FORTRESS
H-O-M-E-S

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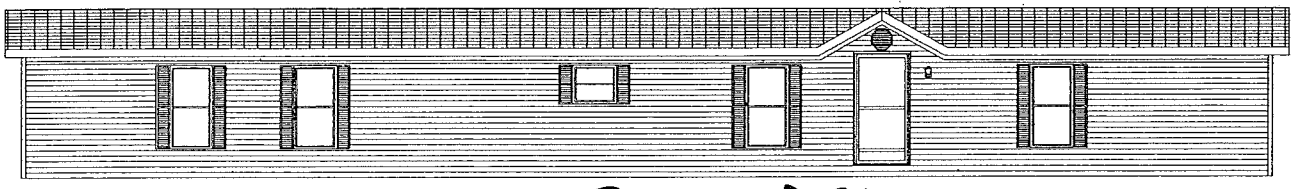
"The People Place"



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SINGLEWIDE INSTALLATION MANUAL

Retain this Manual With Home
For Reference by the Homeowner

FORTRESS HOMES CORPORATION
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PREFACE

YOUR ***FORTRESS*** HOME WAS DESIGNED, CONSTRUCTED AND INSPECTED FOR CONFORMANCE TO *THE FEDERAL MANUFACTURED HOUSING CONSTRUCTION AND SAFETY STANDARDS* IN EFFECT ON THE DATE OF MANUFACTURE. THIS NATIONAL STANDARD SETS FORTH THE REQUIREMENTS OF DESIGN CONSTRUCTION, FIRE SAFETY, PLUMBING, HEATING SYSTEMS AND ELECTRICAL SYSTEMS FOR FACTORY-BUILT HOUSING DESIGNED TO BE USED AS DWELLINGS.

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THIS MANUAL CONTAINS INFORMATION ON THE PROPER INSTALLATION OF YOUR ***FORTRESS*** HOME. WE SUGGEST YOU READ THIS MANUAL BEFORE YOUR HOME IS INSTALLED. HOME INSTALLATION IS THE HOMEOWNER'S RESPONSIBILITY!

CONSULT WITH BUILDING OFFICIALS IN YOUR AREA PRIOR TO INSTALLATION TO DETERMINE NECESSARY PERMITS, LICENSES AND INSPECTIONS WHICH ARE REQUIRED FOR THE PROPER AND SAFE INSTALLATION OF YOUR HOME.

THE DRAWINGS CONTAINED IN THIS MANUAL ARE INTENDED TO BE REPRESENTATIVE OF THE PRODUCT. DESIGNS AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE. **NEVER** SCALE THE DRAWINGS! ONLY USE THE DIMENSIONS.

THIS MANUAL IS INTENDED TO INSTRUCT AND ASSIST QUALIFIED PERSONNEL ON THE PROPER INSTALLATION OF YOUR ***FORTRESS*** HOME. IT IS **NOT** INTENDED FOR USE BY PERSONS NOT FAMILIAR WITH HOME SET-UP!

IT IS RECOMMENDED BY *THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT* (**HUD**) THAT, SUBSEQUENT TO COMPLETION OF THE INSTALLATION, YOUR HOME IS INSPECTED BY AN INDEPENDENT, QUALIFIED PROFESSIONAL.

DO **NOT** CONTACT ***FORTRESS HOMES*** ABOUT THE INSTALLATION OF YOUR HOME. CONTACT YOUR **DEALER** AND THEY WILL CONTACT US IF NECESSARY.

FORTRESS HOMES APPRECIATES YOUR PATRONAGE AND HOPE YOUR HOME WILL BRING MANY YEARS OF HAPPINESS TO YOU AND YOUR FAMILY. ALL COMMENTS AND SUGGESTIONS ARE WELCOME AND MAY BE SENT TO THE MAILING ADDRESS ON THE FRONT COVER.

DEALER NAME:_____

ADDRESS:_____

PHONE:_____

PERSON TO CONTACT:_____

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SECTION 1 INTRODUCTION

1.1 ABOUT THIS MANUAL. This manual contains installation instructions for the set-up of your ***FORTRESS*** home. Several charts and figures are included to provide information for proper installation. Careful adherence to this manual by the homeowner ,an experienced set-up crew, and consultation with a registered professional engineer in circumstances not covered by this manual, will ensure a safe and proper installation of your home.

1.2 PRE-INSTALLATION. Before installing or relocating your home, contact the local authority having jurisdiction over the installation of manufactured homes, to see if permits for blocking, anchoring, and utility connections are required. Inspections may be required during or prior to installation of the home. Zoning and development regulations may also apply.

1.3 SAFETY. ONLY SPECIALLY TRAINED CREWS SHOULD ATTEMPT TO INSTALL THE HOME. Installers should follow the instructions provided in this manual as well as all general safety procedures as with any construction endeavor. Remember that the home weighs several tons. Without proper safety blocking and common sense a rollover or collapse can **CAUSE SEVERE INJURY OR DEATH!** Always assume that the home is unstable until it is completely installed. Never allow anyone under the home until **all** support blocking is safely in place. Check all safety equipment for defects before each and every installation.

SECTION 2 SITE PREPARATION

2.1 SITE LOCATION AND LAYOUT

2.1.1 WEATHER ZONE MAPS. The home is designed for certain regional weather conditions. See the zone maps in **figures 2.1.1(a), (b), and (c)** and the data plate installed in the home. Do not install or relocate the home in an area that requires greater wind, roof load, or heating/cooling capacities than the home is designed for. It is, however, safe to locate the home in an area with **less stringent** roof load and/or weather requirements.

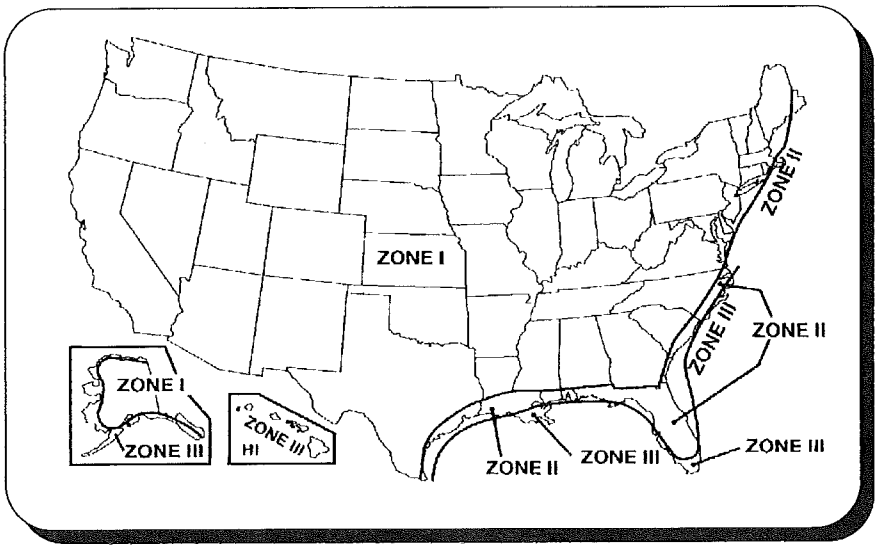


FIGURE 2.1.1 (a)
BASIC WIND ZONE MAP

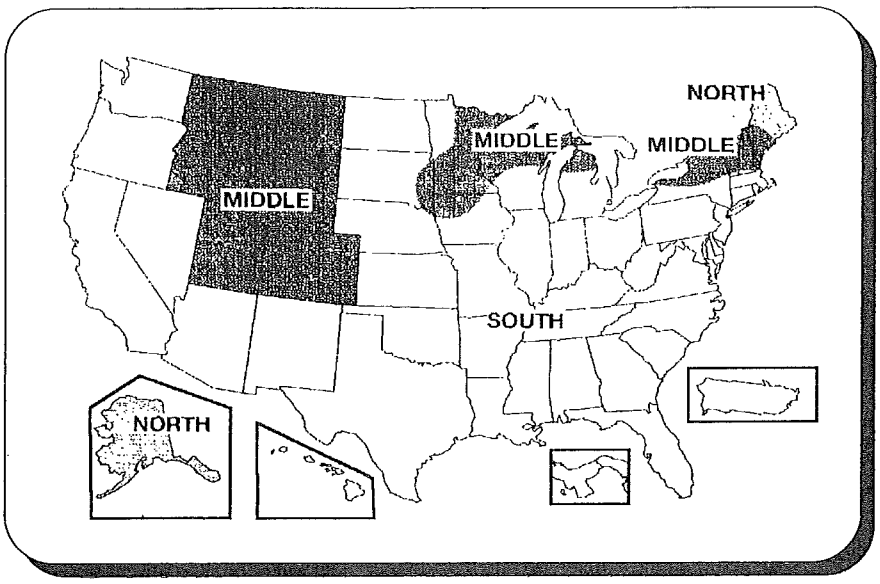


FIGURE 2.1.1 (b)
BASIC ROOF LOAD ZONE MAP

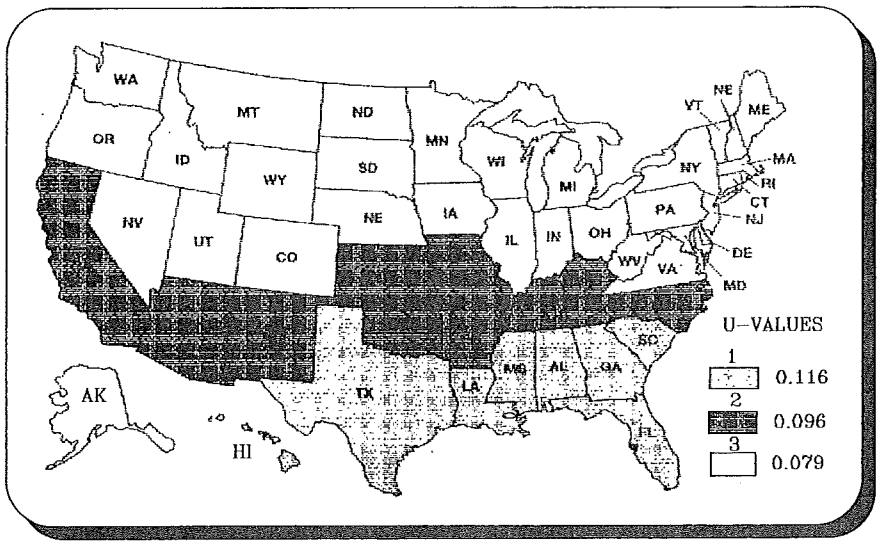


FIGURE 2.1.1 (c)
BASIC U/O VALUE ZONE MAP

2.1.2 TRANSPORTATION TO SITE. Make certain that the site is properly prepared and complete. All concrete work is finished and has had adequate time to cure. Site work that may be difficult with the home at the site (such as anchors and ground moisture barriers) is already installed. Before transporting the home to or from the site check to be sure that the shipping equipment can safely reach the site. Be certain of the minimum clearance that the home requires by doing a site measurement before attempting to ship the home. The roadway should be clear and provide adequate clearance for maneuvering. Take care to avoid overhead lines and branches. If the road surface is uneven, grade and compact the road surface to remove any possibility of the home tipping. Special permits may be required before transporting the home.

