HOUSING

Manufactured Homes and Factory Built Housing

Installation Handbook

Colorado Department of Local Affairs
Division of Housing
Housing Technology and Standards
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Foreword

This handbook is not intended to replace specified code requirements, regulatory requirements or installation instructions provided by the **manufacturer**. It is solely intended to provide the installer and inspector with a reference guide to highlight areas that may require consideration at the time of installation and inspection.

The standards and this handbook are only applicable to the setting and tying together of manufactured housing, from the mud sill up. It does not include permanent foundation construction, which is under the authority of the local jurisdiction.

Handbook Revisions

May 2001--This handbook was first produced. "yellow cover"

Feb 2014--Major revision "green cover"

April 2014--Minor revision "added flood area check to check list"

Jan 2015--Minor revision "added information on flood damaged units"

Jan 2016—Minor revision "Added clarity to labeling of the installation, drainage, vapor retarder, pier and plumbing sections, updated energy code, updated inspection checklist"

Chapter

1

Manufactured Home and Factory Built Housing –General Requirements

Manufacturer's Installation Instructions

CRS24-32-3316. *"Compliance with manufacturer's installation instructions*
Any installation of a manufactured home in this state shall be performed in strict accordance with the applicable manufacturer's installation instructions. Where the manufacturer's instructions are not applicable, installation shall be in accordance with standards promulgated by the division. A copy of the manufacturer's instructions or the standards promulgated by the division shall be available at the time of installation and inspection."

New homes shall be installed per the **Manufacturer's** Installation Instructions. Contact the Division of Housing if for some reason the **Manufacturer's** Installation Instructions are not available for a new home.

If the **Manufacturer's** Installation Instructions are not available for a used or older home then the following standards must be used:

Factory Built Modular units:

A. Structural attachment requirements approved by a State of Colorado licensed engineer.

B. Current version of the International Residential Code as adopted by the State of Colorado Housing Board.

Mobile Homes and HUD homes:

A. NFPA 225, Model Manufactured Home Installation Standard, 2013 Edition as amended by Resolution 38.

Other references:

24 CFR Part 3285, Model Manufactured Home Installation Standards, April 1, 2009 or most recent version.

24 CFR Part 3280, Manufactured Home Construction and Safety Standards, April 1, 2009 or most recent version.

Permanent Foundations Guide for Manufactured Housing (HUD–7584), September 1996 Edition, published by the United States Department of Housing and Urban Development or most recent version.

Guide to Foundation and Support Systems for Manufactured Homes, March 2002, U.S. Department of Housing and Urban Development or most recent version.

Plumbing: 2012 IPC or most current version as adopted by the State Plumbing Board.

Electrical: 2011 NEC or most current version as adopted by the State Electrical Board.

Labeling of HUD Units and Important HUD Regulations

HUD Label: Each section of each home manufactured under the Federal Manufactured Home Construction and Safety Standard shall contain a label (See figure 1.1) issued by the inspection agency. The label is generally located on the rear of each unit and is required to be affixed in a permanent manner. The label indicates that the **manufacturer** has certified that the home meets the applicable standards and that the construction process has been monitored by a third-party inspection agency. The label is generally referred to as the "HUD label".

Manufactured homes bearing the red HUD label and rated for Colorado shall be accepted and installed to meet the MHIP requirements as outlined in Colorado State Law CRS 24-32-3318, which supersedes the building codes of counties, and municipalities.

FIGURE 1.1 – HUD Label

Data Plate: Each HUD home shall bear a data plate (See figure 1.2) affixed in a permanent manner near the main electrical panel, master bedroom closet, laundry room, or other readily accessible and visible location. The data plate contains the name of the **manufacturer**, the design-approval agency, factory-installed equipment, and the wind, roof load, and thermal zones for which the unit was constructed. The installer shall ensure that the home has been constructed for the requirements of Colorado as outlined in CFR 24 Part 3280.

Data plates of HUD homes installed in the State of Colorado shall indicate the following minimums:

WIND ZONE:	ZONE 1
THERMAL	ZONE 3
ROOF LOADS	MIDDLE (30 PSF)

IF ANY CRITERIA DO NOT MEET THE MINIMUM REQUIREMENTS,
DO NOT SET THE HOME. CALL THE DIVISION OF HOUSING!

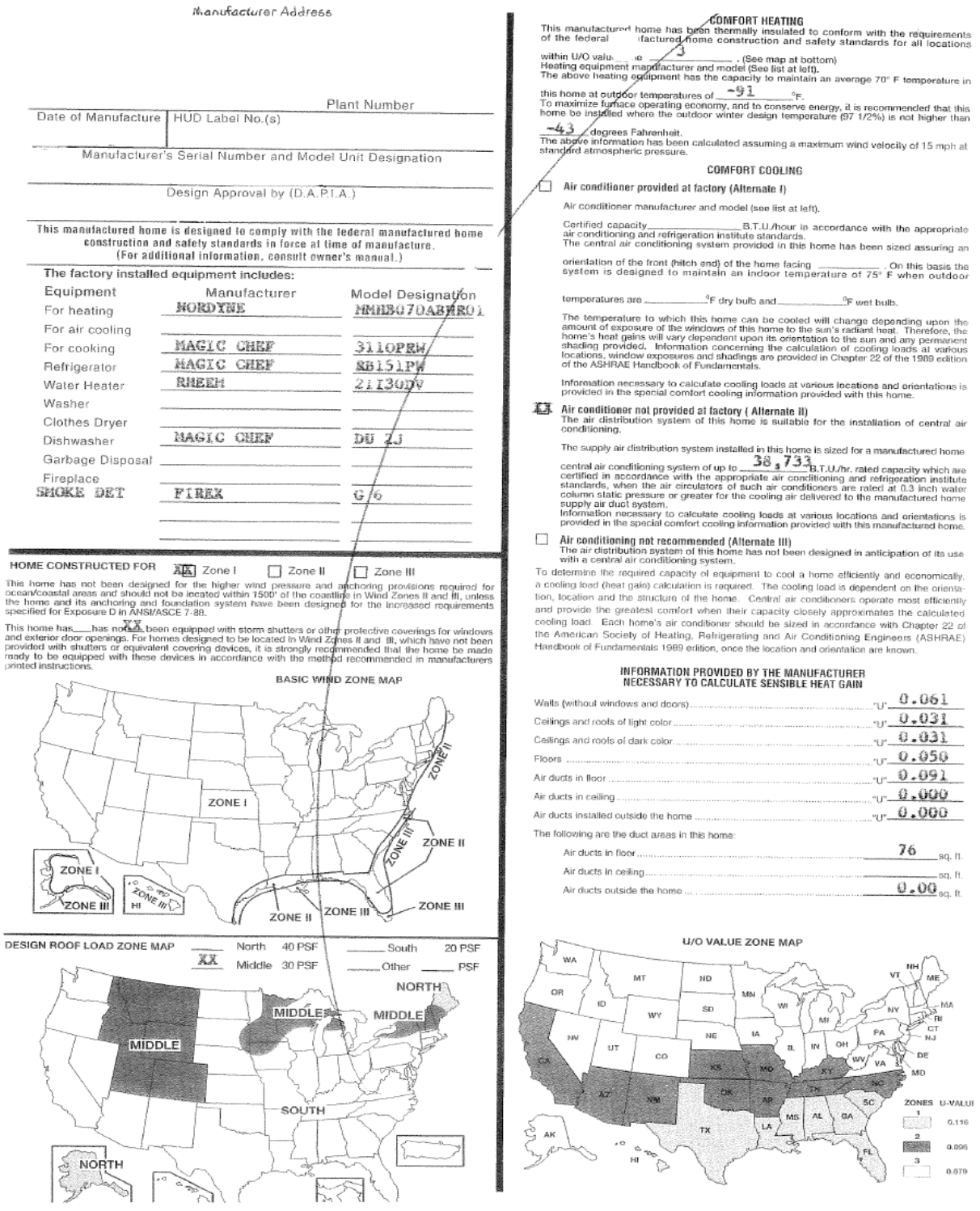


FIGURE 1.2 – Data Plate Example

Special Snow and Wind Load Conditions: Homes designed for and located in heavy snowfall areas or high wind areas may require special piers and footings or tie-downs. Check with the authority having jurisdiction.

HUD has determined that all of Colorado is in the middle Zone of 30 lb./sq. ft. for the required design roof load (snow load). As Colorado has snow loads up to 120 lb./sq. ft., local jurisdictions may require snow load mitigation plans. HUD has determined that all of Colorado is in wind zone I which relates to a 15 psf horizontal loading and a 9 psf net uplift loading. As Colorado homes may be subject to wind speeds up to 140 mph, local jurisdictions may require wind mitigation plans. These snow and wind mitigation plans could include:

1. Having the home built for the proven snow load or wind load.
2. An approved snow removal maintenance program or
3. A protective shelter built over the home, not connected to the home
4. A shelter designed by a Professional Engineer or Architect

Damaged Homes:

Manufactured home inspectors and installers are reminded of their responsibility to inspect each home for all damage, including damage from natural disasters (flood, fire, etc), prior to the installation of the home. Any home that has been inspected and identified as having damage shall not be set until the damage is corrected. In some cases, flood damaged manufactured homes may not be able to be repaired and are considered salvaged units not fit for occupancy.

Transportation Damage: The unit may be damaged in transport so that it no longer conforms to the Manufactured Home Construction and Safety Standards, and should not be accepted by local building official or other authorized inspection personnel. When damage is discovered or suspected, the inspection personnel may require tests on plumbing, fuel-burning, or electrical systems to determine the adequacy of repairs.

Please note that the manufactured home retailer is prohibited from selling, leasing or offering for sale or leasing any manufactured home that does not conform to the applicable Standards. Please refer to the Manufactured Home Construction and Safety Standards and Manufactured Home Procedural and Enforcement Regulations, Title 24, CFR Parts 3280 and 3282. Authorized inspection personnel should report violations of the Standards to the Colorado Division of Housing.

Units Damaged From Natural Disasters: The local jurisdiction has authority over repair of previously set and occupied Mobile Homes (pre-1976), HUD Manufactured Homes, and Factory-Built Modular Homes, including homes damaged or listed as destroyed in a natural disaster such as flood or fire. The local jurisdiction shall control when and if the home can be re-occupied or if the home is to be salvaged/destroyed. Local jurisdictions may contact the Division of Housing for guidelines and recommendations.

In areas that have no local building department, the MHIP Installer/Inspector shall contact the Division of Housing for requirements on damaged homes. The Division of Housing has authority over flooded manufactured homes that happen to be re-installed through the MHIP program.

Homes that are known to have been flooded above the floor line are not recommended to be reinstalled and should be confirmed as salvaged/destroyed. For all other units that were previously in a flooded area contact the Division of Housing for inspections and approval prior to re-installing the home.

Consumer Protection: In addition, the purchaser and/or occupant of all homes damaged from a flood that are resold/reinstalled for occupancy must be informed of the previous flood damage. [CRS 6-1-105(1)(o)]

Labeling of Factory Built Units

Each living unit of a factory-built home is constructed to the International Series of Codes (or for older units the Uniform Series of Codes) and the National Electric Code. The home will bear an insignia (See figures 1.3 and 1.4) issued by the State of Colorado, Division of Housing. The insignia indicates that the **manufacturer** has certified that the unit is built in compliance with Colorado standards, and that the construction process has been monitored by the Division of Housing or an approved third-party inspection agency. The insignia will be found in the kitchen sink cabinet.

The home bearing a factory-built insignia shall be accepted in all locations as meeting the requirements of Colorado State Law, 24-32-3311, which supersedes the building codes of counties and local jurisdictions. Factory Built Units must meet the snow and wind load requirements for the specific home site.

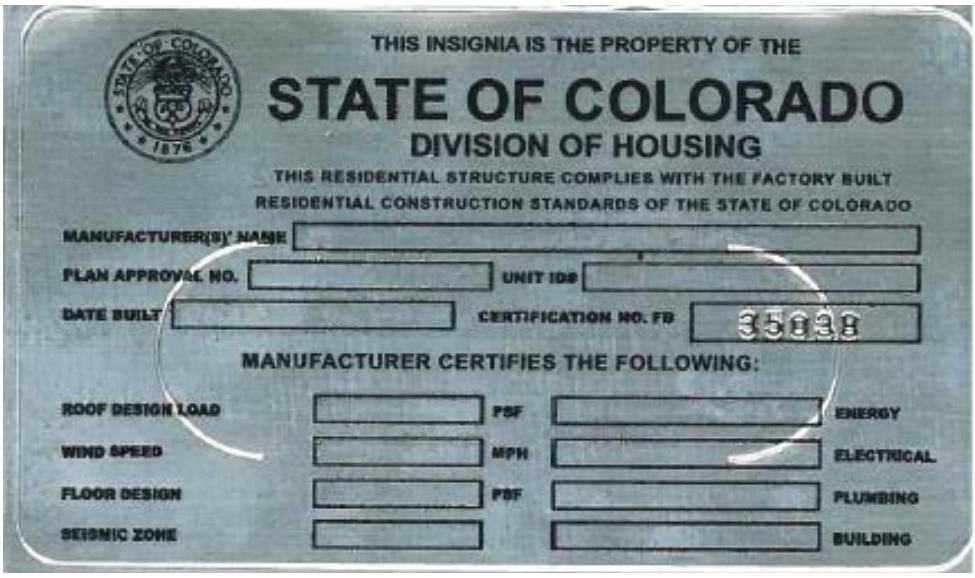


FIGURE 1.3 – Factory Built Primary Insignia

Each additional manufactured box for the dwelling will show approval by the affixing of an additional floor tag adjacent to the primary insignia.

FIGURE 1.4 – Additional Floor Tag

Oversite of Factory Built Units

All out-of-State factories will use an approved third party inspection agency to verify construction meets current codes as adopted by the Housing Board. In-State factories typically have CDOH inspect construction in the factory, but may use a third party inspection agency if they choose. Initially, units that have third party approval will also require an oversite inspection by CDOH in the field. These units will not have the Factory Built Insignia affixed by the Factory. The Insignia is held by CDOH until the unit passes inspection by CDOH at which time the CDOH inspector will apply the insignia. CDOH may grant certification to factories based on quality and allow the factory quality assurance personnel to affix the insignia prior to shipment.

Factory Built "AC" Units

Alternative Construction "AC" is specific additional construction and/or modification of the factory-built structure that directly affects the life, health, safety, energy use and/or habitability of the structure and is not covered by the factory-built or installation insignias and requires building permits and inspection(s) to verify code compliance. This specific additional construction is not part of a typical home installation.

Typically "AC" units are determined at plan review where the **manufacturer** has noted that certain required construction is to be completed in the field. i.e. "roof trusses, sheathing and roof covering to be completed by others on site."

"AC" units may also be determined after plan review in the factory, i.e. window and doors did not arrive prior to shipment and they have to be installed on site, the **manufacturer** would notify CDOH to make this an "AC" unit and the window and door installation would then be inspected in the field.

Local jurisdictions may sign the "AC inspection required notice form" and complete the "AC" inspection, or a CDOH inspector will perform the "AC" inspection. The Factory Built insignia may or may not be applied in the Factory depending on who will do the inspection and whether the factory is certified or registered. More specific details on "AC" units are contained in (Alternative Construction Procedures) available from CDOH.

Labeling of the Installation

Colorado State Resolution 38, Section 7 – Prior to beginning the installation of a manufactured home, the owner, registered or certified installer of a manufactured home shall make an application for an Installation Authorization (See figure 1.5) from the Division of Housing or certified installation inspector. Owners, registered, and certified installers shall display an Installation Authorization at the site of the manufactured home to be installed until an installation insignia is attached to the manufactured home certifying MHIP compliance. When installing in a participating jurisdiction the appropriate installation authorization from the local jurisdiction shall be displayed, typically the building permit.

STATE OF COLORADO
MANUFACTURED HOUSING INSTALLATION PROGRAM

INSTALLATION AUTHORIZATION

DIVISION OF HOUSING NOTIFICATION DATE: _____

____ **BY FAX: 303/864-7857** ____ **BY MAIL: 1313 SHERMAN STREET, ROOM 321**
____ **BY E-MAIL: JOYCE.CALBART@STATE.CO.US** **DENVER, COLORADO 80203**
____ **IN PERSON 303/864-7837 – PH#**

INSTALLATION BY:
___**REGISTERED INSTALLER** ____**CERTIFIED INSTALLER** _____**HOMEOWNER**

SCHEDULED INSTALLATION DATE: _____

INSTALLATION ADDRESS: _____

_____

DIRECTIONS: _____

HOME TYPE: ___**MOBILE** ___**HUD** ___**IRC** ___**MF**

SERIAL#: _____

SOIL BEARING CAPACITY IF OTHER THAN 1500 PSF:_____
INSTALLATION CONTACT:

NAME: _____ **PHONE #:** _____ **CELL/ALT#:** _____

____**INSTALLER** _____**INSPECTOR** _____**OWNER** _____**OTHER**

OWNER NAME: _____ **OWNER PHONE#:** _____

INSTALLER NAME: _____ **INSTALLER ID#:** _____

INSTALLER PHONE#: _____ **CELL/ALT#:** _____

INSPECTOR NAME: _____ **INSPECTOR ID#:** _____

INSPECTOR PHONE#: _____ **CELL/ALT#:** _____

INSTALLATION INSIGNIA#: _____ **DATE ISSUED:** _____

MHIP INSTALLATION AUTHORIZATION FORM (07/2014)

FIGURE 1.5 – Authorization Form

Every manufactured home (includes mobile homes, HUD homes and Factory Built Modular homes) that is installed in a temporary or permanent location and is designed and commonly used for occupancy by persons for residential purposes, must display an installation insignia (See figure 1.6) issued by the Division of Housing certifying that the unit is installed in compliance with the Rules and Regulations of the Division of Housing. All manufactured homes that are found to be in compliance shall have an installation insignia completed and permanently attached by the inspector making the inspection.

The type of inspector who may affix the installation insignia are as follows:

Certified installer: An installer who has a long, demonstrated history of MHIP performance and has been approved by the Division of Housing to inspect their own installations.

Certified inspector: These inspectors are from the private sector and are approved by DOH to inspect installations. They provide the inspection service directly to the installer.

Participating Jurisdiction: A local jurisdiction code official who is approved by the DOH to inspect installations in their jurisdiction. They have the exclusive authority to inspect installations in their area and may impose additional installation requirements that are consistent with DOH rules.

DOH inspector: A DOH employed code official or inspector contracted with the DOH. In all cases a DOH inspector may inspect the home's installation.

No permanent utilities will be released to the home prior to the affixing of the installation insignia! Temporary Utility connections are permitted for construction purposes when pertinent testing has been completed.

The installation insignia shall be affixed to the unit prior to occupancy of the home.

Shown below is an installation insignia. The insignia will be placed within 30" of the expected location of the electric meter housing, or electric service entry or on the meter housing.

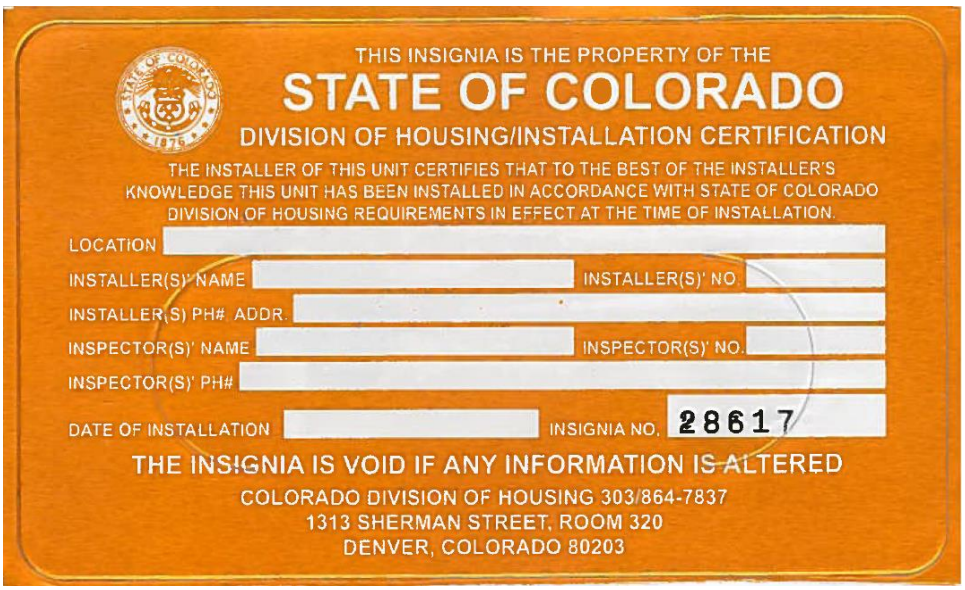


FIGURE 1.6 –Installation Insignia

Jurisdictional Authority

CRS 24-32-3301(b) *"The comprehensive regulation of the installation of manufactured homes to ensure safety, affordability, and performance is a matter of statewide and local concern."*

CRS24-32-3310. *"Local enforcement*

Nothing in this part 33 shall interfere with the right of local governments to enforce local rules governing the installation of factory-built housing approved pursuant to this part 33 if the local rules are not inconsistent with state rules adopted pursuant to section 24-32-3305."

CRS24-32-3316. *"Compliance with manufacturer's installation instructions*

Any installation of a manufactured home in this state shall be performed in strict accordance with the applicable manufacturer's installation instructions. Where the manufacturer's instructions are not applicable, installation shall be in accordance with standards promulgated by the division. A copy of the manufacturer's instructions or the standards promulgated by the division shall be available at the time of installation and inspection."

CRS 24-32-3318 *"Local installation standards preempted*

A local government unit may not adopt less stringent standards for the installation of a manufactured home than those promulgated by the division. A local government unit may not, without express consent by the division, adopt different standards than the standards for the installation of a manufactured home promulgated by the division. Nothing in this section shall preclude a local government unit from enacting standards for manufactured homes concerning unique public safety requirements, such as weight restrictions for snow loads or wind shear factors, as otherwise permitted by law."

Installation of manufactured homes in Colorado must comply with the home **Manufacturer's** Installation Instructions. For used Mobile and HUD units these instructions are often absent and then the standards adopted in Resolution 38 apply. The current standard is NFPA 225-2013 edition with extensive amendments.

Local Authority over Trailer Homes (Pre-1950)

- The local jurisdiction has complete authority over trailer homes.
- The acceptance of trailer homes for permanent occupancy and under what conditions (code compliance) is the authority of the local jurisdiction.

Local Authority over Mobile Homes (1950-1976)

- When there is no certification label, there is no preemption of local building codes.
- The acceptance of unlabeled homes and under what conditions (code compliance) is the authority of the local jurisdiction.
- DOH labeled homes must be accepted, but the local jurisdiction may require mitigation measures for local snow loads.

