

SINGLE WIDE INSTALLATION INSTRUCTION MANUAL

RADCO

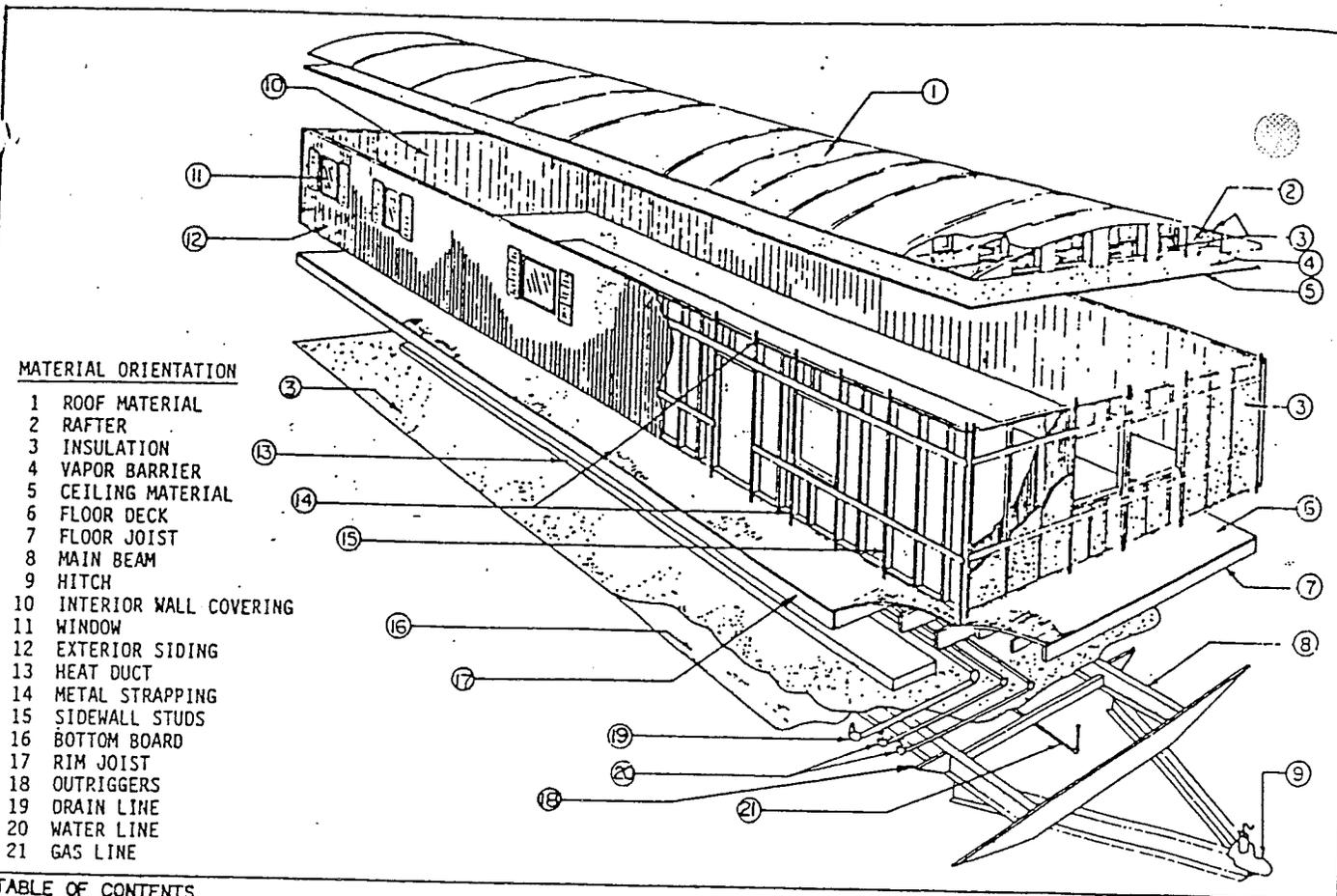
FEDERAL MANUFACTURED
HOUSING CONSTRUCTION
& SAFETY STANDARDS

OCT 21 1988

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HIGHLAND MANUFACTURING INC.
P.O. BOX 427 • WORTHINGTON, MN 56187 • 507/376-9460



MATERIAL ORIENTATION

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- 3 INSULATION
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INTRODUCTION

Your Highland home was designed, constructed and inspected for conformance to the Federal Manufactured Housing Construction and Safety Standards in effect on the date of manufacture. This National Standard sets forth the requirements of design construction, fire safety, plumbing, heating systems and electrical systems for factory built housing designed to be used as dwellings.

Consult with building officials in your area to determine necessary permits, licenses and inspections required for installation of this home.

The step-by-step instructions which are required for the correct installation of your home are presented in this manual.

Before attempting to install your home, these instructions must be carefully read and understood.

The drawings contained in these instructions are intended to be representative of the product. Designs and specifications are subject to change without notice.

NOTE: This manual is intended to instruct and to assist already qualified personnel in the proper installation of the home. It is not intended to enable someone unfamiliar with home set-up to perform the installation.

It is recommended by the Department of Housing and Urban Development (HUD) that, subsequent to completion of the installation, your home be inspected by an independent, qualified professional.

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SITE PREPARATION

Proper Drainage

The site area for your home must be sloped to provide storm drainage. Check your local codes which may specify slope requirements. It is generally recommended that a slope of 1" to 12" be followed and that the site be evenly graded so that there are no depressions where surface water will accumulate, either underneath or outside the home. This is to prevent excessive humidity in the home.

A Firm Foundation

The portion of the lot intended for location of the home must be of undisturbed soil or compact fill. Make certain that you have not selected a loosely filled area, and that all top soil and vegetation materials are removed.

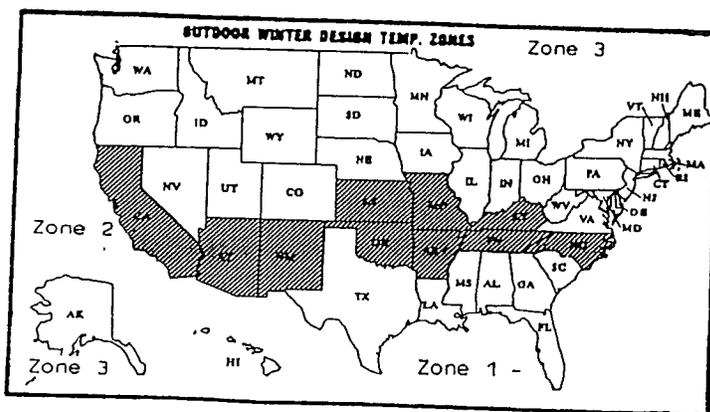
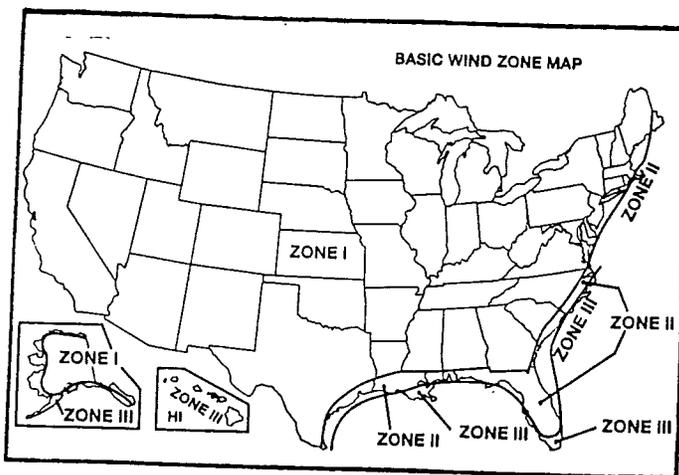
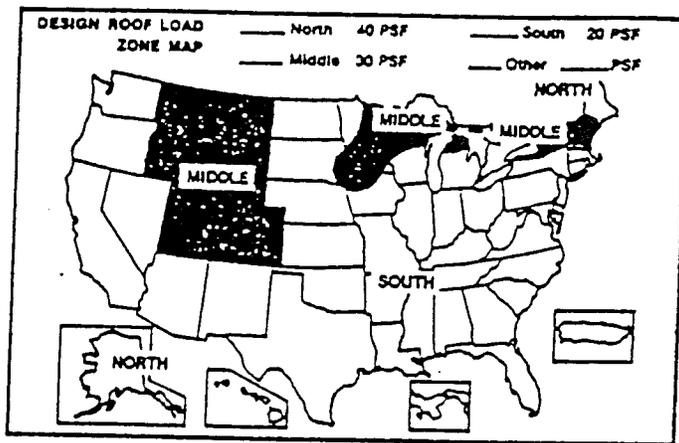
NOTE: If skirting is to be installed, the entire area under the home must be covered with a moisture vapor barrier. This is to prevent excessive humidity in the home. The moisture vapor barrier must be a minimum of 6 mil thick and be overlapped 6" at all joints.

ZONE MAPS

The following Zone Maps will help you make installation decisions with regard to prevailing weather in the zone where the home is to be located.

NOTE: Do not install your home in a zone that requires greater loads or climatic requirements than those on the Compliance Certificate. You may, however, install a home in a zone requiring lesser loads or climatic requirements.

1. From the following maps, determine and mark the zones where the home is to be located. This information will be required to determine information from other charts and tables in this manual.



PIER AND FOOTING SELECTION

The piers used must have enough capacity to transmit the vertical load which includes the weight of the home, its furnishings, and temporary roof loading to the foundation surface below it. If the load imposed is greater than the capacity of the pier, then two or more piers must be equal to or greater than the load to be transmitted.

FLOOR LIVE LOADS - Excessively heavy furniture or appliances, such as pianos, organs, deep freezers, heavy chests, large china cabinets, water beds, etc., require the installation of additional support footings and piers directly beneath them. If such loads are over or between main beams, install additional piers along the main beams. If such loads are located outside the main beam install additional piers with headers to distribute the weight over several floor joists.

Complete the following steps to determine the pier and footings requirements for the home.

1. Determine pier height to be used based on site conditions.
2. Determine main beam pier spacing (10'-0" max.). Determine additional piers and headers at rim joist.
3. Using the preceding information, determine the required main beam pier capacity from the following tables.

MAIN BEAM PIER CAPACITY TABLE (LBS.)

PIER SPACING	ROOF ZONE & WIDTH OF HOME								
	SOUTH			MIDDLE			NORTH		
	12'	14'	16'	12'	14'	16'	12'	14'	16'
3'-0"	3800	4400	5000	4300	5000	5600	4300	5500	6200
9'-0"	4300	5000	5600	4800	5600	6300	5400	6200	7000
10'-0"	4800	5500	6200	5400	6200	7000	6000	6900	7800



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4. To determine the soil bearing capacity, contact the local jurisdictional authority for building codes or run test. If tests are required, always use a qualified professional to determine the capacity. Examples of soil types and their capacities are listed below.