2.1.3 ADDITIONAL CONSIDERATIONS. Be sure that all local permits required for the transportation and installation of a manufactured home have been obtained. Obtain information on local laws as to the encroachments in streets, yards, and courts, as well as permissible setback distances from property lines and public roads. The distance between the home and other structures depends on local requirements. On-site attached structures may require that fire separation materials be used between them and the home.

2.2 SOIL CONDITIONS

2.2.1 SOIL REQUIREMENTS. To aid in the prevention of settling, insure that the site is of undisturbed fill that has been compacted to a minimum of 90% of its maximum relative density.

2.2.2 BEARING CAPACITY. The bearing capacity of the soil should be tested after the site has been graded and filled Check with local building code officials for acceptable methods that may be used to test soil bearing capacity. The soil is to be tested at the depth of the footings. If the soil capacity cannot be tested but the type can, then refer to **chart 2.2.2** to obtain the bearing capacity. If neither the soil bearing capacity nor the soil type can be identified, then the lowest value (1,000 lbs./sq. ft.) must be used. If the soil appears to be peat or uncompacted fill, consult a professional engineer before continuing.

SOIL TYPE BASED ON THE UNIFIED CLASSIFICATION SYSTEM	BEARING CAPACITY (LBS. PER SQ. FT.)
ROCK OR HARD PAN	4,000 AND UP
SANDY GRAVEL AND GRAVEL	2,000
SAND, SILTY SAND, CLAYEY SAND, SILTY GRAVEL, OR CLAYEY GRAVEL	1,500
CLAY, SANDY CLAY, SILTY CLAY, OR CLAYEY SILT	1,000
UNCONSOLIDATED FILL	SPECIAL ANALYSIS
PEAT OR ORGANIC CLAYS	SPECIAL ANALYSIS

CHART 2.2.2 SOIL BEARING CAPACITY

This chart is **only** to be used when **none** of the following is available:

1. Soil investigation and analysis of the site
2. Complete local building code information.
3. Recommendation of an engineer or code official

2.3 REMOVAL OF VEGETATION. To reduce the chances of settling and insect/rodent damage remove all organic materials from beneath the home. This includes grass, roots, top soil, wood scraps, etc. Remove tree branches in the vicinity of the home to prevent windstorm damage.

2.4 DRAINAGE.

2.4.1 PURPOSE. Proper site drainage is necessary to prevent excessive humidity under and in the home that may damage building materials or cause them to swell (which will cause problems with the operation of doors and windows).

2.4.2 REQUIREMENTS. The site for your home must be sloped to provide storm drainage. Check local building codes which may specify slope requirements. It is generally recommended that a slope of 1" per 36" be maintained and that the site be evenly graded so that there are no depressions or low-spots where standing water may accumulate, either underneath or outside of the home. Be certain not to grade the home so that there is a drainage ditch beneath the home as soil erosion can result, always crown the site under the home so drainage flows away from the home at all angles.

2.4.3 DRAINAGE STRUCTURES. Depending on the site and local codes, ditches and/or culverts may be required to provide adequate site drainage. If necessary consult a professional engineer.

2.5 GROUND MOISTURE

2.5.1 PURPOSE. To prevent excessive humidity in the home and possible damage.

2.5.2 REQUIREMENTS. If skirting is to be installed, the entire area under the home must be covered with an acceptable type of moisture vapor barrier (ground cover). Use minimum 6 mil polyethylene sheeting or equivalent. Overlap all seams at least 6". Where frost and soil conditions allow the footings to be placed at grade level, place the sheeting directly underneath them.

SECTION 3 FOUNDATIONS

3.1 PIERS

3.1.1 PURPOSE. The piers are a key element in the installation of your home. The piers used must have enough capacity to transmit the vertical load which includes the weight of the home, its furnishings, and temporary roof loading to the foundation below. If the piers or footings are inadequate, sagging floors, walls, and roofs and undue structural stress can result.

3.1.2 SELECTION. Piers may be constructed of concrete blocks capped and shimmed with wedges, adjustable metal or concrete stands, site-poured concrete. Concrete block caps must be the same dimensions as the piers to evenly distribute the weight. They may be constructed of solid hard wood or masonry at least 4" thick or steel. Concrete blocks should have nominal dimensions of at least 8" x 8" x 16" and be arranged with the cells vertically. Capped single stacked concrete blocks have a load-bearing capacity of 10,000 lbs. Regardless of the material used to construct piers and caps they must be able to withstand the required load as found in **table 1.0.** Select adjustable pier height so that the risers do not extend more than 3" when installed.

3.1.3 FLOOR LIVE LOAD. Excessively heavy furniture or appliances, such as pianos, organs, deep freezers, heavy chests, large china cabinets, water beds, etc., require the installation of additional piers along the main beams. When excessive loads are not located in the vicinity of the main beams, additional piers with headers to distribute the weight over several floor joists must be installed.

3.1.4 LOAD-BEARING CAPACITY. The required capacity of the piers depends on several factors such as the size of the home, roof live load, and pier spacing. Refer to **tables 1.0 and 1.1, and figure 1.0** for information on pier spacing and capacity.

3.1.5 LAYOUT. Figure 1.0 shows a typical pier layout for a FORTRESS single-wide (your configuration may vary depending on the home and the type of piers used). Perimeter support is not required except at openings. Concrete blocks should have nominal dimensions of at least 8" x 8" x 16" and be arranged with the cells vertically. Capped single stacked concrete blocks have a load-bearing capacity of 10,000 lbs. Piers shall be located a maximum of 2' (24") from the either end of the home. All perimeter openings, such as patio doors, windows, porches, etc., that are greater than 4' (48") will require additional piers at both ends. Maximum pier spacing is 12'-0" (144") center to center for 12" I-beam frames, 10'-0" (120") for 10" I-beam frames, and 8'-0" (96") for 8" I-beam frames. A model specific pier layout is provided by ***FORTRESS HOMES*** to assist you in determining the most efficient pier layout.

3.1.6 CLEARANCE. A maximum height of 63" shall be maintained from the bottom of the rim (perimeter) joist to grade when the standard tie-down method is used. A minimum clearance of 12" shall be maintained between the lowest point on the frame and grade to provide access to utility and plumbing connections in the floor. Untreated wood building materials shall be no less than 6" from grade at all times to prevent damage.

3.1.7 PIER HEIGHT. You may use dry-block single-stacked piers up to a height of 30" (double-stacked up to 48") from the bottom of the main frame to grade. When using dry-block piers (single or double stacked) at a height of more than 48" they must be designed by a registered engineer and approved by the local building authorities. Pre-manufactured piers must be approved by a nationally recognized agency and used in accordance with the manufacturers instructions. Site built piers must be approved by the local building authorities if applicable.

3.2 FOOTINGS.

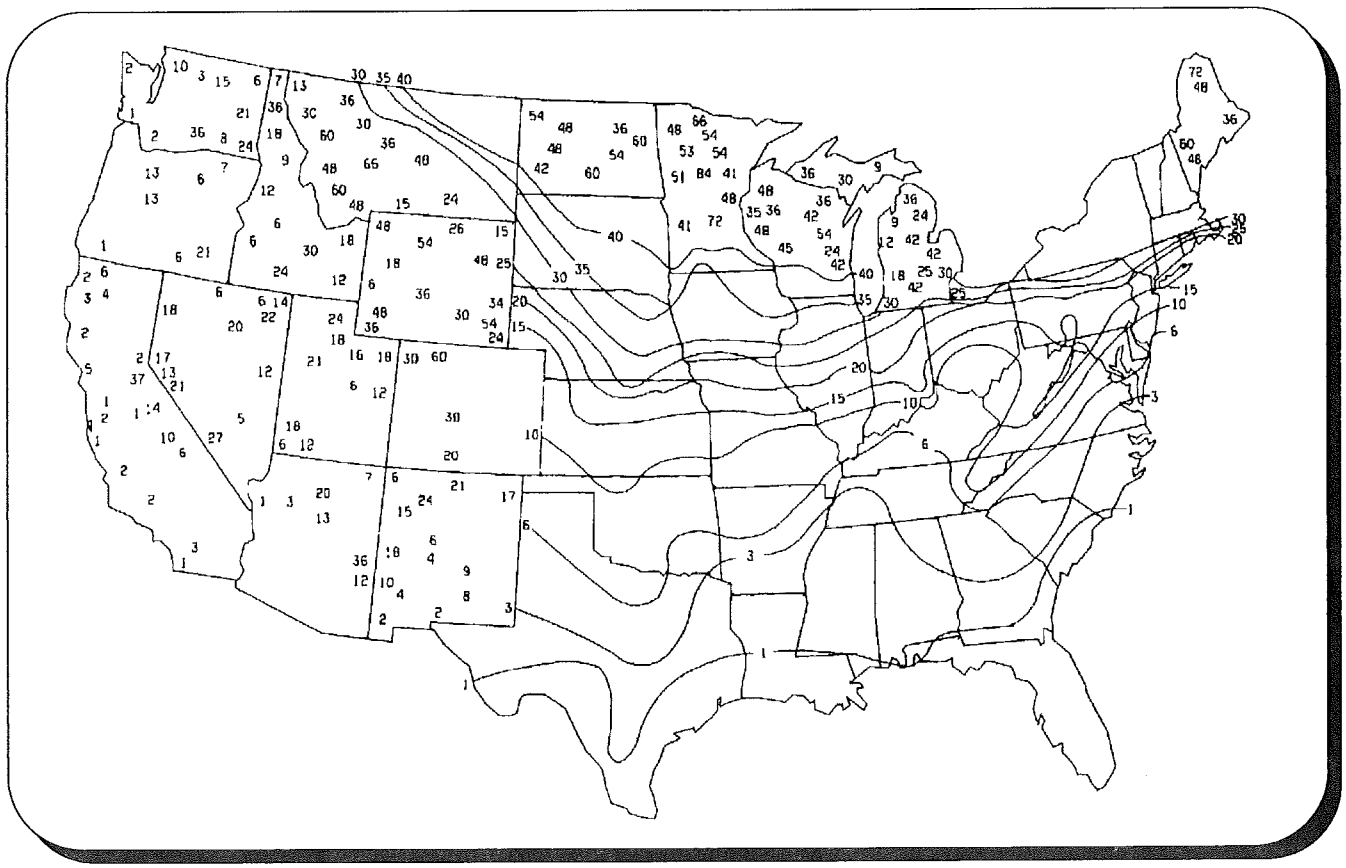
3.2.1 PURPOSE. Like piers, footings are a key element in the longevity of your home. Improper footings can cause sagging and severe damage to your home.