Local Authority over HUD homes (1976-Current)

- HUD labeled homes preempt local building code requirements with two exceptions:
  - Local snow load requirements. Mitigation options are compliance, snow shed, or snow removal plan.

    - Local wind load requirements. Mitigation options are compliance or wind fence.
- Local jurisdictions have authority over all repair, remodel, and addition work related to HUD homes after they are occupied for residential use.
- Local jurisdictions, through a zoning ordinance, may require permanent foundations for HUD homes on private property.

Local Authority over FB Homes Modular (1976-Current)

- Colorado labeled Factory Built homes generally pre-empt local building code requirements.
- Factory Built Modular homes must be designed for local snow and wind loads (design loads listed on insignia), and installed on a permanent foundation.
- The local jurisdiction has authority over construction of the permanent foundation and any other site-built construction except for materials shipped loose by the factory. Site-built stairs should match the factory-built stair design.
- Local jurisdictions have authority over repair, remodel, and addition work after the home has been occupied for residential use.

Local Authority over Panelized Structures

- The local jurisdiction has complete authority over panelized structures not approved by the Division of Housing.
- A DOH approved panelized structure would be similar to an FB unit (Modular) with DOH or the local jurisdiction inspecting the on-site assembly.

Local Authority over RV's & Park Trailers

- The Colorado Division of Housing inspected and labeled Recreational Vehicles and Park Trailers from 1970 to 1999.
- Currently, the only inspection of RV's and Park Trailers is by the **manufacturer**.
- The local jurisdiction has complete authority over the permanent occupancy of RV's and Park Trailers. Recreational Vehicles and Park
- Trailers are not considered to be appropriate as a permanent residence by DOH.
- Local jurisdictions should be aware that there are no minimum structural requirements in the ANSI standards governing RV's and Park Trailers.

Chapter

2

Site Preparation and Foundations

Access, Setbacks, Separation, Permits

Before attempting to move a home, it shall be ensured that the transportation equipment and home can be routed to the installation site and that all transportation permits required by the state, county, or municipality have been obtained. Local laws regarding encroachments in streets, yards and courts shall be obeyed, and permissible setback distances from property lines and public roads shall be met. Fire separation distances shall comply with local rules or regulations. In their absence, the most current version of the International Residential Code as adopted by the State of Colorado Housing Board, shall apply. All necessary local permits shall be obtained and all fees shall be paid. The local jurisdiction regulates if and when the unit may be occupied, except the home is not to be occupied prior to the installation insignia being affixed.

Flood Hazard Area

Consult your local jurisdiction for flood zones and requirements for setting homes in the flood zones. NFPA 225, Chapter 12 and 15 lists specific requirements.

Important:

As part of the site preparation the site should be checked for marked and unmarked underground utilities. Call the Utility Notification Center of Colorado at 811 or 1-800/922-1987 before digging or using an auger. Visit Colorado811.org for more details.

Ground Prep

Prior to construction, the area to be occupied by the structure shall be cleared of debris, vegetation, and topsoil to a depth sufficient to remove all organic material.

Drainage

Site grading and drainage shall provide diversion of any surface water away from the home, and prevent water build-up under the home. It should also prevent standing water and soil saturation from becoming detrimental to the structure. The ground shall be crowned in the center of the home and sloped to drain toward the exterior. The ground shall be sloped away from the foundation a minimum of ½" per foot each side to at least 10 feet beyond the home's exterior walls. See figure 2.1.

It is strongly recommended that the installer not install the home unless the exterior grade is sloped away from the home or another approved method is provided to prevent runoff from draining under the home. The home will not pass inspection if it is not drained properly. The installation insignia shall not be placed on the unit until the drainage is acceptable.

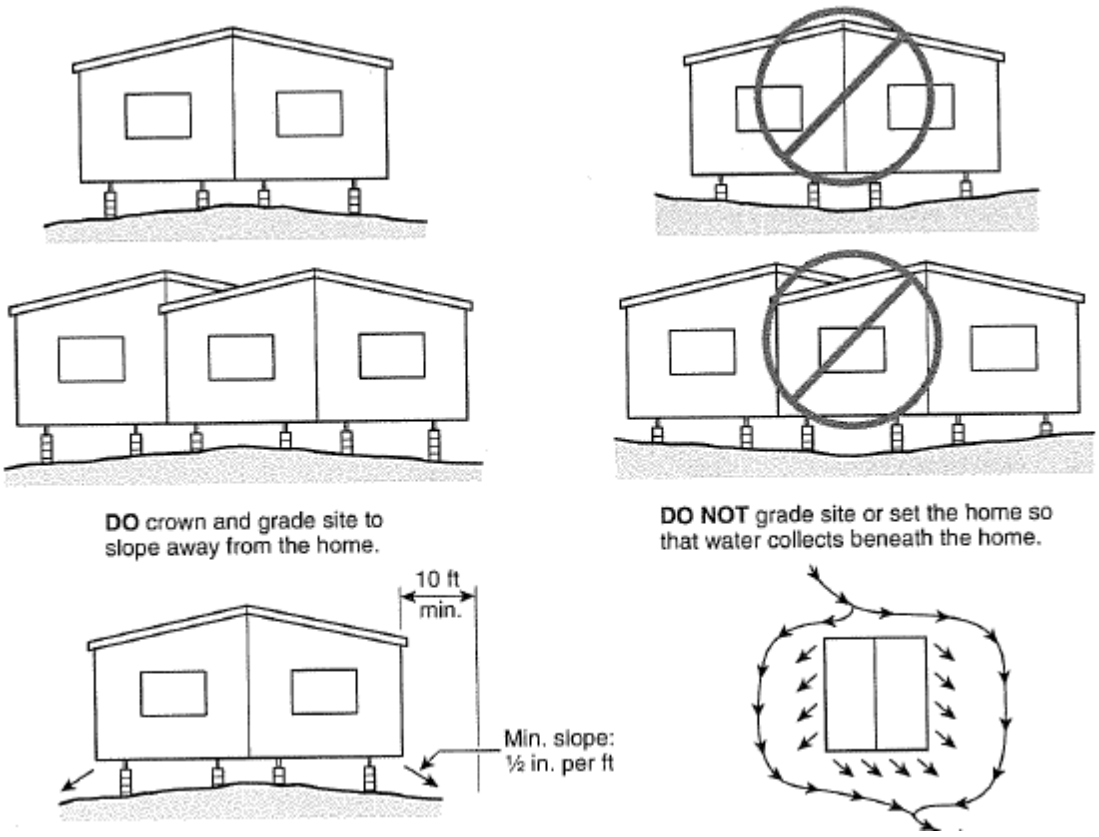


FIGURE 2.1- Drainage

Soil

Every soil has a bearing capacity. This is the ability of the soil to support a load without sinking. The unit of measure of bearing capacity is pressure, or force per unit area, usually in pounds per square foot (psf). For a permanent foundation, many local jurisdictions will require a geotechnical soils analysis be performed by a licensed engineer prior to the construction of the foundation to determine the soil type and properties including determining a design bearing pressure.

Where a non-permanent foundation will be installed and the local jurisdiction is not requiring a soils analysis, the following may be used for determining soil bearing capacity.

Soil that supports footings and foundations shall be capable of accommodating all loads required by the appropriate installation standard. To help prevent settling or sagging the foundation must be constructed on firm, undisturbed soil or 90% compacted fill. Soils that appear to be composed of peat, organic clays, uncompacted fill, expansive or other unusual conditions shall have a registered engineer determine the classification and maximum allowable soil bearing capacity.

Otherwise the bearing capacity of the soil shall be assumed to be 1,500 psf.

A larger bearing capacity for the soil may be used as follows provided the class of soil is known:
Sandy gravel and/or gravel, very dense or cemented sands (GW, GP, SW, SP, GM, SM) ---- 2,000 psf
Sedimentary and foliated rock---------- 4,000 psf

CDOH discourages the use of the pocket penetrometer in determining an allowable soil bearing pressure due to the high variability in results. If one is used, the following procedure shall be followed to help eliminate variability.

1. Test a typical area adjacent to or within 10 feet of the perimeter of the unit. Additional test sites may be required.
2. Dig down to undisturbed soil a minimum of 4". This should be a minimum of 1 square foot.
3. Using the pocket penetrometer to take seven readings, eliminate the highest and lowest and average the middle five.
4. Drive a wooden stake beside this area and record the final average on the stake. This will allow the inspector to check or verify this reading.
5. Enter the soil bearing capacity on the "Installation Authorization" form.

When a value other than 1,500 psf is determined for the soil bearing capacity it shall be recorded by the installer on the Authorization form or other approved form and justification for higher values shall also be provided to the inspector.

Vapor Retarder

The ground within the enclosed crawl space beneath every manufactured home shall be covered with a 6 mil, (.006") thick continuous black membrane sheeting vapor retarder installed according to the following requirements. (See figure 2.2)

1. Membrane sheeting seams shall be overlapped by at least twelve inches (12").

2. Edges of the membrane sheeting shall not extend beyond the perimeter of the manufactured home.

3. All holes, tears, and penetrations in the membrane sheeting shall be adequately sealed or patched with durable tape.

4. Under floor membrane sheeting shall not be in contact with wood unless the wood is pressure treated lumber.

5. Black polyethylene membrane sheeting shall be installed over the ground. Clear sheeting may be installed under gravel or concrete.

6. When the manufactured home has a recessed entry, porch, or deck, and the floor in the recessed area is constructed of open decking, the membrane sheeting shall not be installed below the open decking floor.

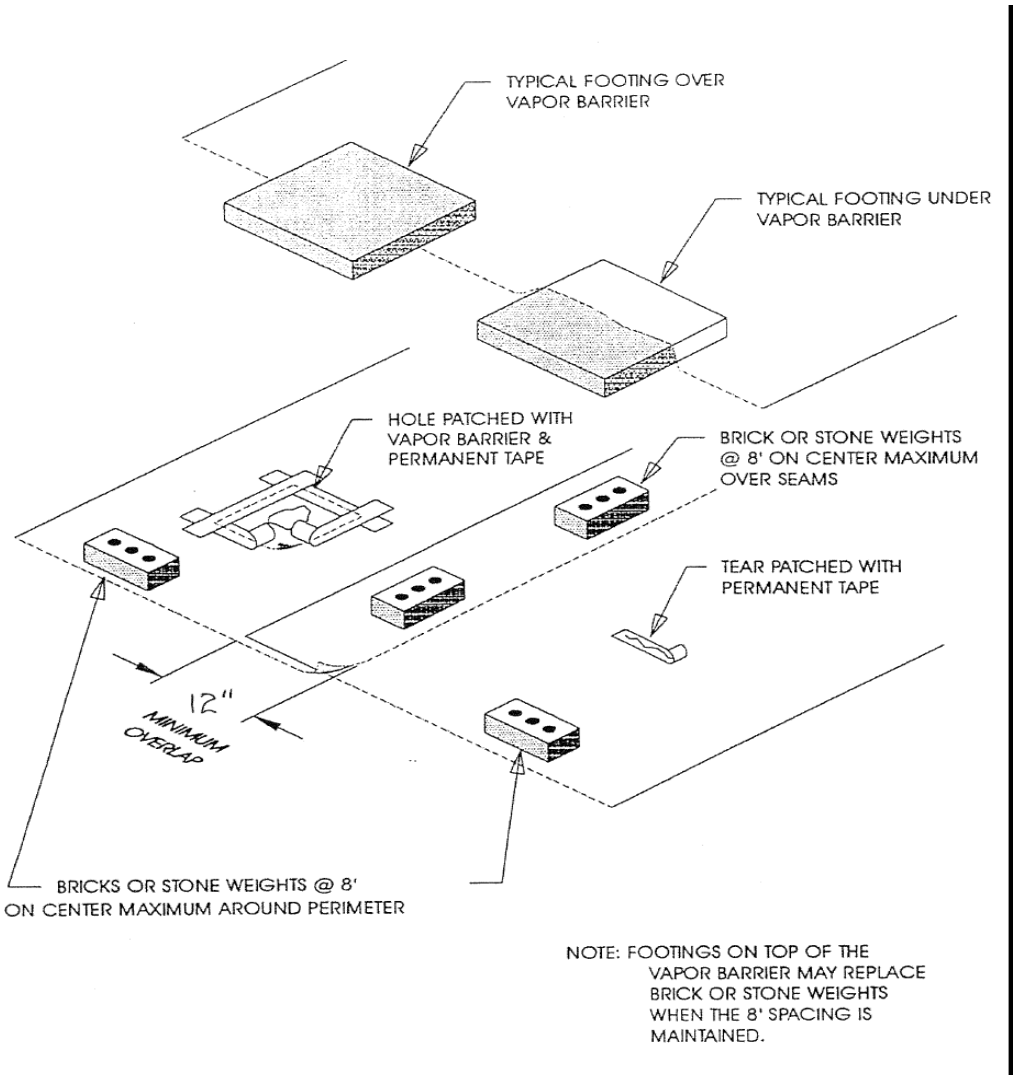


FIGURE 2.2 – Vapor Retarder Installation

Protection from Frost

Depth: Whenever a unit is located in an area where the soil is subject to frost heave, then the footing must be protected from the effects of frost heave or placed below the frost line. Contact the local jurisdiction to assure the proper depth.

If the **manufacturer** allows a frost protected shallow foundation then their instructions must be followed completely. Other systems installed above the frost line should be engineering approved and have the acceptance of the state and local jurisdiction.

Piers

Concrete Block Pier Construction: Installation instructions commonly provide specifications for the construction of piers. Options may include stacked Concrete Masonry Unit (CMU) blocks and pre-manufactured tripod stands. A CMU pier is typically described as stacked, un-mortared blocks capped with a wood or solid masonry cap. 4" x 6" hardwood shims are commonly specified to provide a means of leveling the structure. Group A and B hardwood species shall be used, Ash, Beech, Birch, Hickory, Oak, Rock Elm, Black or Red Maple, Sweetgum. (See figure 2.3 for details of block pier construction)

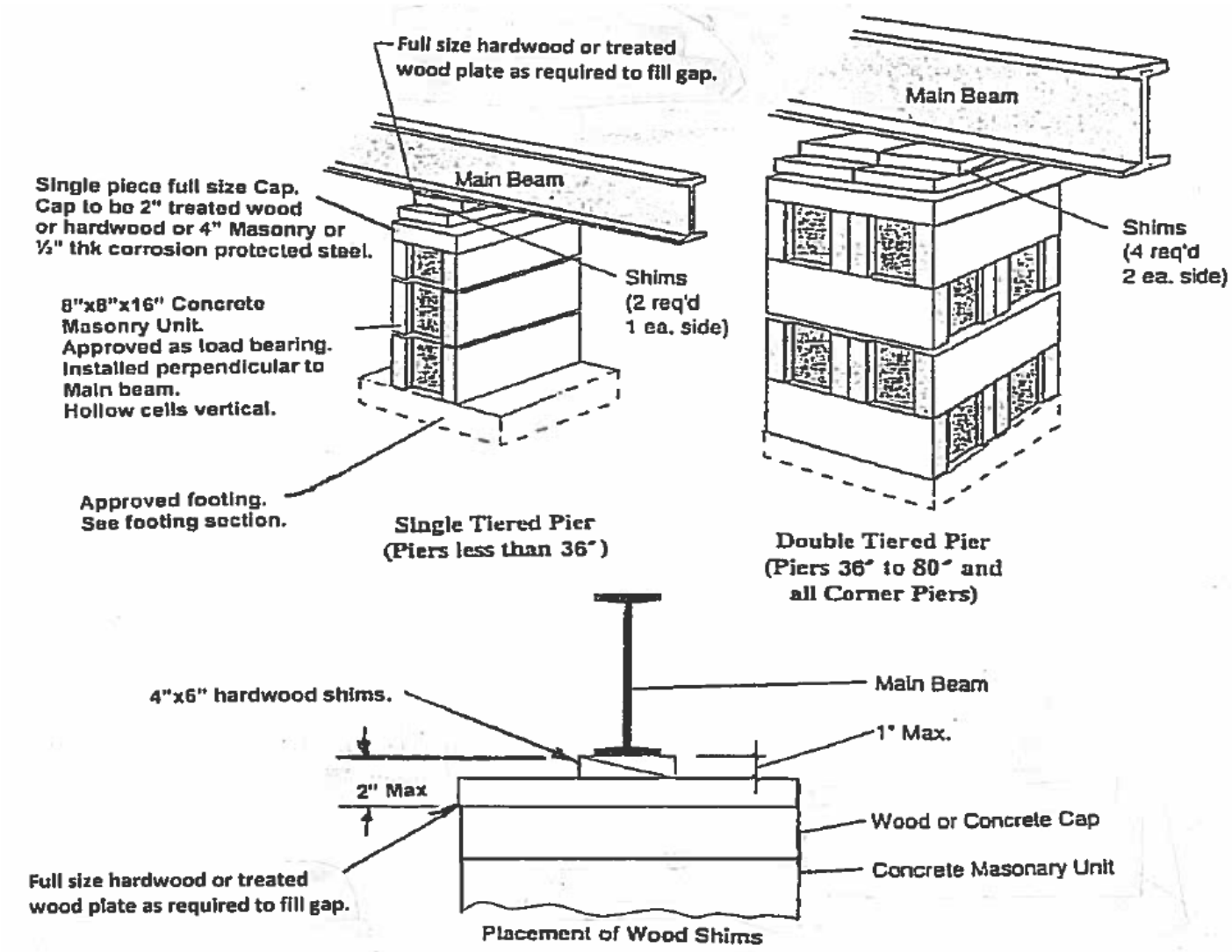


FIGURE 2.3 –Concrete Block Pier Construction

Pier Height Above Grade: Pier heights shall be measured from the top of the footing or slab to the bottom of the main frames or to the bottom of the floor joists.

Piers 36 inches (0.91 meters) or less in height under the main frame, perimeter or center line floor shall be constructed of single, open or closed cell, 8 inch (20 cm) by 8 inch (20 cm) by 16 inch (41 cm) concrete blocks with open cells placed vertically upon an approved footing. Under the main frame, single stacked block piers shall be installed with the 16 inch (41 cm) dimension perpendicular to the main frame (I-beam or channel beam). Under the centerline, single stacked block piers may be installed either parallel or perpendicular to the main frame. Piers shall be capped and shimmed with approved material.

Piers over 36 inches (0.91 meters) in height but not exceeding 80 inches (2.03 meters), shall be double blocked with blocks interlocked and placed on an approved footing.

Minimum Clearance: (See figure 2.4) A minimum clearance of 12 inches (30 cm) shall be maintained beneath the lowest member of the main frame (I-beam or channel beam) and the top of the footing or slab in the area of the utility connections. Adequate space, which may be required to exceed 12 inches (30 cm), shall also be maintained for heat duct crossover connections. No more than 25% of the main frame shall be less than 12" above grade. All cap and shim materials shall be decay resistant within 18" of the ground.

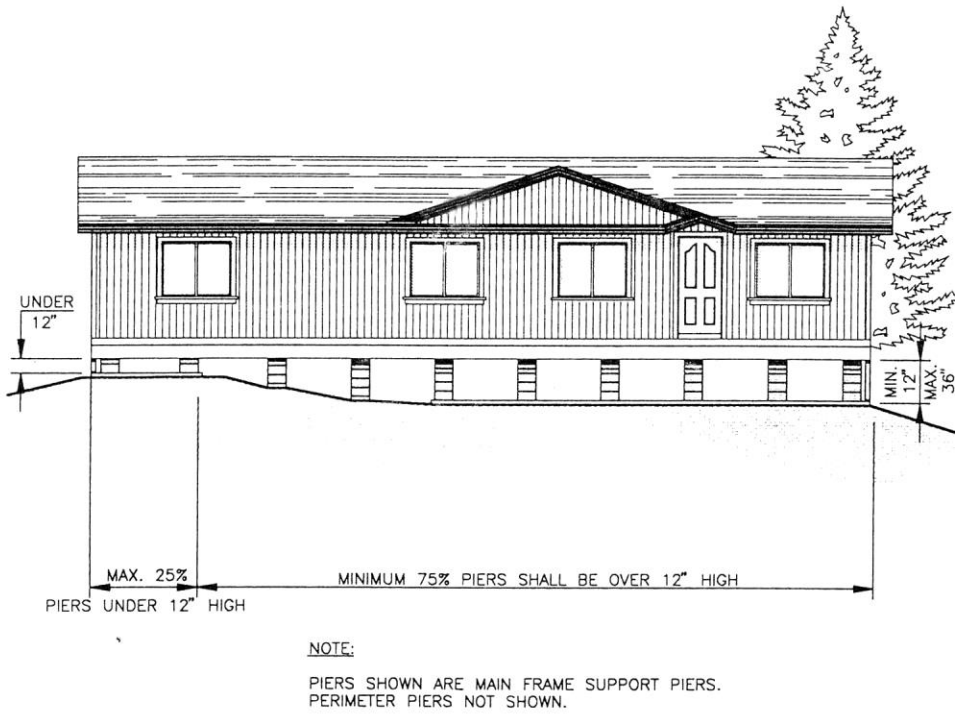


FIGURE 2.4 – Minimum Clearances

Height of Unit Above Grade: No more than 25 percent of the underside of the main frame of the manufactured dwelling shall be more than 36 inches (0.91 meters) from the top of the footing or slab to the underside of the main frame. Piers over 80" in height are to be designed by a professional engineer. (See Figure 2.5).