TYPICAL SOIL BEARING CAPACITY

CLASS OF MATERIALS	ALLOW FOUNDATION PRESSURE (PSF)
Massive Crystalline Bedrock	4000
Sedimentary and Foliated Rock	2000
Sandy Gravel and/or Gravel (GW and GP)	2000
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel, (SW, SP, SM, SC, GM and GC)	1500
Clay, Sandy Clay, Silty Clay and Clayey Silt (CL, ML, MH and CH)	1000

5. Using the preceding information, you can select a concrete footing size from the following table.

FOOTING SIZE TABLE (MINIMUM)

REQUIRED PIER CAPACITY (LBS.)	SOIL BEARING CAPACITY					FOOTING SIZE
	1000	1500	2000	3000	4000 AND OVER	
	0001-2500	0001-2500	0001-2600	0001-2600	0001-3500	
2501-3000	2501-3200	2601-3400	2601-3900	3501-5200	16x12x4	
3001-3600	3201-3800	3401-4300	3901-5200	5201-7000	16x16x4	
3601-4500	3801-3900	4301-5200	5201-6500	7001-8700	20x16x4	
4501-5400	3901-4700	5201-5300	6501-7800	8701-10500	24x16x4	
5401-6700	4701-5600	5301-6400	7801-8100	10501-10900	20x20x6	
6701-7900	5601-7000	6401-7600	8101-9700	10901-13100	24x20x6	
7901-9200	7001-8400	7601-9500	9701-11600	13101-15600	24x24x8	
9201-10700	8401-10500	9501-11400	11601-14500	15601-19500	30x24x8	
10701-12300	10501-12400	11401-14200	14501-17400	19501-29400	36x24	
12301-14000	12401-14400	14201-16700	17401-21700		36x36	
	14401-16900	16701-19700			36x36x10	
	16901-19300	19701-2300			42x36x10	
	19301-22000				42x42x10	
					48x42x10	
					48x48x10	

NOTE: FOOTING CONCRETE MUST BE 3000 P.S.I. IN 28 DAYS



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In 20 and 30 psf roof load areas the rim joist must be supported by outriggers spaced no greater than 8 ft. o.c. for 12 ft. wide units, 6 ft. 8 in. o.c. for 14 wide units and 4 ft. o.c. for 16 wide units. Should the outrigger spacing exceed these dimensions piers must be provided between these excessively spaced outriggers to support the rim joist. Additional rim joist blocking is also required at the ends of any opening in the sidewall over 4'-0" in width.

Rim joist blocking is also required in areas with roof loads greater than 30 psf regardless of the outrigger spacing.

Rim joist blocking is required at the ends of any opening in the sidewall over 1'-4" in width and no distance greater than 8'-0" on center for 40 psf roof load areas; 6'-0" on center for 60 psf roof load areas, and 4'-0" on center for 80 and 100 psf roof load areas.

Proper support for the home must allow for soil conditions in the immediate area. Pier footings must be placed on firm undisturbed soil (not loose fill) or which has been compacted to at least 90 per cent of its maximum relative density. Pier supports may also be placed directly on concrete slabs designed for the home's placement.

Climatic conditions must also be taken into account. If footings are placed on frost-susceptible soil, such as clay or silt, heaving and/or settlement may occur. In areas where temperatures go below freezing, it is important that the pier footings be located below the frost line.

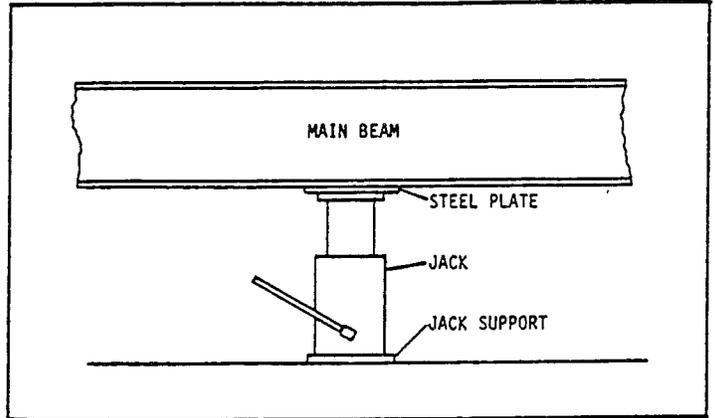
PIER AND FOOTING CONSTRUCTION

1. Construct footings and piers as shown in the following illustrations.

BLOCKING AND LEVELING

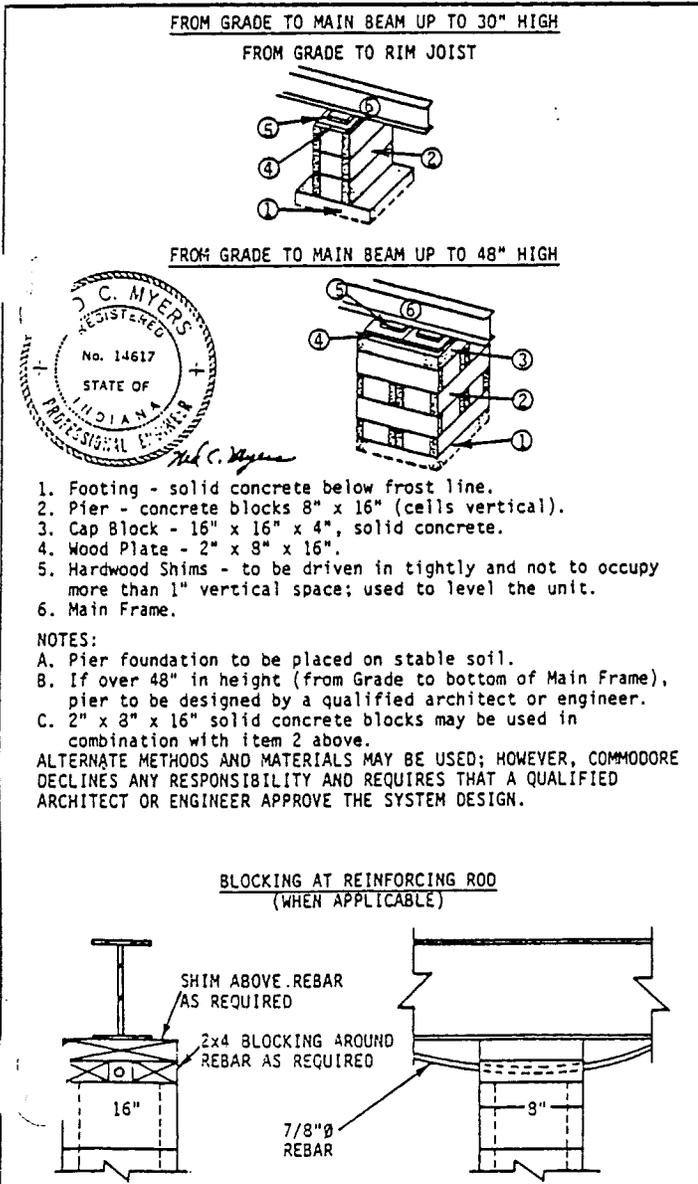
The following equipment will be required:

- A. Two jacks with a minimum 10 ton rating.
- B. Two steel plates with a minimum size of 3/8x2-1/2x5" to use between the jack and the main beams.



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

1. Level the home from front to rear by means of the hitch jack.
2. Place one Jack just forward of the front spring hanger and another just behind the rear spring hanger under one of the main beams.
3. Operating the two jacks simultaneously, raise the home and install footings and piers next to the jacks.
4. Jack up the front and rear end of the main beam, under which you have just installed two piers, to a level position and install a footing and pier 1'0" from each end. The home should now be near level from front to rear along the first main beam.
5. Repeat the preceding three steps on the other main beam, bringing the home level crosswise and lengthwise.
6. Place the remaining footings and piers along the main beams taking care not to exceed the maximum pier spacing from the table in step 3, of the pier and footing selection section, and that the end piers are 1'0" maximum from the ends of the main beams. Piers should be located as close as possible to the optional over-the-roof ties. As a precaution, especially in areas subject to "frost heave", it is recommended that additional piers be placed directly under the perimeter of the home at each optional over-the-roof tie. This will prevent the exterior walls from being pulled downward should the main beam piers heave upward due to climatic conditions.
7. Complete the leveling procedure with a 6 ft. level, adjusting pier heights with shims. Check to make sure that all doors and windows operate properly.



TIE DOWN INSTRUCTIONS

WARNING: Before any anchors are installed, check to assure that underground pipes, wires, cables and/or utility services are not located where anchors are to be driven.

The home must be in its final level position, with all anchors and pliers in place, prior to the installation of tie-down straps.

After blocking and leveling, the home must be anchored to provide you safety and protection from the danger of high winds. Using frame ties only or a combination of frame ties and optional over-the-roof ties, as noted below, is required.

All tie-down straps and connecting hardware must be certified by a professional engineer or a recognized testing laboratory to adequately support 3150# allowable load min. (ultimate load 4725# min.) and/or to comply with ASTM D3953-91. All ground anchors must be certified by a professional engineer or a recognized testing laboratory to adequately support a 4000# allowable load min. (ultimate load 6000# min.) When loaded both parallel with the anchor shaft and at a 45 degree angle from the anchor shaft. The ground anchors must be installed to their full depth in accordance with the manufactures instructions (eg. approved for installation in the soil type which exists at the site, etc.) and must extend below the frost line and be atleast 12" above the water table; all ground anchors connected to the sidewall frame tie downs must be provided with stabilizer plates to minimize horizontal movement.

A. Frame Ties. These are furnished by the owner or installer. The frame ties are to be spaced equally and located as close as possible to a pier. The number of frame ties required will vary, depending on the following items as noted in the tie down location details.

1. Wind Zone
2. Size of Home

B. Optional over-the-roof ties. These straps are factory installed and must be anchored to the ground on site. If ordered, the proper number of over-the-roof ties have been installed at the factory to meet the zone requirements for which this home was built.

CAUTION: Optional over-the-roof tie-downs must not be used alone. Their use does not alter the necessity to install diagonal frame tie-downs. Over-the-roof ties are supplemental equipment only and, when installed, they are installed in addition to, not in lieu of, the required frame tie-downs.