3.2.2 TYPES OF FOOTINGS. Footings may be pre-cast or site-poured unreinforced concrete at least 4" thick. Reinforced concrete may require a smaller thickness but must be approved by a registered engineer.

3.2.3 WEATHER CONSIDERATIONS. To avoid the effects of frost heave the footings shall be placed below the frost line. Check local building codes to determine a safe depth for the footings. In the absence of local codes use the frost penetration map in **figure 3.2.3** below.

3.2.4 FOOTING SIZE. The footing size varies depending on the soil bearing capacity (from **section 2.2.2 and chart 2.2.2**)and the pier capacity (from **table 1.0**). Use **table 1.1** to determine footing sizes.

FIGURE 3.2.3 FROST PENETRATION MAP



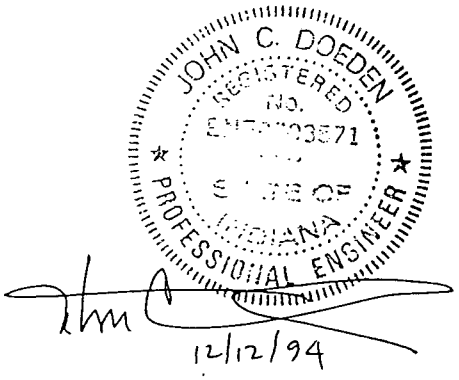
TABLES 1.0 AND 1.1
FIGURES 1.0, 2.0, AND 2.1

PAGE 7 - TABLE 1.0
PAGE 8 - TABLE 1.1
PAGE 9 - FIGURE 1.0
PAGE 10 - FIGURE 2.0
PAGE 11 - FIGURE 2.1

FOUR SEASONS HOUSING
MINIMUM PIER CAPACITY TABLE
(FRAME BLOCKING ONLY)

SECTION WIDTH (FEET)	SIDE OVERHANG (INCHES)	ROOF LIVE LOAD (PSF)	MINIMUM PIER CAPACITY (POUNDS) MAXIMUM PIER SPACING (FEET)				
			4	6	8	10	12
14 (160" FLOOR)	8"	30 40	3040 3330	4370 4810	5700 6270	7035 7770	8370 9370
16 (182" FLOOR)	3"	30 40	3360 3680	4660 5335	6350 6990	7850 8770	9470 10425

MAXIMUM SPAN BETWEEN PIER SUPPORTS FOR FRAME BLOCKING CONDITION IS: 8'-0" ON CENTER FOR 8 " I-BEAM, 10'-0" FOR 10" I-BEAM, AND 12'-0" FOR 12" I-BEAM.



NOTES:

1. PIER LOADS BASED ON 10 PSF ROOF DEAD LOAD AND 10 PSF FLOOR DEAD LOAD.
2. PERIMETER BLOCKING IS NOT REQUIRED EXCEPT AS NOTED FOR LARGE OPENINGS.
3. REFERENCE DETAILS IN FIGURES 1.0 AND 1.1 FOR PIER LOCATIONS.

TABLE 1.0
MINIMUM FRAME PIER CAPACITIES

PIER CAPACITY (POUNDS)	MINIMUM FOOTING SIZE (OR EQUAL AREA) (INCHES) SOIL BEARING CAPACITY (PSF)			
	1000	1500	2000	4000
600	12x12	12x12	12x12	12x12
800	12x12	12x12	12x12	12x12
1000	12x12	12x12	12x12	12x12
1500	15x15	12x12	12x12	12x12
2000	17x17	14x14	12x12	12x12
2500	19x19	15x15	13x13	12x12
3000	21x21	17x17	15x15	12x12
3500	22x22	18x18	16x16	12x12
4000	24x24	20x20	17x17	12x12
4500	25x25	21x21	18x18	13x13
5000	27x27	22x22	19x19	13x13
5500	28x28	23x23	20x20	14x14
6000	29x29	24x24	21x21	15x15
6500	31x31	25x25	22x22	15x15
7000	32x32	26x26	22x22	16x16
7500	33x33	27x27	23x23	16x16
8000	34x34	28x28	24x24	17x17
8500	35x35	29x29	25x25	17x17
9000	36x36	29x29	25x25	18x18
9500	37x37	30x30	26x26	19x19
10000	38x38	31x31	27x27	19x19
11000	40x40	32x32	28x28	20x20
12000	42x42	34x34	29x29	21x21
13000	43x43	35x35	31x31	22x22
14000	45x45	37x37	32x32	22x22
15000	46x46	38x38	33x33	23x23
16000	48x48	39x39	34x34	24x24
17000	49x49	40x40	35x35	25x25
18000	51x51	42x42	36x36	25x25
19000	52x52	43x43	37x37	26x26
20000	54x54	44x44	38x38	27x27
21000	55x55	45x45	39x39	28x28
22000	57x57	46x46	40x40	28x28
23000	58x58	47x47	41x41	29x29
24000	59x59	48x48	42x42	30x30
25000	60x60	49x49	43x43	30x30

NOTES:

1. FOOTING SIZES SHOWN ARE FOR SQUARE PADS AND ARE BASED ON THE AREA (SQUARE INCHES) REQUIRED FOR THE LOAD. OTHER FOOTING CONFIGURATIONS, SUCH AS RECTANGULAR, MAY BE USED PROVIDED THE AREA (SQUARE INCHES) IS EQUAL TO OR GRATER THAN THE AREA OF THE SQUARE FOOTING SHOWN IN THE TABLE. FOR EXAMPLE, A 12"x22" (288 SQ. IN.) FOOTING MAY BE USED IN PLACE OF A 16"x16" (256 SQ. IN.) FOOTING. ALSO, TWO 12"x24" PADS MAY BE USED IN PLACE OF ONE 24"x24" PAD. **FOOTER PROJECTION FROM PIER SHALL NOT EXCEED THE THICKNESS.**
2. THE FOLLOWING TABLE SPECIFIES THE MAXIMUM FOOTING SIZE FOR VARIOUS FOOTING THICKNESSES. THIS TABLE IS BASED ON UNREINFORCED FOOTINGS. REINFORCED FOOTINGS MAY REQUIRE A SMALLER THICKNESS THAN THAT LISTED BUT MUST BE DESIGNED BY A LICENSED ENGINEER. ALSO SEE SECTION 4.2.1 FOR ALTERNATIVES.

FOOTING THICKNESS	SINGLE STACKED PIERS (W x L)	DOUBLE STACKED BLOCKS (L x W)
4"	16"x16"	16"x16"
6"	16"x24"	24"x24"
8"	19"x27"	27"x27"
12"	24"x32"	32"x32"
18"	32"x40"	40"x40"

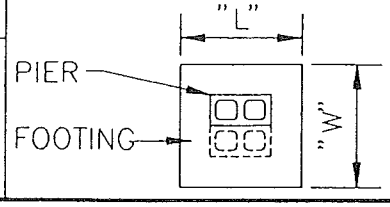
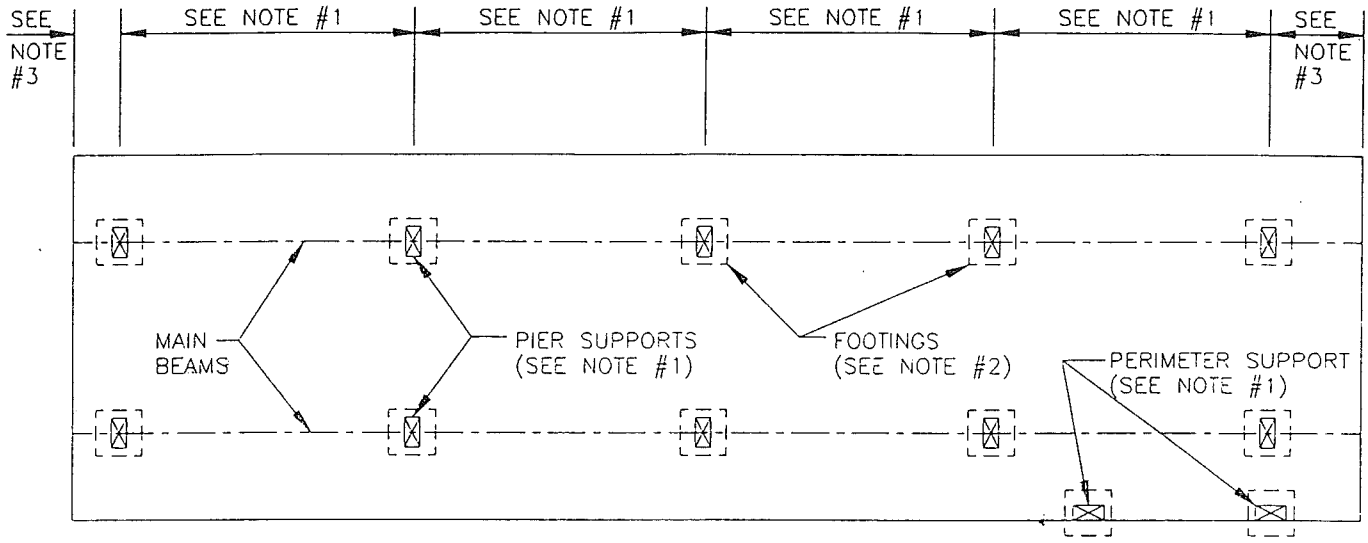
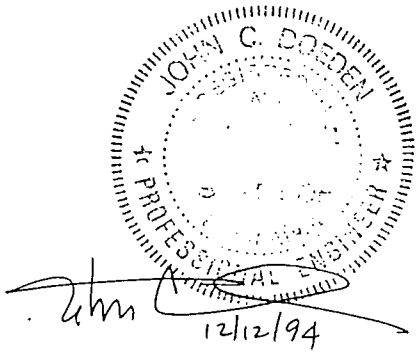


TABLE 1.1
FOOTING SIZES

JOHN C. DOEDEN
REGISTERED
PROFESSIONAL ENGINEER
12/12/94





NOTES:

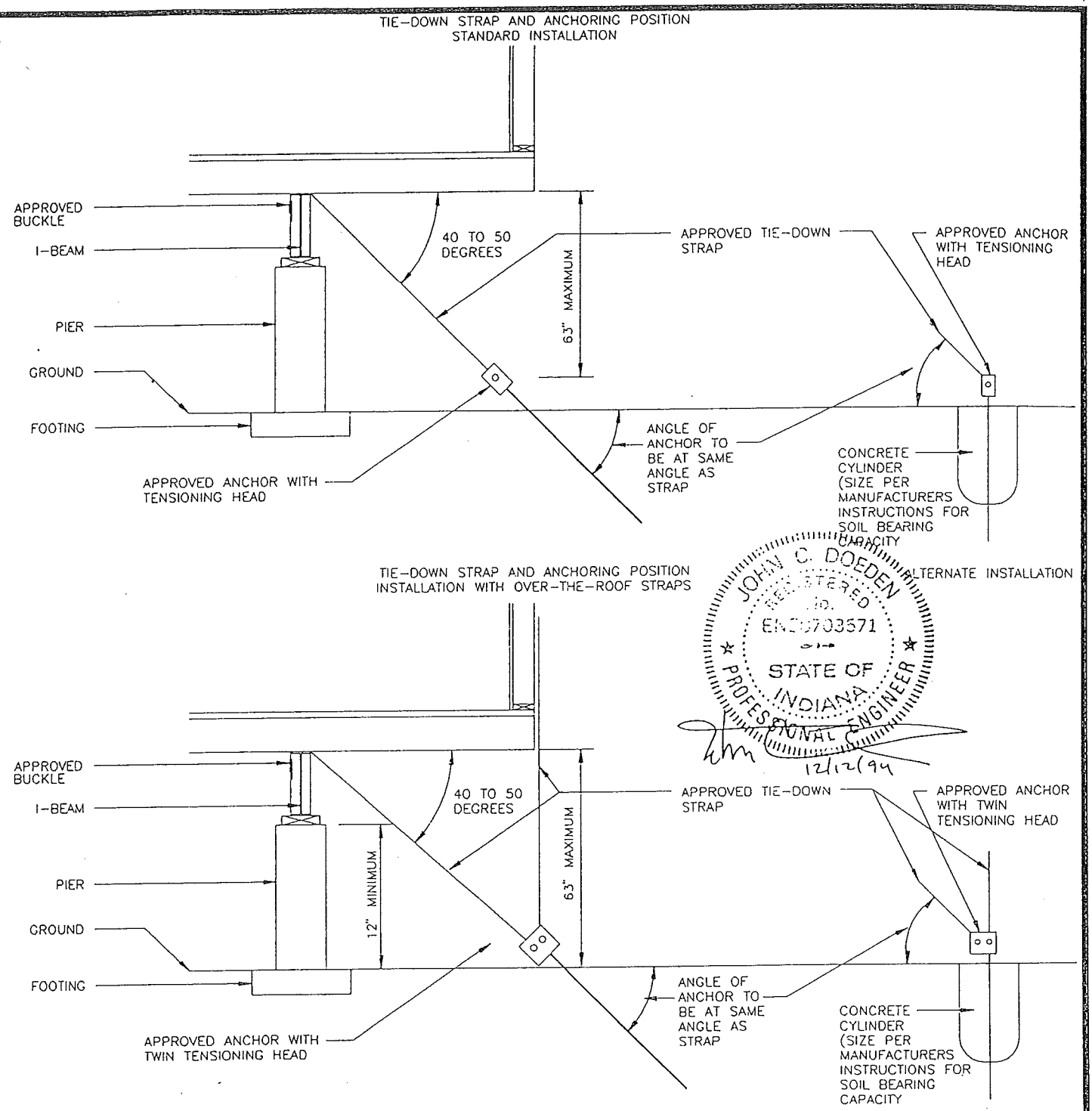
1. SEE TABLE 1.0 FOR REQUIRED PIER CAPACITY AND SPACING.

2. SEE TABLE 1.1 FOR FOOTING REQUIREMENTS.

3. PIERS SHALL BE LOCATED AT A MAXIMUM OF 2 FEET FROM BOTH ENDS.

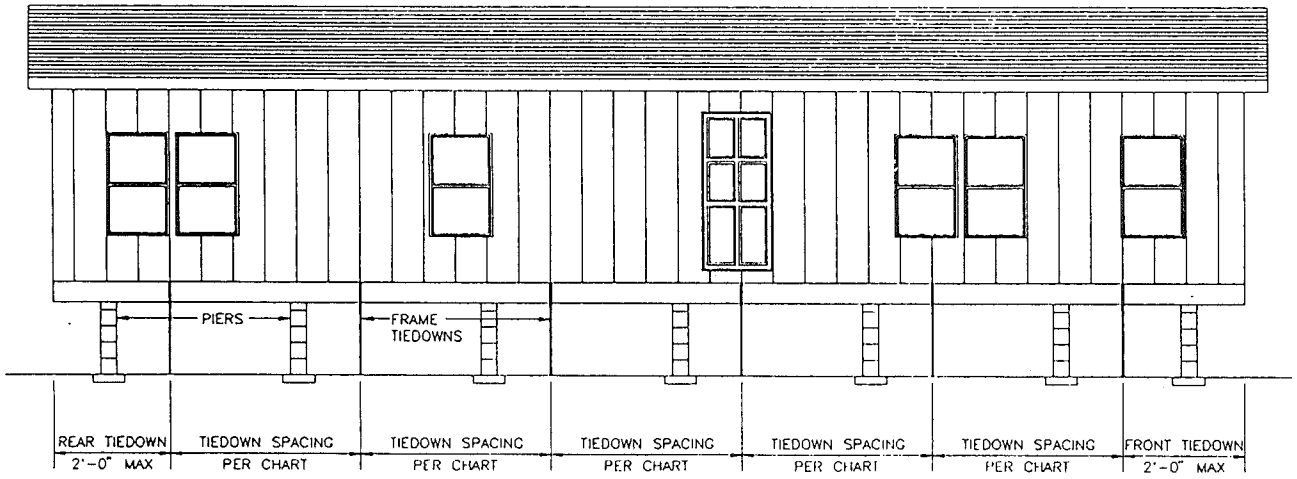
4. PIERS SHALL BE LOCATED AT EACH SIDE OF ALL PERIMETER OPENINGS (4) FEET OR GREATER IN WIDTH. THIS WILL INCLUDE DOORS, WINDOWS, RECESSED ENTRIES, PORCHES, ETC. USE TABLE 4.2 FOR PIER CAPACITY REQUIREMENTS.

FIGURE 1.0
TYPICAL BLOCKING LAYOUT FOR SINGLE-SECTION HOMES



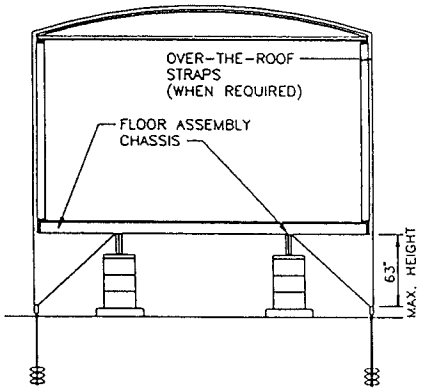
NOTES:
1. OVER-THE-ROOF TIE-DOWN STRAPS ARE NOT REQUIRED
2. ANCHORS, TIE-DOWN STRAPS AND DEVICES TO HAVE A MINIMUM WORKING LOAD RATING OF 3150# (OVERLOAD OF 4725#) AND MUST BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

FOUR SEASONS HOUSING
SINGLE WIDE HOMES – 16' WIDE
TIEDOWN & ANCHORING DETAILS
FIGURE 2.0



TYPICAL SIDE ELEVATION SHOWING TIEDOWN SPACINGS

NOTES:
1. FRAME TIE-DOWN SHOULD BE INSTALLED TO PROPERLY SECURE THE HOME.
2. OVER-THE-ROOF TIES ARE NOT REQUIRED WITH PROPERLY SPACED AND INSTALLED FRAME TIEDOWNS. HOWEVER, IF OVER-THE-ROOF TIEDOWNS ARE REQUIRED BY THE LOCAL JURISDICTION, THEY MAY BE INSTALLED.
3. OVER-THE-ROOF TIES (WHEN REQUIRED) MAY BE SECURED TO THE SAME GROUND ANCHORS AS THE FRAME TIEDOWNS.
4. FRAME TIEDOWNS AND ANCHORS ARE NOT SUPPLIED BY FOUR SEASONS HOUSING.
5. OVER-THE-ROOF STRAPS (WHEN REQUIRED) ARE SUPPLIED BY FOUR SEASONS HOUSING. ANCHORS AND END TREATMENTS ARE TO BE SUPPLIED BY OTHERS.
6. GROUND ANCHORS AND FRAME TIES SHALL BE CAPABLE OF RESISTING A TENSILE LOAD OF 4725 POUNDS AND ARE TO BE INSTALLED PER THE MANUFACTURER'S INSTALLATION INSTRUCTIONS, BUT ARE NOT TO EXTEND BEYOND THE SIDEWALL OF THE HOME.
7. STEEL ANCHORING EQUIPMENT EXPOSED TO THE WEATHER SHALL BE PROTECTED WITH AT LEAST 0.30 OZ. OF ZINC PER SQUARE FOOT OF STEEL.
8. PLACEMENT OF FRAME TIEDOWN STRAPS AND ANCHORS MAY BE OFFSET UP TO FOUR FEET TO ALLOW ALIGNMENT WITH OVER-THE-ROOF STRAPS PROVIDED NO DECREASE IN THE TOTAL NUMBER OF FRAME TIEDOWNS RESULTS.
9. DESIGN BASED ON 99 1/2" I-BEAM SPACING AND A MAXIMUM SIDEWALL HEIGHT OF 84".



TYPICAL CROSS SECTION SHOWING TIEDOWNS

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STATE OF
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12/12/94

FRAME TIEDOWN SPACING CHART		
FLOOR WIDTH	EAVE OVERHANG	WIND ZONE I (15 PSF LATERAL)
15'-2"	3"	10'-0"

FOUR SEASONS HOUSING
RECOMMENDED TIEDOWN SYSTEM
SINGLE WIDE HOMES – 16' WIDE
FIGURE 2.1

SECTION 4 SET-UP PROCEDURES

4.1 TRANSPORTING TO SITE. See **section 2.1.2.**

4.2 LEVELING AND BLOCKING. See **section 1.3** before continuing!

4.2.1 JACKS. 1. Use steel plates with a minimum size of 3/8" x 2-1/2" x 5" between the jack and the main beams to distribute the load and prevent damage to the beams.
2. Use jacks that have a minimum 10 ton rating and are in good working condition.
3. Use a firm support underneath the jacks to prevent tipping or settling.

