4.2.
(b) The connection between a regulator mounted on a removable container support bracket or a regulator directly attached to the shutoff valve of a removable container and the gas supply system shall be made with a listed flexible hose connector.

2-4.12 Appliance Connections.
2-4.12.1 General. Except as provided herein, all gas-burning appliances shall be connected to the fuel piping with materials as provided in 2-4.2.
Exception: A flexible connector may be used to connect a gas appliance under the following conditions:
1) It is a listed flexible hose connector conforming to UL 569, Standard for Pigtails and Flexible Hose Connectors for LP-Gas and shall not pass through any floor or ceiling. They shall be permitted to pass through a wall or partition provided the entire length of hose is readily available for visual inspection, provision is made to protect against chafing, and no part of the flexible connector is concealed in the hollow space of a wall or partition, or

2) On vehicles greater than 8 ft. wide in the travel mode, it is a flexible metal appliance connector conforming to ANSI Z21.24, Metal Connectors for Gas Appliances or ANSI Z21.45, Flexible Connectors of other than All-Metal Construction for Gas Appliances.

2-4.12.2 Exterior Appliances. A recreational park trailer containing an LP-Gas system or combination LP-Gas and natural gas system shall be permitted to be provided with a gas outlet to supply exterior appliances when installed on the exterior of the vehicle in accordance with the following:
(a) Portions of the completed installation shall not project beyond the wall of the recreational park trailer.
(b) The outlet shall not be located less than 3 ft. (0.9 m) from any appliance combustion air inlet.
(c) The outlet shall be provided with an approved "quick disconnect" device, which shall be designed to provide a positive seal on the supply side of the gas system when the appliance is disconnected. A hand-operated shutoff valve shall be installed immediately upstream of the quick disconnect device and shall be accessible from the exterior of the vehicle. The complete device shall be provided as part of the original installation.
(d) Protective caps or plugs for the "quick disconnect" device, when disconnected, shall be permanently attached to the recreational park trailer adjacent to the device.
(e) A tag shall be permanently attached to the outside of the exterior wall of the recreational park trailer as close as possible to the gas supply connection. The tag shall indicate the type of gas and the BTUH capacity of the outlet and shall be legibly inscribed as follows:

2-4.13 Gas Shutoff Valves.
2-4.13.1 Type Authorized. Shutoff valves used in connection with gas piping shall be of a type designed and listed for use with LP-Gas.

2-4.13.2 Appliance Shutoff Valves. A listed shutoff valve with non-displaceable rotors shall be installed in the fuel piping within the living space, within 6 ft. (1.8 m) of a gas cooking stove and within 3 ft. (0.9 m) of any other gas appliance. Such valves shall be upstream of the appliance union or connector in addition to any valve on the appliance and shall be located to allow the

replacement of the complete appliance gas piping assembly. Such shutoff valves may serve more than one appliance if located as required herein.

2-4.14 Gas Inlet Cap.
(a) LP-Gas only and combination LP-gas--natural gas systems with a single gas inlet shall be effectively covered when disconnected from the source of supply and not in use.
(b) If either of the above systems has multiple gas supply outlets, each inlet shall be equipped with a threaded brass cap or equal to close the supply inlet when that inlet is not used.

2-4.15 Prohibiting Use of Gas Piping as Electrical Ground. Gas piping shall not be used for a grounding electrode.

2-4.16 Gas Pipe Couplings. Sections of threaded pipe shall be joined by pipe couplings or ground joint unions. Right and left nipples and couplings shall not be used.

2-4.17 Gas Pipe Hangers and Supports. All gas piping shall be adequately supported by galvanized, painted, or equivalently protected metal straps or hangers at intervals of not more than 4 ft. (1.2 m), except where adequate support and protection is provided by structural members. Iron-pipe gas supply connection(s) shall be rigidly anchored to a structural member within 6 in. (152 mm) of the supply connection(s). Iron piping shall be anchored within 6 in. (152 mm) of tubing connections at the end of pipe runs and within 12 in. (304 mm) of tubing connections within runs.

2-4.18 Testing for Gas Leakage.
2-4.18.1 Before Appliances are Connected. Piping systems shall be proven by test to be leak-free by maintaining an air pressure of at least 6 in. mercury (1.49 kPa) or 3 psi (20.7 kPa) for a period of at least 10 minutes. Before the test is begun, temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the period. Leaks, if observed, shall be located and corrected. Defective material shall be replaced. Tests shall be conducted by either of the following methods:
(a) Source of air pressure to the piping system shall be shut off. The pressure in the system shall be measured over a period of 10 minutes with a mercury manometer, slope gage, or equivalent device, calibrated so as to be read in increments of not greater than 1/10 psi (0.7 kPa). During the 10-minute period, a drop in pressure shall not occur.
(b) A bubble-type leak detector shall be installed between the source of air pressure and the piping system. After a 10-minute equalization period, the bubble detector shall not indicate any air flow for a period of 1 minute. Products that contain ammonia or chlorine shall not be used for testing.