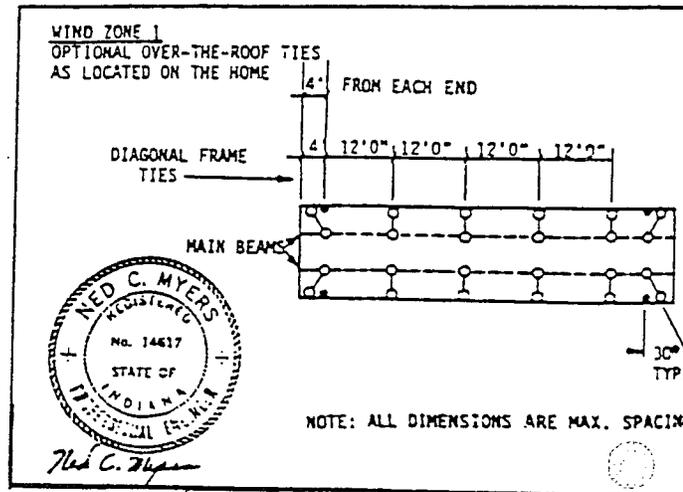
When optional over-the-roof ties are installed, a frame tie is required at each over-the-roof tie location. The balance of the frame ties are to be spaced equally between the optional over-the-roof ties and located as close as possible to a pier.

The following instructions are for installing tie-downs on the home.

Construct the tie-down system with adjustment devices in order that the strap tension may be periodically adjusted to compensate for heaving or settling.

1. Using the following information, you can determine the required number of tie-downs from the following drawings.

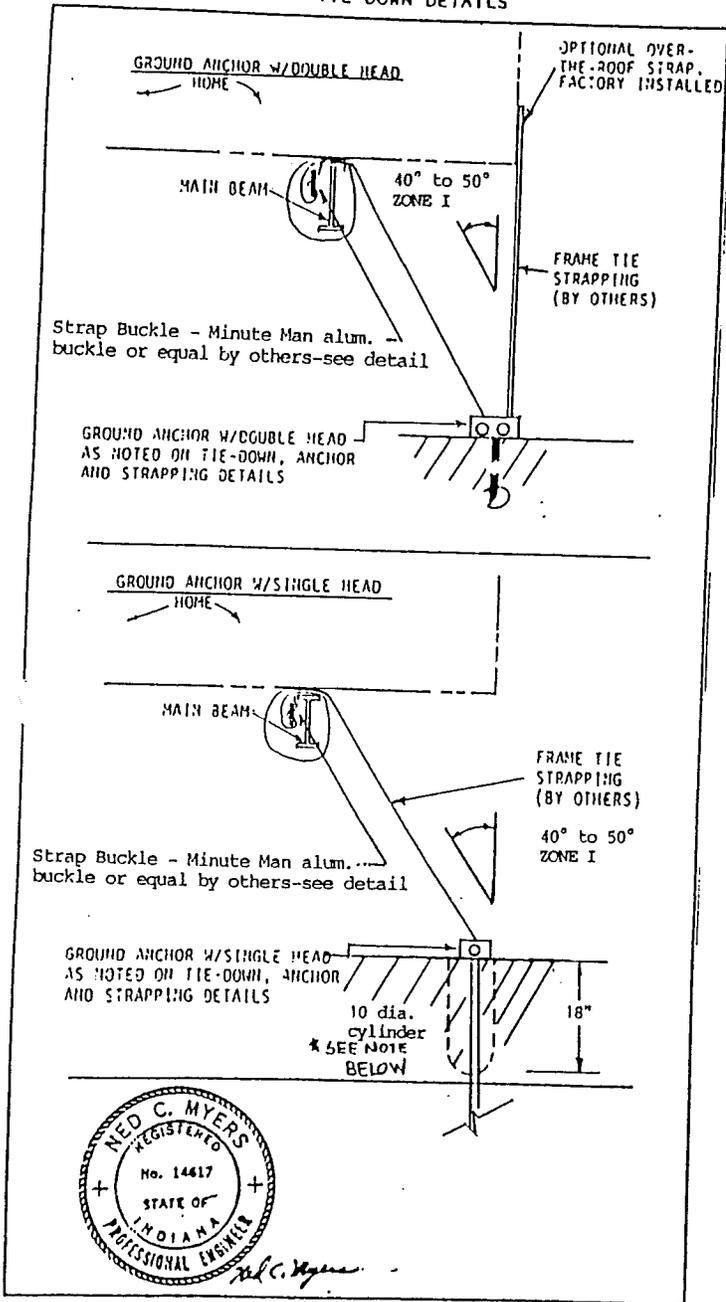
TIE DOWN LOCATION DETAIL



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2. Install ground anchors with single heads at the frame tie-down locations on both sides of the home.
3. If optional over-the-roof ties are to be used, install ground anchors with double heads on each side of the home, directly below each of the factory installed over-the-roof tie-downs.

TIE DOWN DETAILS



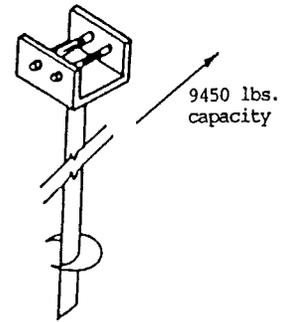
* Note: For those homes which are designed to require only diagonal frame ties, the anchor should be installed in line with the ties. When the load on the anchor is not applied in line with the long axis of the anchor, the magnitude and effect of the horizontal movement of the anchor head should be investigated. The method of restricting lateral deflection shown, is from the Department of Defense, Defense Civil Preparedness Agency publication TR-75, "Protecting Mobile Homes From High Winds". To minimize the deflection slicing through the soil by the anchor rod at ground level when frame ties are connected to provide a diagonal tension, it is recommended that a concrete cylindrical "collar" (approximately 10" in diameter and 18" deep) be poured around the anchor shaft.

TIE DOWN, ANCHOR AND STRAPPING DETAILS

TIE-DOWN STRAPPING REQUIREMENTS

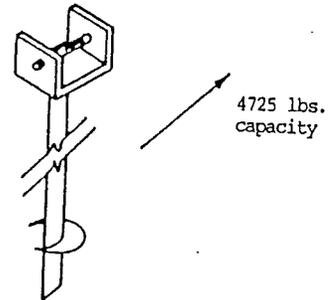
FRAME TIE STRAPPING MATERIAL MUST MEET, OR EXCEED, THE FOLLOWING SPECIFICATIONS:
0.035" x 1.250" FEDERAL SPECIFICATIONS
QQ-S-781H TYPE 1, CLASS B, GRADE 1,
0.130 OZ/SQ. FT.

GROUND ANCHOR WITH DOUBLE HEAD



Double-fastening Minute Man Anchor or Equal-by others: Minimum ultimate load capacity-9,450 lbs.

GROUND ANCHOR WITH SINGLE HEAD

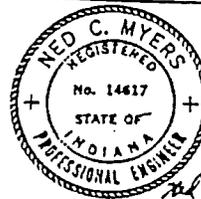


Single-fastening Minute Man Anchor or Equal-by others: Minimum ultimate load capacity-4,725 lbs.

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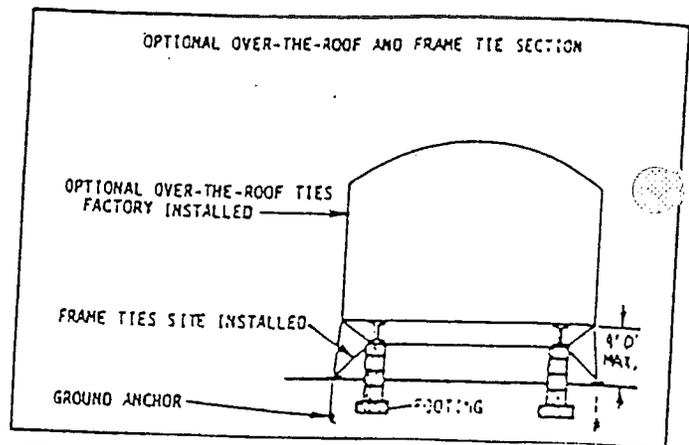
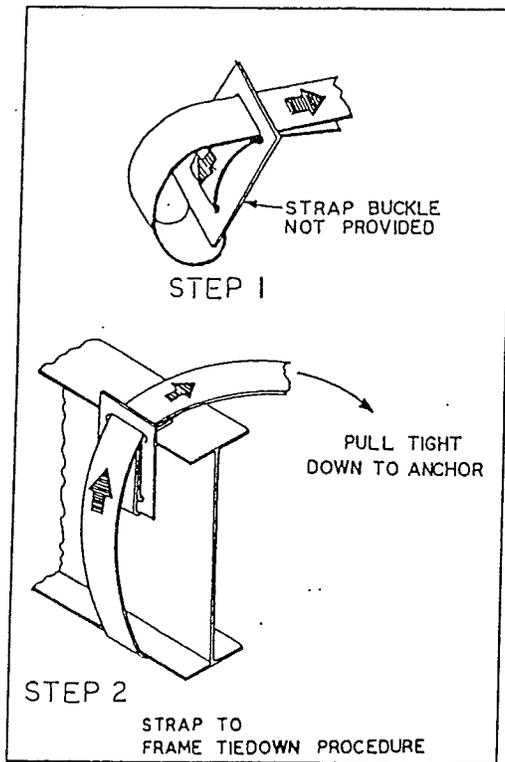
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4. Connect frame ties to the main beams of the home at all ground anchors (double head and single head), on both sides of the home. See the following diagrams for connecting details.



CAUTION: Failure to follow tensioning procedure as described above may result in disturbing home set-up and level, or even pull the home off the piers.

Tie-down straps are not leveling devices. Their effectiveness is not increased by over tightening. Do not apply any excess pressure as damage to the home structure, piers and/or footings may result. Make taut only.

When re-leveling the home do not raise the home without relieving the tension of the tie-down straps.

NOTE: After all tie-downs are taut, check all pier supports to insure full contact between the home's main beams and the piers.

5. Connect all frame ties and over-the-roof ties loosely to the ground anchors. Do not tighten.
6. With one man on each side of the home, start at the front and tighten straps on both sides at the same time.

R. M. Hudgins, Jr., P.E.
P.O. Box 5695
Asheville, N.C. 28813
704-274-4627

June 8, 1989

Mr. Locke M. Jones
Minute Man Anchors, Inc.
105 West Walker Street
East Flat Rock, North Carolina 28726

Dear Mr. Jones:

I have analyzed design drawings and physical testing reports for those Minute Man Anchors listed in the tabulation attached. My analysis and the physical test reports define the breaking strength of each of these anchors and their components to be in excess of 5,000 pounds. The strapping meets Federal Specification QQ-S-781H for Type I, Class B, Grade 1 strapping. The strapping is 1 1/4 X .035 hot dip galvanized steel.