4.2.3 PROCEDURE. Follow this step-by-step procedure to avoid placing undue stress on structural members of the home.

1. Locate the approximate location of the home. Lay out the support devices in their approximate locations. Maneuver the home into position over the site.
2. Level the home from front to rear by means of the hitch jack. Use safety blocking in the event the jack or hitch fails.
3. Place one jack just forward of the front spring hanger and another just behind the rear spring hanger under the same main beam.
4. Operating the two jacks simultaneously, raise the home slightly higher than its final position.
5. Jack up the next main beam using the same method for the first.
6. Place the piers at the proper locations and level them with the methods described in **section 4.2.4.** Remember to install any additional piers that may be required due to excessive floor live load or perimeter openings wider than 4' (48").
7. Complete the leveling procedure by adjusting all pier heights per **section 4.2.4.**
8. Recheck the soundness of all piers and adjust as required. Check all doors and windows to assure that they operate properly.

4.2.4 LEVELING PROCEDURE. Use 4" x 6" hardwood shims driven in tightly and not to occupy more than 1" vertical space. Use 2" x 8" x 16" hardwood plates to fill any vertical voids. Do not lower the home until all piers have been leveled to avoid placing undue stress on the piers, footings, and frame. Use one of the following methods for leveling the home.

1. Transit (optical or laser type)- used by a trained and competent operator.
2. Water level - see **section 4.2.4.1** for instructions on using a water level.
This is the method recommended by ***FORTRESS HOMES*** due to its simplicity and accuracy.
3. Minimum 6' (72") level. This method has a very high percent error factor.

4.2.4.1 USING A WATER LEVEL. A typical water level is 100' of 3/8" or 1/2" clear plastic hose that is connected to the bottom of a water-filled container. Dye should be added to the water to aid in the removal of air bubbles and allow the water to be visible. The container must have a vent hole which can be sealed when it is not in use. A shut-off valve should be installed on the opposite end of the tube. The water in the tube will remain level with the water in the container as long as the vent and shut-off valve are fully open. To use a water level to level a home follow these step-by-step instructions.

1. Locate the container so that the tubing can easily reach any corner of the home. Raise the container on a firm level surface so that the water in the container is at the height of the bottom

of the I-beam.

2. Check for air bubbles in the tubing. To remove air bubbles remove the vent seal on the container and place the entire length of tubing below the water level in the container and open the valve on the tubing to let all the bubbles flow out. When all the bubbles are out close the valve.

3. With the tubing valve and vent seal fully open check the water level in the tubing with the water level in the container. Make certain that the tubing is kink free. Check the height of each pier location against the water in the tube and adjust as necessary.

4. Repeat with all piers and then recheck all piers before continuing.

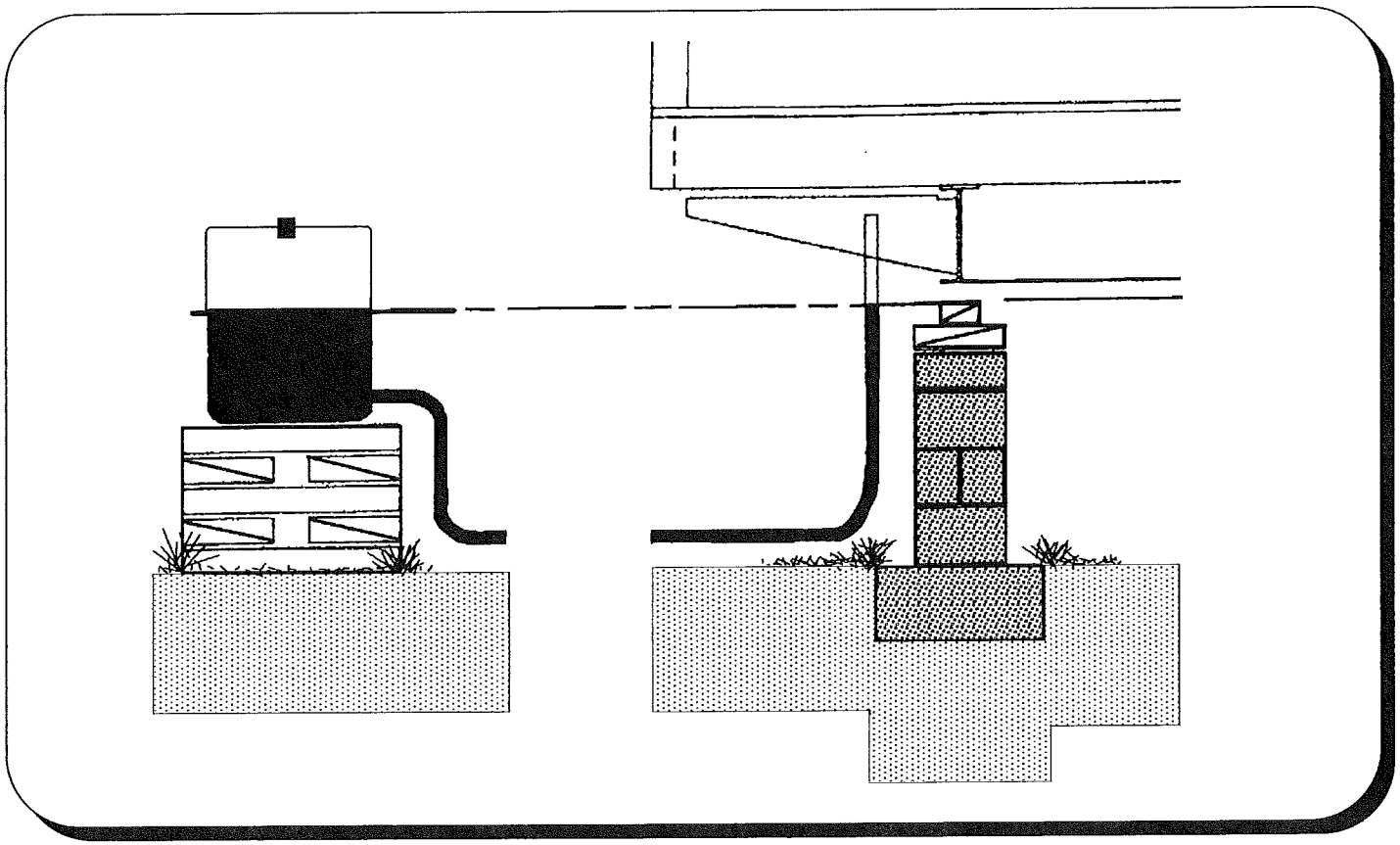

FIGURE 4.2.4.1
TYPICAL WATER LEVEL

4.3 ANCHORING.

4.3.1 PURPOSE. Anchoring is necessary to prevent the home from tipping or becoming unstable in extremely windy or stormy conditions. The home is designed for a particular wind zone which is noted on the data plate.

4.3.2 ANCHORING DEVICES. Anchors, tie-down straps, and devices are to have a minimum working load of **3,150#** and an overload of **4,725#**. All anchoring devices must be installed in accordance with the manufacturer's installation instructions and the guidelines provided in this manual. Ground anchors and frame ties shall be capable of resisting a tensile load of **4,725#**. Steel anchoring equipment exposed to the weather shall be protected with at least 0.30 oz. of zinc per square foot of steel. Slit or cut edges of zinc-coated strapping need not be coated with zinc. All anchoring devices must be approved for use as such.

4.3.3 ANCHORING INSTALLATION. See the frame tiedown spacing chart on **figure 2.1** for information on the maximum spacing of the tie-down anchors. When possible locate the tie-downs directly over piers to lessen the effects of frost heave. Make certain that the anchors are installed below the frost line and a minimum of 12" above the water table. Ground anchors must be installed with the manufacturers hardware and instructions. The tie-down straps should be installed around the frame members. Maintain the proper angle when installing the ground anchors (**see figure 2.0**) to prevent undue stress on the anchoring components. Follow these steps when installing the anchoring system.

1. Space anchors according to the chart on **figure 2.1**. Install an anchor a maximum of **2'-0"** from both ends of the home on both sides. Drive the anchors at the angle given on **figure 2.0**.
2. Connect straps to the ground anchors and frame.
3. Tighten the straps to remove slack.
4. After all straps have had the slack removed begin tensioning. Follow the manufacturer's instructions. Do **not** over-tighten or you could force the home off level and reduce the effectiveness of the anchoring system. The best method is to have two persons and tighten the straps at both sides of the home at the same time. Otherwise, you should tension the straps alternately on opposite sides of the home.
5. Recheck the tension of all straps.
6. Never attempt to jack up the home for any reason without relieving the tension on the straps.

SECTION 5 OPTIONAL FEATURES

5.1 CAUTION. ***FORTRESS HOMES CORPORATION*** cannot be held responsible for any damage resulting from the installation of accessories or any modifications to the home subsequent to shipment from the factory. All alterations must comply with the *Federal Manufactured Housing Construction and Safety Standards* and are at the risk of the installer and/or owner. Local building officials should be consulted prior to making any alterations to the home to insure compliance with all applicable codes and requirements.

5.2 SKIRTING. Skirting not only increases the value of your home but has other benefits as well. Skirting helps keep the floors warm in the winter, cool in the summer, and helps prevent plumbing freeze-ups. You can purchase skirting from your dealer. Install skirting according to the manufacturer's instructions. You must allow for an access panel and venting when installing skirting. The access panel must be no less than 18" in any dimension and no less than 3 square feet in area. The access shall be located so that the water supply and sewer drains are accessible for inspection and no special tools shall be required to remove them. Ventilation shall be provided in the form of non-closing vents located at each corner and as high as possible. The venting area shall be equal to no less than one square foot for every 150 square feet of the home's floor area. This area should be increased when insect screen and slats are installed. In freezing climates allow 3-4" for frost heave to prevent buckling. The vents must be located to provide cross-ventilation to the entire system under the home. Before skirting is installed a ground moisture vapor barrier must be installed . See **section 2.5** for information on the vapor barrier. Never vent the clothes-dryer under the home. If the home is equipped with a fuel burning sealed combustion appliance with a fresh air intake under the home a vent must be placed in the skirting adjacent to the fresh air inlet of the appliance.

5.3 CARPORTS AND AWNINGS. The best choice for carports and awnings would be free-standing units that are designed to support their own weight. Never attach a structure to your home that will add additional stress or weight to the framing or any other portion of the home.

5.4 ON-SITE ATTACHED STRUCTURES. When a home that is installed on a foundation is to have additional buildings or structures attached or located immediately adjacent to it, the building ordinance may require fire separation techniques and materials to be used. Most building ordinances require a minimum of a one

hour fire wall to be installed between garages, zero lot line homes, workshops, etc. When required, the fire separation wall must be approved by a recognized agency. All attached structures must be designed to support all of its own live and dead loads without placing additional stress or weight on any portion of your home.

5.5 EXHAUST AND VENTING. All ***FORTRESS*** homes have a Mller/Nordyne active fresh air ventilation system standard. Instructions on its use are provided with the furnace.

