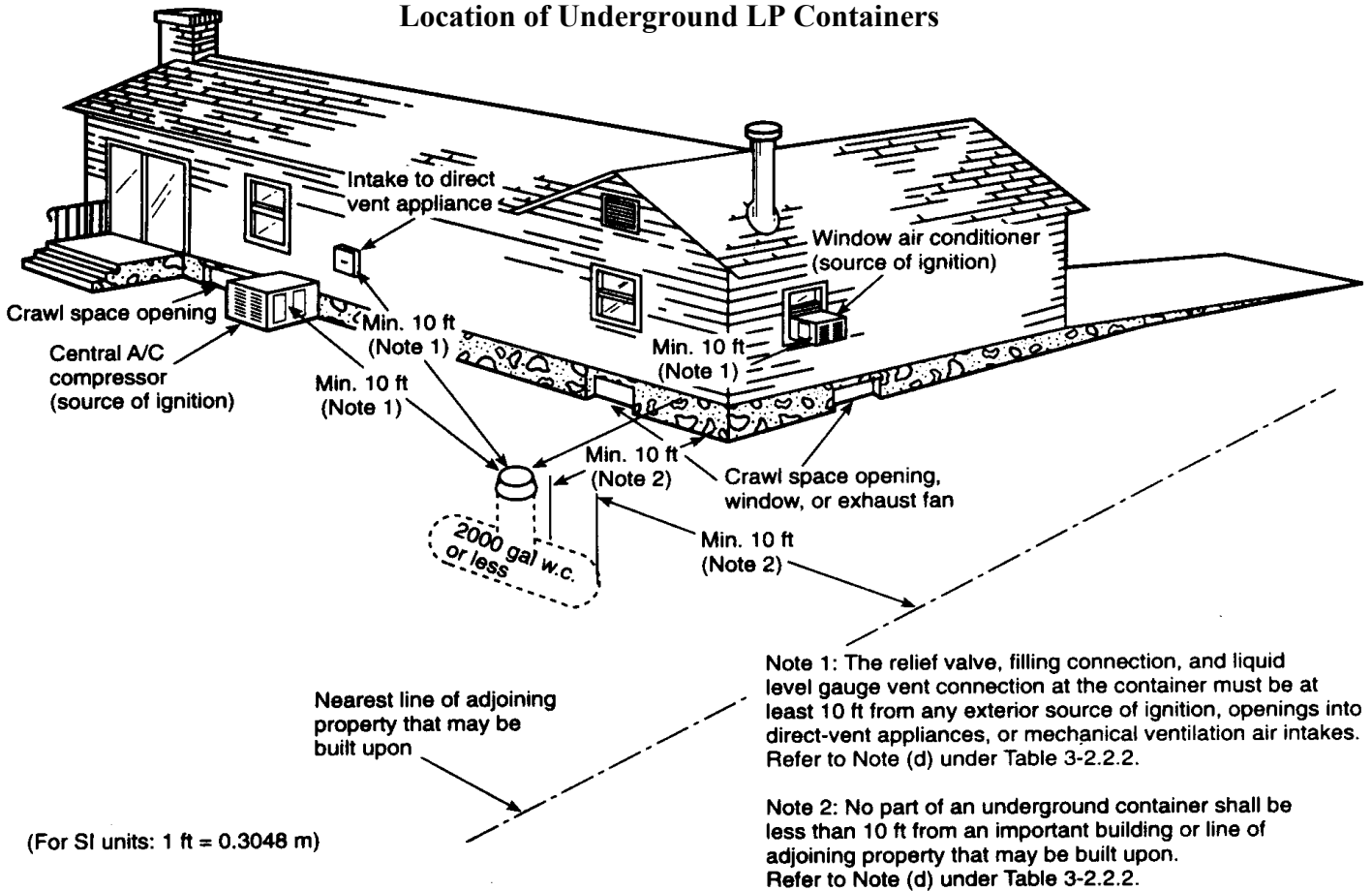
(For SI Units: 1 ft = 0.3048 m)

Note 1: Regardless of its size, any ASME tank filled on site must be located so that the filling connection and fixed liquid level gauge are at least 10 ft from any external source of ignition (i.e., open flame, window A/C, compressor, etc.). Intake to direct vented gas appliance or intake to a mechanical ventilation system. Refer to Note (b) (3) under Table 3-2.2.2.

Note 2: Refer to Note (b) (2) under Table 3-2.2.2.

Note 3: This distance may be reduced to no less than 10 ft (3 m) for a single container of 1,200-gal (4.5-m<sup>3</sup>) water capacity or less provided such container is at least 25 ft (7.6 m) from any other LP-Gas container of more than 125-gal (0.5-m<sup>3</sup>) water capacity. Refer to Note (c) under Table 3-2.2.2.