On file are testing reports of the direct withdrawal strength of these anchors. These tests evaluate the anchorage strength of Minute Man Anchors installed resisting an axial and 45 degree angle applied withdrawal load. For the anchors listed on the attached sheet the average ultimate holding power is not less than 5,433 pounds when installed in accordance with manufacturer instructions in the soil types indicated in the "table".

Very truly yours,

R. M. Hudgins, Jr.
R. M. Hudgins, Jr., P.E.



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LIST OF CERTIFIED MINUTE MAN ANCHORS WITH A MINIMUM HOLDING POWER OF 4,725 POUNDS (2143 kg).

1. Sound hard rock.
2. Very-dense and/or cemented sands, coarse gravel and cobbles, preloaded silts, clays, and corals. (Probe torque value range-greater than 550 inch pounds).
3. Medium-dense coarse sands, sandy gravels, very-stiff silts and clays. (Probe torque value range- 350-550 inch pounds).
4. Loose to medium dense sands, firm to stiff clays and silts, alluvial fill. (Probe torque value range- 200-349 inch pounds).

MARK	MODEL	DESCRIPTION	USE IN SOIL TYPE*
MMA-2	650-DH 5/8	Double Head, Earth Auger Anchor	2, 3, 4
MMA-4	650-DH 3/4	Double Head, Earth Auger Anchor	2, 3, 4
MMA-38	650-DH 1 1/16	Double Head, Earth Auger Anchor	2, 3, 4
MMA-40	636-DH 5/8	Double Head, Earth Auger Anchor	2, 3, 4
MMA-28	636-DH 3/4	Double Head, Earth Auger Anchor	2, 3, 4
MMA-30	4430-DH 5/8	Double Head, Double Disk, Earth Auger Anchor	2
MMA-36	4430-DH 1 1/16	Double Head, Double Disk, Earth Auger Anchor	2
MMA-6	4430-DH 3/4	Double Head, Double Disk, Earth Auger Anchor	2
MMA-35	36-XDH	36" Double Head Cross Drive Anchor	1
MMA-8	48-XDH	48" Double Head Cross Drive Anchor	1
MMA-18	THDH	Double Tension Head	SLAB
MMA-16	THDHLS	Double Tension Head W/Lag & Shield	SLAB
MMA-10	36-OH	Double Head Coral Anchor	CORAL
MMA-12	210-DH	Double Head Tension Device for Slab	SLAB
MMA-14	210-POH	Double Head Tension Device for Concrete	SLAB
MMA-42	210-JDH	Swivel Double Head Anchor W/base for Concrete	SLAB
MMA-22	100-DH	Double Head Tension Device Adaptor	CONNECT
MMA502		Stabilizing Device	2, 3, 4

*NOTE: MANY ANCHORS ARE DESIGNED FOR PARTICULAR SOIL CONDITIONS AND ARE UNACCEPTABLE FOR USE IN OTHER TYPE SOILS. WE HAVE THEREFORE LISTED THE SOILS FOR WHICH EACH ANCHOR IS DESIGNED AND APPROVED. SOIL CLASSIFICATIONS ARE TAKEN FROM THE "STANDARD FOR THE INSTALLATION OF MOBILE HOMES" NFPA 501A 1975/ANSI A225.1 1967.

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SKIRTING YOUR HOME

Highland recommends installation of skirting.

Skirting not only increases the value of the home but has other benefits. Skirting helps keep the floor warmer in the winter, cooler in the summer, and helps prevent plumbing freeze-ups in winter. You may purchase skirting from your dealer, or make your own. In any event, it is important to remember that the skirting must allow for adequate ventilation.

NOTE: Before skirting is installed, the entire area under the home must be covered with a moisture vapor barrier. This is to prevent excessive humidity in the home. The moisture vapor barrier must be a minimum of 4 mil thick polyethylene and be overlapped 6" at all joints.

The skirting around the home must be provided with non-closing vents. The free air of the vents must be equal to, but not less than 1/150th of the floor area of the home. (Divide sq. ft. of home by 150). The vents must be located to provide cross ventilation to the entire area under the home.

If the home is equipped with a fuel burning sealed combustion appliance with fresh air intake under the home, such as furnace, water heater and/or wood burning fireplace, a vent MUST be provided in the skirting adjacent to the fresh air inlet(s) of the appliance. Vents must be sized in accordance with the equipment manufacturer's installation instructions.

A removable panel should be provided in the skirting to allow crawl space access.

Special provisions must be made for venting clothes dryers beyond the perimeter of your home. Dryers must not, under any circumstances, be allowed to vent under the home. For special instructions for venting dryers see Clothes Dryer Section.

GROUND LEVEL INSTALLATION

Ground level installation is preferred by many homeowners for aesthetic purposes and the convenience afforded by the elimination of excessive steps and the need for skirting. Some parks provide such installations only on request while in some areas ground level installations are required by local ordinances.

The foundation system design (footings, piers and tie-downs) for a ground level installation is the same as described previously for an above ground installation. The primary difference between the two installations is in the preparation of the site.

For ground level installations, provisions must be made to insure proper drainage of rain and ground water seepage to avoid accumulation in the silt (excavation). Appropriately banked backfilling at grade to drain water away from home and provisions for natural drainage at the lowest point of the silt are necessary. If natural grade drainage cannot be provided, a ground drain at the lowest point of the silt connected to a storm drain should be provided. Additionally, provisions to divert roof run-off by means of gutters and downspouts are necessary.

To protect the home from the entrance of ground moisture and excessive condensation build-up, the entire silt should be poured, reinforced concrete or adequately covered by a moisture vapor barrier.

The procedure for locating the home in the silt is contingent on factors existing at the site. If the silt is the type where the home is backed directly into it, extreme care must be exercised to avoid dragging. Shimming or blocking for the wheel runs may be required. The complete silt may be cribbed and the home sited and jacked down into the silt if necessary. Extra jacks and cribbing are required for this type of installation.

Extreme care must be exercised to avoid damage to the home and injury to the installers during the home siting, blocking, leveling, and tie-down procedures necessary for ground level installations. Homeowners should not attempt such installations themselves, but always contract a qualified installer.

PERMANENT FOUNDATIONS

In the event you are considering a permanent foundation for the home, Highland has a typical system available that would be acceptable in most areas. Drawings may be obtained by contacting the Highland factory which manufactured your home.

Once obtained, the typical drawings must be submitted to the local jurisdiction for all required permits.

EXHAUST SYSTEMS

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Visually inspect bathroom and kitchen exhaust vents to see that they are free and clear to the outside of the home and that nothing has been disturbed due to in-transit vibrations.

UTILITY HOOKUP AND TESTING

This section of the manual deals with the connection of the water supply, drainage, gas, oil and electrical systems of the home to the site service.

Regulations governing utility connections vary with localities; thus, the authorities having jurisdiction must be consulted to insure connection in accordance with all applicable regulations. Connections must be made only by experienced, qualified personnel who are familiar with local regulations.

The utility systems for all Commodore homes are subjected to stringent tests prior to leaving the factory. This, however, cannot provide a guarantee against possible damage in transit. For this reason, it is imperative that the test procedures for each of the utility systems be conducted as outlined in this manual.

NOTE: In some instances certain electrical, plumbing or furnace/air conditioning drops may fall over an axle which may require removal of the axle to complete installation.

The information on the following pages will assist in determining the proper connection procedures for which the home was designed and serve as a guide for inspection of the system upon completion.

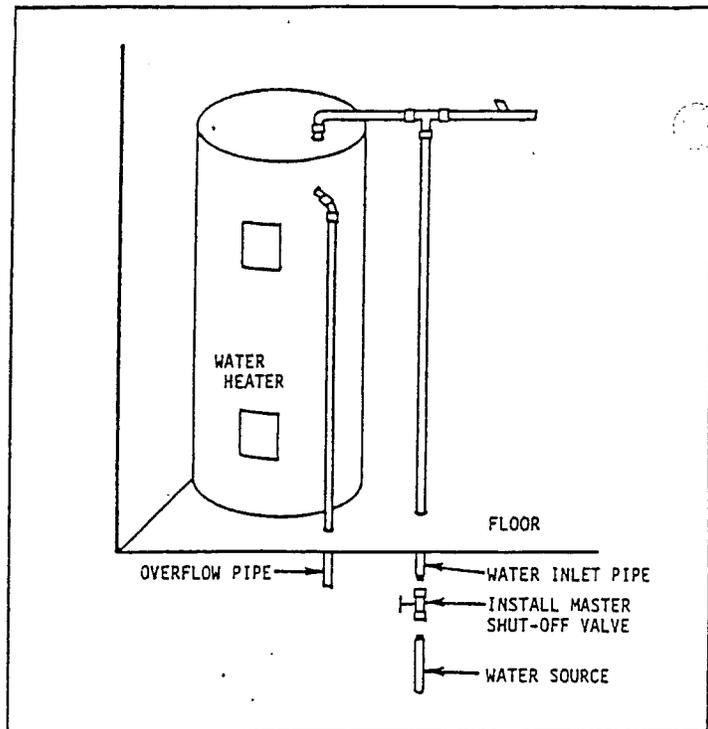
Upon completion of your utility installation, it is important that access to connections be provided for periodic inspection and possible future service.

WATER SUPPLY HOOKUP AND TESTING

NOTE: Water heaters must be by-passed during test. Test involves use of pressurized air which can permanently damage the water heater or may even cause rupture or explosion which could result in serious injury. Water heater is by-passed by disconnecting both the cold water line inlet and the hot water line outlet from the water heater and then connecting the hot and cold water lines together through the use of appropriate connection fittings.

The water system was tested at the factory; however, it is essential that it be rechecked at the site for leaks that may have been caused by in-transit vibrations.

1. Install a master shut-off valve at the bottom of the water inlet pipe (either a full port gate or a full port ball valve, with threaded or solder joints). Generally, the 3/4" water inlet is located in the area of the water heater compartment. Install a pressure reducer if site pressure goes over 80 psi. These items to be supplied by the installer or owner.
2. Proceed with test as follows:
 - A. Close all water faucets, spigots and stool tank float valves.
 - B. Pressurize the system to 100 psi.
 - C. Isolate the pressure source from the system.
 - D. The gauge must stand 15 minutes with no drop.
 - E. If leakage is evidenced, locate the problem and correct. Re-test system as described above.



- F. After successful completion of test, re-connect the water heater and connect the water supply to the home water inlet.
- G. Turn on the water supply and visually check all connections for leakage. Operate all water faucets, showers, etc. to clear air blocks.