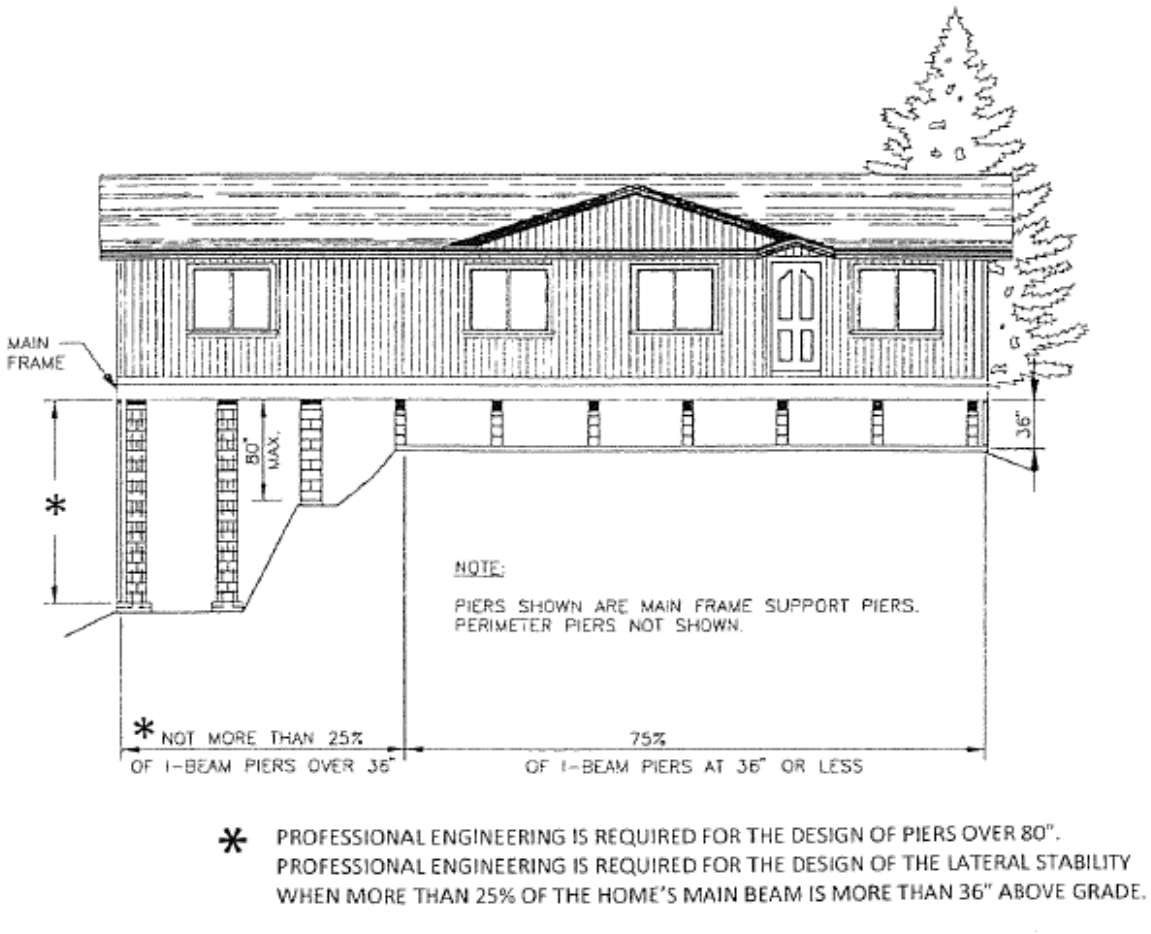


FIGURE 2.5 – Height Above Grade

Pre-manufactured Tripods: **Manufacturer's** Installation Instructions may allow the use of pre-manufactured tripods. Any manufactured system with load-bearing supports or devices must be listed for the loads and the use intended. These are generally manufactured with a steel base and an adjustable support post, which supports under the bottom flange of the I-beam. Tripods are most commonly used with pre-cast footings. Select manufactured pier heights so that the adjustable risers do not extend more than 2 inches when finally positioned. (See figure 2.6)

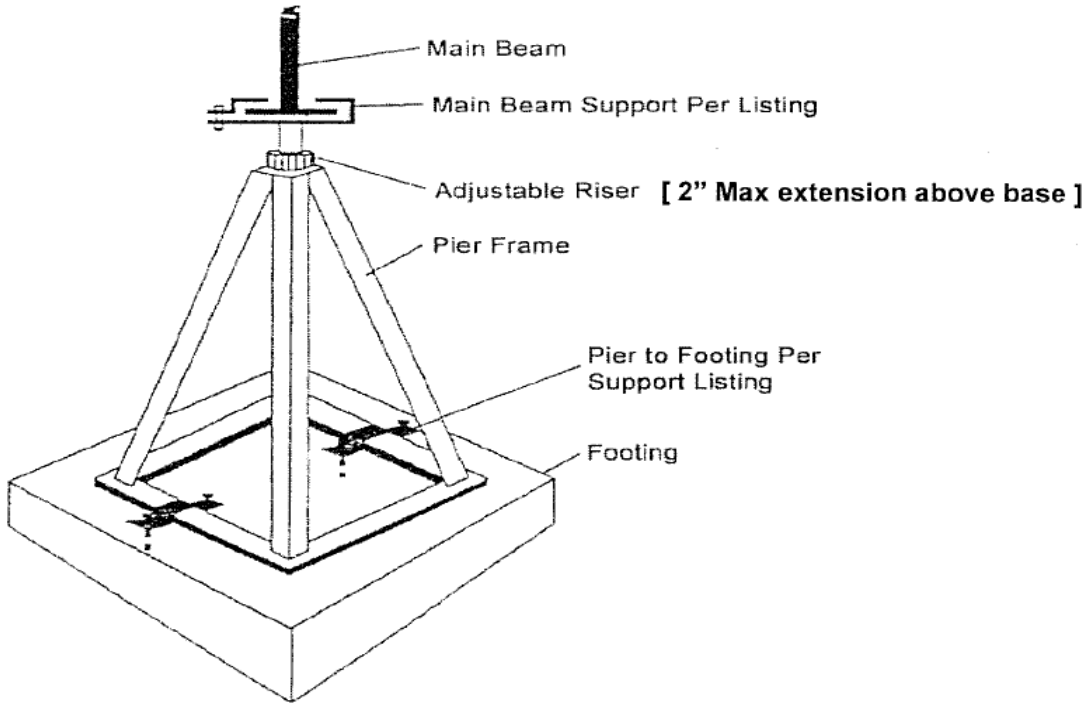


FIGURE 2.6 – Pre-Manufactured Pier Construction

Alternate Support Methods

Basement/Split Levels: When the manufactured dwelling is installed on a basement, split level type, or other non-prescriptive foundation the foundation system shall be approved by the authority having jurisdiction. In areas of the State where no building codes have been adopted the foundation shall be designed and approved by a State of Colorado licensed engineer unless plans are approved by the Division of Housing as in compliance with the Division adopted IRC foundation prescriptive requirements.

Ground Level Installation: Ground level installations are only permitted when an approved drainage system has been provided.

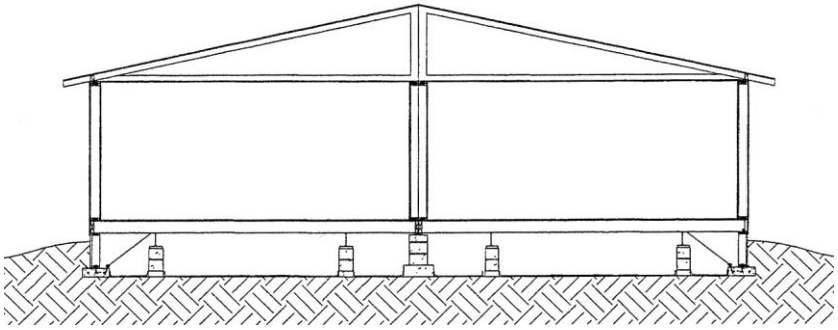


FIGURE 2.7 – Ground Level Installation

Footings

Footing shall be not less than the width of the pier being supported. Footing material shall be one of the following:

1. One or two 4 inch (10 cm) nominally thick pre-cast concrete blocks. (See Figure 2.8)

2. 6 inch (15 cm) thick poured-in-place individual concrete footing. (See Figure 2.9);

3. Two layers of nominal 2-inch thick pressure-treated wood having 0.60 pcf retention with the long dimensions of the second layer placed perpendicular to that of the first (See Figure 2.10);

4. A minimum of 6 inch (15 cm) nominally thick continuous concrete ribbon footings, not less than 18 inches (46 cm) wide with two continuous #4 rebar. Rebar shall be lapped 12 inches (30 cm), centered vertically in the footing and shall not be closer than 3 inches (8 cm) from the edge of the footing. Rebar shall be located 10 inches (25 cm) apart in the footing and centered beneath the pier location. (See Figure 2.11);

5. A minimum of 6 inch (15 cm) nominally thick continuous footings, not less than 48 inches (121 cm) wide, reinforced with 10 gauge 6 inch (15 cm) by 6 inch (15 cm) wire fabric centered vertically within the continuous footing and no closer than 1 inch (3 cm) from the edge of the continuous footing.;

6. A minimum of 6 inch (15 cm) nominally thick slab not less in area than the manufactured dwelling and cabana, reinforced with 10 gauge 6 inch (15 cm) by 6 inch (15 cm) wire fabric centered vertically within the slab;

7. Tested and listed prefabricated footings installed per the footing manufacturer's instructions.

8. Footings designed by a Colorado licensed professional engineer or architect, or;

9. Other equivalent materials approved for the intended use by the CDOH.

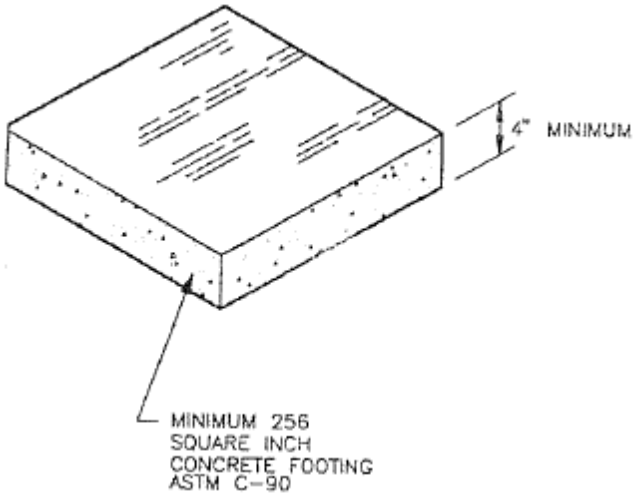


FIGURE 2.8 – Pre-cast Concrete Footing

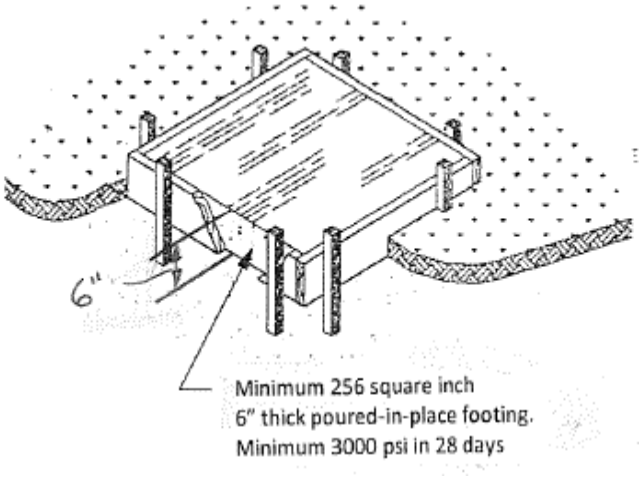


FIGURE 2.9 – Poured Concrete Footing

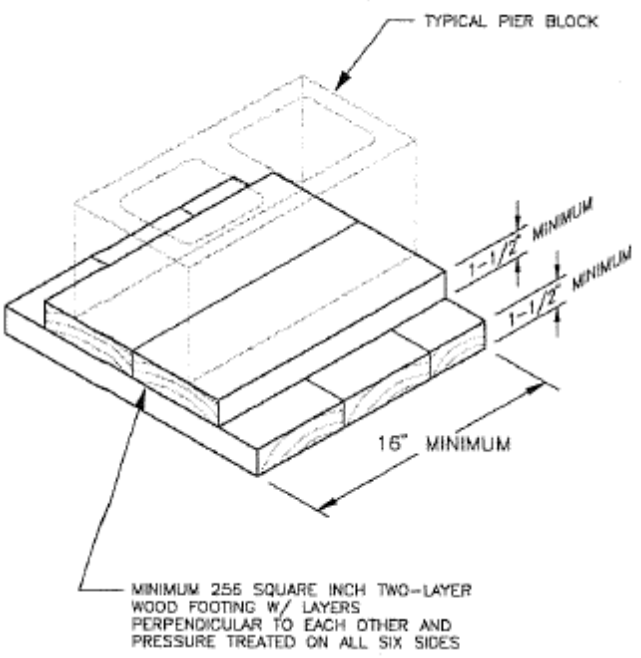


FIGURE 2.10 – Pressure Treated Lumber Footing, Double Thickness

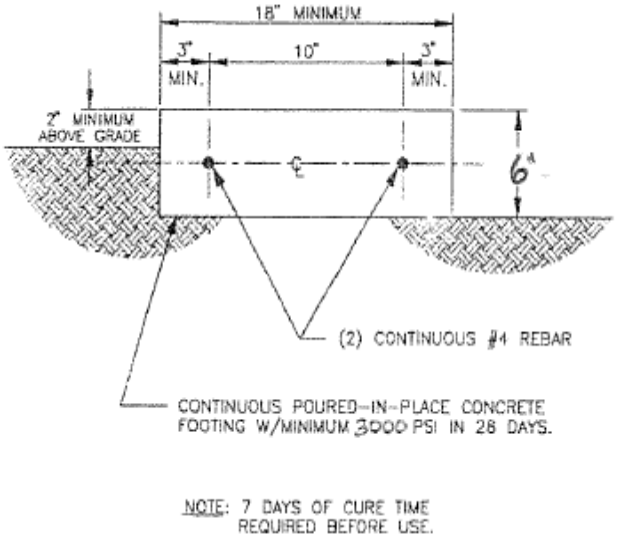


FIGURE 2.11 – Continuous Poured in Place Concrete Footing

Support and Footing Sizing Methods

The next pages explain how to use the tables to determine the footing sizes required to support single section and multi-section homes.

Note: The figures and tables are numbered from amendments to NFPA 225 listed in Resolution 38.

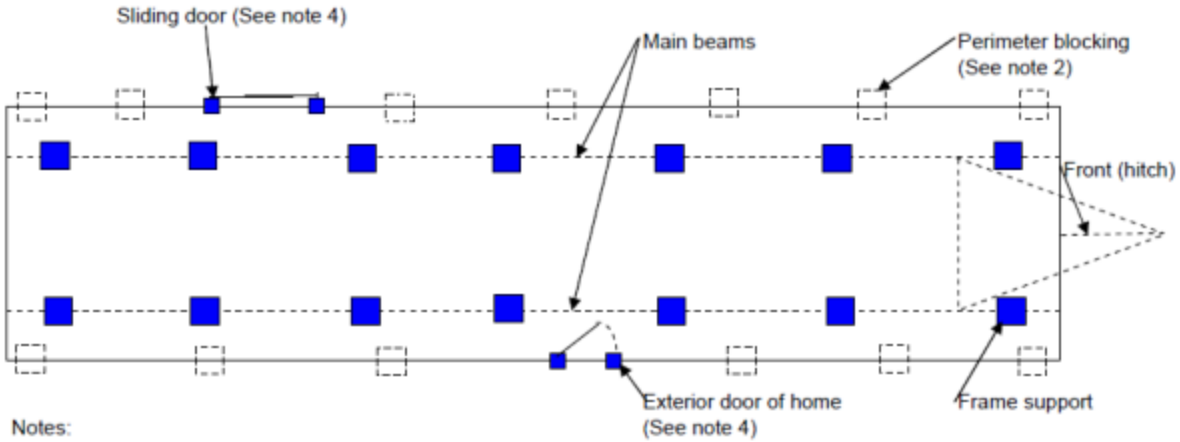
1. See the appropriate figure based on the home style to be set. Single Wide, Multi-Section, With or Without Perimeter Blocking. Homes requiring evenly spaced perimeter blocking (this includes the center/marriage line for multi-section homes) will be indicated by pier tags, labels, paint or other means by the **manufacturer**. The requirement for perimeter blocking may also be noted on the data plate or indicated in the serial number (last letter is a P).

2. Follow the figure's notes to determine which tables to use.

All homes "6.2.5.5". Supports shall be placed on both sides of side wall exterior doors and any other side wall openings greater than 48 in. (such as entry and sliding glass doors), and under porch posts, factory installed fireplaces and wood stoves. Size perimeter piers under openings based on table 6.2.3.1.3(b) "Exterior wall" where the actual side wall opening shall be less than or equal to the spacing selected from the table.

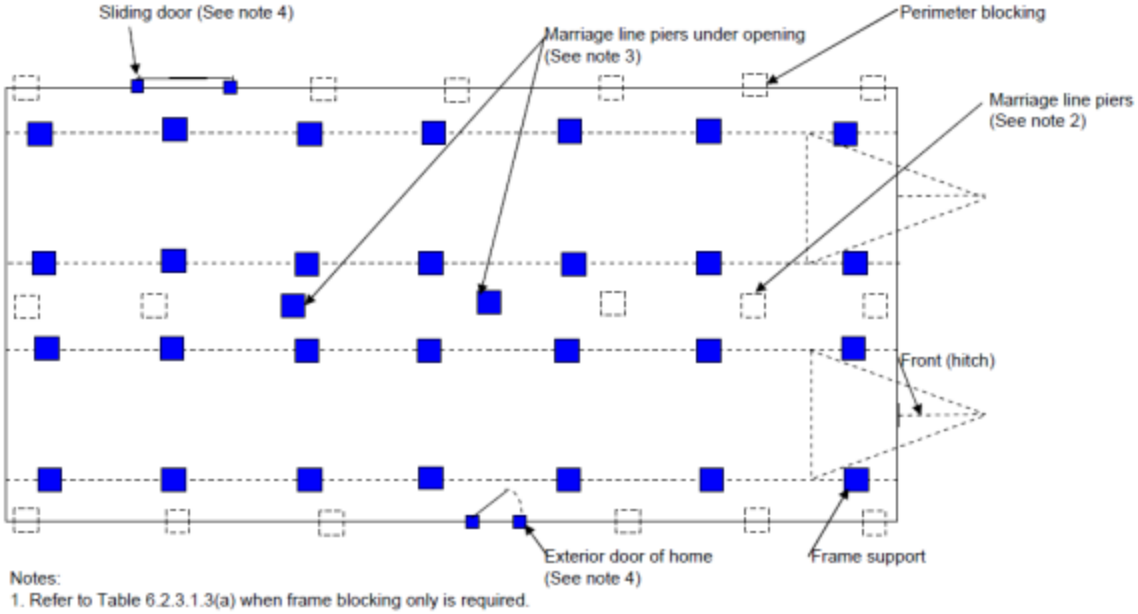
Homes requiring perimeter blocking. Refer to Figure 6.2.5.3 and Figure 6.2.5.4 and Table 6.2.3.1.3(b) for homes requiring perimeter blocking in addition to sidewall opening blocking described above.

FIGURE 6.2.5.3 Typical blocking Diagram for a Single Section



Notes:
1. Refer to Table 6.2.3.1.3(a) when frame blocking only is required.
2. Refer to Table 6.2.3.1.3(b) when perimeter blocking is required.
3. Locate piers a maximum of 24 inches from both ends.
4. **All homes:** Place piers on both sides of sidewall exterior doors, patio doors, and sliding glass doors: under porch posts, factory-installed fireplaces, and fireplace stoves; under jamb studs at multiple window openings; and at any other sidewall openings 48 inches or greater in width.

FIGURE 6.2.5.4 Typical blocking Diagram for a Multi-section home



Notes:
1. Refer to Table 6.2.3.1.3(a) when frame blocking only is required.
2. Refer to Table 6.2.3.1.3(b) when perimeter blocking is required.
3. Refer to Table 6.2.3.1.3(c) for piers under marriage line wall openings
4. Locate piers a maximum of 24 inches from both ends.
5. **All homes:** Place piers on both sides of sidewall exterior doors, patio doors, and sliding glass doors: under porch posts, factory-installed fireplaces, and fireplace stoves; under jamb studs at multiple window openings; and at any other sidewall openings 48 inches or greater in width.

Table 6.2.3.1.3(a)

Single and Multi Section Pier Loads Without Perimeter blocking
(at both I beams, in Lbs)
See section 6.2.5.5 for required perimeter blocking at side wall openings
See Table 6.2.3.1.3(c) for piers required under marriage line openings

Roof snow load (PSF)	Section Width (feet)	Maximum pier spacing			
		4'	6'	8'	10'
30	10	2360	3390	4420	5450
	12	2704	3906	5108	6310
	14	3048	4422	5796	7170
	16	3392	4938	6484	8030
40	10	2600	3750	4900	6050
	12	2984	4326	5668	7010
	14	3368	4902	6436	7970
	16	3752	5478	7204	8930
60	10	3080	4470	5860	7250
	12	3544	5166	6788	8410
	14	4008	5862	7716	9570
	16	4472	6558	8644	10730
80	10	3560	5190	6820	8450
	12	4104	6006	7908	9810
	14	4648	6822	8996	11170
	16	5192	7638	10084	12530
100	10	4040	5910	7780	9650
	12	4664	6846	9028	11210
	14	5288	7782	10276	12770
	16	5912	8718	11524	14330

Notes:
1. See Table 6.3.3 for footing design using the noted loads
2. This Table is based on the following design assumptions:
   Nominal width is used, 12" eave, 20plf chassis dead load, 300 lbs. Pier dead load,
   35 plf wall dead load, 10psf roof dead load and 6 psf floor dead load
3. Interpolation for other pier spacing is permitted
4. These loadings are not for flood or seismic conditions.

Table 6.2.3.1.3(b)

Single and Multi Section Pier Loads With Perimeter blocking
(Lbs)
See section 6.2.5.5 for required perimeter blocking at side wall openings
See Table 6.2.3.1.3(c) for piers required under marriage line openings

Roof snow load (PSF)	Section Width (ft)	Frame Maximum pier spacing				Exterior wall Maximum pier spacing				Marriage wall Maximum pier spacing			
		4'	6'	8'	10'	4'	6'	8'	10'	4'	6'	8'	10'
30	10	1400	1950	2500	3050	1400	1950	2500	3050	2480	3420	4360	5300
	12	1584	2226	2868	3510	1560	2190	2820	3450	2800	3900	5000	6100
	14	1768	2502	3236	3970	1720	2430	3140	3850	3120	4380	5640	6900
	16	1952	2778	3604	4430	1880	2670	3460	4250	3440	4860	6280	7700
40	10	1400	1950	2500	3050	1640	2310	2980	3650	2880	4020	5160	6300
	12	1584	2226	2868	3510	1840	2610	3380	4150	3280	4620	5960	7300
	14	1768	2502	3236	3970	2040	2910	3780	4650	3680	5220	6760	8300
	16	1952	2778	3604	4430	2240	3210	4180	5150	4080	5820	7560	9300
60	10	1400	1950	2500	3050	2120	3030	3940	4850	3680	5220	6760	8300
	12	1584	2226	2868	3510	2400	3450	4500	5550	4240	6060	7880	9700
	14	1768	2502	3236	3970	2680	3870	5060	6250	4800	6900	9000	11100
	16	1952	2778	3604	4430	2960	4290	5620	6950	5360	7740	10120	12500
80	10	1400	1950	2500	3050	2600	3750	4900	6050	4480	6420	8360	10300
	12	1584	2226	2868	3510	2960	4290	5620	6950	5200	7500	9800	12100
	14	1768	2502	3236	3970	3320	4830	6340	7850	5920	8580	11240	13900
	16	1952	2778	3604	4430	3680	5370	7060	8750	6640	9660	12680	15700
100	10	1400	1950	2500	3050	3080	4470	5860	7250	5280	7620	9960	12300
	12	1584	2226	2868	3510	3520	5130	6740	8350	6160	8940	11720	14500
	14	1768	2502	3236	3970	3960	5790	7620	9450	7040	10260	13480	16700
	16	1952	2778	3604	4430	4400	6450	8500	10550	7920	11580	15240	18900

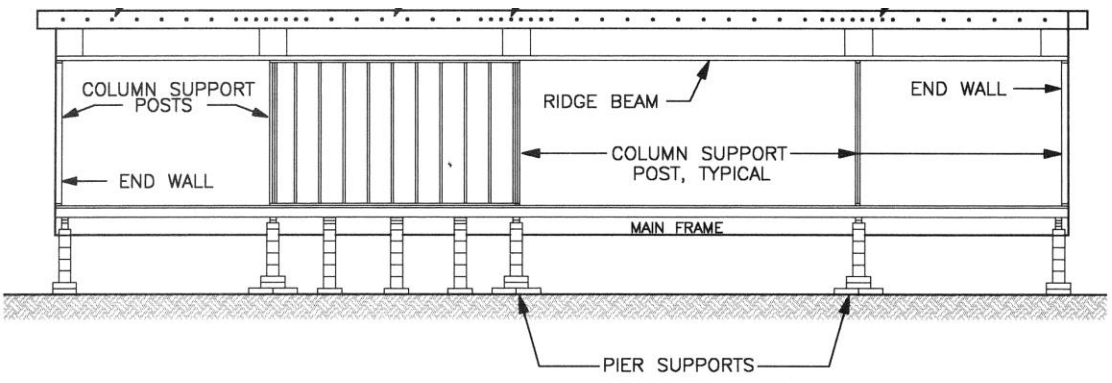
Notes:
1. See Table 6.3.3 for footing design using the noted loads
2. This Table is based on the following design assumptions:
   Nominal width is used, 12" eave, 20plf chassis dead load, 300 lbs. Pier dead load,
   35 plf wall dead load, 10psf roof dead load and 6 psf floor dead load
3. Interpolation for other pier spacing is permitted
4. These loadings are not for flood or seismic conditions.