5.6 TELEPHONE AND CABLE TELEVISION. Use care when adding any wiring to your home. The walls, floors, and ceilings contain electrical wiring and plumbing. Careless installations could damage your home or cause **severe personal injury or death.** If in doubt contact a trained professional to perform such installations.

SECTION 6 FINAL ASSEMBLY

6.1 PURPOSE. FORTRESS HOMES ships some parts of your home "loose" (not attached) that will need to be installed after the home has been properly set-up. This section describes the procedure for installing these items.

6.2 EXTERIOR LIGHTS. Disconnect power at main electrical box. Remove covers and any protective shipping materials. Complete wiring connections using the appropriate size and type wire nuts. Use silicon base caulk (or equivalent) to provide a water-tight seal. Attach fixture to outlet box with provided hardware. Attach globe and correct wattage light bulb. See **figure 6.2** for wiring details.

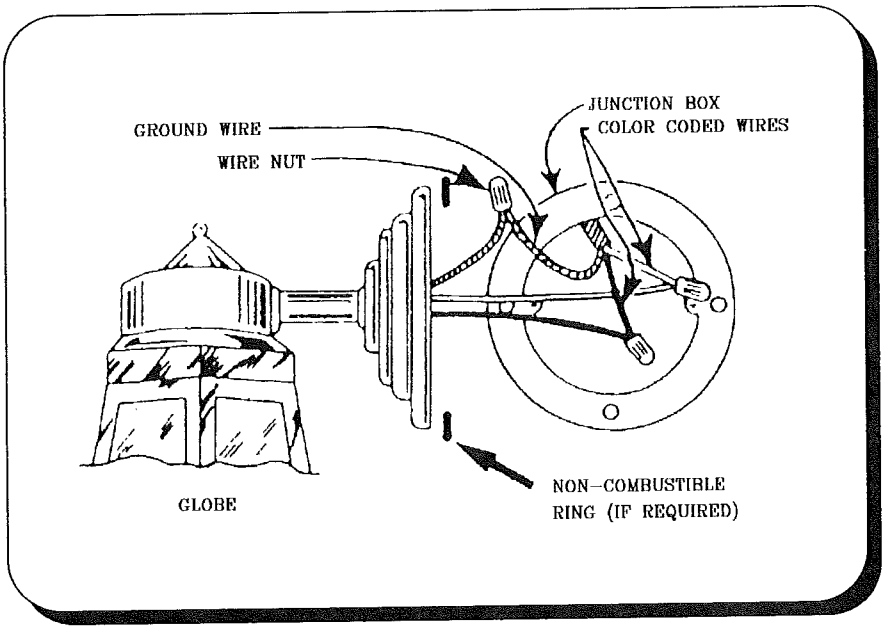

FIGURE 6.2
EXTERIOR LIGHT DETAIL

6.3 CEILING FANS. Install ceiling fans with the blades no lower than 76" off the floor. Follow the instructions provided with the fan.

6.4 HITCH, WHEEL, AND SUSPENSION REMOVAL. The front hitch used for transporting the home has been designed to be removed after the home is installed. The hitch should be stored with the house in the event the home is ever relocated. Common practice is to store the hitch under the home where it will be protected from the elements and concealed by the skirting. The axles and complete suspension system can also be removed. After removal, hub surfaces should be coated with heavy grease to resist rust and corrosion. The tires, wheels, and suspension system are designed only for use to transport your particular home and are not intended for any other purpose.

6.5 MISCELLANEOUS ITEMS. Install the glass globes for interior and exterior lighting fixtures. Install the toilet tank lid. Attach bathroom exhaust vent covers.

SECTION 7 APPLIANCES

7.1 CLOTHES DRYER. Your home has been equipped with attachments to ease the installation of an electric or gas clothes dryer. The power, gas (when applicable), and drainage systems are installed at the factory. The venting system has been roughed in and must be completed after the home has been set-up. If your home has not been equipped with a gas clothes dryer, installing one requires significant alteration of the home. Under no circumstances should the framing (rafters, joists, studs, etc.) be cut to create room for gas lines or any other item. Only qualified personnel should install a gas dryer. To complete the dryer vent installation follow these steps. See **figure 7.1** for details.

1. Remove any covers over the venting holes (interior and exterior).
2. Install a flexible dryer duct compatible with the type of dryer being installed. Be sure to obtain enough ducting to reach the outer edge of the home.
3. Secure the termination fitting to the outside edge of the floor. Be sure not to vent the dryer under the home.
4. Secure the duct to the termination fitting with clamps. Don't use screws or other devices which extend into the duct.
5. Seal the duct hole with a high quality grade of silicon caulk or tape.
6. Connect the duct to the dryer.

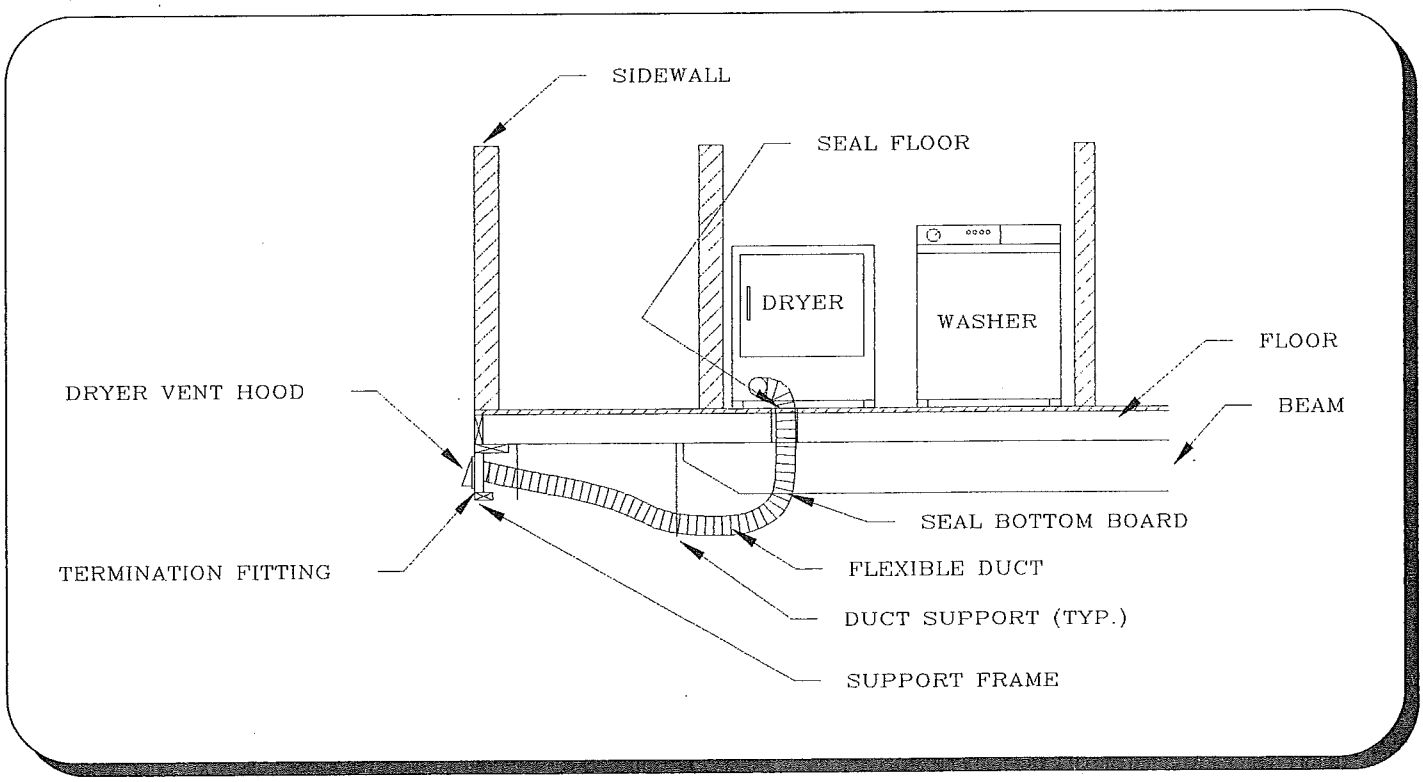

FIGURE 7.1
TYPICAL DRYER VENT INSTALLATION

7.2 FUEL BURNING DEVICES (FIREPLACES, ETC.)

7.2.1 CHIMNEYS. Some homes equipped with fireplaces require that the installation of additional section(s) of chimney pipe and a rain cap assembly be done on site. To insure sufficient draft for the fireplace, the chimney must extend 3 feet above the highest point where it penetrates the roof and be at least 2 feet higher

than any other building or obstruction within 10 feet. Parts necessary to complete the installation are provided. Note, however, that the chimney section(s) provided will be of sufficient length to meet requirements for the home only (not additional structures within 10 feet). Chimney installation must be in accordance with the fireplace manufacturers instructions. See **figure 7.2** for details. A typical installation is as follows.

1. Remove shipping coverings from the chimney
2. Install the required chimney sections and secure.
3. Install spark arrestor.
4. Install rain cap

7.2.2 COMBUSTION AIR INLETS. The air intake ducts for fireplaces and other fuel burning devices must be completed after the home is installed. Follow the manufacturer's instructions provided with the device. Do not terminate the duct beneath the floor of the home. Do not allow the combustion air inlet to dispense material beneath the home. See **figure 7.2** for details.