IF THE WATER HEATER IS OMITTED IN A UNIT, THE HOT AND COLD WATER INLETS WILL BE STUBBED THRU THE BOTTOM BOARD AND CAPPED. THE WATER HEATER MUST BE SITE INSTALLED BY OTHERS AND MEET ALL OTHER REQUIREMENTS OF THE HUD CONSTRUCTIONS AND SAFETY STANDARDS SECTION 3280,609,(WATER DISTRIBUTION SYSTEM), AND ALL STATE AND LOCAL CODE REQUIREMENTS. THE COMPLETE INSTALLATION SHOULD BE MADE ONLY BY QUALIFIED PERSONNEL.

PROTECTION FROM FREEZING

3. If the home is to be left unheated in cold weather, after the above test, it is necessary to drain the water lines and blow them clear with compressed air to prevent damage from freezing.
4. If the home is installed in an area subjected to freezing temperatures, the exposed section of the water supply piping, shut-off valve, and pressure reducer must be protected. The most efficient and recommended means of accomplishing this is by the use of a thermostatically controlled heat tape. For this purpose, your home is equipped at the factory with an electrical receptacle under the home in the vicinity of the water supply inlet.

THE HEAT TAPE USED MUST BE LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY FOR USE WITH MANUFACTURED HOMES, AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

In mild climates subject to only occasional below freezing temperatures, an alternative to the use of heat tape is wrapping exposed sections of the water supply piping with insulation, loosely taped to prevent excessive compression.

NOTE: Before energizing water heating system you must be sure to fill the water heater with water. The water heater may be damaged if heat is generated prior to filling with water.

DRAIN SYSTEM HOOKUP AND TESTING

The drainage system was checked for leaks at the factory; however, it is essential that it be rechecked at the site for leaks which may have been caused by in-transit vibrations.

a) Check completed system for leaks before connecting the sewer by capping the outlet and filling the entire drain with water for 15 minutes.

b) Secondary bath stool drops must be connected to the main stool drop with a 3" drain line. Drain line, vents, & fittings must be installed according to the DAPIA approved drain line schematics provided with the installation manual & with the parts provided with the home.

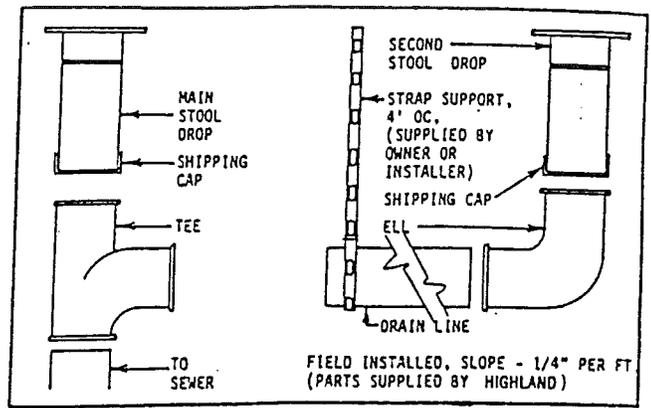
c) Use approved ABS solvent cement and it's manufacturer's instructions for drain line connections.

d) The main drain connection to the sewage system should be made with 3" drain sloped at 1/4" per foot.

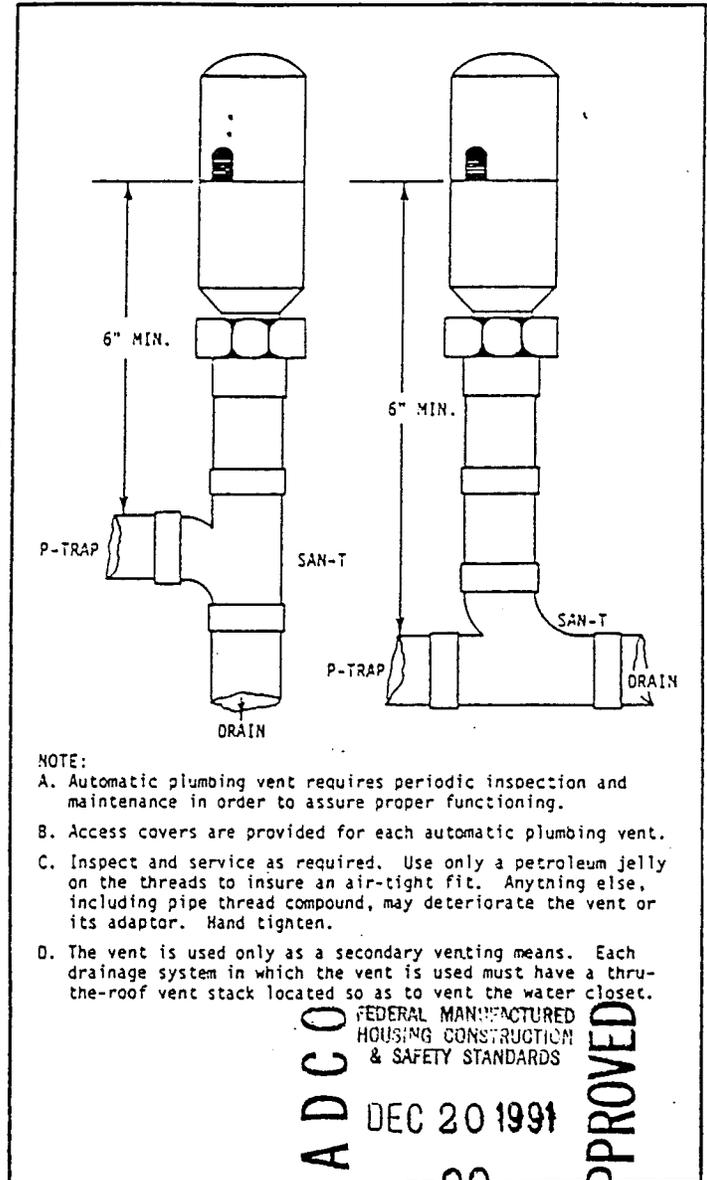
e) all site installed drain lines must be supported by 3/4" x .020 strapping. (4'-0" O.C. MAX.) Strap to be wrapped around drain line pipe and secured to floor joist using 8d coated sinkers. (see drawing on this page)

f) Cleanouts shall be accessible through an unobstructed minimum clearance of 12 inches directly in front of the opening.

g) The drain outlet shall be provided with a minimum clearance of 3 inches in any direction from all parts of the structure or appurtenances and with not less than 18 inches unrestricted clearance directly in front of the drain outlet.



3. ANTISIPHON DRAIN VENT



NOTE:

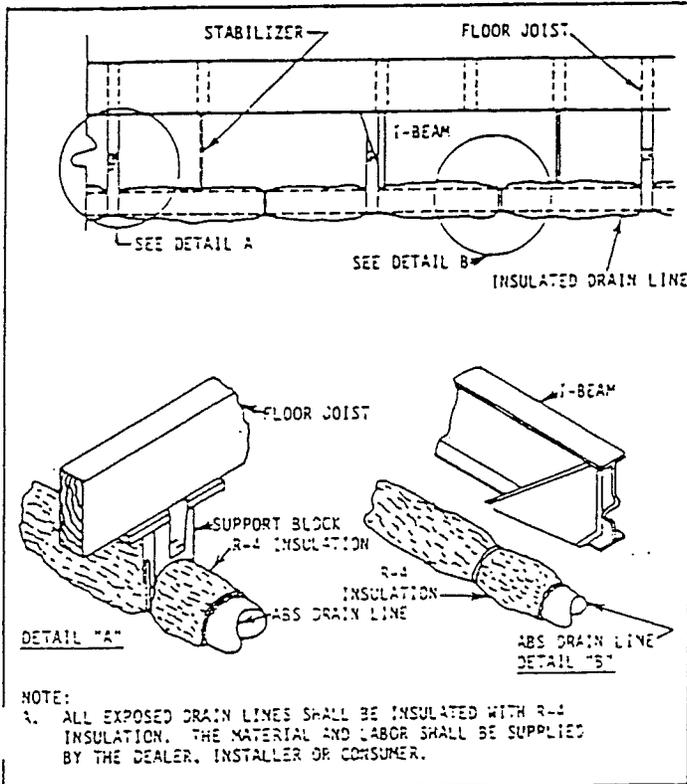
- Automatic plumbing vent requires periodic inspection and maintenance in order to assure proper functioning.
- Access covers are provided for each automatic plumbing vent.
- Inspect and service as required. Use only a petroleum jelly on the threads to insure an air-tight fit. Anything else, including pipe thread compound, may deteriorate the vent or its adaptor. Hand tighten.
- The vent is used only as a secondary venting means. Each drainage system in which the vent is used must have a thru-the-roof vent stack located so as to vent the water closet.

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PROTECTION FROM FREEZING

4. Access to fittings in the drainage system subject to freezing, such as P-Traps in the floor, have been protected with insulation by the manufacturer. Insulation must be replaced if removed during the testing.

5. If the home has drain lines installed underneath the bottom board on site and is located in areas subject to freezing temperatures, the drain lines must be wrapped with insulation to prevent freezing.



6. If the home is to be left unheated in cold weather after the above tests, it is necessary to drain the entire system to prevent damage from freezing.

P-Traps at all fixtures and stools can be protected by pouring 1/2 cup of antifreeze into each one.

NOTE: Do not use heat tape on exposed drain lines.

ELECTRICAL SYSTEM HOOKUP & TESTING

The electrical test and connection of the home should be made only by qualified personnel in accordance with applicable sections of the National Electrical Code along with any additional requirements imposed by local authorities having jurisdiction.

A sufficient power supply must be available at the site. Insufficient power supply will result in improper operation and possible damage to motors and appliances and costly electric service. The amperage rating of the electrical distribution panel main disconnect is shown on the tag located outside the home adjacent to the feeder entrance and on the electrical distribution panel itself.

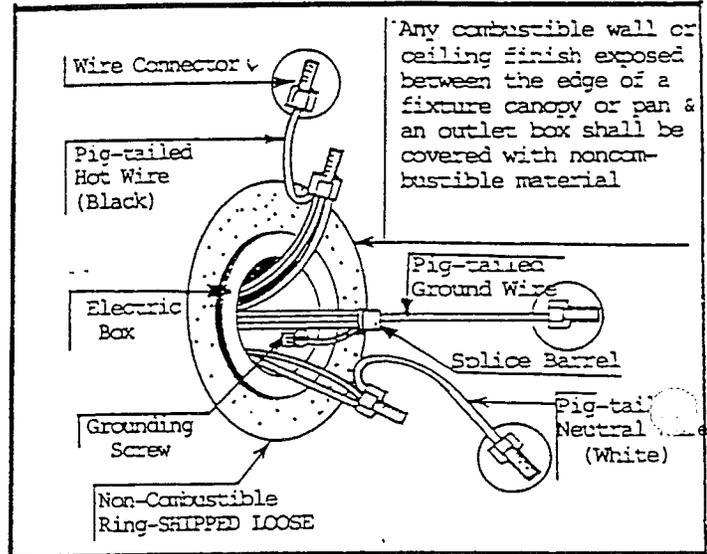
The home was tested at the factory, but must be retested after set-up, because of the possibility of connections loosening due to in-transit vibrations.