2-4.18.2 After Appliances are Connected. When appliances are connected to the piping system, the entire piping system shall be pressurized to not less than 10 in. (2.5 kPa) nor more than 14 in. (3.5 kPa) water column and the appliance connections tested for leakage with either soapy water or bubble solution. Products containing ammonia or chlorine shall not be used. As an alternative procedure a pressure drop test can be conducted in the following manner:
The entire system shall be pressurized to not less than 10 in. (2.5 kPa) nor more than 14 in. (3.5 kPa) water column, the appliance shutoff valves closed and the source of pressure shut off. Temperature of both the air and piping

shall be approximately the same and a uniform temperature shall be maintained through the test period. Before the test is begun, open one valve and lower the pressure to 9 in. (2.24 kPa +.5 in.) water column so that the appliance regulator is in an open condition. The pressure in the system shall be measured over a period of 3 minutes with a manometer or with a pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period.

2-5 Fuel Oil Piping Systems.
2-5.1 General. The requirements of this section shall govern the installation of all fuel oil piping attached to any recreational park trailer. None of the requirements listed in this section shall apply to the piping in the appliance(s).

2-5.2 Oil Piping System Materials. All materials used for the installation, extension, alteration, or repair of any oil piping system shall be new and free from defects or internal obstructions. The system shall be made of materials having a melting point of not less than 1450°F (788°C) except as provided in 2-5.4. They may consist of one or more of the following materials:
(a) Pipe shall be steel or wrought-iron pipe complying with ANSI B36.10M, Wrought-Steel or Wrought-Iron Pipe. Threaded copper or brass pipe in iron pipe sizes may be used;
(b) Fittings for oil piping shall be wrought-iron, malleable iron, steel, or brass (containing not more than 75 percent copper);
(c) Copper tubing shall be annealed Type K or L con forming to ASTM B88, Specifications for Seamless Copper Water Tube, or shall comply with ASTM B280, Specifications for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service;
(d) Seamless brass tubing shall have a minimum wall thickness of 0.030 in. (.762 mm); or
(e) Steel tubing shall have a minimum wall thickness of 0.049 in. (1.24 mm), conforming to ASTM A539, Specifications for Electric-Resistance Welded Coiled Steel Tubing for Gas and Fuel Oil Lines, and shall be externally protected from corrosion.

2-5.3 Size of Oil Piping. The minimum size of all fuel oil tank piping connecting outside tanks to the appliance shall be not smaller than 3/8 in. o.d. copper tubing or 1/4 in. IPS. In those cases where No. 1 fuel is used with a listed automatic pump (fuel lifter), 1/4 in. o.d. copper tubing may be used if specified by the pump manufacturer.

2-5.4 Joints for Oil Piping. All pipe joints in the piping system, unless welded or brazed, shall be screw joints which comply with ANSI B1.20.1, Pipe Threads (except Dryseal). The material used for welding or brazing pipe connections shall have a melting temperature in excess of 1000°F (538°C).

2-5.5 General Specifications for Flared Oil Tubing Joints.

NOTE: See also 2-4.6.

(a) After cutting, tubing ends shall be internally reamed prior to flaring.
(b) Flares shall be square with the axis of the tubing within one-half degree.
(c) Flares shall be free from loose scale, burrs and cracks. Seating surfaces shall be smooth and free from pit marks.

2-5.6 Oil Pipe Joint Compound. Screw joints shall be made uptight with

approved pipe joint compound, or other approved material, which shall be applied to the male threads only.

2-5.7 Couplings for Oil Piping. Where it is necessary to join sections of screw piping, right and left nipples and couplings shall not be used. Ground joint unions shall be permitted to be installed at appliance inlet connections.

2-5.8 Slope of Oil Piping. Fuel oil piping installed in con- junction with gravity feed systems to oil heating equipment shall slope in a gradual rise upward from a central location to both the oil tank and the appliance in order to eliminate air locks.

2-5.9 Strap Hangers for Oil Piping. All oil piping shall be adequately supported by galvanized, painted, or equivalently protected metal straps or hangers at intervals of not more than 4 ft. (1.2 m), except where adequate support and protection is provided by structural members. Iron-pipe oil supply connection(s) shall be rigidly anchored to a structural member within 6 in. (152 mm) of the supply connection(s). Iron piping shall be anchored within 6 in. (152 mm) of tubing connections at the end of the pipe runs and within 12 in. (304 mm) of tubing connections within runs.

2-5.10 Testing for Oil System Leakage. Before setting the system in operation, tank installations and piping shall be checked for oil leaks with fuel oil of the same grade that will be burned in the appliance. No other material shall be used for testing fuel oil tanks and piping. Tanks shall be filled to a maximum capacity for the final check for oil leakage.

2-6 Fuel-Burning Appliances.
2-6.1 General.
2-6.1.1 Listing Requirements. Heat-producing appliances and vents, roof jacks, and chimneys necessary for their installation shall be listed or certified by a recognized agency. Combination heating and air conditioning units and heating units shall be listed or certified by a recognized agency for the application for which the unit is in tended. Appliances listed for use in manufactured homes (mobile homes) or recreation vehicles shall be permitted to be installed in recreational park trailers.

2-6.1.2 Basic Venting Requirements. Fuel-burning heat- producing and refrigeration appliances, except illuminating appliances, ranges, and ovens, shall be of the vented type and vented to the outside.

2-6.1.3 Gas Appliance Fuel Utilization. Gas appliances shall be listed for use with LP-Gas only or for use with both natural gas and LP-Gas (convertible from natural gas to LP-Gas and vice versa).