Table 6.2.3.1.3(c)

Multi Section Pier Loads Under Marriage Line Openings
(Under each end of opening in Lbs)
See section 6.2.5.5 for required perimeter blocking at side wall openings

Roof snow load (PSF)	Section Width (ft)	Marriage wall opening width									
		5'	8'	10'	12'	14'	16'	18'	20'	25'	30'
30	10	1300	1900	2300	2700	3100	3500	3900	4300	5300	6300
	12	1500	2220	2700	3180	3660	4140	4620	5100	6300	7500
	14	1700	2540	3100	3660	4220	4780	5340	5900	7300	8700
	16	1900	2860	3500	4140	4780	5420	6060	6700	8300	9900
40	10	1550	2300	2800	3300	3800	4300	4800	5300	6550	7800
	12	1800	2700	3300	3900	4500	5100	5700	6300	7800	9300
	14	2050	3100	3800	4500	5200	5900	6600	7300	9050	10800
	16	2300	3500	4300	5100	5900	6700	7500	8300	10300	12300
60	10	2050	3100	3800	4500	5200	5900	6600	7300	9050	10800
	12	2400	3660	4500	5340	6180	7020	7860	8700	10800	12900
	14	2750	4220	5200	6180	7160	8140	9120	10100	12550	15000
	16	3100	4780	5900	7020	8140	9260	10380	11500	14300	17100
80	10	2550	3900	4800	5700	6600	7500	8400	9300	11550	13800
	12	3000	4620	5700	6780	7860	8940	10020	11100	13800	16500
	14	3450	5340	6600	7860	9120	10380	11640	12900	16050	19200
	16	3900	6060	7500	8940	10380	11820	13260	14700	18300	21900
100	10	3050	4700	5800	6900	8000	9100	10200	11300	14050	16800
	12	3600	5580	6900	8220	9540	10860	12180	13500	16800	20100
	14	4150	6460	8000	9540	11080	12620	14160	15700	19550	23400
	16	4700	7340	9100	10860	12620	14380	16140	17900	22300	26700

Notes:
1. See Table 6.3.3 for footing design using the noted loads
2. This Table is based on the following design assumptions:
   Nominal width is used, 300 lbs. Pier dead load,
   10psf roof dead load
3. Interpolation for other pier spacing is permitted
4. For piers supporting two adjacent openings, the required capacity is the sum of the loading from each opening.
5. These loadings are not for flood or seismic conditions.



Example marriage line opening piers.

Table 6.3.3 Footing Size and Capacity

Soil Capacity (psf)	Minimum Footing Size (in.)	Single Stack Pier (8" X 16")		Double Stack Pier (16" X 16")	
		Maximum Footing Capacity (lb)	Unreinforced Cast-in-Place Minimum Thickness (in.)	Maximum Footing Capacity (lb)	Unreinforced Cast-in-Place Minimum Thickness (in.)
1000	16 x 16	1,600	6	1,600	6
	20 x 20	2,600	6	2,600	6
	24 x 24	3,700	6	3,700	6
	30 x 30	5,600	8	5,800	6
	36 x 36	7,900	10	8,100	8
	42 x 42	10,100	12	10,700	10
	48 x 48	13,000	15	13,600	12
1,500	16 x 16	2,500	6	2,500	6
	20 x 20	4,000	6	4,000	6
	24 x 24	5,600	8	5,700	6
	30 x 30	8,600	10	8,900	6
	36 x 36	12,200	12	12,600	8
	42 x 42	16,100	15	16,500	12
	48 x 48	20,400	18	21,000	15
2000	16 x 16	3,400	6	3,400	6
	20 x 20	5,300	6	5,300	6
	24 x 24	7,600	8	7,700	6
	30 x 30	11,600	10	11,900	8
	36 x 36	16,300	15	16,900	10
	42 x 42	21,700	18	22,700	12
2500	16 x 16	4,300	6	4,300	6
	20 x 20	6,700	6	6,700	6
	24 x 24	9,600	8	9,700	6
	30 x 30	14,700	12	15,000	8
	36 x 36	20,800	15	21,400	10
3000	16 x 16	5,200	6	5,200	6
	20 x 20	8,100	8	8,100	6
	24 x 24	11,500	10	11,700	6
	30 x 30	17,800	12	18,100	8
	36 x 36	25,000	18	25,700	12
4000	16 x 16	7,000	6	7,000	6
	20 x 20	10,800	8	10,900	6
	24 x 24	15,500	10	15,600	8
	30 x 30	23,800	15	24,200	10

(1) The 6" cast-in-place values can be used for 4" precast concrete footings.

(2) Other footing configurations (rectangular, circular, etc.) can be used provided the area and depth of the footing is equal to or greater than that listed and the distance from the pier to the footing edge does not exceed the footing depth.

(3) Capacities listed have been reduced by the dead load of the footing.

(4) Interpolation between values is allowed provided the next higher footing thickness is used when the actual pier capacity is more than halfway between values. Actual values may be rounded to the nearest hundredth.

Example 1:

14' Single Wide (with perimeter blocking)

40 Pounds per square foot roof snow load

1500 PSF Soil Capacity

6' Pier Spacing

3' Front door

6' Sliding back door

Question: Size footings under required piers.

Solution:

Main I beam Frame Piers-From Table 6.2.3.1.3(b) use the 40 PSF roof snow row and find the 14' Section Width. Follow across this row until under the Frame 6' column which gives 2502 lbs. Go to the Footing Size Table 6.3.3. Follow the 1500 psf soil capacity row. A 16"x16" -4" pre-cast or 6" poured concrete pier footing may be used under the frame piers.

Evenly spaced Perimeter Piers- From Table 6.2.3.1.3(b) use the 40 PSF roof snow row and find the 14' Section Width. Follow across this row until under the Exterior wall 6' column which gives 2910 lbs. Go to the Footing Size Table 6.3.3. Follow the 1500 psf soil capacity row. After interpolation(2910 is between 2500 and 4000 lb) a minimum 17.19" x 17.19" -4" pre-cast or 6" poured concrete pier footing may be used under the exterior perimeter wall piers. These piers are also to be placed directly under each side of the front door opening and the back sliding door opening. See figure 6.2.5.3 for pier configuration.

Example 2:

28' Double Wide (without perimeter blocking)

60 Pounds per square foot roof snow load

8' Main I Beam Pier Spacing

2000 PSF soil capacity

14' Marriage Wall Opening

3' Front door

6' Sliding back door

Problem: Size footings under required piers.

Solution:
Main I beam frame piers-From Table 6.2.3.1.3(a) use the 60 PSF roof snow row and find the 14' Section Width (28' double wide). Follow across this row until under the 8' column which gives 7716 lbs for the frame piers.
Go to the Footing Size Table 6.3.3. Follow the 2000 psf soil capacity row. A double stack pier using a 24" x 24"- 4" pre-cast or 6" cast in place footing may be used or a single stack pier if under 36" tall may be used with a minimum 24.19" X 24.19" footing, 8" thick poured in placed concrete.

Marriage wall opening piers- From Table 6.2.3.1.3(c) use the 60 PSF roof snow row and find the 14' Section Width (28' double wide). Follow across this row until under the 14' marriage wall opening width. This gives 7160 lbs for the load acting down on each side of the marriage wall opening piers.
Go to the Footing Size Table 6.3.3. Follow the 2000 psf soil capacity row. A double stack pier using a minimum 23.16" x 23.16"- 4" pre-cast or 6" cast in place footing may be used or a single stack pier if under 36" tall may be used with a minimum 23.29" X 23.29" footing, 8" thick poured in placed concrete.

Piers under door openings- From Table 6.2.3.1.3(b) use the 60 PSF roof snow row and find the 14' Section Width (28' double wide).Follow this row over to the exterior wall column. The front door is 3' wide so the 4' column can be used and the pier loading would be 2680 lbs. The sliding back door is 6' wide so the 6' column is to be used and the pier loading would be 3870 lbs. Go to the Footing Size Table 6.3.3. Follow the 2000 psf soil capacity row. A double stack pier or single stack pier if under 36" tall using a minimum 16" x 16"- 4" pre-cast or 6" cast in place footing may be used under each side of the front door opening. A double stack pier or single stack pier if under 36" tall using a minimum 17.08" X 17.08"- 4" pre-cast or 6" cast in place footing may be used under each side of the sliding back door opening.

Anchoring

After blocking and leveling, the installer shall secure the manufactured home against wind by installing a proprietary anchorage system or by installing a ground anchorage system. Anchorage shall be for Wind Zone I. Homes that are designed for Wind Zone II and III must be anchored per the **Manufacturer's** Installation Instructions or the requirements of a professional engineer.

Proprietary Anchorage Systems-
A proprietary anchorage system may be used to resist overturning and lateral movement (sliding) caused by wind as long as it complies with all of the following:

1. The system shall be listed by a nationally recognized third-party agency for anchoring manufactured homes.

2. The system shall be evaluated and approved by a licensed professional engineer.

3. The system shall be recognized as acceptable for use by CDOH.

4. The installer shall follow the requirements in the anchorage system installation instructions.

Proper Anchor Installation: Anchor manufacturers shall provide **Manufacturer's** installation instructions for all listed and approved anchoring systems sold in Colorado. Anchor **Manufacturer's** installation instructions shall be consistent with the product listing or approval. One set of installation instructions shall be provided by the manufacturer or distributor, for each installation where their product is being used. After the installation is complete, the anchor manufacturer's installation instructions shall be temporarily attached to the pier located closest to the utility connections or the under floor access for the inspector's use. If installation instructions are not provided at the time of inspection, the authority having jurisdiction may charge re-inspection fees.

Ground Anchorage Systems-

A ground anchorage system may be used to resist overturning and lateral movement (sliding) caused by wind as long as it complies with all of the following:

1. **Tie-Down Straps and Anchors**

   Straps and anchors are to have corrosion protection at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz/ft² of surface coated. Straps and anchoring equipment must be capable of resisting a minimum ultimate load of 4,725 lbs and a working load of 3,150 lbs as installed determined by a registered professional engineer, architect or tested by a nationally recognized third-party agency. Straps are to be 1.25"x0.035" or larger steel strapping conforming to ASTM D 3953, Type 1, Grade 1, Finish B. Anchors are to be installed in accordance with their listing or certification to their full depth.

2. **Number and Location of Anchors**

   Transverse Anchorage.

   The number and location of anchors and anchor straps for securing single-section and multi-section manufactured homes in the transverse direction shall conform to the **Manufacturer's** Installation Instructions. When relocating the home or when the **Manufacturer's** Installation Instructions are not available, the number and location of anchors and anchor straps shall conform to Table 7.5.3.2.1 and Figure 7.5.3.2.1 (a) and 7.5.3.2.1(b).

   Longitudinal Anchorage.

   The number and location of anchors and anchor straps for securing single-section and multi-section manufactured homes in the longitudinal direction shall conform to the **Manufacturer's** Installation Instructions. When relocating the home or when the **Manufacturer's** Installation Instructions are not available, the number and location of longitudinal anchors and anchor straps shall conform to Table 7.5.3.2.2 and Figure 7.5.3.2.1 (a).

   Note: The figures and tables are numbered from amendments to NFPA 225 listed in Resolution 38.

Table 7.5.3.2.1 **Number and Location of Ground Anchors**

Section Floor Width	Main I-Beam spacing (in)	Max height from ground to strap attachment (in)	Anchor Spacing (ft)		Angle
10 ft 20 ft double wide	82.5	25	9		59 1/2
		33	12	FAR BEAM	18 1/2
		46	12	FAR BEAM	25 1/2
		67	11 1/2	FAR BEAM	34 1/2
	99.5	25	12	FAR BEAM	13 1/2
		33	12	FAR BEAM	17 1/2
		46	12	FAR BEAM	23 1/2
		67	11 1/2	FAR BEAM	32 1/2
12 ft 24 ft double wide	82.5	25	12		43
		33	10 1/2		51
		46	7 1/2		60
		67	11 1/2	FAR BEAM	31 1/2
	99.5	25	10		54
		33	12	FAR BEAM	15 1/2
		46	12	FAR BEAM	21 1/2
		67	11 1/2	FAR BEAM	29 1/2
14 ft 28 ft double wide	82.5	25	12		33
		33	12		40 1/2
		46	9 1/2		50
		67	6 1/2		60
	99.5	25	12		39 1/2
		33	11		47 1/2
		46	8		56 1/2
		67	11 1/2	FAR BEAM	27 1/2
16 ft 32 ft double wide	82.5	25	N/A		26
		33	12		33
		46	10 1/2		42
		67	8		53
	99.5	25	12		30 1/2
		33	12 1/2		38
		46	10		47 1/2
		67	7		58

Notes:

1. See Figures 7.5.3.2.1(a) and (b).
2. This Table is based on the following design assumptions:
   8' wall height, 4/12 roof pitch, 4 inch anchor inset from home edge, 12' max anchor spacing
3. Main beam spacing outside those shown may be used provided the inside strap angle from the ground to the strap is less than the angle shown and is between 30 and 60 degrees or connection is provided to both the near and far beam.Choose spacing from values shown.
4. FAR BEAM. Spacings shown with FAR BEAM require connection to **both** the near and far beam. This also applies to other main I beam spacing. See note 3.
5. Anchors must have a 3150 lbs working load capacity and be installed within 2' of each end of the home.
6. These spacings are not for flood or seismic conditions.

FIGURE 7.5.3.2.1(a) Anchor spacing and location

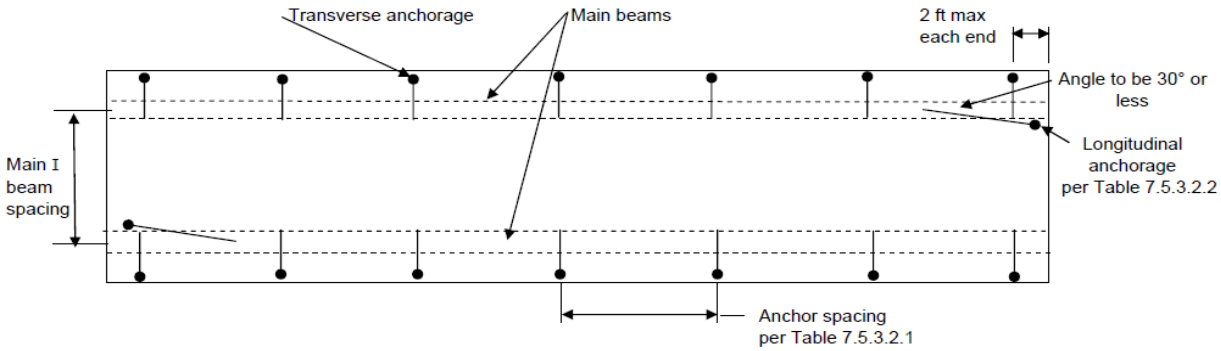
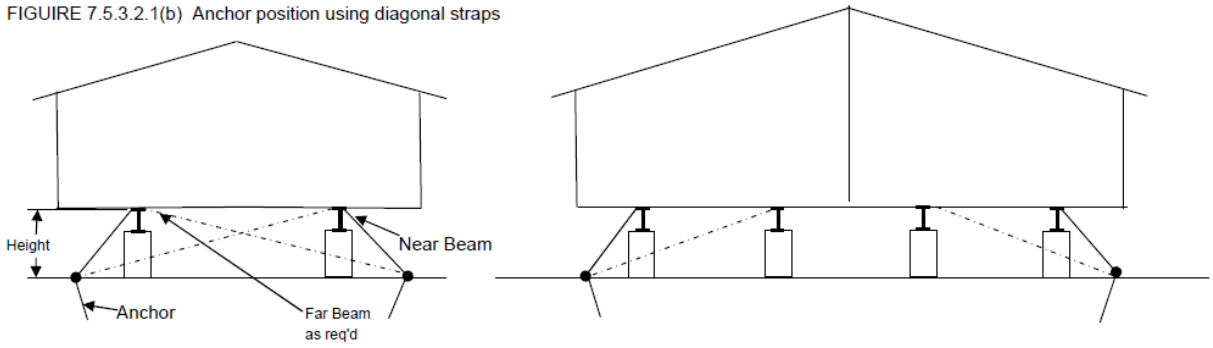


FIGURE 7.5.3.2.1(b) Anchor position using diagonal straps



SINGLE WIDE

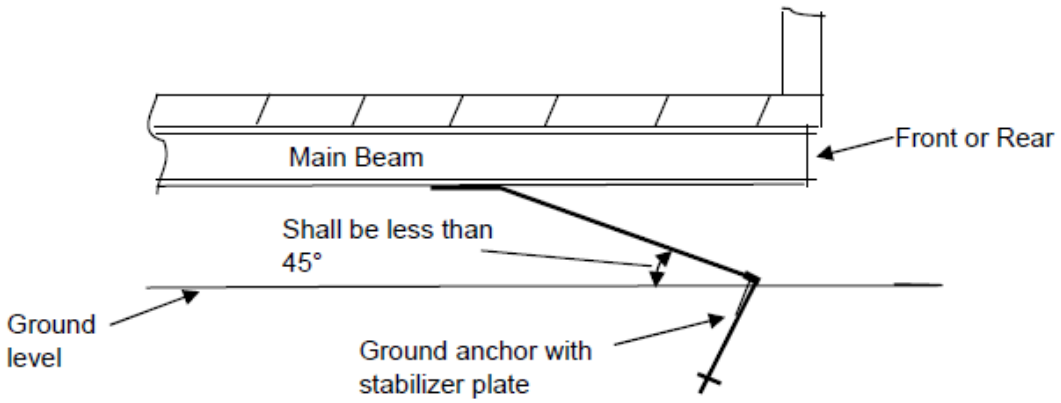
DOUBLE WIDE

Table 7.5.3.2.2 Longitudinal Anchorage

NUMBER OF STRAPS REQUIRED AT EACH END OF THE HOME				
Number of Sections	Max Section Width (feet)			
	10	12	14	16
SINGLE WIDE	1	1	1	1
DOUBLE WIDE[1]	2	2	2	3

Footnote[1] Number of anchors may be reduced by 1 for homes greater than 60 feet in length

Notes: 1. Longitundal straps shall be attached to the home's main frame as specified by the maunfacturers installation instructions.



Using the Anchor Tables: The ground anchor tables are only to be used when the home **Manufacturer's** Installation Instructions are not available. See figures 7.5.3.2.1(a) and (b)

To determine the appropriate anchor spacing follow the steps below:

1. Take the following measurements from the home: **Section or Floor Width, Main I-beam spacing,** and **Height** above grade to strap attachment. Note that **Section or Floor Width** does not include projections or overhangs. For double section homes, use the width of only one of the floors. Use the largest height along the transverse (sidewall) direction in determining the **Height**.

2. On table7.5.3.2.1, find the rows corresponding to the home's **Section or Floor Width**. Within this group of rows, find the rows corresponding to the **Main I-beam Spacing**. Finally, select the row height which is equal to or greater than the home's max **Height** and follow to the next column to obtain the maximum anchor spacing. The strap angle is given for informational purposes and must be between 30 and 60 degrees.

3. The required number of Longitudinal straps are shown on table 7.5.3.2.2.

Example: A 14'-wide Single Section home is being installed. The home's Main I-beam Spacing is 82.5" and the largest height is 40" from grade to strap attachment at the beam. Table 7.5.3.2.1, find the rows for Section or Floor Width of 14 feet, Main I-beam Spacing of 82.5" and max height of 46". Read across this row to obtain a maximum anchor spacing of 9.5 feet. Note: Connection to the Far beam is not required. From Table 7.5.3.2.2 one (1) longitudinal strap is required at each end of the home.

Anchor Installation.

The installed ground anchor type and size/length must be listed for use in the soil class at the site and for the minimum and maximum angle permitted between the diagonal strap and the ground. All ground anchors must be installed in accordance with their listing or certification and the ground anchor manufacturer installation instructions. Anchor manufacturers typically require a soil torque test probe to determine the soil class and then the appropriate ground anchor type and length to be used for that soil may be determined. Unless the foundation system is frost-protected to prevent the effects of frost heave, the ground anchors shall be installed below the frost line. Ground anchor stabilizer plates shall be installed in accordance with the anchor and plate manufacturer installation instructions.

Use the following steps to complete a proper ground anchor installation: Defer to the anchor manufacturer's installation instructions if there are conflicts.

1. Place the Anchors approximately four inches to the inside of the exterior wall line of the home or a sufficient distance to avoid interference with the skirting (See Figure 2.12).

2. Hold the Anchor at an angle of approximately 15 degrees off of vertical so that the head of the Anchor is just outside the sidewall (See Figure 2.12).

3. Install the Anchor to a depth of approximately one-third (1/3) the Anchor length.

4. Place a Stabilizer Plate (all lateral loaded Ground Anchor must have Stabilizer Plates) to the inside of the Anchor Shaft (side of Shaft toward center of house) and two inches from the shaft (See Figure 2.12).

5. Drive the Stabilizer Plate into the ground until the top of the Plate is flush with the surface of the ground.

6. Install the Anchor to its full depth.

7. Attach the Anchor Head to the chassis main rail with approved strapping and connection hardware in accordance with the Strap manufacturer's instructions.