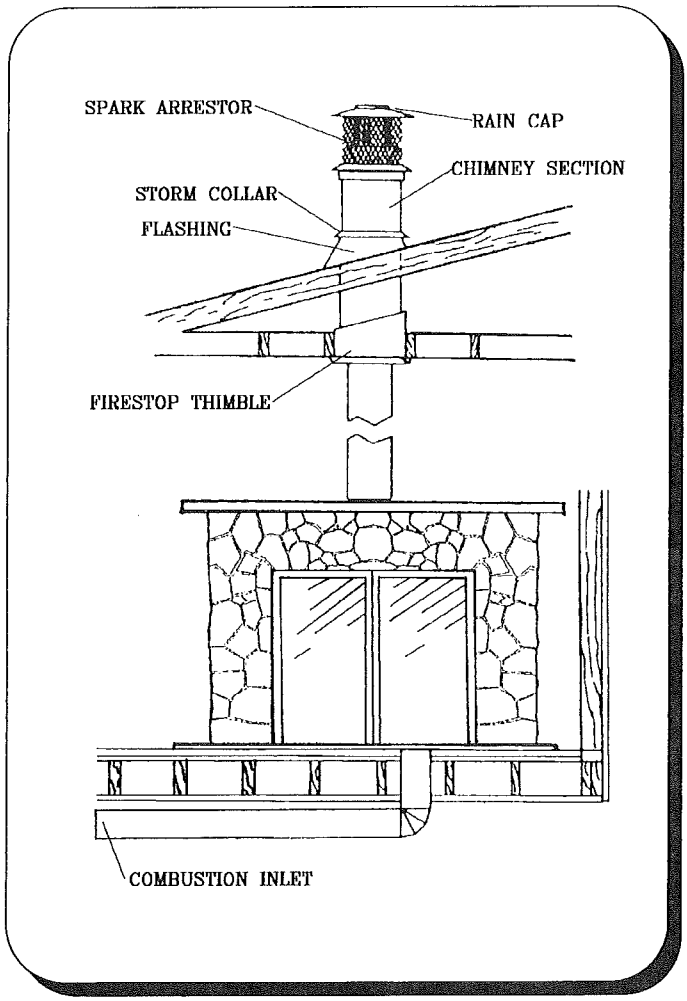

FIGURE 7.2
TYPICAL FIREPLACE

7.4 AIR CONDITIONING. Your home has been designed to accommodate a central air conditioning system. Installation of an air conditioning system should only be made by qualified personnel. The completed installation must comply with the *National Electric Code* and all applicable local codes. When installing an air conditioning system follow the manufacturer's installation instructions. The maximum allowable B.T.U./hr. rating must not exceed that which is indicated on the data plate. ***FORTRESS HOMES*** does not recommend the installation of window air conditioning units. Select an air conditioner that is intended for a manufactured home and is compatible with the home's heating system.

7.5 HEAT PUMP INSTALLATION. When installing an add-on heat pump, follow all applicable codes and the manufacturer's installation instructions. The maximum allowable B.T.U./hr. rating must not exceed that which is indicated on the data plate. Select a heat pump that is intended for use in a manufactured home and is compatible with the home's heating system.

7.6 WATER HEATER. Do **not** operate the water heater until it has been completely filled with water or the unit will be damaged. ***FORTRESS HOMES*** cannot be responsible for damage to the water heater by failure to fill it before operation.

7.7 FURNACE. The furnace manufacturer and model number are listed on the home's data plate. ***FORTRESS HOMES*** installs the proper orifice for burning natural gas at the factory (orifices for L.P. gas are

included with the furnace). The furnace is designed to accommodate the installation of a central air conditioning system.

SECTION 8 UTILITY HOOKUP AND TESTING

8.1 PURPOSE. This section deals with connecting the water, gas, drainage, oil, and electrical systems of the home to the site services. Regulations governing the utility connections vary with location; thus, the authorities having jurisdiction must be consulted to insure the connections are in accordance with all applicable regulations. Connections must be made only by experienced, qualified personnel who are familiar with local codes. The utility systems for all ***FORTRESS*** homes are subject to stringent tests before leaving the factory. This, however, cannot provide a guarantee against possible damage in transit. For this reason, it is imperative that the tests for each of the utility systems be carried out as described in this manual. Upon completion of your utility system it is important to provide access to connections for periodic inspections and possible future service.

8.2 WATER SUPPLY HOOKUP AND TESTING PROCEDURE.

8.2.1 WATER SUPPLY TESTING. The water supply system was tested at the factory, however, it is essential that it be rechecked at the site for leaks that may have been caused during transit. Close all water faucets, spigots and toilet supply valves. The water heater must be bypassed during this test. This type of test involves use of pressurized air which can permanently damage or rupture the water heater causing **severe injury.** By-pass the water heater by disconnecting the cold water inlet and the hot water outlet and then connecting them together through the use of an appropriate fitting. Pressurize the entire system to 100 P.S.I., then isolate it from the pressure source. The system must hold steady at 100 P.S.I. for at least 15 minutes. If the system fails this test locate and repair any leaks (repressurize the system and use a soapy solution to aid in finding leaks). Retest after properly repairing leaks. Reconnect the water heater. Operate all water faucets, showers, etc. to clear any air blocks.

8.2.2 WATER SUPPLY HOOKUP. Water inlet is usually located near the water heater compartment through the floor or adjacent to the water heater compartment near the sidewall through the floor. The location of the water supply inlet is labeled on the lowest row of siding. Connection is made via a 3/4" threaded nipple. Install a master shut-off valve (if not factory installed). Install a pressure reducer if site pressure exceeds 80 P.S.I. Site connections must meet local codes.

8.2.2.1 PROTECTION FROM FREEZING. If the home is installed in an area subject to freezing conditions it is necessary to protect any exposed (not insulated) portions of the water supply system. The use of a thermostatically controlled heat tape is recommended by ***FORTRESS HOMES***. An electrical receptacle has been factory installed for use as a power source for electric heat tape. The receptacle is not GFI protected so the heat tape's power will not be interrupted. The receptacle is within 2'-0" of the water inlet. The heat tape used must be listed by a nationally recognized testing laboratory as for use with manufactured homes. Install heat tape in accordance with the manufacturer's instructions.

8.3 DRAINAGE SYSTEM HOOKUP AND TESTING.

8.3.1 DRAINAGE SYSTEM TESTING. The drainage system was tested at the factory, however, it is essential that it be rechecked at the site for leaks that may have been caused during transit. The following procedure is for conducting a flood level test.

1. Cap off the stool drop(s) underneath the home with a water tight seal.
2. Plug the tub/shower drains.
3. Fill the entire system to the level of the toilet bowl rim(s).
4. Open the shower/tub drains to release trapped air.

5. Close as soon as water begins to be expelled from the shower/tub drains, and trapped air is released.
6. Replug the shower/tub drains.
7. Refill to rim of toilet.
8. Let stand undisturbed for 15 minutes.
9. Check for evidence of water leaks.
10. Check level of water in toilet to determine any loss of fluid.
11. Repair any leaks and retest.
12. Remove the caps on the stool drops and allow the system to drain.
13. If the home is be left unheated in a freezing climate, remove the water from the traps or add antifreeze to prevent damage.

8.3.2 DRAINAGE SYSTEM HOOKUP. Some portions of the drainage system may not be assembled in an effort to protect the system from damage during shipping and/or the installation process. ***FORTRESS HOMES*** provides the necessary materials to complete the drainage system up to the main drop. Completion of the drainage system should be performed by persons trained in the use of ABS pipe and plumbing. The location of the main sewage drop is labeled on the lowest row of siding. When completing the system start at the outer-most point and work toward the main drop. Cut all pipe square and deburr any rough edges inside and out. Maintain a 1/4" per foot slope on all piping. Dry assemble the entire system before using any solvent to assure proper fit and alignment. Attach supports at 4 feet or less.

8.3.2.1 PROTECTION FROM FREEZING. If the home is installed in an area subject to freezing conditions it is necessary to protect any exposed (not insulated) portions of the drainage system. This can be accomplished by insulation these areas.

8.4 GAS SYSTEM HOOKUP AND TESTING.

8.4.1 GAS SYSTEM TESTING. The gas system was tested at the factory, however, it is essential that it be rechecked at the site for leaks that may have been caused during transit. Before a test is begun the ambient air temperature and the temperature of the gas piping should be approximately the same. Conduct the test when the air temperature is to remain stable. Do **not** apply more pressure than specified as it can damage the gas valves and/or regulators. The gas system must be tested two ways; **1**. The piping only - with the appliances isolated. **2.** The entire system - with appliances.

8.4.1.1 PIPING SYSTEM TESTING. To conduct a test of the gas piping system follow these steps.

1. Isolate all gas appliances from the system by closing all shut-off valves.
2. At the gas inlet, attach a pressure gauge.
3. Pressurize the system with air to no less than 3 P.S.I. (48 ounces).
4. Isolate the pressure source from the system.
5. The pressure must remain stable for at least 10 minutes.
6. If the system fails this test locate and repair any leaks (repressurize the system and use a soapy solution to aid in finding leaks). It is not permissible to repair fittings or piping. Any defective pipe of fittings must be replaced. Retest.

8.4.1.2 TOTAL GAS SYSTEM TESTING. To conduct a test of the completed gas system (including appliances) follow these steps. Do **not** bubble check brass fittings with solutions containing ammonia.

1. Open all appliance shut-off valves.
2. At the gas inlet, attach a pressure gauge.

3. Turn off all pilot lights (if possible).
4. Pressurize and maintain the system with air at no less than 0.5 P.S.I. (8 ounces).
5. Apply a soapy solution to the gas fittings between the shut-off valves and appliances. There should be no evidence of leakage.
6. If the system fails this test locate and repair any leaks. It is not permissible to repair fittings or piping. Any defective pipe of fittings must be replaced. Retest.

8.4.2 GAS SYSTEM HOOKUP. The gas piping system is complete and installed when the home leaves the factory. Prior to connecting to site service, gas inlet orifices of appliances (oven, stove, furnace, etc.) must be checked to insure they are the correct type for the kind of gas (liquefied petroleum or natural) being used at the site. The gas supply pressure should not exceed 7" to 14" water column. Only trained and qualified persons should attempt to attach the home's gas system to the site supply. The location of the gas inlet is labeled on the lowest row of siding.

8.5 ELECTRICAL SYSTEM HOOKUP AND TESTING.

8.5.1 ELECTRICAL SYSTEM TESTING. The electrical system was tested at the factory, however, it is essential that it be rechecked at the site for defects that may have been caused during transit. There are two sections of electrical tests that are to be performed. One section (**section 8.5.1.1** pre-connection tests) deals with electrical tests that are to be completed before the home's electrical system is connected to the site service. The other section (**section 8.5.1.2** post-connection tests) deals with tests that are to be performed after the home's electrical service is connected to the site service. Make certain that the water heater is filled with water before activating the water heater circuit.

8.5.1.1 PRE-CONNECTION ELECTRICAL TESTING. There are two tests that **must** be completed before the home's electrical service is connected to the site service. They are the grounding continuity and circuit continuity tests. The dielectric strength (or hi-pot) test is not required, but can be done if the proper equipment and a trained technician are available.

8.5.1.1.1 GROUNDING CONTINUITY TEST. When conducting the ground continuity test follow these steps.

1. Before beginning the test make certain that all the appliances are installed and hooked up and all electrical fixtures have been properly installed.
2. Using a continuity tester, connect one test lead to the ground bus.
3. The other test lead (which must be long enough able to reach all portions of the home) will be used to test all exposed non-current carrying metal parts. Which include, but is not limited to, the following.
    a. Metal gas piping.
    b. Light and fan fixture canopies (the metal parts that mount the fixture to the wall or ceiling).
    c. The steel frame.
    d. All metal appliances (appliances must be plugged-in).

    NOTE: Continuity to ground is not required on metal plumbing parts that are connected to a plastic piped water distribution and/or drainage system. If, however, the fixture is connected to electric power it must be properly grounded.