2-6.1.4 Conversion of Appliances. Fuel-burning appliances shall not be converted from one fuel to another unless converted in accordance with the terms of their listings and the appliance manufacturer's instructions.

2-6.1.5 Controls for Regulation of Interior Temperature. Each space heating, cooling, or combination heating and cooling system shall be provided with at least one readily adjustable automatic control for regulation of interior temperature.

2-6.2 Clothes Dryers.

2-6.2.1 Exhaust Duct System. All gas and electric clothes dryers shall be exhausted to the outside by a moisture-lint exhaust duct and termination fitting. When the clothes dryer is supplied by the manufacturer, the exhaust duct and termination fittings shall be provided by the manufacturer. If the exhaust duct system is not completely installed at the factory, a moisture-lint exhaust duct system shall be roughed in and installation instructions provided in accordance with 2-6.2.3 and 2-6.2.4.
(a) A clothes dryer moisture-lint exhaust duct shall not be connected to any other duct, vent or chimney.
(b) The exhaust duct shall be of sufficient length so as not to terminate beneath the recreational park trailer.
(c) Moisture-lint exhaust ducts shall not be connected with sheet metal screws or other fastening devices which extend into the interior of the duct.
(d) Moisture-lint exhaust duct and termination fittings shall be installed in accordance with the appliance manufacturer's printed instructions.

2-6.2.2 Prevention of Negative Pressure in Recreational Park Trailer. Fuel-burning clothes dryers shall receive their combustion air and drying air from outside the vehicle and shall exhaust the combustion products and drying air to the out side. If electric dryers receive the drying air from inside the vehicle, a warning label with 3/8 in. (9 mm) high letters shall be posted on or near the dryer in a conspicuous location which shall read:

2-6.2.3 Provisions for Future Installation of a Gas Clothes Dryer. A recreational park trailer may be provided with gas piping to facilitate a future gas clothes dryer installation by the owner provided it complies with the following provisions: (a) Its gas outlet shall be provided with a shutoff valve, the outlet of which is closed by threaded pipe plug or cap; (b) Its gas outlet shall be permanently labeled to identify it for use only as the supply connection for a gas clothes dryer; (c) A moisture-lint exhaust duct system shall be roughed in by the manufacturer. The manufacturer shall provide written instructions to the owner on how to complete the exhaust duct installation in accordance with provisions of 2-6.2.1.

2-6.2.4 Provisions for Future Installation of an Electric Clothes Dryer. When wiring is installed to supply an electric clothes dryer for future installation by the owner, the manufacturer shall: (a) Provide a roughed in moisture- lint exhaust duct system; (b) install a receptacle for future connection of the dryer; (c) provide written instructions on how to complete the exhaust duct installation in accordance with the provisions of 2-6.2.1.

2-6.2.5 Clothes Dryers Installed in Closets or Alcoves. Each clothes dryer installed in closets or in alcoves shall be listed as suitable for such installation. Closets containing clothes dryers shall have ventilation openings sized in accordance with the appliance manufacturer's installation instructions.

2-6.3 Installation of Fuel-Burning Appliances.
2-6.3.1 General Installation Requirements. The installation of each appliance shall conform to the terms of its listing and the appliance manufacturer's installation instructions. Floor-mounted fuel-burning appliances shall not be installed on carpeting unless the appliance is listed for such installation. Every appliance shall be secured in place to avoid displacement.

2-6.3.2 Separation of Combustion System from Interior Atmosphere. All fuel-

burning appliances, except ranges, ovens, illuminating appliances, clothes dryers, solid fuel- burning fireplaces and fuel-burning fireplace stoves, shall be designed and installed to provide for the complete separation of the combustion system from the interior atmosphere of the recreational park trailer. Combustion air inlets and flue gas outlets shall be listed as components of the appliance. The required separation shall be permitted to be obtained by:
(a) The installation of direct-vent system (sealed combustion system) appliances, or
(b) The installation of appliances within enclosures so as to separate the appliance combustion system and venting system from the interior atmosphere. There shall not be any door, removable access panel, or other opening in to the enclosure from the inside of the recreational park trailer. Any opening for ducts, piping, wiring, etc., shall be sealed.

Exception: A fuel-burning appliance need not be of the direct vent type provided that it conforms to all of the following:
1. It is a vented appliance.
2. It incorporates provisions for introduction of combustion air from outside the vehicle.
3. It incorporates a safety control system that will prevent burner operation under any operating conditions that would allow products of combustion to discharge into the interior of the recreational park trailer.
4. It incorporates provisions either integral with the appliance design or by use of a safety control system(s) to protect against ignition of flammable materials which could come in contact with any heat source or part of the appliance.
5. It is listed for recreational vehicle installation and is installed within the terms of the listing.

2-6.3.3 Arrangement of Air Supply/Return to Appliances.
(a) A forced-air appliance and its return-air system shall be designed and installed so that negative pressure created by the air-circulating fan cannot affect its or another appliance's combustion air supply or act to mix products of combustion with circulating air.
(b) The air circulating fan of a furnace installed in an enclosure with another fuel-burning appliance shall be operable only when any door or panel covering an opening in the furnace fan compartment or in a return air plenum or duct is in the closed position.