8. Pre-tension the Anchor by pulling it up to the Stabilizer Plate. Pull the Anchor approximately 1/2-inch more while it is in contact with the Plate using the Strap and take-up bolt to move the Anchor Head.

9. After all Anchors have been installed and pre-tensioned, recheck all Anchor Straps to assure that they are tight and that the Anchor Shafts have remained in contact with the Stabilizer Plate.

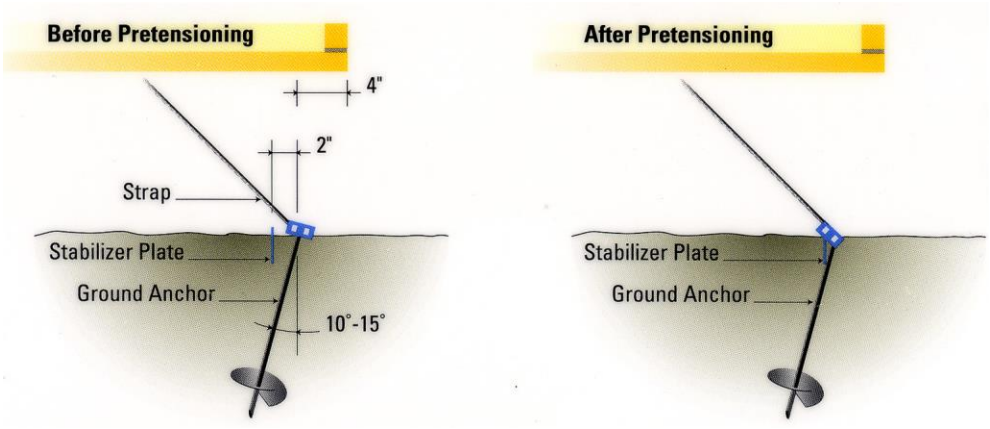


FIGURE 2.12 – Anchor Installation

All helical ground anchors installed in Colorado must have stabilizer plates installed with them. The only exception would be if the anchor were installed in line with the anchor strap.

Ties: Ties, strapping or other approved methods or material shall be suitable for the purpose of this standard and shall meet the following criteria:

1. All ties shall be fastened to ground anchors and drawn tight with turnbuckles, other adjustable tensioning devices or devices supplied with the ground anchor;

2. Tie materials shall be capable of resisting an allowable working load of 3,150 pounds (1,430 kg) with no more than two percent elongation and shall withstand a 50 percent overload;

3. Ties shall connect the ground anchor to the main structural steel frame (I-beam or equivalent), which runs lengthwise under the manufactured dwelling. Ties shall not connect to steel outrigger or cross member beams which fasten to and intersect with the main structural frame;

4. The connection of cable frame ties to the manufactured dwelling main structural frame member shall be by a 5/8 inch (16 mm) drop-forged, closed-eye bolt through a hole drilled in the upper one-quarter of the main frame or other approved methods. The mainframe shall be reinforced, if necessary, to maintain the design strength of the mainframe.

5. Cable ends shall be secured with at least three U-bolt type cable clamps with the U-portion of the clamp installed on the short (dead) end of the cable; and

6. Tension devices such as turnbuckles or yoke type fasteners shall be ended with clevis, forged or welded eyes.

Permanent Foundation Systems for HUD Units

Design Requirements: The design and approval for permanent foundations for HUD units are the responsibility of the local jurisdiction. They may require an engineered and sealed foundation design or have a prescriptive foundation design system to be used throughout the jurisdiction. With no adopted building codes, a professional Architect or Engineer may design and certify a foundation system or a foundation designer using the "Permanent Foundations Guide for Manufactured Housing" may design and certify a foundation system.
http://www.huduser.org/Publications/PDF/foundation_guide_complete.pdf

Permanent foundations must be constructed of durable materials; i.e., concrete, mortared masonry, or treated wood. They shall have attachment points to anchor and stabilize the manufactured home and to transfer all loads to the underlying soil or rock. Permanent foundations shall be structurally developed in accordance with the adopted Colorado Standards or be structurally designed by a Licensed Professional Engineer for the following:

VERTICAL STABILITY

- Rated anchorage capacity to prevent uplift and overturning due to wind or seismic forces, whichever controls. Screw-in soil anchors are not considered a permanent anchorage.
- Footing size to prevent overloading the soil-bearing capacity and avoid soil settlement. Footings shall be reinforced concrete to be considered permanent.
- Base of footing below maximum frost-penetration depth (required at the perimeter of the unit).
- Encloses a basement or crawl space with a continuous wall (whether bearing or non-bearing) that separates the basement or crawl space from the backfill, and keeps out vermin and water.

LATERAL STABILITY

- Rated anchorage capacity to prevent sliding due to wind or seismic forces, whichever controls, in the transverse and longitudinal directions.

Two Basic Types of Permanent Foundations: There are two basic types of permanent foundations used. The first is a non-bearing exterior wall set. With this type of foundation system, the site preparation includes excavating to below frost depth. Continuous concrete runners or individual footings are poured to support piers below the main I-beams. The same method can be used to support the marriage wall. In HUD's "Permanent Foundations Guide for Manufactured Housing" this would be a Type C foundation design. This unit would have an exterior foundation wall that goes down to frost depth and is backfilled with dirt. This wall encloses the crawl space.

The second basic permanent foundation system is a continuous perimeter support foundation like that used for a site-built home. A poured concrete foundation is typical; however, there are two additional foundation wall options: a mortared concrete block wall reinforced with rebar or an all-weather wood wall. This foundation also has centerline and I-beam support, but fewer I-beam support piers are required because the perimeter foundation supports much of the home's weight. When using this foundation system, many contractors also opt to use runners or ribbon footings instead of individual footings for ease of setup. In the HUD's "Permanent Foundation Guide for Manufactured Housing" these would be Type E and I foundation designs. Because the exterior wall is bearing on the foundation this type of permanent foundation must be approved in the **Manufacturer's** Set-Up Instructions.

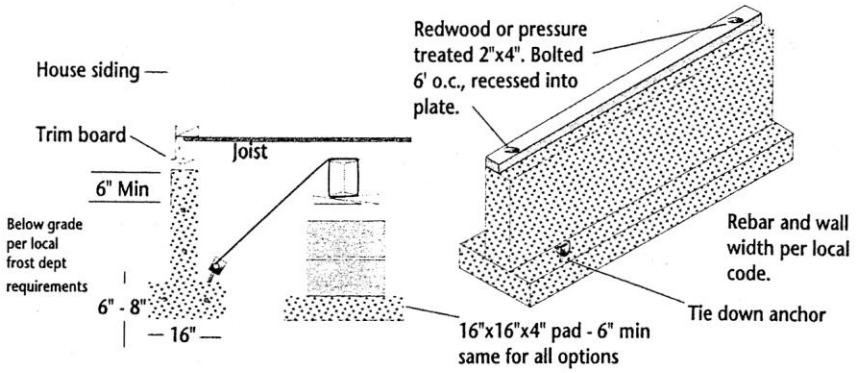


FIGURE 2.14 – Poured Concrete Foundation

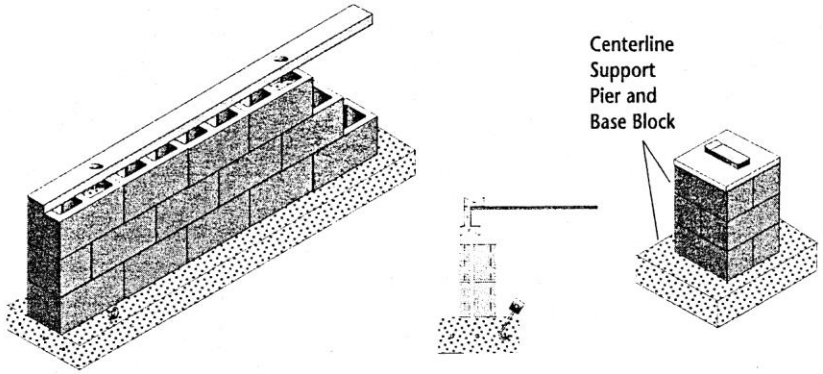


FIGURE 2.15 – Mortared Concrete Block Foundation

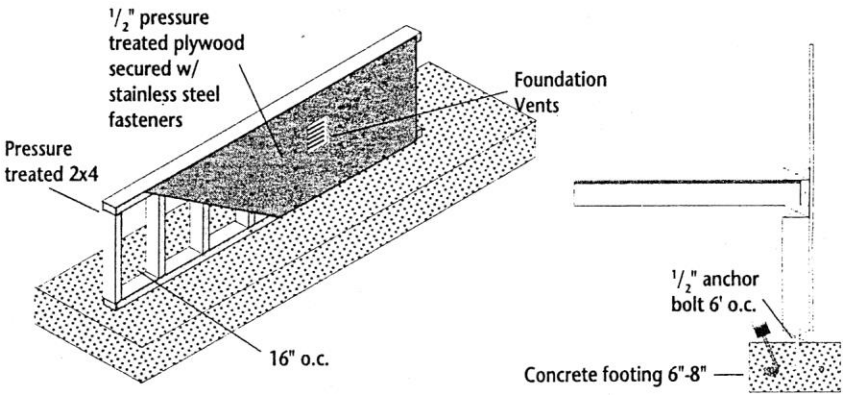


FIGURE 2.16 – All Weather Wood Foundation

Permanent Foundation Site Preparation and Clearances: The site must be prepared to meet drainage requirements found in previous sections of this handbook. In addition, the ground level must be at least 18 inches below bottom of wood floor joints and 12 inches below bottom of chassis beam. Where it is necessary to provide access for maintenance and repair of mechanical equipment located in the under floor space, the ground level in the affected area shall not be less than 2 feet below wood floor joists.

Interior vs. Exterior Ground Level: The interior ground level must be above the outside finish grade unless:

1. Adequate gravity drainage to a positive out fall is provided, or

2. The permeability of the soil and the location of the water table is such that water will not collect in the crawl space, or

3. Drain tile and automatic sump pump system is provided.

Minimum Foundation Wall and Wall Footing Thickness: For masonry or concrete construction, the minimum foundation wall will be 6 inches. The minimum reinforced concrete footing thickness must be 6 inches or 1-1/2 times the length of the footing projection from the foundation wall, whichever is greater.

Pier and Column Footing Requirements: Footings for pier foundations shall be reinforced concrete and should be placed level on firm undistributed soil of adequate bearing capacity and below the frost penetration depth. They can also be placed on engineered, compacted fill, approved by a Licensed Geotechnical Engineer.

Minimum Pier and Pier Footing Thickness: The minimum thickness for a pier is 8 inches. The minimum thickness for pier footings is 8 inches.

Footing Reinforcing (Horizontal): Reinforce footings when the projection on each side of the wall, pier, or column exceeds 2/3 of the footing thickness, or when required because of soil conditions.

Masonry Piers and Walls: All masonry piers and walls shall have mortared bed and head joints. Reinforcing and grouting shall be in accordance with the foundation design.

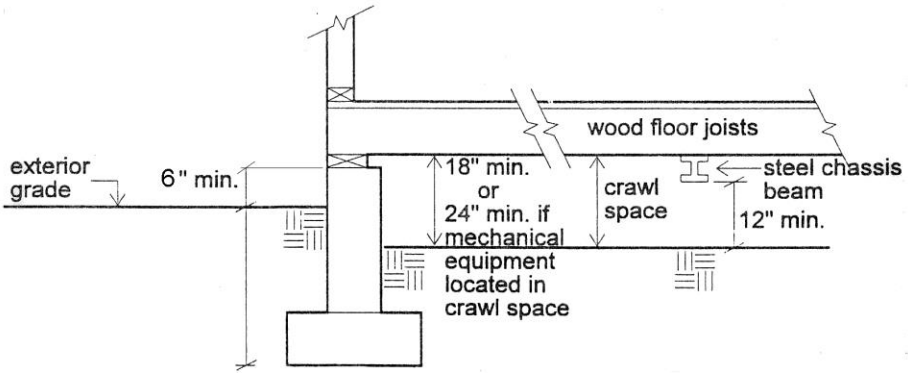


FIGURE 2.17 – Permanent Foundation Site Preparation

Anchorage for Permanent Foundation Systems: The superstructures of manufactured homes are too light to relay upon their mass to provide all resistance to overturning and uplift and must rely on the assist of their foundation to achieve adequate resistance. The anchorage requirements must be engineered and spacing and methods must be followed exactly.

Factory-Built or IRC Home Foundation Systems

These homes are always set on permanent foundations and must be attached according to their **Manufacturer's** Installation Instructions. The design requirements for permanent foundations are under the authority of the local jurisdiction. The state's authority exists specifically for the attachment of the units to the foundation, and connecting the units together, and to assure proper load carry down to the ground. Most permanent foundations will be designed by a Professional Engineer or designed to locally approved prescriptive standards.

Prescriptive Foundation Design from IRC: The International Residential Code has foundation design requirements prescribed in Chapter 4. The following are a few of the requirements prescribed by the International Residential Code.

They are for reference only and do not include exceptions. Contact the local jurisdiction having authority for specific design requirements.

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other *approved* point of collection that does not create a hazard. *Lots* shall be graded to drain surface water away from foundation walls. The *grade* shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

R401.4 Soil tests. Where quantifiable data created by accepted soil science methodologies indicate expansive, compressible, shifting or other questionable soil characteristics are likely to be present, the *building official* shall determine whether to require a soil test to determine the soil's characteristics at a particular location. This test shall be done by an *approved agency* using an *approved* method.

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems which shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill. Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

R402.2 Concrete. Concrete shall have a minimum specified compressive strength of f'_c, as shown in Table R402.2. Concrete subject to moderate or severe weathering as indicated in Table R301.2(1) shall be air entrained as specified in Table R402.2. The maximum weight of fly ash, other pozzolans, silica fume, slag or blended cements that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in Section 4.2.3 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapter 3 of ACI 318 or ACI 332.

R402.1.2 Wood treatment. All lumber and plywood shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall bear the *label* of an accredited agency. Where lumber and/or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain a minimum of 2 percent copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

Chapter 3

Structural

Shimming

Joints between manufactured dwelling sections may be shimmed up to a maximum of 1 inch (2.54 cm) and sealed per Chapter 4.

Multi-Section Connections

The interconnection of multi-section homes shall be completed in accordance with the **Manufacturer's** Installation Instructions. When the **Manufacturer's** Installation Instructions are not available, the interconnection of multi-section homes shall be in accordance with Table 7.3 or per the requirements approved by a State of Colorado Licensed Engineer.
Note: The table is numbered from amendments to NFPA 225 listed in Resolution 38.

Table 7.3 Connections of Multi-Box Home

Shim any gaps between structural elements prior to connection with dimensional lumber up to one inch. If gaps exceed one inch, re-position home to eliminate gapping condition.

CONNECTOR LOCATION	CONNECTOR SIZE	FASTENER ANGLE	FASTENER SPACING
Roof support beam at ridge or ceiling line	1/2 inch carraige bolts	90 degrees	48 inches on center
Roof ridge beam or ridge rail	3/8 inch lag screws with washers	Approx 45 degrees	24 inches on center each side and staggered
Roof rafter connection	4x12 inch 18 gauge galv strap or listed 1.25 x 22 inch 16 gauge strap centered on truss and peak	90 degrees into truss	48 inches on center for straps, 5-10d nails each side of ridge
or	8 inch continuous 18 gauge galv metal sheet centered on peak	90 degrees into roof sheathing/beams/truss	8D nails at 6 inches on center each side of ridge
Floor rim joist connection	3/8 inch lag screws with washers	Approx 45 degrees	24 inches on center each side and staggered
End wall and interior wall connection	#8 wood screws	Approx 45 degrees	18 inches on center

Notes:

1. Fastener length shall be adjusted as required to obtain full penetration into all structural members being connected on both sides of the marriage line.
2. 3/8" lag screws are to be piloted with 1/4" dia. holes prior to installation.
3. When the support post for a roof support beam can only be located on one side of the marriage line, install eight 1/2" cluster bolts with washers, spaced 4" on center, centered on the post, to connect the roof support beams together.

Ridge/ roof support beams:

1. Connect with 1/2 inch diameter carriage bolts spaced equally along the length of the ridge beam at a maximum of 48 inch on center at 90 degrees;

2. Connect with 3/8 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;

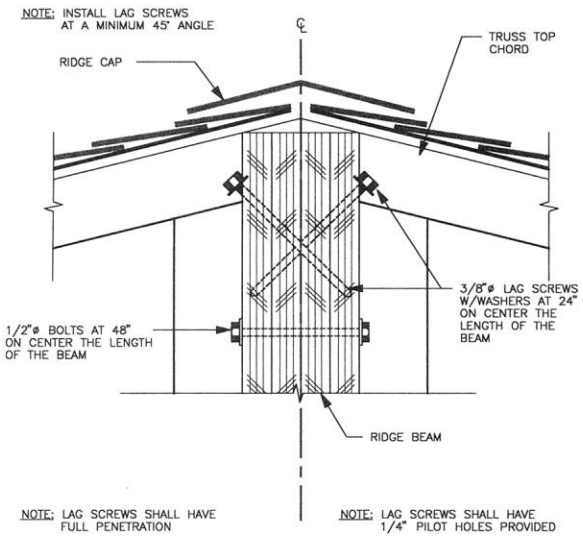


FIGURE 3.1 – Marriage Line Fastening Schedule

3. When a ridge beam center line support is located on one section (side) only, eight 1/2 inch diameter bolts with washers, spaced 4 inches on center, installed at 90 degrees and centered over the support shall secure the two ridge beams together;

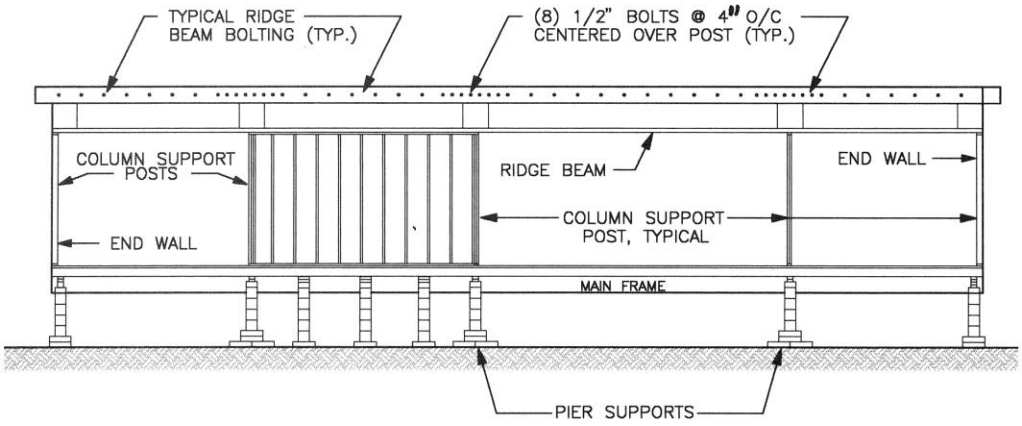


FIGURE 3.2 – Ridge Beam Bolt Connections

Roof rafters/trusses:

1. Connect with 4x12 inch x 18 gauge galvanized steel straps or 1.25x22inch x 16 gauge listed steel straps spaced equally along the length of the ridge at a maximum of 48 inches on center and fastened into the ridge beam and the top chords of the rafters or trusses with five 10d nails or equal on each side;

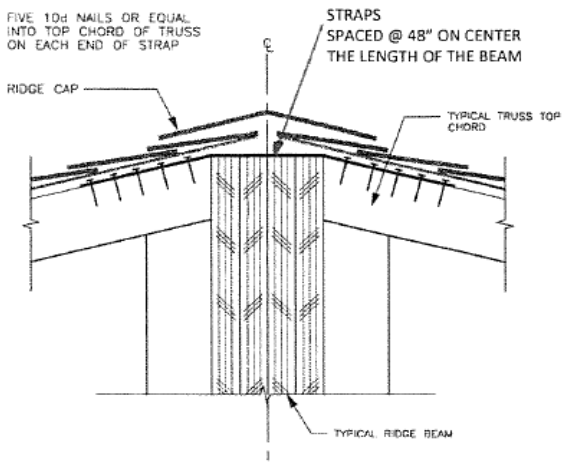


FIGURE 3.3 – Ridge Beam Strap Connections

2. Connect by placing an 8 inch continuous piece of 18 gauge galvanized metal longitudinally at the center of the ridge, fastened into the roof sheathing, ridge beam, and top chords of the rafters or trusses with 8d nail at 6" on center each side of the ridge.

Floor Connections:

1. Connect floors together with 3/8 inch diameter lag screws with washers installed diagonally at 45 degrees or less through each section's rim joists installed in pairs or staggered, but not exceeding a maximum spacing of 24 inches on center.

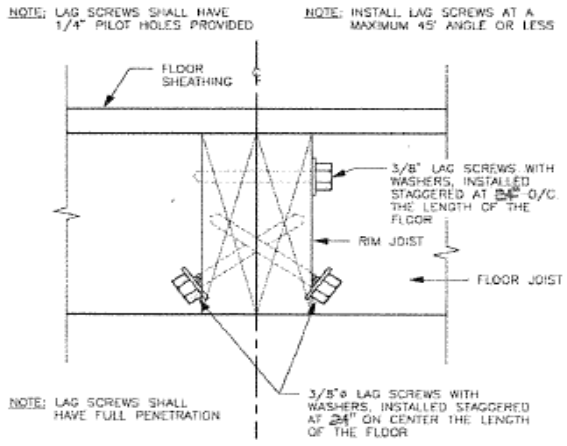


FIGURE 3.4 – Floor Connection with Lag Screws

Hinged Roofs

Hinged roofs are unique to each **manufacturer's** design standards and must be erected and fastened according to the **Manufacturer's** Installation Instructions and the truss detail drawing requirements. If the **Manufacturer's** Installation Instructions cannot be obtained, a Professional Engineer must provide specific details to follow during this portion of the set-up process.

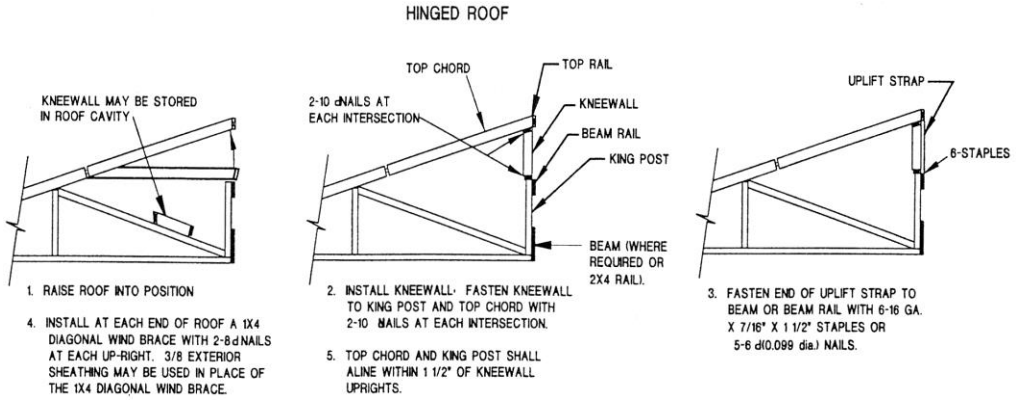


FIGURE 3.2 –Example of Hinged Roof Details

Mechanical Connections: Some hinged roof homes have fuel fired heating appliances located under the hinged portion of the roof, which require vent installation thru the roof and inspection at the site prior to occupancy. This is an important step to keep in mind when preparing for or conducting the structural connector inspection, since these elements will be visible at that time.