**Figure 8-5  
Location of Underground LP Containers**



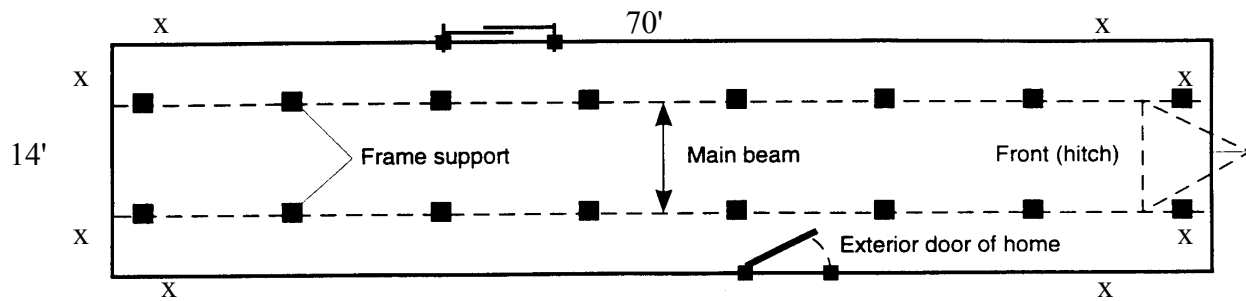
## 9. PERIMETER ENCLOSURES

The perimeter enclosure material is to be of material manufactured for this purpose. The material should be installed in a manner that will not allow water to be trapped between the siding or trim to which it is attached. The perimeter enclosure material is to be vented according to the manufacturer's recommendation to prevent moisture buildup. If the manufacturer's specifications are not available, to assure proper ventilation, the open area of the vents should be equal to at least 1/300th of the floor area of the home (divide total square feet of home by 300). (See Figure 9-1.)

Perimeter enclosure material should be installed in order to accept possible frost heave. Perimeter enclosure will conserve energy and add to the general protection of the underside of the home. The perimeter enclosure should be installed to the manufacturer's specifications.

A utility inspection panel that can be opened without the use of tools with a minimum width of 24 inches should be provided and located so that connections to the water supply and sewer drain are accessible for inspection and maintenance. As described in Section 6, dryer exhaust vents must be vented outside the perimeter enclosure.

**Figure 9-1  
Perimeter Enclosure Ventilation**



A 14'x70' foot home requires 980 square feet  $\div$  300 or 3.27 total square feet of ventilation. The vented vinyl skirting provides 0.2 square feet per linear feet of 18 inch panels and the home is 2 feet off the ground. Each panel therefore provides 0.4 square feet of ventilation. Therefore, 9 panels will be required. The above figure shows the location of these panels (marked by an x) to provide cross ventilation. Vented panels should be within 2 feet of the corners of the home.

## 10. ACCESSORY STRUCTURES

Accessory structures (porches, decks, garages, carports, etc.) should be free-standing and able to support their own weight. The structures, if site-constructed, should conform to local building code requirements. Accessory structures that are attached to the home should have a foundation system compatible with that of the home (either a floating system or one that extends below the frost depth).

## 11. RESOURCES

In addition to the manufacturer's installation instructions, the following material may be of additional assistance in installing manufactured homes.

1. NCSBCS/ANSI A225.1-1994, "Manufactured Home Installation," published by the National Conference of States on Building Codes and Standards, Inc., 505 Huntmar Park Drive, Suite 210, Herndon, VA 22070, 703-437-0100
2. "One and Two Family Dwelling Code," published by the International Code Council, 5203 Leesburg Pike, Suite 708, Falls Church, VA 22041-3401, 703-931-4533
3. Mobile Home Park Act and Manufactured Home Community Code; Mobile Home Tiedown Act and Manufactured Home Tiedown Code, administered by the Illinois Department of Public Health, 525 West Jefferson Street, Springfield, IL 62761, 217-782-5830
4. National Electrical Code, 1999 Edition, published by the National Fire Protection Association, Battery March Park, Quincy, MA 02169, 703-437-0100
5. Illinois Plumbing License Law and Code, administered by Illinois Department of Public Health, 828 South Second, Springfield, IL 62704, 217-524-0799
6. Illinois Roofing Industry Act and Rules, administered by the Illinois Department of Professional Regulation, 320 West Washington Street, Springfield, IL 62786, 217-782-8556
7. National Fuel Gas Code, 1999 Edition, published by National Fire Protection Association, Battery March Park, Quincy, MA 02169, 703-437-0100
8. Standard for the Storage and Handling of Liquefied Petroleum Gases, 1998 Edition, National Fire Protection Association, Battery March Park, Quincy, MA 02169, 703-437-0100
9. Manufactured Home Construction and Safety Standards, Department of Housing and Urban Development, 451 Seventh Street, SW, Washington, DC 20410, 202-708-6423
7. The following design manuals also may be of assistance:

ASCE 7-1988, "Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineering, 1430 Broadway, New York, NY 10018

FEMA 85, "Manufactured Home Installation in Flood Hazard Areas," Federal Emergency Management Agency, Washington, DC 20472, September 1985

HUD Handbook 4930.3 (1989), "Permanent Foundations Guide for Manufactured Housing," U.S. Department of Housing and Urban Development, 451 Seventh Street, SW, Washington, DC 20410

"Permanent Wood Foundation System Design, Fabrication, and Installation Manual 1987," National Forest Products Association (NAPA), 1250 Connecticut Avenue, NW, Washington, DC 20036

"Frost-Free Shallow Foundation Design Guidelines," Energy Design Update, March 1988

"Building Foundation Design Guidebook," Doc. No. DE88013350, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161

"Installation Certification Course for Manufactured Housing," 1994 Edition, George Porter, P.O. Box 9, Nassau, DE 19969, 302-645-5552.

For information concerning the dates of manufactured home installation courses in Illinois, contact Mr. Chris Kratzer, Executive Director, Illinois Manufactured Housing Association, 3888 Peoria Road, Springfield, IL 62702, 217-528-3423.



## **APPENDIX A**

### **SAMPLE PROBLEM REGARDING THE DETERMINATION OF FOOTING SIZES**

A homeowner would like to place a multi-section 28 foot wide home on a piece of property. It has been determined by a pocket penetrometer that the soil bearing capacity is 2000 pounds per square foot. The data plate on the home indicates that the home was designed with a 30 pound per square foot roof live load. The supporting piers are proposed to be placed eight feet on center. Table 2-3 on page 7 indicates that the support load for a 14 foot wide section with 8 foot on center piers would be 5550 pounds and for a soil bearing capacity of 2000 lbs/ft<sup>2</sup>, the footing must be a minimum of 400 square inches, a 20 by 20 inch footing per pier.

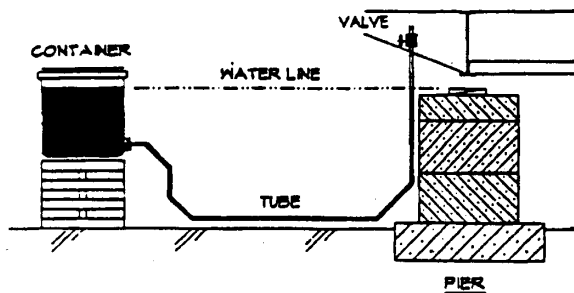
Also, the home has an opening in the mating wall that spans a total of 15 feet located in the great room area of the home. The columns supporting the ridge beam spanning this opening need to be supported by piers with adequate footings. Table 2-7 on page 15 indicates the pier loads for different spans for the mating wall. This table indicates that a 15 foot opening for a 30 pound per square foot roof load would be 4100 pounds. With a soil bearing capacity of 2000 pounds per square foot the footing area needed would be 295 square inches, approximately an 18 by 18 inch footing per pier.

## APPENDIX B

### HOW TO USE A WATER LEVEL

A water level is a very quick, accurate and inexpensive tool for leveling a manufactured home. See Figure A-1 and follow the instructions below.

**Figure B-1**  
**Water Level Detail**



#### Material to Make Water Level

Translucent 5 gallon pail with lid  
Plastic tubing - 100 feet x  $\frac{3}{8}$  inch inside diameter  
Cake coloring - 8 ounces

Note: Use RV antifreeze in cold weather.

1) Locating the Water Level

Position the container near where it will be used and unroll the tubing. Take care that there are no kinks and be careful not to step on or lay anything on the tubing. Open the hole in the container top when using the level.

2) Check for Air Bubbles in Tubing

Remove any air bubbles by lowering the valve below the water line in the container and opening it. Allow the water to run and when tubing is free of air bubbles close the valve.

3) Preparing the Level for Use

Raise the valve above the container. Open the valve and build up under the container until the water line in the tubing is at the height the bottom of the home will be above the ground.

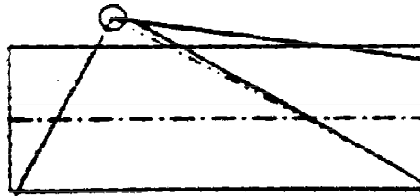
4) Check the Height of the Home

Measure each end of the home to determine if the piers can be set in place. Raise the home if they cannot be.

5) Leveling the Piers

At a pier location, secure the valve above the lower flange of the I-beam and open it. Build and level the pier by adding materials needed to reach the water line in the tubing. Close the valve and move to other pier locations and repeat the procedure. (See Figure A-2.) Continue until all piers have been set. When depth of the I-beams on the home are not the same, adjust for the difference.

**Figure B-2**  
**Water Level Location**



LEVEL CAN BE PLACED AT ANY POINT AROUND HOME