NOTE: This does not apply if both appliances are direct-vent system (sealed combustion system) appliances.

(c) If a warm-air appliance is installed within an enclosure to conform to 2-6.3.2(b), each warm-air outlet and each return-air inlet shall extend to the exterior of the enclosure. Ducts, if used for that purpose, shall not have any openings within the enclosure and shall terminate at a location exterior to the enclosure.
(d) Cooling coils installed as a portion of, or in connection with, any forced-air furnace shall be installed on the downstream side unless the furnace is specifically other wise listed.
(e) A cooling coil shall not be located in the air discharge duct or plenum of any forced-air furnace unless such furnace is listed for use with a cooling coil or listed for operation at not less than 0.5 in. (0.125 kPa) water column external static pressure.
(f) If a cooling coil is installed within a forced-air furnace, the coil shall be listed for use with that furnace in the manner so installed or be approved for

such use.
(g) When an external heating appliance or combination cooling/heating appliance is to be applied to a recreational park trailer, the manufacturer shall make provision for proper location of the connection to the recreational park trailer supply system. This preparation shall include a pull wire or pre-wiring for a thermostat at the proper location.
(h) The installation of a self-contained air conditioner comfort cooling appliance that utilizes ducts common to the heating system shall meet the following requirements:
1. The installation of a duct common with an installed heating appliance shall require the installation of an automatic damper or other means to prevent the cooled air from passing through the heating appliance unless the heating appliance is certified or listed for such application and the supply system is intended for such an application.
2. The installation shall prevent the flow of heated air into the external cooling appliance and its connecting ducts to the recreational park trailer supply and return-air system during the operation of the heating appliance installed in the recreational park trailer.
3. The installation shall prevent simultaneous operation of the heating and cooling appliances.

2-6.4 Venting, Ventilation and Combustion Air.
2-6.4.1 Methods of Accomplishing Venting. The venting as required by 2-6.1.2 shall be accomplished by one or more of the methods given in (a) and (b) below:
(a) An integral vent system listed or certified as part of the appliance.
(b) A venting system consisting entirely of listed components, including roof jack, installed in accordance with the terms of the appliance listing and the appliance manufacturer's instructions (see 2-6.3.2).

2-6.4.2 Installation of Venting and Combustion Air Systems. Venting and combustion air systems shall be installed in accordance with the following:
(a) Components shall be securely assembled and properly aligned using the method shown in the appliance manufacturer's instructions.
(b) Draft hood connectors shall be firmly attached to draft hood outlets or flue collars by sheet metal screws or by an equivalent means.
(c) Every joint of a vent, vent connector, exhaust duct, and combustion air intake shall be secure and in alignment.

2-6.4.3 Location of Flue Gas Outlets of Fuel Burning Heating Appliances. Flue gas outlets from fuel-burning heating appliances shall be not less than 3 ft. (0.9 m) from any motor-driven air intake discharging into habitable areas of the recreational park trailer. Flue gas outlets shall not terminate underneath a recreational park trailer.

2-6.4.4 Ventilation of Areas Accommodating Fuel- Burning Cooking Appliances. The space in which any fuel-burning cooking appliance is located shall be ventilated by a gravity or mechanical vent extending through the roof to the outside. When a combination gravity/mechanical vent is installed, both operations must comply. A gravity vent shall have a free, clear, openable area not less than 1 sq. in. for every 2000 BTUH (11 cm21000 W) rated input of the appliance(s). The location of the vent shall be in the roof within 5 ft. (1.5 m) of any point directly above and unobstructed to the cooking appliance. Vent hood ducts shall be designed so that the duct outlet is located at such a point as to preclude the trapping of products of combustion.

Exception No. 1: Hooded gravity vents located directly above the appliance are permitted to exhaust through the sidewall. (See 2-6.8.2.)
Exception No. 2: Mechanical vents (exhaust fans) having a flow rating of 2 cfm (0.91m3m) for every 1000 BTUH (1000 W) rated input of the appliance are permitted to be located on an adjacent wall higher than the appliance within a horizontal distance of not more than 5 ft. (1.5 m) from the nearest edge of the appliance.

2-6.5 Marking Appliances (Installation and Operational Features).
2-6.5.1 Clearances, Input Ratings, Lighting and Shutdown. Information on clearances, input rating, lighting, and shutdown shall be attached to the appliances with the same permanence as the nameplate, and so located that it is easily readable when the appliance is properly installed.

2-6.5.2 Type(s) of Fuel. Each fuel-burning appliance shall bear the appliance manufacturer's permanent marking designating the type(s) of fuel for which it is listed. If listed and installed for use with either LP-Gas or natural gas, the appliance manufacturer's instructions regarding conversion from one fuel to the other shall be attached to the appliance with the same permanence as the nameplate.

2-6.6 Accessibility for Service/Operation. Every appliance shall be accessible for inspection, service, repair, and replacement without removing permanent construction, or other fuel-burning appliances. Sufficient room shall be available to enable the operator to operate the controls, start the appliance, and observe the ignition, for those appliances where the appliance manufacturer requires such procedure.

2-6.7 Location of Heat-Producing Appliances. Heat-producing appliances shall not be so located that doors, drapes, or other such material cannot be placed or swung closer to the appliance than the clearances specified on the labeled appliances.