EXTERIOR LIGHT FIXTURES & OTHER 110 V APPLIANCES

Connect wires, black to black, white to white and ground to ground, using wire nuts.

Push wires into box and place putty tape on light fixture base and secure fixture in position.

Install bulb and apply caulking around base of light fixture to insure a water-tight seal to the wall (putty tape and caulking not provided by Highland).



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CONNECTION OF THE ELECTRICAL SERVICE

1. Locate service entrance.
2. To determine applicable feeder size amperage, see Main Breaker and the label on electrical distribution panel.
3. Using this information, determine the required feeder size from the following table.

ELECTRICAL FEEDER AND EQUIPMENT SIZES					
Feeder Size (AMPS)	Maximum Neutral Feeder Load (AMPS)	Minimum Required Junction Box Size (Inches)	Feeder Sizes Based Upon Use of 75° C Insulated Copper Conductors		Conduit (Inside Dia.)
			Black-"Power" Red-"Power" White-"Neutral"	Green or Bare Ground	
50	50	10x10x4	#6 THW (Cu)	#8 (Cu)	1-1/4"
100	100	10x10x4	#3 THW (Cu)	#8 (Cu)	1-1/2"
150	115	12x12x6	#1/0 THW (Cu)	#6 (Cu)	2"
200	130	12x12x6	#3/0 THW (Cu)	#4 (Cu)	2"

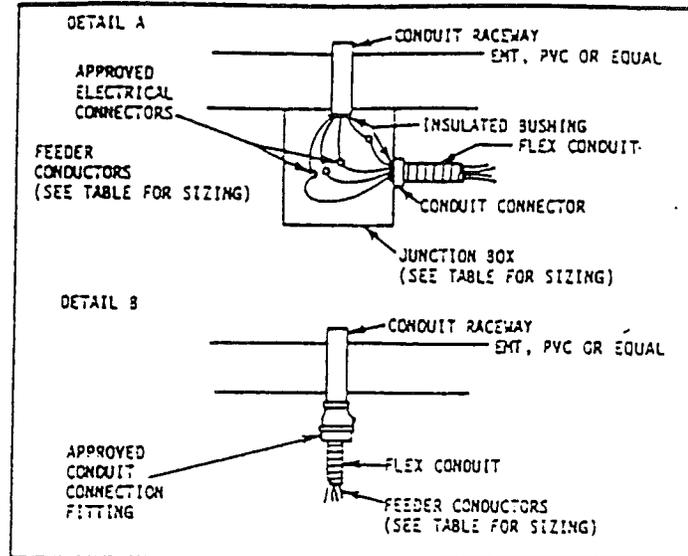
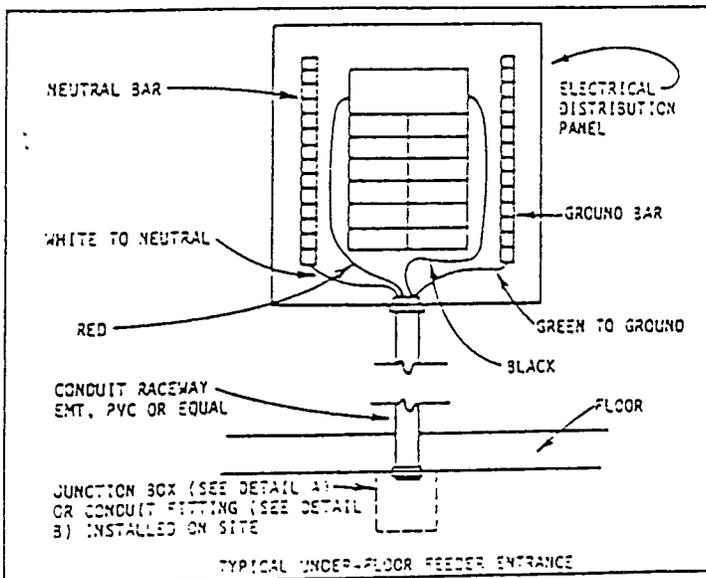
Conductor sizes are in accordance with the National Electric Code, Table 310-16, and do not take voltage drop into consideration. Allowable ampacities are based on ambient temperature of 30°C, 86°F.

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4. UNDER-FLOOR FEEDER ENTRANCE

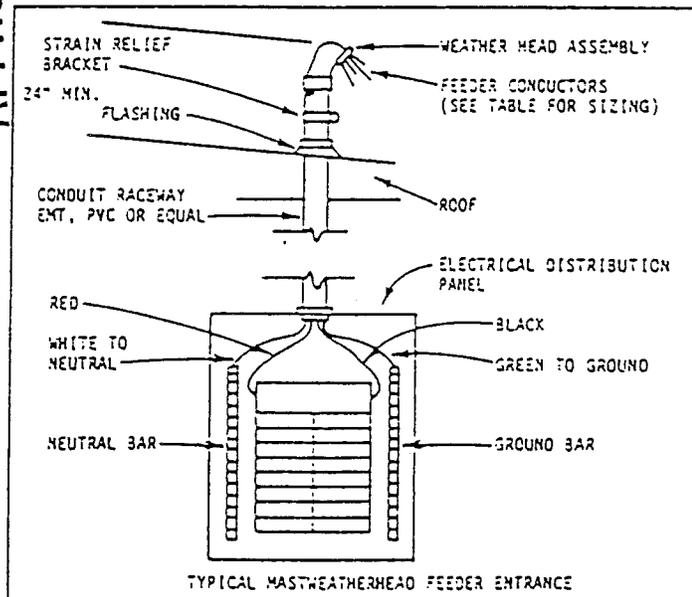
Homes with an under-the-floor feeder entrance are provided with a permanently attached conduit raceway which runs from the electrical distribution panel to a point terminating beneath the floor of the home. A suitable conduit fitting or junction box must be installed at the termination point below the floor.

CAUTION: The connection of the home is a feeder, not a service. When wiring the feeder, a grounding (green) conductor must be installed and the neutral (white) conductor must not be grounded in the electrical distribution panel.



5. MAST WEATHERHEAD FEEDER ENTRANCE

Homes so equipped contain all necessary conduit to the electrical distribution panel but feeder conductors are not provided with this assembly and must be installed on site in accordance with the above table.



CAUTION: If the home has an electric water heater, it must either be filled with water or have the circuit breaker turned "OFF" before energizing the home electrical system or severe damage to the heating element will result.

6. With the electrical distribution panel main circuit breaker and all individual circuit breakers in the home turned off, make electrical service connections. When connections are complete, turn on power at electric meter source. Do not turn on the main panel box circuit breaker in the home until the grounding and continuity testing has been performed.

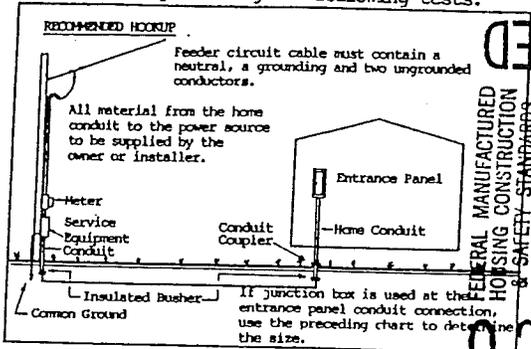
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7. Grounding the Home

NOTE: The grounding bar in the main home electrical distribution panel box must be grounded through the green colored conductor in the feeder wiring to the service ground in the service entrance equipment, provided by the utility company. If grounding through service equipment is impractical, the green colored conductor must be grounded to an approved grounding rod sunk directly into the earth to a depth as specified by authority having jurisdiction.

If the home has an add-on-room, make all electrical connections before performing the following tests.



GROUNDING AND CONTINUITY TEST

8. Perform the following test after all structural assembly, metal and trim installation is finished.
 - A. Connect one clip of a flashlight continuity tester to a convenient ground (metal skin, window frame on metal skinned units, floor duct riser, screw head on receptacle or switch plate, etc.) and touch the other clip to each light fixture canopy (where the light is mounted to ceiling or wall). The continuity tester should light if each fixture is properly grounded.
 - B. Using the continuity tester, check every direct-connected appliance or fan. The tester must be hooked to a convenient ground and to the metal frame of the appliance.
 - C. Using the continuity tester, check the continuity between the following:
 1. Between one riser of furnace duct and convenient ground.
 2. Between metal roof and steel frame.
 3. Between metal skin and steel frame.
 4. Between metal gas piping and steel frame.

NOTE: Continuity to ground is not required on metal inlet of plastic piped water system.

5. Between electrical distribution panel and steel frame.

When plumbing fixtures such as metallic sinks, tubs, faucets and shower risers are connected only to plastic water piping and plastic drain piping continuity to ground is not required.
6. In addition, if home water distribution lines are metal, the ground continuity between the water line inlet and steel frame and all metallic plumbing fixtures such as sinks, tubs, faucets, etc. must be checked.
7. Any loss of grounding continuity found in the above will require investigation and correction.

POLARITY & OPERATIONAL TEST

8. Turn on main panel box circuit breaker and then, at a time, turn on the individual home breakers and perform the following test. If any breaker trip, this indicates a problem with a circuit that must be located and corrected.

CAUTION: Make sure the water heater is filled with water before energizing.

- A. Plug an AC receptacle wiring tester into each receptacle in the home to check for reverse polarity, open grounds and shorts.
- B. Install light bulbs and fluorescent tubes in all light fixtures. Make sure each light fixture is operable by turning the appropriate switch to the "ON" position.
- C. Repair or replace any defective light fixtures or switches. Check operating of furnace and water heater thermostats and set. Check and run furnace blower.
- D. Conduct test of GFI (Ground Fault Interrupter) circuit breaker in accordance with the breaker manufacturer's instructions.
- E. Conduct tests of the smoke detector(s) in accordance with the manufacturer's instructions.

GAS SYSTEM HOOKUP & TESTING

The gas piping system was tested at the factory; however, it is essential that it be rechecked at the site for leaks that may have been caused by in-transit vibrations.

NOTE: Do not apply more than the specified pressure as damage to gas valves and/or regulators may result.

Before a test is begun, the temperature of the ambient air and the piping should be approximately the same. Conduct the test when air temperatures will remain stable.