4. If a defect is found during the test, the problem must be corrected and repaired, and the entire system rechecked.

8.5.1.1.2 CIRCUIT CONTINUITY TEST. The circuit continuity test is accomplished by placing all branch circuit breakers and switches in the "on" position. Using a continuity tester check for any indication of a connection between any of the supply conductors (including neutral) and the ground circuit.

8.5.1.1.3 DIELECTRIC STRENGTH (HI-POT) TEST. This test should only be conducted by qualified individuals. Follow the testing equipment's instructions and these steps. This test involves the use of high voltage electricity and careless or improper use can result in **serious injury or death.**

1. Check that the testing equipment cord is plugged into a 115 volt power source.
2. Turn the power switch "on". Touch the probes together to verify that the machine indicates a short.
3. Turn the voltage to zero.
4. Apply the **ground** lead of the hi-pot to **ground** terminal of the panel box.
5. Attach the **high voltage** terminal of the hi-pot to one of the **hot** terminals of the panel box.
6. Gradually raise the hi-pot voltage from 0 to 1,080 volts, hold for one second, then reduce the voltage back to zero.
7. Gradually raise the hi-pot voltage from 0 to 900 volts, hold for one minute, then reduce the voltage back to 0.
8. Gradually raise the hi-pot voltage from 0 to 1,080 volts, hold for one second, then reduce the voltage back to zero.
9. Remove the **high voltage** lead from the **hot** terminal and attach it to the **neutral** terminal of the panel box.
10. Repeat steps **6-8.**
11. Remove the **high voltage** lead from the **neutral** terminal and attach it to the **other hot** terminal on the panel box.
12. Repeat steps **6-8.**
13. If the testing equipment indicates a problem, it must be corrected and then the entire system rechecked.

8.5.1.2 POST-CONNECTION TESTING. Complete the procedures in **section 8.5.2** before conducting any of these tests. After the home has been connected to the site power supply, the following tests must be completed. Make sure that the water heater is filled before it is energized.

8.5.1.2.1 POLARITY TEST. After the power system has been energized, turn on all the breakers and switches to lights and/or receptacles. Using a circuit testing device capable of detecting and identifying wiring problems, test **every** light socket and receptacle. If the testing equipment indicates a problem, it must be corrected and then the entire system rechecked.

8.5.1.2.2 OPERATIONAL TEST. After the power system has been energized, turn on all the breakers (and switches to receptacles). Make sure that the water heater is filled before it is energized. Install light bulbs/tubes in all light fixtures (do **not** switch the lights on while installing the bulbs/tubes). Make certain that each fixture is operational by switching it on. Check the operation of all motorized appliances (furnace blower, bathroom vents, garbage disposal, etc.). Check the operation of all ,smoke detectors. Check the operation of all G.F.I. receptacles by manually tripping the test buttons.

8.5.2 ELECTRICAL HOOK-UP. The tests in section **8.5.1.1** must be completed before connecting the home to site power. Use the information in these sections to complete the connection of the home's electrical distribution system to the site supply.

8.5.2.1 ELECTRICAL FEEDER AND EQUIPMENT SIZES. To determine the proper feeder size amperage, see the main breaker and the label on the electrical distribution panel. Using this information, determine the required feeder size from **table 8.5.2.1**. Feeder sizes are in accordance with the *National Electric Code*, table 310-16, and do not take voltage drop into consideration. Allowable ampacities are based on an ambient temperature of 30 degrees C. (86 degrees F.).

ELECTRICAL FEEDER AND EQUIPMENT SIZES						
FEEDER SIZE (AMPS)	MAXIMUM NEUTRAL FEEDER LOAD (AMPS)	MINIMUM EQUIPMENT SIZES		FEEDER WIRE SIZES (AWG) BASED UPON USE OF 75 DEGREE C. COPPER CONDUCTORS		
		CONDUIT (INCHES)	JUNCTION BOX (INCHES)	POWER (RED OR BLACK)	NEUTRAL (WHITE)	GROUND (BARE OR GREEN)
100	100	1-1/2"	10x12x4	#3 THW	#3 THW	#8
150	115	2"	12x16x6	#1/0 THW	#1/0 THW	#6
200	130	2"	12x16x6	#3/0 THW	#3/0 THW	#4

TABLE 8.5.2.1
ELECTRICAL FEEDER AND EQUIPMENT SIZES CHART

8.5.2.2 GROUNDING THE HOME. The grounding bar in the main electrical distribution panel box must be grounded by qualified personnel in accordance with applicable sections of the *National Electrical Code* as well as any applicable requirements imposed by local authorities.

8.5.2.3 MAST WEATHERHEAD FEEDER. The installation of the service drop must meet local codes. ***FORTRESS HOMES*** designs the electrical distribution panel to accept any type of feeder connection. Install according to *NEC* articles **230-24 and 230-26.** See **figures 8.5.2.3(a), (b), and 8.5.2.4** for installation details.

8.5.2.4 UNDER-FLOOR FEEDER. The installation of the service drop must meet local codes. ***FORTRESS HOMES*** designs the electrical distribution panel to accept any type of feeder connection. Install according to *NEC* articles **230-24 and 230-26.** See **figure 8.5.2.4** for installation details.

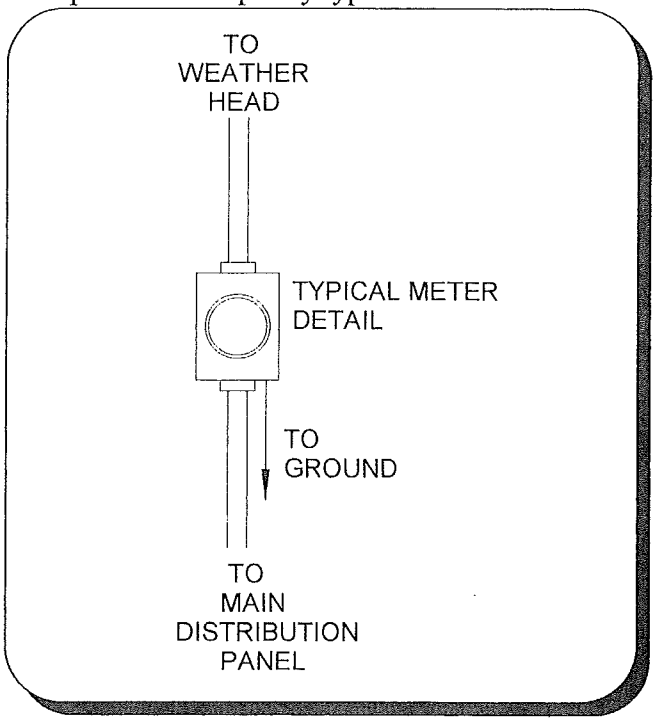

FIGURE 8.5.2.3 (a)
TYPICAL METER DETAIL

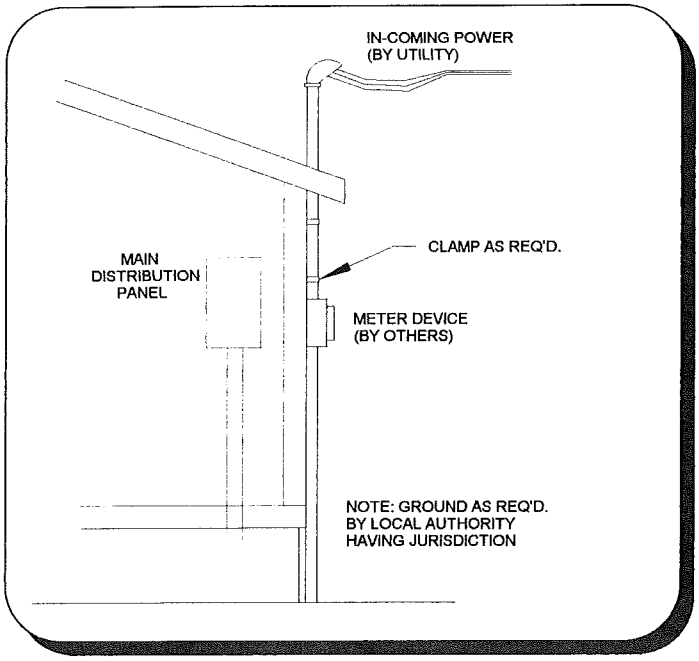

FIGURE 8.5.2.3 (b)
WEATHERHEAD INSTALLATION

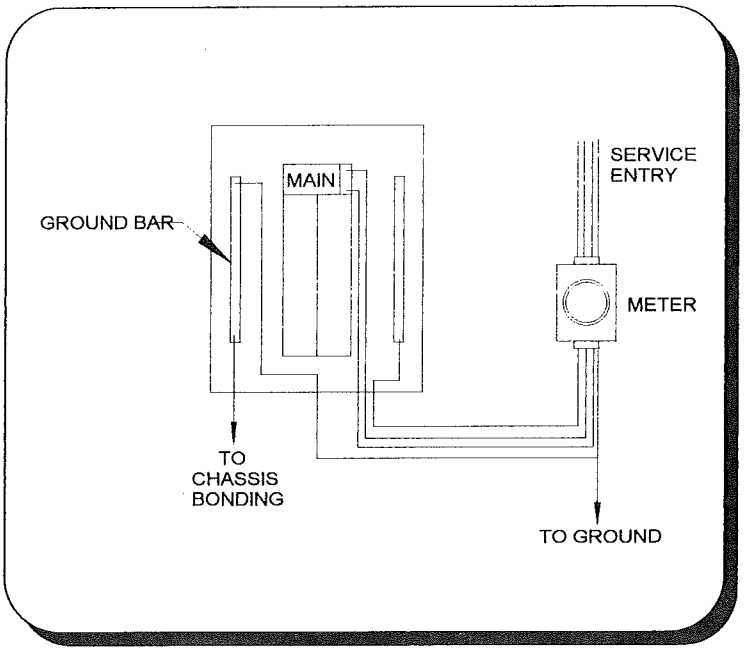

FIGURE 8.5.2.4
MAIN DISTRIBUTION PANEL HOOKUP

SECTION 9 MISCELLANEOUS

9.1 BOTTOM BOARD PATCHING. The bottom of your home has been covered with a vinyl-coated plastic material. It is important that any tears or holes in this covering be repaired. To repair rips, tears, and small holes can be repaired using a special bottom board tape. ***FORTRESS HOMES*** recommends **CS-12** from Sheperd Products of Kalamazoo, Michigan or **#620** from First Line Corporation in Valdosta, Georgia. Large holes must be repaired with a patch. The patch should first be affixed with one of the types of tape listed above. Then secure with 1" x 5/8" x 16 gauge staples at 3" intervals.

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