2-6.8 Clearances of Heat-Producing Appliances.
2-6.8.1 Maintaining Listed Clearances. Clearances between heat-producing appliances and adjacent surfaces shall not be less than as specified in the terms of their listing. Clearance spaces shall be framed in or guarded to prevent creation of storage space within the clearance specified. The only exception to framing-in or guarding such spaces will be those necessary to allow access to shutoff valves or controls in order to comply with 2-4.9 and 2-6.3.1, in which case the unguarded area must have a warning tag, posted in an easily readable location, as follows:

2-6.8.2 Vertical Clearances of Ranges. Ranges shall have a vertical clearance between the cooking top and combustible material or metal cabinets in accordance with Table 2-6.8.2 or the terms of their listings.

TABLE 2-6.8.2

2-7 Circulating Air Systems.
2-7.1 Supply System Duct Materials.
(a) Air supply ducts shall be made of galvanized steel, tin-plated steel,

aluminized steel or aluminum, or made of Class 0 or Class 1 listed air ducts or air connectors as tested in accordance with UL 181, Standard for Factory Made Air Ducts and Connectors. A duct system integral with the structure shall be of durable construction that can be demonstrated to be equally resistant to fire and deterioration. Air ducts and plenums constructed of sheet metal shall be in accordance with Table 2-7.1.

TABLE 2-7.1

Minimum Metal Thickness for Ducts*
For SI Units: 1 in. = 25.4 mm.

(b) Ducts for External Appliances When Supplied:
1. Air ducts used for connecting external heating, cooling, or combination heating/cooling appliances to the supply system and return air system shall be listed by a recognized agency. Ducts applied to external heating appliances or combination heating/cooling appliance supply system outlets shall be constructed of metal in accordance with Table 2-7.1 or shall be listed Class 0 or Class 1 air ducts for those portions of the duct closer than 2 ft. (0.6m) from the outer casing of the appliance.
2. Ducts applied to external appliances or exposed directly to the outside air shall be insulated with material having a minimum thermal resistance of R4 with a continuous vapor barrier having a perm rating of not more than 1 perm and shall be resistant to deteriorating environmental effects including but not limited to ultraviolet rays, cold weather, or moisture, and shall be resistant to insects and rodents.

2-7.2 Sizing of Supply Ducts. Ducts shall be designed so that when a labeled forced-air furnace is installed and operated continually at its normal input rating in the recreational park trailer, with all registers in full open position, the static pressure measured in the duct plenum shall not exceed that shown on the label of the appliance. When an air-cooling coil is installed in the system, the total static pressure of the coil and the system shall not exceed that shown on the label of the appliance. The minimum dimension of any branch duct shall be at least 11/2 in. (38.1 mm) and of any main duct, 2 1/2 in. (63.5 mm).

2-7.3 Supply Duct System Test. A supply duct system shall be considered substantially airtight when the static pressure in the duct plenum with all registers sealed and with the furnace air circulator at high speed, is at least 80 percent of the static pressure measured in the duct plenum with its outlets sealed and the furnace air circulator operating at high speed. Pressures shall be measured with a water manometer or equivalent device calibrated to read in increments not greater than 1/10 in. (0.025 kPa) water column.

2-7.4 Return Air System Air Openings. Provisions shall be made to permit the return of circulating air from all rooms and living spaces to the circulating air supply inlet of the furnace, except that toilet rooms shall not be required to have return air openings.

2-7.5 Return Air Duct Materials. Return air ducts and diverting dampers, if used, shall be in accordance with the following:
(a) Portions of return air ducts directly above the heating surfaces, or closer than 2 ft. (0.6 m) from the outer jacket or casing of the furnace, shall be

constructed of metal in accordance with 2-7.1 or shall be listed Class 0 or Class 1 air ducts.
(b) Return air ducts, except as required in (a) above, shall be constructed of 1 in. (25 mm), nominal, wood boards (flame spread classification of not more than 200), or other suitable material no more combustible than 1 in. (25 mm) board. The interior of such combustible ducts (ducts of material other than as specified in 2-7.1) shall be lined with noncombustible material at points where there might be danger from incandescent particles dropped through the register or from the furnace, such as directly under the floor registers and bottom of vertical ducts or directly under furnaces having bottom return.

2-7.6 Sizing of Return Air Ducts. The cross-sectional area of the return air duct shall not be less than 2 sq in. for each 1000 BTUH (44 cm21000 W) input rating of the appliance. A complete ducted heating system need not comply with this return air duct sizing requirement if the numerical total of the static pressure at the inlet and the outlet of the appliance is equal to or less than that shown on the label of the appliance. Example: Supply Duct Static Pressure +0.10 in. w.c. and Return Air Duct Static Pressure -0.04 in. w.c. Numerical Total is 0.14 in. w.c. static pressure. Dampers shall not be placed in any return air duct, except that a diverting damper may be placed in a combination fresh air intake and return air duct so arranged that the required cross-sectional area will not be reduced at all possible positions of the damper.