Chapter

4

Exterior Close-up

Joints: During installations, joints and seams that have been created or disturbed shall be cleaned and shimmed where the gap exceeds 1/2 inch (13 mm) top or bottom; then sealed with a weatherproof material to limit heat loss and prevent air, moisture and other damaging infiltration. The gasket material shall be durable, non-porous caulking, closed cell foam, urethane or approved sill seal. Caulking, if used, shall be capable of compressing and stretching. Sill seal, if used, shall be a minimum of 5-1/2 inches (13.97 cm) wide and attached with fasteners staggered at 6 inches (15 cm) on center.

Under Floor Area: 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 shall be adequately repaired to prevent the entrance of rodents and to limit heat loss.

Mating Line Insulation: Special care must be taken to ensure that the mating line joint(s) are tight to resist air infiltration and minimize condensation. Remove **all** shipping plastic before mating sections together. On multi-section units, install strips of approved sill sealer around the ceiling, end walls and floor mating line ensuring that it is not placed in a position where it could restrict the air ducts of the heating system, or supply or return air ducts, which might cross at the floor line or through the ridge beam. Fasten sill sealer with staples or nails to secure in place. Approved aerosol dispensed polyurethane foam or mating line insulator may be substituted for sill sealer. Do not use carpet pad for this application.

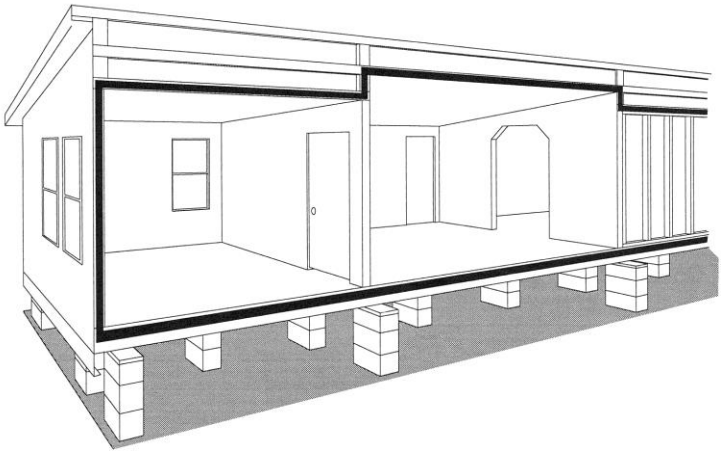


FIGURE 4.1 – Mating Line Insulation

Siding

Before the installation of any siding material, remove any polyethylene or other shipping wrap and fasteners. Upon completing the installation of wood, hardboard or other porous siding material, all exposed edges and unfinished faces must be painted, sealed or treated to provide moisture and weather tightness. All exterior fasteners must be non-corrosive.

Hardboard Siding: Where hardboard siding has been partially or fully left on the ends of a multi section unit, install each piece of siding so all edges are supported by framing members and are secured at 4" o.c at the edges and 8" o.c in the field using 1 ½" siding or 6d nails. If required, cut siding to size and rabbit the edge to create the proper lap joint.

Where close off or trim strips are used at flat areas and inside or outside corners, caulk the joints and strips prior to nailing down. Nail the strips with 6d or 1 ½" siding nails at 12" o.c. staggered then caulk all leading edges of all the strips. If needed, using the same method, install the strips at the bottom of the roof overhang, the soffit and the hardboard trim piece at the fascia.

Vinyl Siding: Vinyl siding shall be attached to the sheathing with 1 ½" siding nails or 16 gauge x 7/16" x 1 ¼" crown staples at 16" o.c. All siding shall be attached loose to allow for expansion and contraction. A minimum ¼" gap is required at trim and ends and a 1" minimum lap is required at splices. No splices are allowed in the siding courses directly above or below a door or window.

Wood/Composite Clapboard Siding: Wood or composite clapboard siding shall have all joints located on framing members. Use 1 ½" siding nails or 6d nails at each framing member per course. Fill and paint nail holes and seal joints with silicone based caulk.

Stucco: For units that are stuccoed at the plant, close off the unit with a 1x wood member that has been sealed with stucco applied over it using 6d nails. As an alternate, the stucco can be left off of the end of the unit or the mating line and applied at the site per the stucco manufacturer's instructions.

Roofing

In addition to completing the appropriate roofing close up, holes resulting from any fasteners used to secure any shipping material at the roof must be sealed with a silicone or asphalt based sealant.

Composite Roofing: Check any exposed roofing underlayment for tears. Repair any defects with similar material, according to product manufacturer's instructions. Secure this material at 6" o.c with staples. If the roof is not shingled, begin by applying a starter strip to the eve end of the roof. Acceptable starter strip materials includes, but is not limited to, a row of shingles with the tabs facing up the roof or a continuous strip of 12" rolled roofing material. A bead of asphalt roofing cement or caulk shall be placed between the starter strip and the first course of shingles to seal these shingles down. Remaining courses are self-sealing. Install the shingles using roofing nails or wide crown staples, if allowed, following the placement guidelines found on each package of shingles (shingle manufacturer's installation instructions). Finish by installing the continuous ridge vent or ridge cap.

Where no shingle manufacturer's instructions are available for applying a ridge cap, the following method can be used. Apply an 8" x 30 gauge strip of rolled metal flashing secured with 1x 1 ¼" x 16 gauge staples or roofing nails at 6" o.c., each side, for the length of the ridge. Over this, apply a 10" strip of 15 lb. roofing

felt or roofing paper securing each side with staples. Using roofing nails or crown staples, attach roof cap shingles to the ridge securing with one fastener at each side of the ridge. The fasteners shall be long enough to penetrate the roof deck by ¾". Place fasteners in an area that will be covered by the next shingle. Shingles must bend downward over the peak to allow for proper drainage. It is also important that the shingles are centered over the peak and that, if possible, they are placed to face away from prevailing wind.

Tile Roofing: After securing the roof together, replace the sheathing used for the access to the beam fasteners and install a 2X4 ridge nailer with 8d nails at 16" o.c. Install the rake tile to a 1x4 nailer using 2 corrosion resistant 8d nails (top and bottom), with a rake overhang of not less than 1/2"and an eve overhang of not less than 2". Install a large dab of construction grade adhesive or mastic cement on the barrels. Install field tile up to 2x4 ridge. Cut tile if needed. Make sure tile joints are staggered by trimming off each course of tile as needed. Before installing the ridge tile, the void between the 2 x 4 nailer and the top course of field tile must be filled with mortar. As an alternative, roofing tape can be used (Flashband or equivalent). Fasten the ridge tile to the 2X4 nailer using a corrosion-resistant 8d nail two inches from the back end of the tile. Apply a large dab of construction adhesive or mastic cement over the fastener. The first and last ridge tile should be face nailed.

Gable Roof Tag Units: Multi section homes with gable roof tag units may be shipped with the sheathing left off from the mating line at both the tag and the main sections. To complete this installation, cut roof sheathing to size and install with the length perpendicular to the trusses, leaving a 1/8" gap between sheets for expansion. Nail the sheathing down to all framing members at 6" o.c. with 16 gauge x 7/16 x 1 ½" crown staples or 8d nails.

Some tag units with eaves will require shingles to be installed in the valley areas and where the tag unit abuts to the main unit. With staples, apply 15 lb. Felt or "Plydry" type material (two layers wet mopped together with asphalt for the first 36" up from the eave), overlapping all joints 12". Apply 18" wide asphalt rolled roofing material or 20 gauge galvanized metal to the valley, securing every 12". No fasteners should be placed within 6" of the valley center. Install the remaining shingles, interlacing them with those already installed at the roof, using 1" crown x 1" leg 16 gauge galvanized staples or 1 ¼" 12 gauge galvanized roofing nails with a minimum 3/8" diameter heads. If creating a woven valley, no fasteners shall be located within 6" of the valley center the top course should be cut back 3 inches from the valley center. If using metal valley flashing, an open valley is also permitted. Other installation methods are allowed if approved by the shingle manufacturer.

Roof Jacks: Site installation of attic vents, mechanical vent flashings and plumbing roof jacks require special attention when installed during the setup of the home. To install these, a 1/4-inch bead of roofing cement or asphalt based caulk shall be placed on the roofing underlayment and the shingles near the bottom edge of the jack. Embed the roof jack firmly into the roofing cement or caulk lapping the bottom of the jack over the last row of installed shingles. Fasten with roofing nails at the holes provided or at 6" o.c. max. Apply another 1/4-inch bead of roofing cement or asphalt based caulk to the top of the roof jack where additional courses of shingles will be installed. Continue applying the shingles, carefully cutting to fit snugly around the roof jack. Finish by applying caulk to any exposed fasteners at the bottom edge of the roof jack.

Additional Considerations: Any setup related installation of light fixtures, hose bibs or other exterior penetrations must be made weather tight. All shall be caulked or flashed to prevent moisture from entering the wall cavity.

Skirting

Skirting, if used, shall be of durable materials suitable for exterior exposures. Skirting shall be recessed under the siding or trim and must not be attached in a manner that could cause water to be trapped between the siding or trim and the skirting. Skirting made from wood or wood products, including all wood siding, shall be pressure treated to prevent decay and termite infestation if it will be used within 6 inches of the ground. A minimum of one square foot of net free ventilation area for every150 square feet of the home's floor area shall be provided for the crawl space. Ventilation openings shall be placed at or near each corner of the home and as high as practical. Openings shall be located to provide cross-ventilation on at least two opposite sides. Where an acceptable ground vapor retarder is installed and one ventilation opening is within 3 feet of each corner of the home, the total area of ventilation openings may be reduced to one square foot for every 1500 square feet of the home's floor area.
Dryer vents, condensation drains, water heater pan drains and combustion air inlets must pass through the skirting to the outside.

Crawl access

A minimum 18x24" access opening (typically in the skirting) to the underfloor area shall be provided and located so that utility connections are accessible.

Site-Installed Features

Carports, awnings, porches, roof covers, and other similar attachments or additions shall not be supported by a manufactured home unless the home was specifically designed to accommodate such attachments or the attachment is designed by a registered professional engineer. Non-structural connections for flashings and coverings at the junction are acceptable.

Chapter

5

Plumbing

All plumbing must be properly installed and connected while completing a home installation. Water and sewer single hook-ups may be completed by the installer provided they are inspected by a State or local plumbing inspector. See plumbing board rules for hook-up definition. Plumbing installation falling outside of a single hook-up shall be installed by a State licensed plumber. In either case, a permit and inspection shall be obtained through the local jurisdiction or the state plumbing board.

Water Supply

Maximum Supply Pressures: The water systems of each home are designed for a maximum inlet pressure of 80 pounds per square inch.

Important:

If a home is located in a water district where the local water supply pressure exceeds 80 pounds per square inch, install a pressure-reducing valve.

Mandatory Shut-off Valve: An accessible full-flow shut-off valve (gate or ball valve) must be installed between the water supply and the inlet, as shown in Figure 5.1.

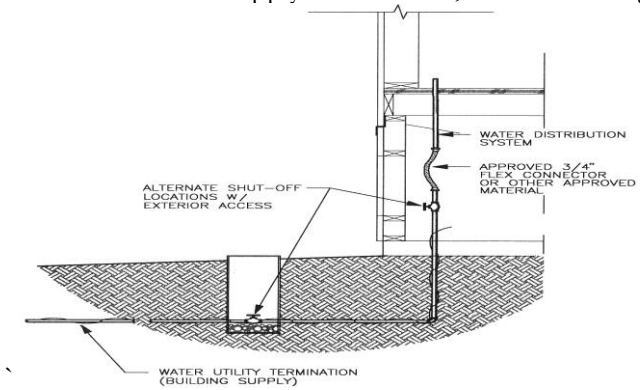


FIGURE 5.1 – Water Connection to Home

Crossovers: Multi-section homes with plumbing in both sections require crossover connections. Remove the shipping caps from the water lines and install crossover connectors shipped with the home or any other material approved as a high-pressure waterline connector. If freezing could occur, wrap crossovers with insulation.

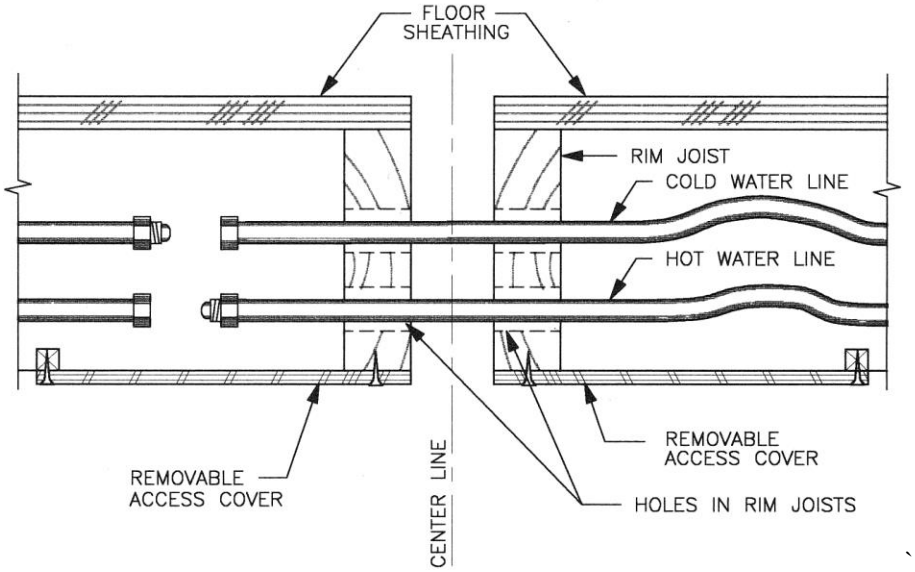


FIGURE 5.2 – Crossover Connectors through Rim Joist

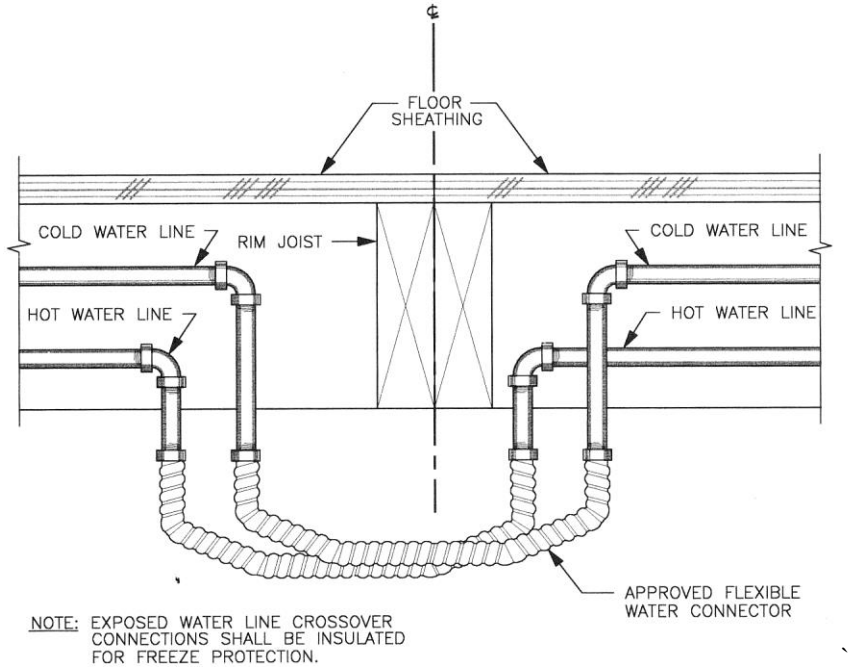


FIGURE 5.3 – Exposed Crossover Connectors

Protection from Freezing: In areas subject to freezing temperatures, provide insulation at exposed sections of water supply piping, shut-off valves, pressure reducers, and pipes in exterior water heater compartments with non-insulated doors.

Use of Heat Tapes: In non-heated or un-insulated areas, the use of heat tapes (either automatic or non-automatic) can protect exposed plumbing from freezing.

Caution:

In order to reduce the risk of fire, use only heat tapes listed by a nationally recognized testing laboratory for use with manufactured homes, and install them only in accordance with the manufacturer's instructions.

Testing Procedures

Even though the water system was tested at the factory, it shall be rechecked for leaks at the installation site. Close all water faucets, spigots and toilet-tank float valves, and use one of the following procedures.

Hydrostatic Test: Be sure the water heater tank is full of water. Fill the entire piping system with water then pressurize the system to 100 psi and isolate it from the pressure source. The system must hold this pressure for at least 15 minutes without any loss. If the pressure falls off, locate and correct any leaks and retest the system. Use only hydrostatic tests on homes with plastic piping systems.

Pneumatic Test:

Caution:

If this procedure is used, **the hot water tank must be bypassed** by hooking its cold inlet and hot outlet lines together. This method will protect the hot water tank from damage and protect those involved in the test from possible injury.

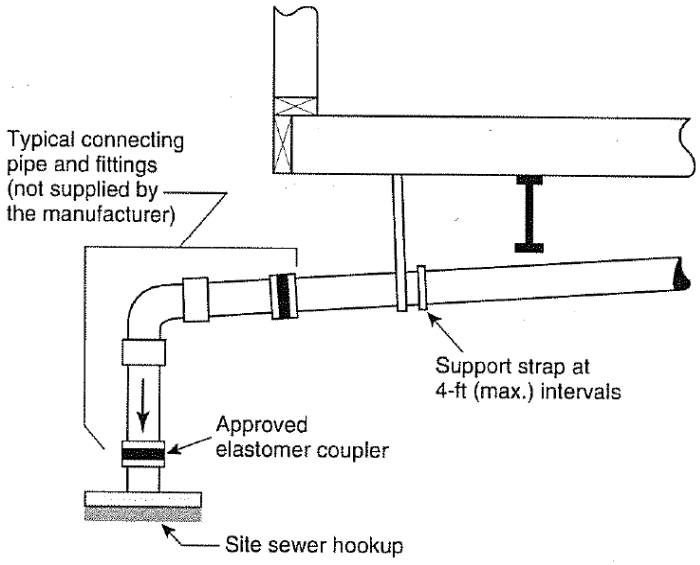
Connect an air pump and pressure gauge to the water inlet and pressurize the system to 100 psi. Isolate the pressure source from the system. The gauge must stand for at least 15 minutes with no drop in pressure. If there is a drop in pressure, locate and repair leaks and repeat the test procedure. Reconnect the water heater and the water supply.

Drainage System

Assembly and Support: Because of the remoteness of the plumbing fixtures or to protect the drainage system from over the road damage, it is sometimes necessary to assemble any under-floor piping on site after the home has been set on its foundation and the tie-down operation is complete. If portions of the drainage system were not installed at the factory, or if the home is being relocated, use the materials and diagrams supplied by the factory to complete the plumbing connections. This may be done by a certified

installer. If no materials or diagrams are available, plumbing connections made must conform to the International Plumbing Code and must be made by a licensed plumber.

Proper Slopes and Connector Sizes: Drain lines must slope at least ¼ inch fall per foot of run. The slope can be reduced to 1/8 inch per foot if a cleanout is installed at the upper end of the run. This reduction does not apply to sewer laterals.
Connect the main drain line to the site sewer hookup using an approved elastomer coupler.



When the entire system has been completed, install permanent drain line supports at 4 feet on center, as shown in Figure 5.4. Hangers may be secured to any frame member or to the wood floor joists.

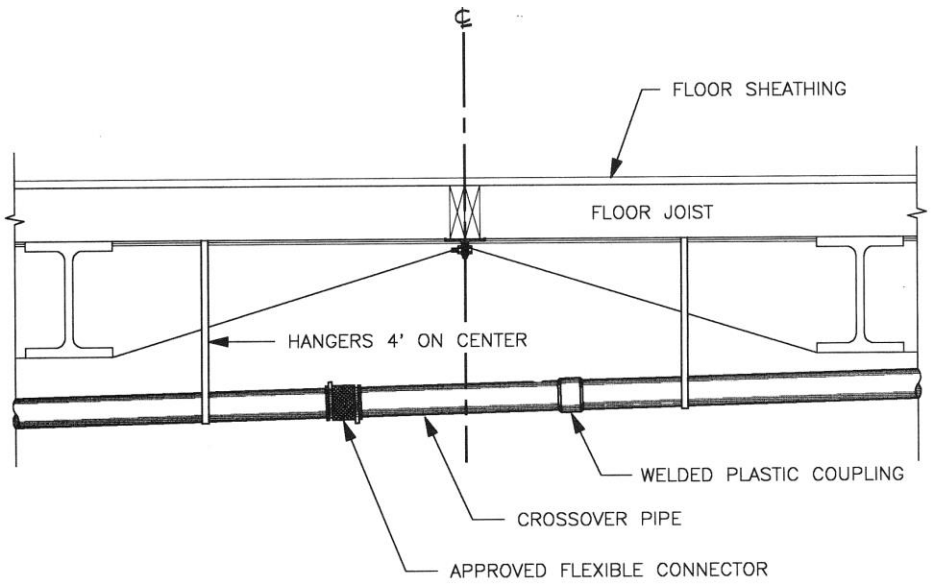


Figure 5.4 – Drainage System Crossover and Strapping

Solvent Welding Procedures: The solvent cement used to assemble the drain lines must be compatible with the pipe installed in the home. Follow the manufacturer's instructions on the container and complete the permanent connection of all pipe and fittings, again starting at the most remote fixture.

Crossovers: If applicable, connect multi-section home crossovers insuring proper slope and using approved material and fittings. Add the required support straps or blocks as needed.

Protection from Freezing: The floor insulation provides freeze protection for fittings in the floor. If this insulation is removed during assembly or testing, replace it. In cold climates, fittings and piping outside the floor insulation may also need to be protected.

Test Procedures

Even though the drainage system was tested at the factory, it must be rechecked for leaks at the installation site. This shall be accomplished by capping the drain line, filling it with water, and holding it for 15 minutes. If leaks are found, repair and retest the system. In freezing conditions, the water must be forced out of the system or approved antifreeze placed in the traps.

Chapter

6

Electrical

For HUD units, Article 550 of the National Electric Code must be followed for all electrical work performed at the site. For Factory Built units, the entire National Electrical Code must be followed. Contact the local jurisdiction or State Electrical Board for required electrical permits.