The gas piping system must be tested two ways:

- A. Piping only - all appliances isolated.
 - B. Entire system - with appliances.
1. Piping only test:
 - A. Isolate all appliances from the system by closing all appliance shut-off valves.
 - B. At the home gas inlet, attach a pressure gauge calibrated in ounces.
 - C. Pressurize the system with air to not less than 3 psi or 48 ounces of air pressure.
 - D. Isolate the pressure source from the system.
 - E. The gauge must stand 10 minutes with no drop.
 - F. If pressure loss occurs, check all joints in piping system beneath the home and at all shut-off valves with soapy water or bubble solution until leak is located.
 - G. Repair leak and retest.

2. Entire system test:

- A. All gas equipment controls and pilot light valves must be closed. Refer to individual gas equipment manufacturer's instructions.
- B. Gas shut-off valves for all gas equipment must be in the "Open" position.
- C. At the home gas inlet, attach a pressure gauge calibrated in ounces.
- D. Pressurize the system with air to not less than 6 to 8 ounces of air pressure.
- E. With soapy water, or bubble solution, check all gas shut-off valves and flex line connections to valves and appliances for leaks.

CAUTION: Do not bubble check brass fittings with solutions containing ammonia.

- F. If leak is found, repair and re-test.

Prior to making connection to site supply, gas inlet orifices of furnaces, water heaters and appliances must be checked to insure they are set up for type of gas to be used — L.P. (liquefied petroleum) or natural gas. The gas pressure should not exceed 7" to 14" water column.

If conversion is required, individual appliance, furnace or water heater manufacturers' instructions must be complied with.

Gas appliance vents shall be visually inspected to insure that they have been connected to the appliance and roof jacks are installed and have not come loose during in-transit vibrations.

The gas connection to the gas supply should be made by an authorized representative of the gas company.

If the home has gas piping stubbed in for future installation of appliances, a shut-off valve and threaded pipe plug or cap will be installed at the factory and all of the above tests should be performed on the system.

After completion of tests, close equipment shut-off valves and connect gas supply to the home gas inlet. One at a time, open each equipment valve and light pilots and adjust burners according to each appliance/equipment manufacturer's instructions. Check the operation of the furnace and water heater thermostats and set.

CAUTION: Make sure water heater is filled with water before lighting pilot.

OIL PIPING HOOKUP & TESTING

Homes produced by Commodore which are equipped with oil burning furnaces must have the oil supply piping installed on site. Piping is not supplied by Commodore.

The furnace manufacturer's instructions must be consulted for proper pipe sizing and installation procedures.

In addition, unless the home is installed in a park with a centralized oil distribution system, an oil storage tank of suitable capacity must be installed outside the home in a location accessible for service, and safe from fire and other hazards.

Oil tanks that feed vaporizing-type oil furnaces must be installed so that oil flows by gravity. To achieve efficient gravity flow the tank must be installed so that the bottom of the tank is at least 8 inches above the level of the furnace oil control, while top of the tank is within 8 feet of the oil control level.

For gun type oil furnaces the location of the oil storage tank is left to the discretion of the homeowner. Since the furnace includes a fuel pump, the tank may be installed above or below ground. For tanks installed below ground the filler neck should extend 1 foot above grade and a 1-1/4 inch diameter minimum vent pipe extending at least 2 feet above grade must be provided.

Regardless of the type of oil furnace served, or the tank location, the tank should be installed to provide a gradual slope toward the fill end or drain plug (if so equipped) to facilitate pumping or draining of water and sludge.

An accessible and approved manually operated shut-off valve must be installed at the oil tank outlet. Additionally, it is recommended that a suitable filter be installed in the fuel line near the tank to help trap dirt and water.

NOTE: All oil storage tank and oil piping installations must meet all applicable local regulations and should be made only by experienced, qualified personnel.

BEFORE setting the system in operation, the tank installation and supply piping must be checked for leakage. The tank must be filled to capacity with the fuel to be burned and all joints in the system checked visually for leakage.

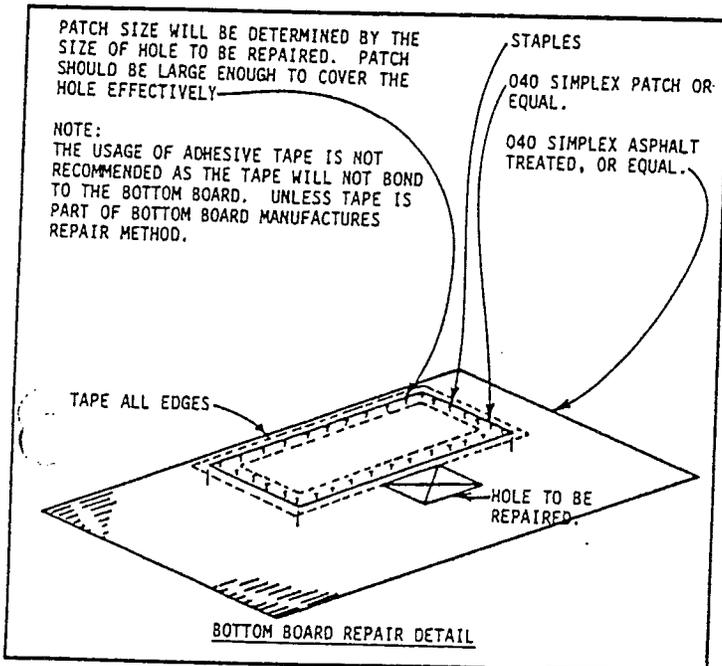
BOTTOM BOARD PATCHING

Below are listed some of the different patching methods which offer the dealer, or home buyer, a means of resealing the bottom board:

Affix the patch with an approved bottom board tape. It is recommended that either CS-12 from Shepherd Products of Kalamazoo, Michigan or #620 from First Line Corp. of Valdosta, Georgia be used.

The outward Flare Tacker is an air operated tool Model LN3045 manufactured by Senco Products, Inc.

The patch should first be affixed to the bottom, using an approved tape to secure the perimeter and then fastened near the perimeter at 3" intervals. Use the staples described in Senco Bulletin M-100.



OPTIONAL ITEM INSTRUCTIONS

CAUTION: Commodore cannot be responsible for any damage resulting directly or indirectly from installation of accessories, nor any modifications to the home subsequent to shipment from the factory. All alterations must be in compliance with the Federal Manufactured Housing Construction and Safety Standards and will be at the risk of the installer and/or home owner.

Local building officials should be consulted prior to making any alterations to the home to insure compliance with all applicable codes and requirements. Your dealer should be consulted as he is a specialist in the proper installation of accessories.

THE VENTING SYSTEM FOR SUCH APPLIANCES AS PLACES, FURNACES, WATER HEATERS AND GAS OVENS MAY BE COMPLETE AND MUST BE INSTALLED BEFORE THE APPLIANCE CAN BE OPERATED. FOLLOW THE MANUFACTURER'S INSTRUCTIONS INCLUDED WITH THE APPLIANCES.

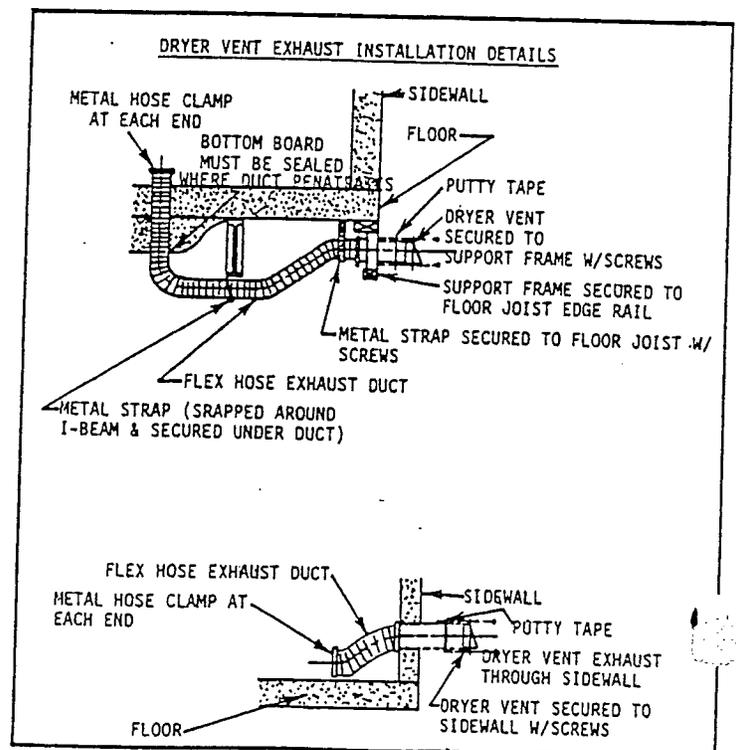
CLOTHES DRYER VENTING

Your home may be designed for the future installation of an electric or gas clothes dryer. A venting system access thru the floor or wall has been installed at the factory and the complete installation should be in compliance with the appliance manufacturer's instructions.

NOTE: Do not allow your dryer vent to terminate under your home. This may cause a build-up of flammable material under your home or it may cause excessive moisture to accumulate under your home.

Homes factory-equipped with an electric dryer receptacle will also have the moisture-lint exhaust system roughed-in. To complete the moisture-exhaust system, the following must be performed:

1. Remove the covers, exterior and interior, over the vent hole in floor or wall.
2. Install duct, make sure that it is clear, and connect to the dryer. All materials and installation should be in accordance with the dryer manufacturer's instructions.
3. Secure the termination fitting to the outside edge of the floor or wall.
4. Secure the flexible duct to the termination fitting with clamps. (Do not use sheet metal screws or other devices which extend into the interior of the duct).
5. Seal the hole where the duct goes through the floor or wall with a good grade of caulking or tape.



Homes factory equipped with a gas dryer stubbed-in outlet will be provided with a shut-off valve and a pipe plug or cap and will also have an access moisture-lint exhaust system. All gas supply piping and venting must be installed according to the dryer manufacturer's installation instructions.

NOTE: Gas dryer installation must be handled by fully qualified, experienced personnel only.

Commodore will not be responsible for damage to home resulting directly or indirectly from failure to install the dryer moisture-lint exhaust system in accordance with the instructions presented herein and those of the dryer manufacturer.

Cutting of major structural elements of home such as rafters or floor joists to facilitate installation is not permissible and any resulting weakening of the structural integrity of the home is not the responsibility of Commodore.

FIREPLACE CHIMNEY INSTALLATION

Homes equipped with fireplaces require that the installation of additional section(s) of chimney pipe and a rain cap assembly be made on site.