2-7.7 Return Air Duct Permanent Unclosable Openings. Living areas not served by return air ducts and closed off from the return opening of the furnace by doors, sliding partitions, or other means shall be provided with permanent unclosable openings in the doors or separating partitions to allow circulated air to return to the furnace. Such openings may be grilled or louvered. The net free area of each opening shall be not less than 1 sq in. (6.5 cm2) for every 5 sq. ft. (0.46 m2) of total living area closed off from the furnace by the door or partition serviced by that opening. Undercutting doors connecting the closed-off area may be used as a means of providing return air area.

2-7.8 Air Duct Joints and Seams. Joints and seams of ducts shall be securely fastened and made substantially air tight. Slip joints shall have a lap of at least 1 in. (25 mm) and shall be individually fastened. Tape or caulking compound may be used for sealing mechanically secure joints. Where used, tape or caulking compound shall not be subject to deterioration under long exposures to temperatures up to 200°F (93.4°C) and to conditions of high humidity, excessive moisture, or mildew.

2-7.9 Air Duct Supports. Ducts shall be securely supported as recommended by the duct manufacturer, by metal straps or by the recreational park trailer structure.

2-7.10 Air Duct Registers or Grills. Fittings connecting the registers or grills to the duct system shall be constructed of metal or material which complies with the requirements for Class 0, or Class 1 air ducts under UL 181, Standard for Factory Made Air Ducts and Connectors. Registers or grills shall be constructed of metal or conform with the following:
(a) Be made of a material classified 94 V-0 or 94 V-1 when tested as described in UL 94, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
(b) Floor registers or grills shall resist without structural failure a 200 lb. (90.7 kg) concentrated load on a 2 in. (51 mm) diameter disc applied to the most

critical area of the exposed face of the register or grill. For this test the register or grill is to be at a temperature of not less than 165°F (74°C) and is to be supported in accordance with the manufacturer's instructions.

2-7.11 Penetration of Air Supply Ducts by Piping or Wiring. Air supply ducts shall not be penetrated by piping or by wiring except as permitted by section 300-22(b) of the National Electrical Code NFPA No. 70.

2-8 Comfort-Cooling Appliances.
2-8.1 Comfort Cooling Appliances Required. Air conditioning units or combination air conditioning and heating units when installed shall be listed for the application for which the unit is intended and installed in accordance with the terms of its listing.

2-8.2 Heat Pumps. Heat pumps when installed shall be listed in the ARI Directory of Certified Unitary Heat Pumps or certified to comply with the requirements of ARI Standard 240-74, The Standard for Unitary Heat Pump Equipment. A control shall be provided and set to prevent operation of supplemental electrical resistance heat at outdoor temperatures above 40°F, except for defrost operation.

2-8.3 Securing of Appliances. Appliances shall be secured in place to avoid displacement and movement from vibration and road shock.

2-8.4 Location of Appliance Rating Plate. The appliance rating plate shall be located so that it is easily readable when the appliance is installed.

2-8.5 Accessibility of Installed Appliances. Every in stalled appliance shall be accessible for inspection, service, repair and replacement without removing permanent construction.

2-9 Consumer Information.
2-9.1 Required Information.
2-9.1.1 Installation Instructions for LP-Gas Supply Systems. When LP-Gas containers are not provided by the recreational park trailer manufacturer, instructions shall be provided for installation methods, material and components for field application of the LP-Gas supply system. These instructions shall be consistent with 2-2.1 through 2-2.8.3.

2-9.1.2 Instructions for Appliances. Operating instructions shall be provided for each appliance, including air-conditioning appliances.

2-9.1.3 Owner's Manual. Each recreational park trailer shall be provided with an owner's manual which shall contain the following information as a minimum:

2-9.1.3.1 WARNING: LP-Gas containers shall not be placed or stored inside the vehicle. LP-Gas containers are equipped with safety devices which relieve excessive pressure by discharging gas to the atmosphere.

2-9.1.3.2 WARNING: IT IS NOT SAFE TO USE COOKING APPLIANCES FOR COMFORT HEATING. Cooking appliances need fresh air for safe operation. Before operation:
1. Open overhead vent or turn on exhaust fan, and
2. Open window.

This warning label has been located in the cooking area to remind you to provide an adequate supply of fresh air for combustion. Unlike homes, the amount of oxygen supply is limited due to the size of the recreational park trailer, and proper ventilation when using the cooking appliance(s) will avoid dangers of asphyxiation. It is especially important that cooking appliances not be used for comfort heating as the danger of asphyxiation is greater when the appliance is used for long periods of time.

2-9.1.3.3 A warning label has been located near the LP-Gas container location. This label reads:

Overfilling the LP-Gas container can result in uncontrolled gas flow which can cause fire or explosion. A properly filled container will contain approximately 80 percent of its volume as liquid LP-Gas.

2-9.1.3.4 A warning that portable fuel-burning equipment, including wood and charcoal grills and stoves, shall not be used inside the recreational park trailer. The use of this equipment inside the recreational park trailer may cause fires or asphyxiation.

2-9.1.3.5 A warning which states not to bring or store LP-Gas containers, gasoline, or other flammable liquids in side the vehicle because a fire or explosion may result.

2-9.1.3.6 The following label has been placed in the vehicle near the range area:

IF YOU SMELL GAS:
1. Extinguish any open flames, pilot lights, and all smoking materials.
2. Do not touch electrical switches.
3. Shut off the gas supply at the tank valve(s) or gas supply connection.
4. Open doors and other ventilating openings.
4. Leave the area until odor clears.
6. Have the gas system checked and leakage source corrected before using again.