Supply Feeders

See figure 6.1.
Manufactured homes are designed for connection to an electrical service system rated at 120/240 volts A.C. Most homes are designed for an underground supply system. They are equipped with a pre-sized conduit for the anticipated loads.

The rating in amperes of the home can be found on a tag on the outside of the home near the service entrance or by inspection of the main breaker in the panel. The correct feeder size must be determined from the **Manufacturer's** Installation Instructions or by calculation. For long feeder runs it is important that feeder wires be sized by qualified individuals according to the NEC, as most installation manuals do not account for voltage drops determined by feeder length.

Feeder wires consist of four (4) insulated color-coded conductors. The feeder conductors must be listed for their intended use (either underground or overhead). Feeder wires shall be installed either underground or overhead according to the requirements outlined in the NEC.

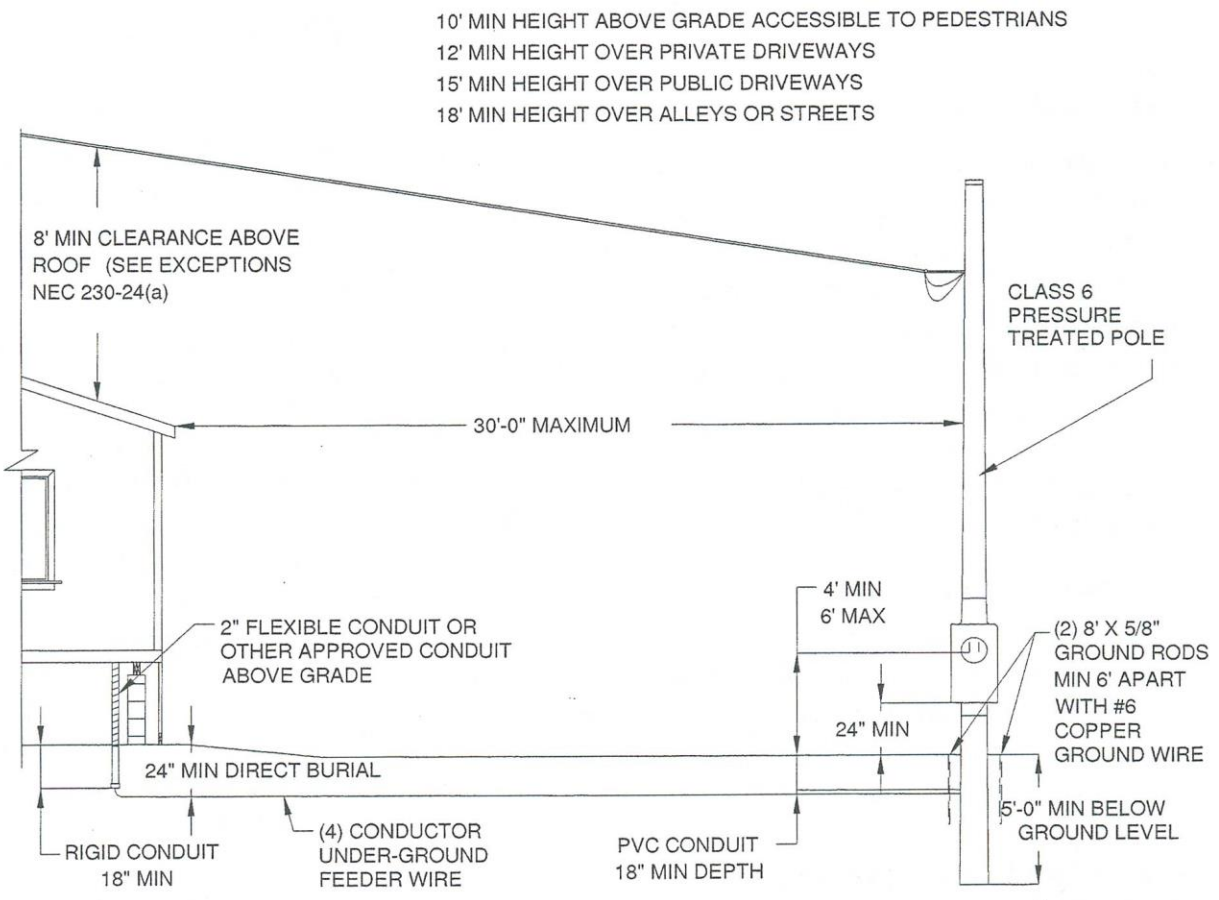


Figure 6.1 – Electrical Service Entrances

Grounding

All manufactured homes must be properly grounded to protect the occupants.

The grounded circuit conductor (neutral or white wire) should be insulated from the grounding conductors (green wires) and from equipment enclosures and other grounded parts.

The ground conductor of the feeder cable connects the grounding bar to an electrical ground back through the power supply system.

All **Manufacturer's** Installation Instructions shall be followed to meet grounding requirements. Also local utility requirements and requirements of the local jurisdiction for grounding must be met.

All 240 volt appliances shall have the bonding strap between the ground and the neutral conductors removed before installation.

In multi-section homes a ground connection must be made between the sections. **Manufacturer's** Installation Instructions must be followed. The grounding connection is commonly made with a ground wire or positive connection of metal parts. A #8 AWG bare copper wire is usually supplied by the

manufacturer and connected to the approved lugs with bolts, star washers and nuts or self-tapping screws. See figure 6.2.

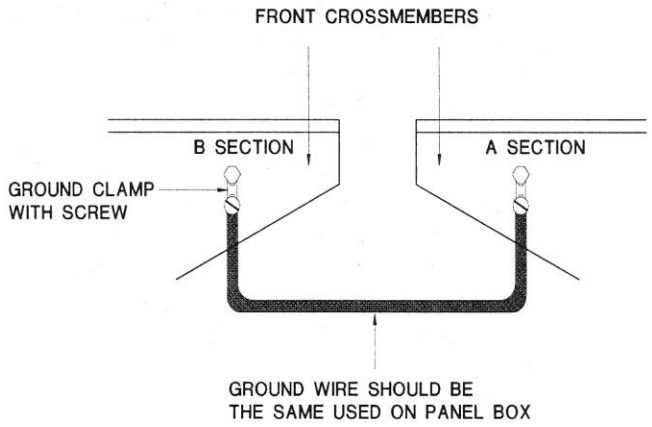


Figure 6.2 – Multi-section Grounding

Warning:

Installation of the electric power to the home can cause exposure to live electrical circuits. EXPOSURE TO LIVE ELECTRICAL CIRCUITS MAY RESULT IN SEVERE SHOCK OR POSSIBLE ELECTROCUTION.

A qualified installer must make the connections for the electric power.

Crossover Connections

Multi section homes are designed with a single electrical panel. Crossover connections are required to supply power to the multiple sections.

Crossover locations can be distinguished by metal junction boxes or access cover panels. Access panels must be removed and the enclosed wires connected according to the **Manufacturer's** Installation Instructions or to wiring methods outlined in the NEC. Some crossover connectors plug together and do not require junction boxes. See figure 6.3.

Circuits should be clearly marked at the manufacturing facility so correct connection in the field can be accomplished. NM cable shall be properly secured within 12" of the box. All grounding conductors shall be connected, and the junction boxes shall have no unused knockouts.

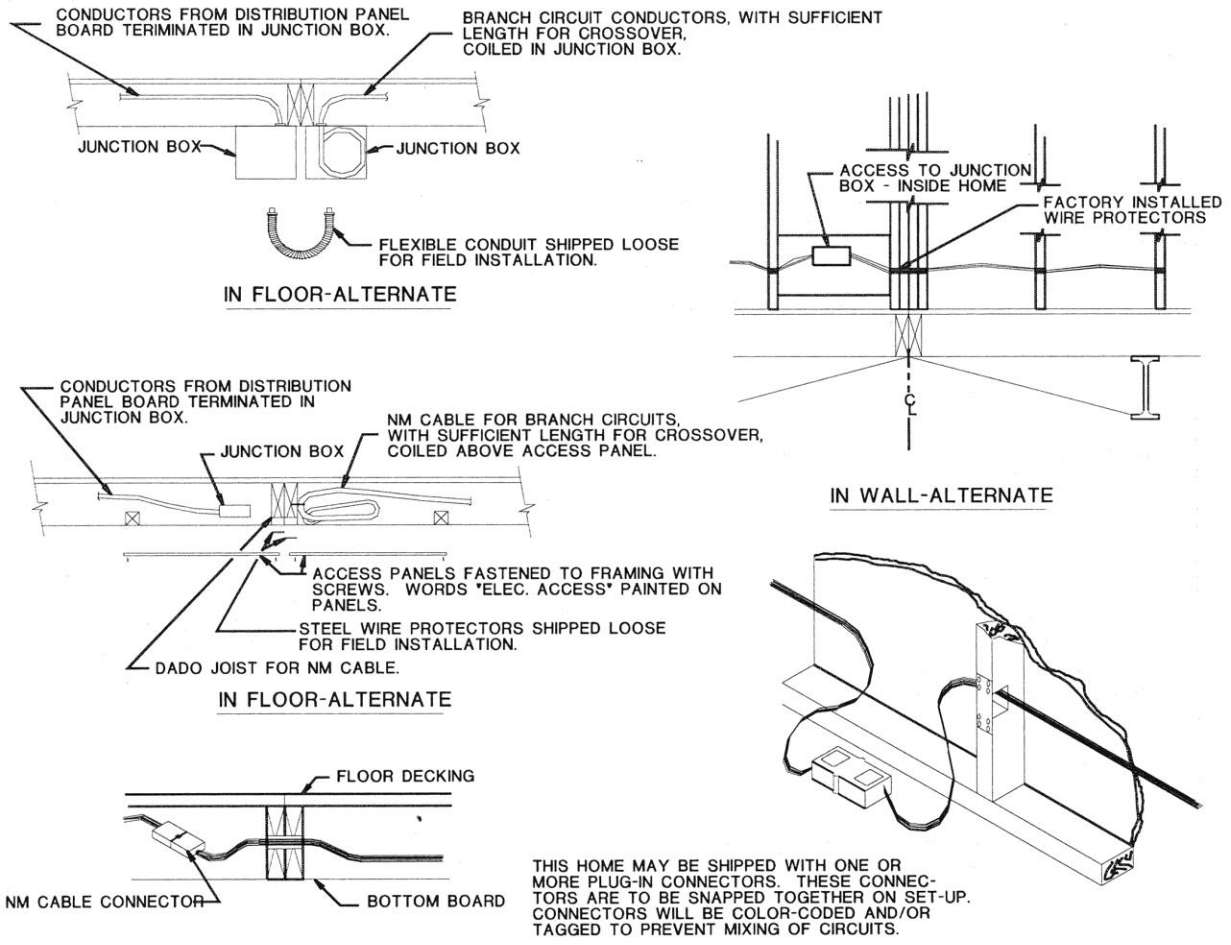


Figure 6.3 – Electrical Crossovers

Fixture Installation

Electrical fixtures are sometimes not installed at the manufacturing facility. Fixture installation instructions must be followed for the fixtures that will be site installed.

Typical site installed fixtures include smoke and carbon monoxide detectors, exterior lights and ceiling fans.

Smoke alarms for HUD units: Verify smoke alarms are installed to protect the living area, rooms designed for sleeping, on upper levels and in the basement for homes installed over a basement. Verify smoke alarms are installed and operating properly to meet the requirements of 24 CFR 3280.

Smoke alarms for Factory Built Modular units: Verify smoke alarms are installed in the following locations: 1. In each sleeping room, 2. Outside each separate sleeping area in the immediate vicinity of the bedrooms, 3. On each additional story of the dwelling, including basements and habitable attics but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level. 4. Smoke and CO alarms are not allowed on a circuit that is dedicated only for alarms.

Carbon monoxide alarms for all units: An approved carbon monoxide alarm shall be installed outside of each separate sleeping area within 15 feet of the entrance to the bedrooms in dwelling units within which fuel-fired appliances are installed and in dwelling units that have attached garages.

Grounding: All exterior lights and ceiling fans shall be grounded by a fixture-grounding screw or by a fixture grounding wire. Chain-hung lighting fixtures shall be grounded using both a fixture-grounding screw and a fixture grounding wire. Lighting fixtures installed on combustible surfaces such as hardboard shall have a noncombustible ring installed to cover the combustible material between the outlet box and fixture. See figures 6.4 and 6.5.

Exterior lights: The lights are to be caulked around the base to ensure a watertight seal to the wall.

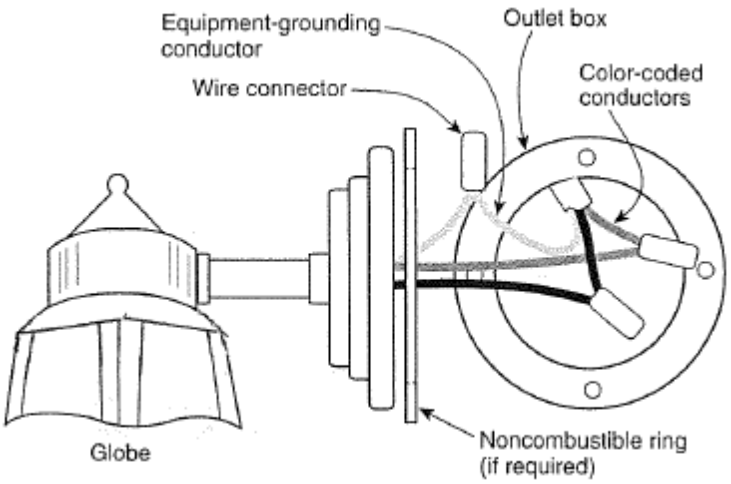


Figure 6.4-Exterior lighting fixtures

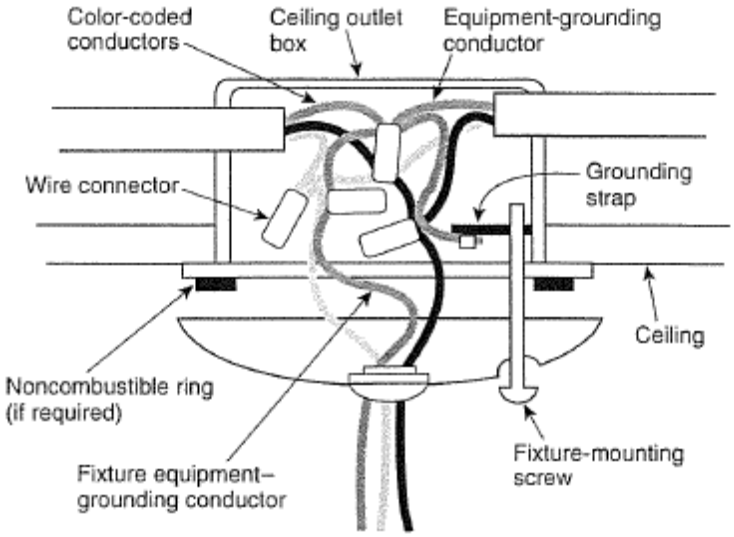


Figure 6.5-Chain hung lighting fixtures

Ceiling fans: The paddle trailing edges of ceiling fans shall be installed at least 6 feet 4 inches above the floor. Ceiling fans are to be suspended from an outlet box that is listed for ceiling fan installation and the weight of the fan.

Telephone and Cable TV: Telephone, cable TV and similar wiring shall be installed per the AHJ requirements and the National Electric Code.

Testing

Although the electrical wiring and fixtures are tested at the manufacturing facility the following tests shall be performed on site.

Continuity Test: Prior to electrical power being supplied to the home, the continuity test shall be performed. The continuity test is performed between an accessible connection to the equipment ground (grounding bus) and all non-current carrying metal parts. The accessible to ground may be the ground bus in the panel, a non-current carrying metal part such as the frame, metal siding or range hood that is bonded to the grounding bus or the ground prongs on outlets. Any non-current carrying metal part may be used as the grounding point as long as one check is made to assure continuity to the ground bus.

Using a continuity tester, test all non-current carrying metal parts. Non-current carrying parts to be checked include the following:

1. Appliance enclosures including fans
2. Fixture enclosures and canopies
3. Metal siding and roofs
4. Metal water lines
5. Metal ducts
6. Gas lines
7. The home's frame

On multi section homes, perform this test only after completing all electrical and bonding connections between the sections. Failure to assure continuity to ground requires repair and retesting.

The following tests shall be performed after turning on the power to the home.

Caution:

Energizing the water heater before it is filled will cause the heater element to burn out. The water heater must be full before activating this circuit. Installation of the electric power to the home can cause exposure to live electrical circuits.

Polarity Test: With 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. GFCI receptacles should be checked for proper location. Each GFCI outlet shall be tested to assure the circuit is open after the test button has been depressed. Replace any GFCI that does not operate correctly.

Operational Test: All circuit breakers shall be on. Check all equipment. 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 there is power to both legs of the circuit. Check all 120 volt receptacles to be sure each is operational. Switched receptacles require the switch to be turned on and off. Appliances need not be tested but their power source must be assured. Test smoke and carbon monoxide detectors for proper operation (test per the detector manufacturer's instructions). Failure of any wiring or fixtures requires repair and retesting.

Other tests may be required according to the home **Manufacturer's** Installation Instructions. If required these tests must be performed in addition to the tests described in this section.

Mobile Home Wiring Requirements

NEC Article 550.

Each mobile home or moveable structure shall have its service (including the feeder termination in the distribution panel inspected any time they are moved, or if any modifications or changes are made in or on the service equipment. This is the obligation of the owner (12-23-116[2]), or the person responsible for the service.

When any other changes or additions are made, (for example additions to out-buildings, or air conditioners are added) only that portion of the wiring need be inspected unless the additional load is such that it requires an increase in the service size.

A homeowner may obtain a permit and complete the service work only if they fulfill all of the following:

1. They own the structure involved.
2. They will be occupying the home.
3. They own the property the home is on. It is **NOT** located in a mobile home court.

Note:

All wiring in a mobile home park **must** be performed by a licensed electrical contractor.

An exception to this is: If the mobile home is of such a size and rating (normally this will be 50 amps) that it may be supplied with a proper cord and plug connection, and the service equipment involved is properly set up for the plug, and meets the current National Electrical Code requirements, a homeowner may obtain the permit.

Mobile home service equipment shall not be rated less than 100 amps, and mobile homes with 100 amp ratings shall be serviced by a permanent wiring method rated at 100 amps. Older mobile homes with a 40 or 50 amp rating may utilize an existing 50 amp service. If the mobile home is rated more than 100 amps, the service equipment shall have a rating equivalent to that of the distribution panelboard in the mobile home.

Mobile homes with a 40 or 50 amp rating may be cord connected. The mobile home cord shall be of an approved type with four conductors. The cord shall be of molded butyl rubber neoprene or equivalent, with a molded or securely attached plug cap, no less than 21 feet, and no more than 36 1/2 feet in length, without splices. **40 or 50 amp cords shall have proper over current protection for the rating of the cord.**

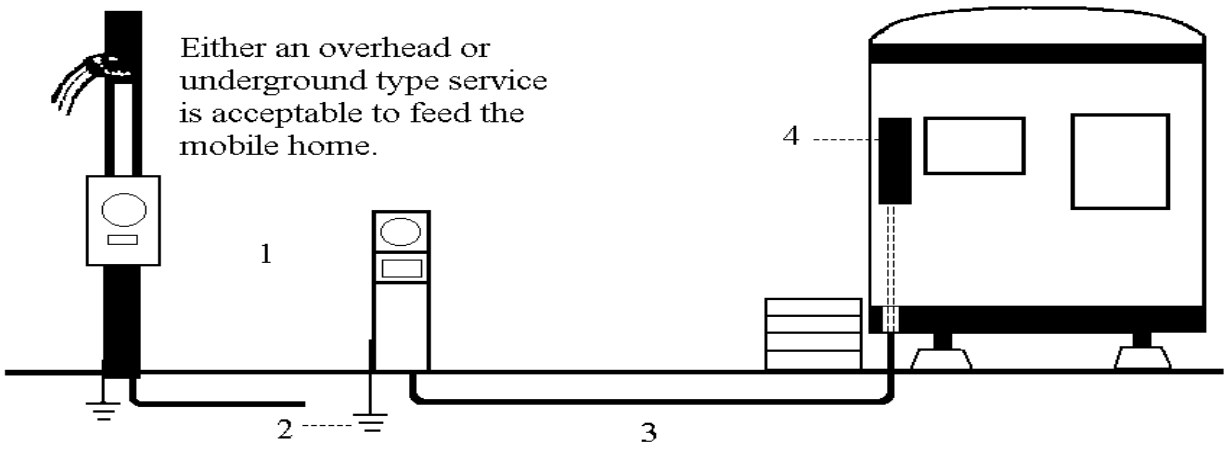
Mobile home service equipment shall also contain a means for connecting a mobile home accessory building or structure or additional electrical equipment located outside a mobile home by a fixed wiring method.

Additional receptacles shall be permitted for connection of electrical equipment located outside the mobile home, and all such 125 -volt, 15 and 20-ampere receptacles shall be protected by approved ground fault circuit protection for personnel.

Mobile home service equipment shall be readily accessible and shall be mounted a minimum of two (2) feet above grade, and be located in sight from and not more than thirty (30) feet from the exterior wall of the mobile home.

All mobile home service equipment shall be grounded in accordance with Article 250 of the NEC for service equipment. The chassis of the mobile home, the metallic water and gas pipes shall be bonded to the equipment ground in the distribution panel. The bonding connections shall be made with listed clamps.

When permanent connections are made between the service equipment and the distribution panelboard in the mobile home, it shall be done with four, insulated color-coded conductors. These conductors require mechanical protection from the point of attachment to the service equipment. The neutral is required to be isolated from the distribution panelboard in the mobile home.



1. Pole or pedestal service, service < 30 ft. from mobile home.
2. Service grounding electrode.
3. Feeder conductors, four insulated conductors required.
4. Distribution panel located in mobile home.

Any hazardous condition or wiring deficiency observed during the course of the inspection will be noted and corrections required.

Any electrical installation that has been made to the mobile home since it was manufactured shall meet the minimum standards of the National Electrical Code. Permits and inspections are required at the time of installation.

Mobile homes falling under the MHIP program requirements shall be approved by the Colorado Division of Housing or be listed to a recognized standard and constructed prior to the adoption of the National Manufactured Housing Construction and Safety Standards Act.

Chapter

7

Mechanical

Heat Producing Appliances

Furnaces, Water Heaters and other appliances: When installed with the home the furnace and the hot water heater shall be inspected for any signs of damage. For homes with fuel fired appliances, verify that all flues are in place and are properly connected, and extend through the roof with flashings and caps. If these appliances are electric, verify all wiring is complete and that no additional connections are necessary.

If the furnace or the hot water heater is not installed at the manufacturing facility, install these appliances according to the appliance manufacturer's instructions, making sure all fire stopping at the floor and roof penetrations is installed.