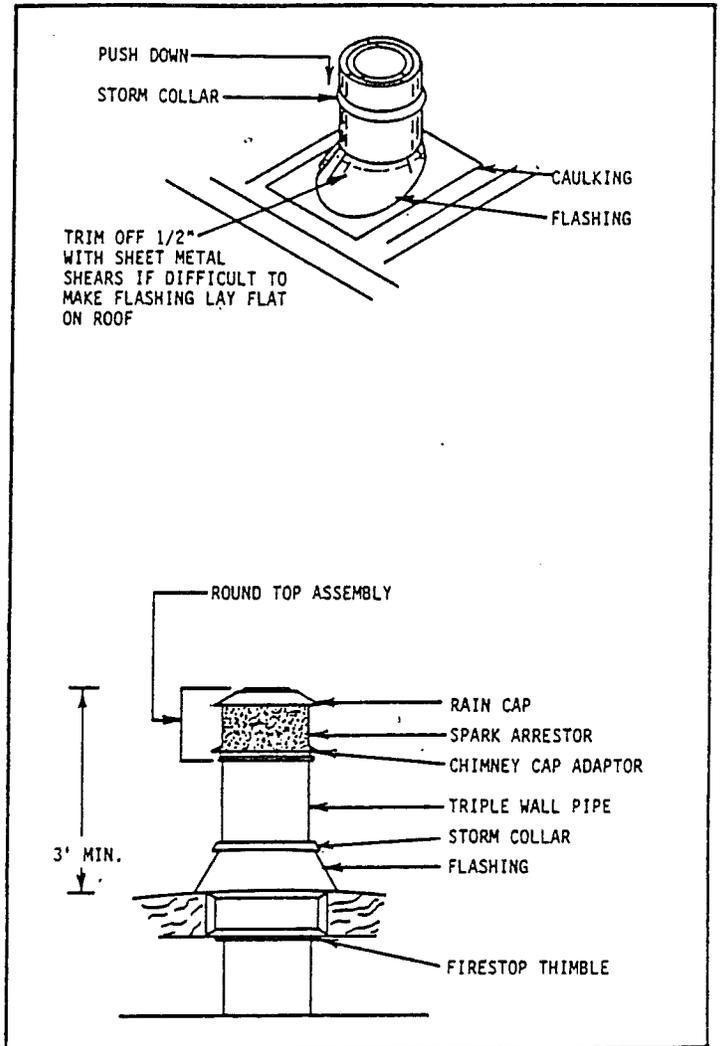
To insure sufficient draft for fireplace, the finished chimney MUST extend 3 feet above the highest point where it penetrates the roof and must be at least 2 feet higher than any building or other obstruction located within a horizontal distance of 10 feet.

Parts necessary to complete installation are provided. Note, however, that chimney section(s) provided will be sized of sufficient length to meet the above stated requirement for the home only.

If the site has obstructions extending higher than the home's roof peak within 10 feet of the chimney, an additional section of chimney pipe may have to be provided by installer.

Chimney installation must be made in accordance with fireplace manufacturer's instructions. Typical chimney installation is as follows:

1. Remove transit protective covering from over the chimney.
2. Install additional chimney section(s) provided and secure.
3. Install spark arrestor.
4. Install rain cap assembly.



AIR CONDITIONING

NOTE: The installation should be made only by qualified personnel. The completed installation must conform to the National Electrical Code and applicable local codes.

Commodore does not recommend the installation of window air conditioning units.

Factory installed circuits for air conditioning are indicated on the electrical distribution panel.

The maximum full load ampere draw for the desired air conditioning unit must not exceed the indicated circuit rating.

The electrical connection is via a circuit terminating in a junction box beneath the home.

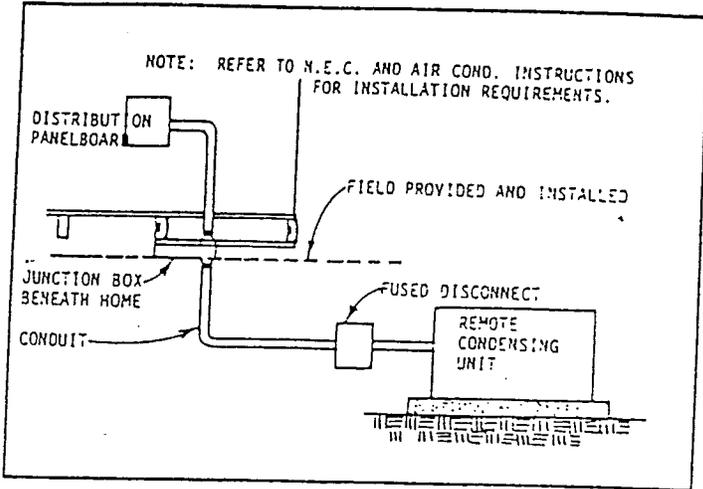
The electrical supply, if not factory installed, may have to be from an outside source as electrical equipment within the home may not have been sized for the additional air conditioning load.

The field installation wiring beyond the junction box, must incorporate a fused disconnect (sized in accordance with NEC Article 440) located within sight of the condensing unit. The maximum fuse size to be used with the fused disconnect is marked on the condenser data plate. The acceptability of the air conditioning equipment, rating the location of disconnect means, fuse type branch circuit protection, and connections to the equipment are to be determined by the local inspection authority.

EVAPORATIVE COOLER

NOTE: The electrical connection should be made only qualified personnel.

Method #1



1. On models equipped for installation of optional evaporative cooler, install the roof-mounted cooler according to the instructions with the cooler. For coolers without an integral air duct the cooler body shall be lined with .016 in. metal. The factory installed branch circuit for the cooler is sized for a maximum cooler electrical load of 12 amperes 120 V. AC, 60 Hz.
2. Remove the cover from the roof-mounted junction box and make the connection of the color-coded wires using the provided wire nuts. The electrical portion of the installation is now complete.

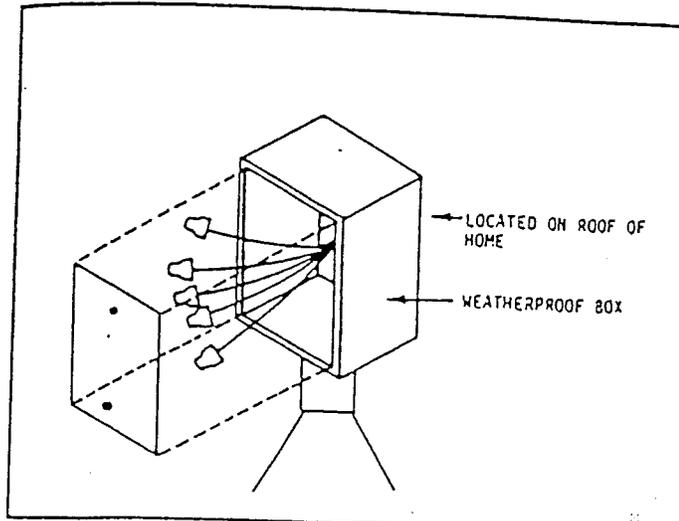
COLOR CODE

White.....	Neutral
Yellow.....	Ground
Black.....	Low-Fuse
Red.....	High-Fuse
Green.....	Ground

The compliance certificate posted in the home will specify the maximum capacity of air conditioning allowable for the home. The equipment you select should not exceed the maximum BTU HR rating on the compliance certificate.

Air conditioning units installed must be compatible with the furnace in the home. For air conditioning installation, see the instructions shipped

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Method #2

1. On special request, HIGHLAND will rough wire evaporative cooler for field installation. A junction box will be located at the roof/ceiling line with two 12-2 or 14-2 wires leading to another junction box located in the wall at switch height. Both junction boxes shall have an access cover. Cooler area shall not be less than 28" x 28". Total weight shall not exceed 180 pounds during operating conditions.

Following are some general installation considerations which are the responsibility of the installer:

1. When working on a home with a metal roof, always use walk-boards to distribute weight evenly over several rafters. Never step between rafters or damage to roof seams may result.
2. A rigid base must be provided for the evaporative cooler to evenly distribute weight of the unit over several rafters. The cooler is secured to the base and the base must be secured directly to the roof rafters.
3. All roof penetrations must be adequately sealed or caulked.
4. Caution must be exercised when installing the boot connecting the cooler to the roof/ceiling opening to insure a tight seal in order to prevent leakage of cool air and afford protection from the elements.
5. An overflow hose must be attached to the cooler's water accumulation pan to route overflow water away from the home.
6. Provisions must be made for an external water supply to the cooler.
7. If guy wires are installed, do not attach them to roof vents, flues or other roof protrusions. To eliminate potential leaks, guy wires should not be secured to the roof itself but routed over the side of the roof and attached to the roof rafter edge rails. All fastener penetrations must be adequately sealed or caulked.

It is prudent to install, directly to earth, an insulated lightning grounding device for all roof installations.

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CARPORTS AND AWNINGS

Points to remember when selecting and installing carports and/or awnings.

1. Awnings and carports of a self-supporting design should be installed to minimize the possibility of damaging the home.
2. Follow installation instructions of accessory manufacturer.
3. Make sure all connections are to structural members of the home such as floor joists or rafter end rails. All penetrations through siding must be properly sealed and caulked.
4. Exercise extreme caution that no fastener penetrates any electrical cables. It is recommended all power be disconnected during installation and all circuits tested after installation is completed.
5. Insure that fasteners and support railings used are capable of handling the intended loads without damaging the home structure.
6. Insure all seams are properly sealed.

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ON SITE ATTACHED STRUCTURES

When homes installed on a foundation are to have other buildings or structures attached or located immediately adjacent to them, the building ordinance may require fire separation. Most building ordinances require a minimum of a one hour fire wall to be installed between garages, zero lot line installed homes, some work shops, etc. When required, the fire separation wall must be approved by a recognized agency.

All attached buildings and structures must be designed to support all of its own design live and dead loads as required by State or Local ordinances.

HITCH AND WHEEL
REMOVAL AND STORAGE

The front hitch used to transport the home may be designed to be detachable, for aesthetic purposes it may be removed after set-up. However, the hitch should be retained in the event the home is ever relocated. Common practice is to store the hitch under the home where it will be protected from the elements and concealed by the skirting.

During or after set-up, it is common practice to remove the wheels and tires. The axles and complete suspension system may be removed.

In some states and localities, owners are allowed to dispose of this equipment, while in others they may not. Before disposing of axles and suspension systems be sure to check carefully with the dealer and/or local authorities.

Although it may be permissible to dispose of the wheels, tires and suspension system, Highland recommends they be retained in the event the home is ever relocated.

This equipment is commonly stored under the home on a waterproof substance, like vinyl sheeting, where it is protected and concealed by the skirting. After wheel removal, hub surfaces should be coated with heavy grease to resist rust and corrosion.

The tires, wheels and suspension systems designed ONLY for use to transport this manufactured home. They are not designed for any other purpose.

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