2-9.1.3.7 LP-Gas regulators must always be installed with the diaphragm vent facing downward. Regulators that are not in compartments have been equipped with a protective cover. Make sure the regulator vent faces downward and the cover is kept in place to minimize vent blockage which could result in excessive gas pressure causing fire or explosion.

2-9.2 Required Markings.
2-9.2.1 Identification of Gas Supply Connections. Each recreational park trailer shall have permanently affixed to the exterior skin at or near each gas supply connection, or at the end of the pipe, a plate complying with the requirements for exterior labels (see 1-4.1) 3 in. (76 mm) by 1 in. (44 mm) minimum size which reads (as appropriate) either:

2-9.2.2 Warning Relative to Refueling. Each vehicle shall have a permanent label adjacent to the LP-Gas container which reads:

NOTE: The above label, where required near the LP-Gas containers, may be incorporated in the plates required in 2-9.2.1.

2-9.2.3 Warning if Gas Odor is Detected. When LP-Gas fuel-burning equipment is installed by the recreational park trailer manufacturer, a permanent label with 3/8 in. (9 mm) high title letters and 1/8 in. (3 mm) high text letters shall be affixed in a noticeable location near the range.

NOTE: This label may be affixed to the back of a cabinet door providing the cabinet door will be frequently used.

2-9.2.4 Warning Label for Cooking Appliances. A permanent warning label with the word "WARNING" with 3/8 in. (9 mm) high letters and body text with 1/8 in. (3.2 mm) high letters shall be affixed in a conspicuous manner adjacent to fuel-burning ranges and shall read:

2-9.3 Set-up and Consumer Manual. The manufacturer shall supply complete set-up and consumer maintenance instructions with each Recreational Park Trailer. These instructions shall include location of blocking, anchors, including stabilizing plates and all special instructions.

CHAPTER 3 — HEALTH, FIRE ANDLIFE SAFETY SPECIAL PROVISIONS

3-1 Space, Light, and Ventilation.
3-1.1 Space.
3-1.1.1 General Use. Recreational park trailers shall provide space which shall comply with the general objectives for cooking, dining, living and sleeping. A range or appropriate space for installation of a range shall be provided.

3-1.1.2 Bath. Recreational park trailers shall have a minimum of one lavatory, one water closet and one tub or shower. These fixtures shall not be required to be in the same room.

3-1.1.3 Room Height. Every habitable room and bathroom shall have a minimum ceiling height of not less than 6 ft., 6 in. for a minimum of 50 percent of the room's floor area. The remaining area may have a ceiling with a minimum height of 6 ft., 0 in. Minimum height of room extensions shall be 5 ft., 0 in.

3-1.2 Light and Ventilation.
3-1.2.1 Habitable Rooms. Habitable rooms shall be provided with exterior windows, skylights, or doors having a total glazed area of not less than 8 percent of the room gross floor area. An area equivalent to not less than 4 per

cent of the room gross floor area shall be openable for ventilation.

3-1.2.2 Bathroom. Each bathroom shall be provided with artificial light and, in addition, be provided with external windows or vents having not less than one square foot of fully openable area except where a mechanical ventilation system to the exterior is provided capable of producing a change of air every 12 minutes.

3-2 Interior Finish

3-2.1 Interior Finish Flame Spread Limitations. Interior Finish (as defined in Section 1-3) of walls, partitions, ceilings, cabinets, habitable areas, hallways, and bath or toilet rooms, including shower/tub walls of recreational park trailers shall be of materials whose flame spread classification does not exceed 200 when tested in accordance with NFPA 255, The Standard Method of Test of Surface Burning Characteristics of Building Materials.

An alternate method of testing for cabinet door and drawer faces, exposed cabinet bottoms and end panels, and tub/shower walls shall be permitted to use the ASTM E162, Test for Surface Flammability of Materials Using a Radiant Heat Energy Source, to establish the flame spread rating not to exceed 200.

Exception: These flame spread limitations do not apply to moldings, decorative trim, furnishings, windows, doors, skylights or their frames, interior passage doors, countertops, cabinet rails, stiles, mullions, toe kicks and padded cabinet ends.

3-2.2 Use of Cellular Foam or Foamed Plastic Materials. Cellular foam or foamed plastic materials shall not be used for interior finish (as defined in 1-3) in recreational park trailers.

Exception No. 1: Cellular or foamed plastic materials shall be permitted on the basis of fire tests which substantiate on a reasonable basis their combustibility characteristics, for the use intended, in actual fire conditions.

Exception No. 2: Incidental use of such materials for molding, trim, splash panels and on doors shall be permitted.

3-2.3 Interior Finish of Fuel-Fired Furnace and Water Heater Enclosures. Walls, doors, and ceilings of fuel-fired furnace and/or fuel-fired water heater enclosures shall be finished in materials whose flame spread classification does not exceed 25 when tested in accordance with NFPA 255, The Standard Method of Test for Surface Burning Characteristics of Building Materials and which provide fire protective characteristics equivalent to 5/16 in. gypsum or better. All openings, including those for pipes or vents, in furnace or water heater compartments shall be tightfitted or firestopped.