Gas appliances are equipped for operating with natural gas (NG) or liquefied petroleum gas (LPG). Before making any connection to the site supply, the inlet orifices of all gas-burning appliances shall be checked to ensure they are correctly set-up for the type of gas to be supplied and are sized correctly for the altitude above sea level where the home is set. The manufacturer's installation instructions for the appliance shall be followed.

Altitude. It is of particular importance in Colorado to verify the furnace is set-up for the altitude where the home is being installed. With higher altitude the air is less dense and therefore the furnace cannot burn as much gas as at sea level. To maintain efficiency with a similar design air/gas mixture the amount of input gas is reduced at higher elevations; this is called **derating** the furnace for altitude (elevation above sea level) which typically is 4% per 1000 feet above sea level. See manufacturer's installation instructions for specifics. Orifices are gas pipe fittings adjacent to the burners that have the proper size hole in them to allow the correct amount of gas to flow for proper burning. They will typically have a number associated with each orifice based on the orifice hole size. The appliance installation instructions will specify which size orifice is to be installed based on altitude and whether the supply is Natural or LP gas. The correct orifices are sometimes installed by the factory and if not should be at a minimum supplied by the **home manufacturer** and shipped with the furnace. The correct orifices are to be installed by a certified/qualified technician. Other fuel burning appliances (water heaters, fireplace, etc) may be affected by altitude. Check the appliance manufacturer's installation instructions to verify proper installation.

Combustion Air. Fuel fired heat producing appliances require outside air for combustion. Verify combustion air inlets are free from obstructions. Combustion air must be drawn from the exterior. If combustion air is drawn from underneath the home, verify the space under the home is properly ventilated. If installed over a basement, combustion air ducts must be installed or modified to draw air from outside

the unit. Any installations, modifications or extensions must be done according to the appliance manufacturer's instructions and shall comply with local building codes.

Ducts: Ducts in manufactured homes may be installed at the manufacturing facility. They are shipped complete and usually require that only a crossover connection at the mating line be made at the site.
There are several different crossover duct systems (See Figure 7.1). In all cases these ducts shall be installed to the **manufacturer's** specifications. Generally, the crossover duct is a flexible, insulated duct. The insulation should be R-8 min. The crossover duct should be attached to the duct boots with approved fasteners and the joint shall be sealed as straight and smooth as possible. It shall not be crushed, compressed or kinked. The duct shall be strapped to the underside of the home to prevent it from coming into contact with the ground. Support straps shall be 4'-0" o.c. Metal straps are to be secured with sheet metal screws

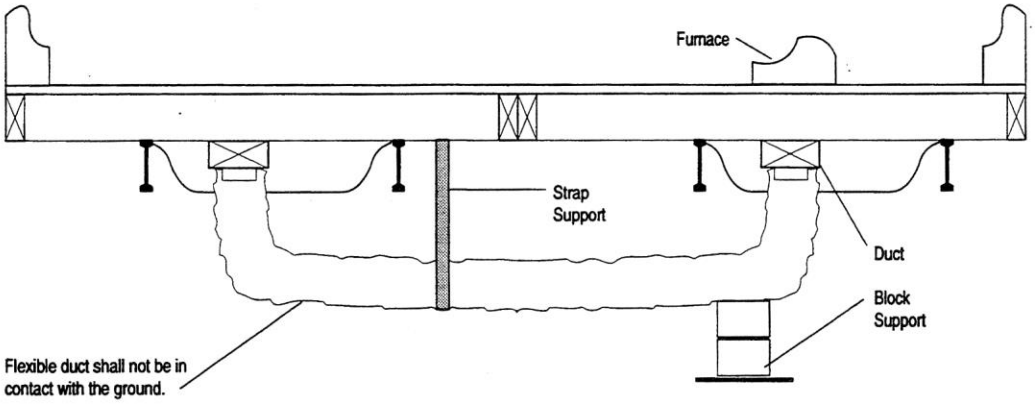


Figure 7.1 – Heat Duct Crossovers and Supports

Blower door testing: Factory Built Modular homes constructed to the 2012 or 2015 and possible later versions of the International Energy Conservation Code require a blower door test. This test is performed on site after the home is set and the furnace ductwork is complete (See figure 7.2). The person performing the blower door test shall be qualified to do so.
below is code excerpt from the 2012 or 2015 IECC

R402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.
During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open;
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

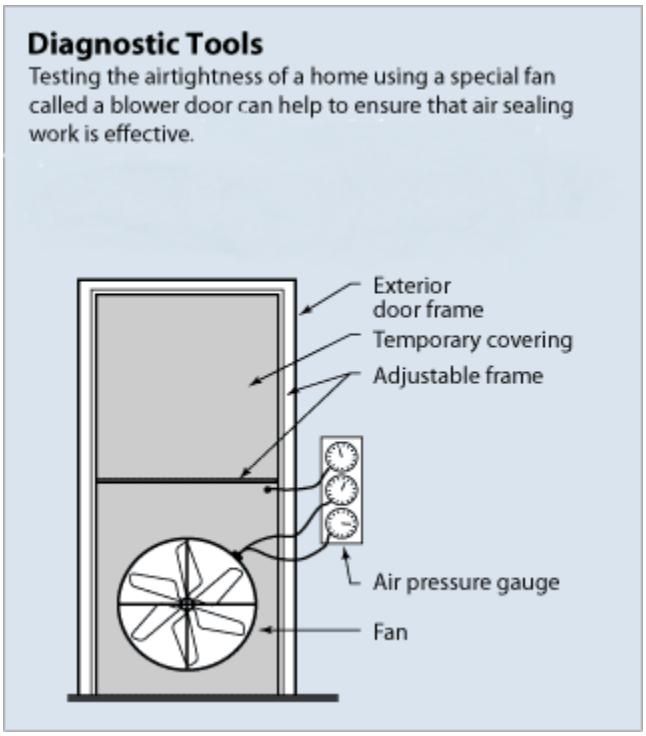


Figure 7.2 – Blower door test

There are two types of blower doors: calibrated and uncalibrated. It is important that the person performing the test use a calibrated door. This type of blower door has several gauges that measure the amount of air pulled out of the house by the fan. Uncalibrated blower doors can only locate leaks in homes. They provide no method for determining the overall tightness of a building. The calibrated blower door's data allow the technician to quantify the amount of air leakage (air changes/hr) and the effectiveness of any air-sealing job.

Whole house ventilation: Factory Built Modular homes constructed to the 2012 or 2015 and possible later versions of the International Energy Conservation Code will also require whole house ventilation. This is called out in Section R303.4 of the 2012 IRC. The whole house ventilation should

be provided by the **manufacturer**. The installer shall verify the ventilation equipment is installed and working properly.

Fireplaces and Wood Stoves: Fireplaces and woodstoves require the installation of additional sections of approved, listed chimney pipe, a spark arrestor and a rain cap assembly (See Figure 7.3). Chimney and air inlets shall be installed according to their listings.

Field installation of a fireplace or woodstove requires approval from the **manufacturer** and local jurisdiction to ensure compliance with the required standards.

To ensure sufficient draft for proper operation, extend the finished chimney at least three (3) feet above the highest point at which it penetrates the roof and at least two (2) feet higher than any building part or other obstruction within a horizontal distance of ten (10) feet. If there are obstructions on the site higher than the roof peak and within ten (10) feet of the chimney, the chimney may need to be extended if required to do so by local code.

Combustion air intake ducts need to be extended to the exterior of the home. Combustion air ducts may be extended to the exterior according to the appliance manufacturers' specifications. The inlet damper must be located above the expected snow depth for the area.

Be sure all protective shipping materials are removed prior to the completion of the chimney and air intake vents.

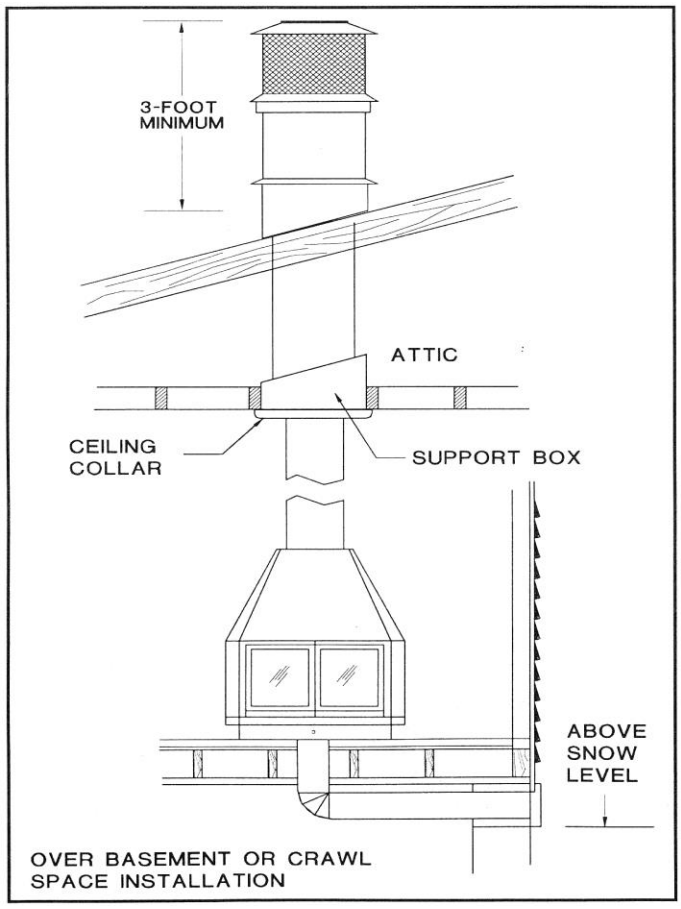


Figure 7.3 – Wood Stove Installation

Comfort Cooling Systems

Air Conditioners: If air conditioning is to be installed the heating/cooling certificate or the furnace should be checked to determine if the air distribution system is designed to accommodate air conditioning. The electrical distribution panel should also be checked to determine if there are factory-installed circuits for the A.C. unit. A separate outside electrical supply may need to be provided for the A.C. system. The air conditioning system must be compatible and listed for use with the furnace installed in the home. All condensate must be directed beyond the perimeter of the home or to a drain by means specified by the equipment manufacturer.

Evaporative Coolers: Roof mounted coolers must be installed by following the appliance manufacturer's instructions. The discharge grill must be at least 3 feet away from a smoke or CO alarm. Prior to installation it must be determined if the roof will support the weight of the cooler. A rigid base must be provided to evenly distribute the weight of the cooler.

Appliances

Range, Cook top and Oven Venting: If the home is equipped with a combination range/grill or oven that contains its own exhaust system, the vent must exhaust to the exterior of the home. This vent may not terminate under the home, and must have an approved vent termination.

Other appliances: If other fixtures or appliances are to be site-installed, follow the appliance manufacturer's installation instructions. Use only products listed for manufactured homes and follow all applicable local codes.

Clothes Dryers: Manufactured Homes are commonly designed for the installation of a clothes dryer. (See Figure 7.3) Venting access is provided by the **manufacturer** through the floor or sidewall. The clothes dryer must exhaust to the exterior of the home and shall not terminate under the home. Transition or flexible ducts shall only be used to transition from the dryer to the dryer duct in nonconcealed locations. An approved damper must be installed on the end of the duct. All shipping covers must be removed prior to the installation of the dryer vent duct. The duct must be supported to prevent contact with the ground and excessive sagging. All penetrations through the floor or walls must be sealed.

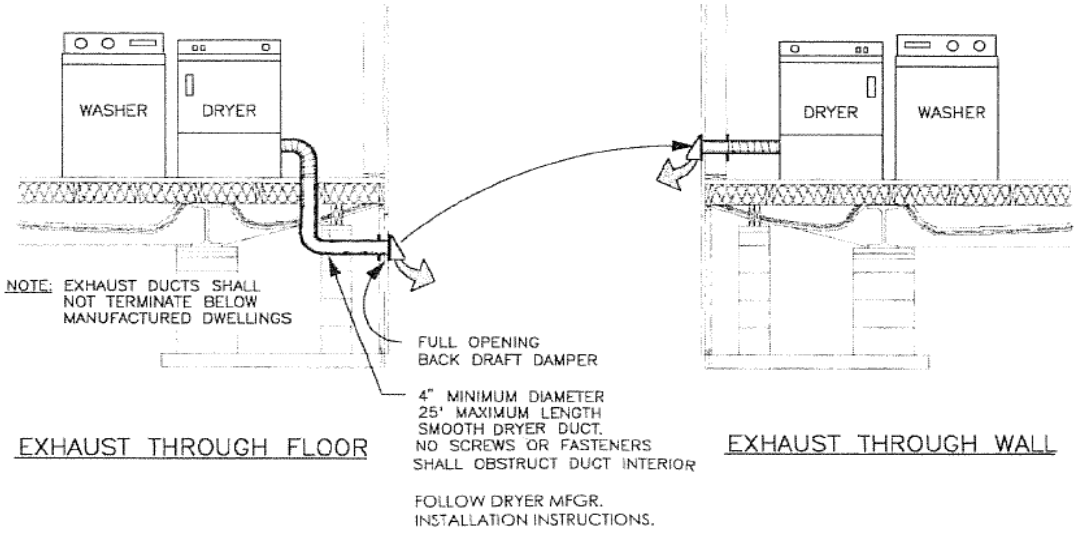


Figure 7.4 – Clothes Dryer Venting

Fuel Supply Systems

In multi-section homes a gas crossover connection may need to be installed. All crossovers and fittings must be listed for exterior use. All fittings and the crossover must be the same size as the connecting gas pipe. This connection typically uses a quick-disconnect device. Some local jurisdictions do not approve quick-disconnect devices under the home. HUD's position is that the HUD Standard pre-empts local jurisdictions but does not interfere with the requirements of a private local gas company. The crossover gas connection must be installed according to the **Manufacturer's** Installation Instructions.

A shut off valve must be installed between the site supplied gas and the inlet to the manufactured home.

If an LPG tank is located on the site it shall be installed according to the tank manufacturer's installation instructions and local regulations. It is important that required clearances and separations be maintained.

Gas piping installed on-site shall be installed in accordance with the **Manufacturer's** Installation Instructions and local regulations. Adequate support for all gas piping is required.

Fuel Piping Testing Procedures

Although the gas piping is required to be tested at the manufacturing facility it shall be retested on-site. The following steps describe the common gas testing procedures required by the **manufacturers**. Some local jurisdictions may require additional testing not described here. The gas testing procedures for HUD Code homes differs from those required for other Manufactured Homes.

1. HUD Code Homes
    a. Visually check all gas piping for damage
    b. Close all pipe openings gas tight with pipe plugs or caps.
    c. Use a pressure gauge that is scaled in 1/10 pound increments
    d. Pressurize the piping system to 3 psi
    e. Isolate the pressure source; and Hold pressure in the system for 10 minutes without any loss
    f. Failure to maintain pressure requires the system be repaired and RETESTED.
2. Non-HUD Code Homes
    a. Visually check all gas piping for damage
    b. Close all pipe openings gas tight with pipe plugs or caps.
    c. Use a pressure gauge that is scaled in 1/10-pound increments
    d. Pressurize the piping system to 10 psi
    e. Isolate the pressure source; and Hold pressure in the system for 10 minutes without any loss
    f. Failure to maintain pressure requires the system be repaired and RETESTED.

Caution:

The above test pressures are only for the piping system. After valves are installed and connections to appliances are made check for leaks from the valve to the appliance using a maximum 0.5 psig pressure typically using a bubble test.

APPENDIX A

DOH INSTALLATION INSPECTION CHECKLIST

The Division of Housing Manufactured Home Installation Inspection Checklist shall be used by Division of Housing Inspectors, Certified Inspectors, Registered Installers, and Homeowners as the required on-site form to ensure a complete installation. The Checklist is to be used as a starting basis for the installation inspection. Refer to the applicable reference/standard/code for specific details.

Info	PROJECT INFO	Use Installation manual for
	Project ID:/Address	HUD's or NFPA225 if no manual
	Length	
	Width	Use Installation manual, plans
	Exterior wall height	and IRC for FB modulars
	I-beam spacing	
	Roof pitch	
	Marriage line opening dimensions	
	Marriage line support spacing	
Confirmed	**Criteria**	**Reference**
	ACCEPTANCE OF UNIT	NFPA typically shown, Use IRC for FB Modular
	Manufacturer Name: _____	
	New Home	
	Manufacturer's installation instructions available on-site	4.4.1
	Used Home	
	Manufacturer's installation instructions available on-site	4.4.1
	Alternative standard used and available on-site	Resolution 38
	All Homes	
	DOH MHIP Authorization has been posted	Resolution 38
	HUD or Factory-Built label has not been damaged, removed, or covered	
	No damage noted. **(Transportation, exposure to weather, flood, fire, rodents, vandalism, etc)**	Annex B.2
	Data Plate indicates correct wind zone (1), thermal zone (3), and roof load (30#-middle)*, FB CDOH label indicates correct wind speed and roof load for local jurisdiction requirements	4.4.4/HUD 3280.5 Resolution 34
	** If minimum requirements are not met, do not set home, contact DOH.*	
	SITE PREPARATION	
	Is the set site a flood hazard area? Home set at or above flood elevation and meets local requirements and NFPA 225 chapter 12 and 15	Chapter 12 and 15
	Soil density from a soils report and load capacity is documented on-site* 1500 PSF default	5.5.2
	** Penetrometer readings may be substituted if a soils report is not available*	
	Completed site grading allows water to drain away from the home (site is crowned below home)	5.7
	Foundation drainage system installed when site conditions require	
	Vapor barrier installed when underfloor area is enclosed	5.8
	BLOCKING, FOOTINGS, PIERS	
	Organic material is removed from under the home	5.5.1
	Footings are of correct size and construction for soil and climate conditions	6.3
	Pier spacing and construction is completed to the Manufacturer's Installation instructions or NFPA amendments	6.2
	Shims, when required, are of an acceptable material and correctly installed	6.2.3.2.3
	Perimeter, marriage line, and other required blocking is installed to the Manufacturer's Instructions or NFPA amendments	6.2
	ANCHORING	
	Temporary Set	
	Confirm anchoring components/system is listed for manufactured homes and allowed for Colorado use, and is installed to the Anchor and Home Manufacturer's Instructions* or NFPA amendments	7.5
	** Includes number & location and correct angles, # of wraps, tensions and tightness against the stabilizer plates.*	
	Permanent Set	
	Foundation walls meet all local codes, ordinances and covenants	Local requirements or engineer requirements
	Sill plate is designed and installed based on approved design	Approved plan
	Sill bolt anchors are installed correctly including; spacing, tightness, and hole size	Approved plan
	Engineered foundations are installed to the design specifications	Approved plan
	STRUCTURAL CONNECTIONS	
	Ridge beam is installed securely in accordance with the Manufacturer's Instructions	7.3
	Floors, walls, ceilings are correctly aligned, level, secure	7.3
	Hinged roof mechanisms are installed to the Manufacturer's Instructions	7.3
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	EXTERIOR	
	Bottom board material is intact and repaired as necessary to prevent tears/rips	7.7.5
	Exterior siding damage is repaired and site installed siding is correctly installed	7.7.2
	Required gaskets between boxes are installed to Manufacturer's Instructions	7.7.1.3
	Completed roof is installed to Manufacturer's Instructions	8.2
	Gutter and downspouts when installed, divert water away from home	5.7.4
	Windows and doors operate and seal properly	HUD-3280 103, 105,106 IRC-R310, R311, R612
	Skirting (where installed) is installed in accordance with the Manufacturer's Instructions	8.8
	Roof penetrations from shipping strap attachment are repaired	7.7.1.2
	WATER SUPPLY	
	Water supply line is the correct listed material & size, and is properly connected, supported, insulated & protected from freezing. Water heater pan drain and T/P valve are properly completed and routed to exterior. Licensed plumber required for more than a single hook-up.	10.2, 10.3
	Main water supply shut-off and pressure reducing device (if required by locals) are installed correctly	10.2.2.1 & 10.2.1
	Required water supply tests are confirmed through on-site documentation	10.2.4
	Verify anti scald at tub/shower valves	3280.607, IRC P2708.3
	SANITARY CONNECTION	
	Sewer connection line is the correct listed material & size and is properly sloped, connected, and supported. Licensed plumber required for more than a single hook-up.	10.3
	Positive connection between home and site sewer connection	10.3.3
	Required sewer connections tests are confirmed through on-site documentation	10.3.5
	GAS SUPPLY	
	Gas supply lines are the correct listed material & size and are properly connected and supported	10.4
	Gas supplied to home is compatible with the installed furnace, water heater, and/or kitchen range	10.4.1
	Flexible gas supply connectors used to connect gas supply between home sections, the home and the site connection, and installed appliances are the correct listed material, size and are properly connected, supported and accessible	10.4.4.1
	Low pressure gas supply line test completed	10.4.3
	High pressure gas supply line test completed	10.4.3
	ELECTRICAL SUPPLY	
	Electrical supply lines are the correct listed material & size and are properly connected, supported and provide the correct polarity, continuity, arc fault and circuit size	10.6
	Electrical supply connectors used to connect electrical supplies between home sections and the home and the site are the correct listed material, size and are properly connected, supported and accessible	10.6.2
	Shipped loose electrical fixtures are installed or electrical boxes have been covered	8.5
	Home sections and the electrical supply are properly grounded	10.6.2
	Bonding wire correctly installed between home and gas line between chassis	10.6.3.1(1)
	Installed electrical appliances are correctly connected to the electrical systems	10.6.3.1(2)
	MECHANICAL SYSTEMS	
	Water heater and furnace are listed for the correct use and site gas type	
	Mechanical systems are operational within the manufacturer's specifications	
	Combustion air systems are identified for correct size, location, and free air-flow to exterior of home	9.3.7, 9.7 IRC G2407
	Orifice(s) have been adjusted as necessary to provide the correct gas supply for altitude and gas type of the installed furnace, water heater and/or kitchen range	10.4.2
	Mechanical system vents are of the correct size, distance to combustibles, and termination location/height	9.3, 9.7
	Clothes dryer vent is attached to the appliance and terminates at the exterior of the home using a listed material of the correct size	9.1/8.8.4
	Crossover ductwork is of the correct listed material & size and is properly connected, supported (duct not restricted & not touching ground), insulated and sealed	7.4.2
	ENERGY	
	Factory Built Units constructed to the 2012 or 2015 IECC. Blower Door test completed and less than 3 air changes per hour. Whole House mechanical ventilation provided and working.	IECC R402.4.1.2. IRC R303.4
	LIFE/SAFETY	
	Smoke detectors are operational and installed correctly	11.1
	Carbon monoxide detectors are operational and installed correctly	CRS 38-45
	OTHER	
	INSTALLATION INSIGNIA	DOH
	The installation insignia has been issued and affixed **only** after confirmation of the above criteria, applicable standards, codes and approved plans	
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