Exception: Fuel-fired, direct-vent furnaces and water heaters listed for use in recreation vehicles shall not be required to be surrounded by material having a flame spread classification of 25 or the equivalent of 5/16 in. of gypsum.

3-2.4 Protection of Cabinets Above the Cooking Range. Combustible vertical cabinet face(s) and door(s) directly above the range or range space shall be protected for the full width of the range by a hood with a metal eyebrow extending not less than 2 1/2 in. (63.5 mm) measured horizontally out from the cabinet face.

Exception: The metal hood may be omitted when an oven designed for this purpose is installed between the range and the overhead cabinet.

3-3 Exit Facilities.

3-3.1 Minimum Exit Facilities. Recreational park trailers shall have a minimum of two exits located remote from each other and so arranged as to provide a means of unobstructed travel to the outside of the vehicle. Each bedroom or area designed for sleeping shall have at least two unobstructed paths to exit. The path to exit must not require passing any designated exit to gain use of another designated exit except when any part of a bed in its normal sleeping configuration is within 24 in. of the nearest designated exit.

3-3.2 Access to Alternate Exit. The path leading to an alternate exit shall be not less than 13 in. (330 mm) wide at the narrowest point and as a minimum shall extend vertically from the supporting surface below the alternate exit to the top of the alternate exit. The supporting surface shall be not more than 3 ft. (0.9 m) below the bottom of the alternate exit and shall be capable of supporting a weight of 300 lb. (136 kg).

3-3.3 Operation of Exits. The latch mechanism of any required exit facility shall be operable by hand, and shall not require the use of key or special tool for operation from the inside. No more than 20 pounds of force shall be required to open a required exit.

3-3.4 Size of Alternate Exits. The alternate exit, if not an exterior passage door, shall provide an unobstructed opening of at least 484 sq. in. (3122 sq. cm) with a minimum dimension of 22 in. (558 mm) in any direction. An exterior passage door if used for an alternate exit shall provide an unobstructed opening with a minimum horizontal dimension of 18 in. (457 mm) and a minimum vertical dimension of 48 in. (1.4 m).

3-3.5 Marking of Exits. Alternate exits other than exterior passage doors shall be identified by a waterproof label with the word "EXIT" in a minimum size 1 in. (25.4 mm) red letters on a contrasting background. Label shall be placed on interior wall surface above or below the exit, or on interior ceiling surface, within 8 in. (203 mm) of the opening in an unobscured visible location.
Exception: If surface is unsuitable for adherence of label adhesive or if no such unobscured location is available, label shall be installed on the interior of the exit frame or the movable portion of the exit approximately midway between the sides.

3-3.6 Identification of Exit Handles. Handles that must be operated to open alternate exits shall be colored red.
Exception: Exterior and interior passage door handles need not be colored.

3-4 Fire Detection Equipment.
3-4.1 Smoke Detector. At least one smoke detector, which shall be an integral battery-operated device, shall be installed in each recreational park trailer.
Exception: A recreational park trailer that has interior lighting capable of being powered only by a 120-volt or 120/240-volt external power supply may be equipped with a 120-volt operated smoke detector which shall be on a branch circuit supplying lighting and receptacle outlets and shall not have ground fault protection.

3-4.2 Smoke Detector Listing Requirement. The required smoke detector shall be listed, and marked on the device as being suitable for installation in recreational vehicles under the requirements of UL 217, Single and Multiple Station Smoke Detectors. (Also see Appendix A, A-3-4.2.)

3-4.3 Installation of Smoke Detector. The smoke detector shall be installed in accordance with its listing, but not within the separate sleeping areas, a minimum of 6 in. (152 mm) from all exterior walls measured edge to edge and away from the direct flow of air from heat and air-conditioning outlets.

3-4.4 Operational Check Warning Label. A permanent label shall be installed in a visible location within 24 in. (610 mm) of the smoke detector with the following text in contrasting letters at least 1/8 in. (3.2 mm) high:

3-5 Other Considerations.

3-5.1 Provision for Portable Fire Extinguishers. Each recreational park trailer shall be provided with a listed portable fire extinguisher with a minimum rating of 5B:C as defined in the NFPA 10, The Standard for the Installation of Portable Fire Extinguishers which shall be located in accordance with the fire extinguisher manufacturer's instructions.

3-5.2 Rodent Resistance. Exterior surfaces shall be sealed to resist the entrance of rodents.

3-5.3 Moisture Resistance. Wood floors or subfloors in kitchens, bathrooms (including toilet compartments), laundry areas, water heater compartments, and other areas subject to excessive moisture shall be made moisture resistant by sealing or by an overlay of nonabsorbent material applied with water resistant adhesive.

3-5.4 Anchoring Systems. Each recreational park trailer shall be equipped with at least three vertical (sidewall) ties with provisions for attachment of not less than six ground anchors to the recreational park trailer chassis shall be provided. When over-the-roof ties are provided, strapping shall conform to Federal Specification QQS 781-H American Society for Testing and Materials (ASTM) 3953-91. Tie-down (aircraft) cables shall conform to Military Specification MIL-W-8320.

3-5.5 Resistance to Elements. Exterior coverings and openings for window equipment or vents shall be designed to resist the infiltration of air and water into the roof or wall cavity except for designed ventilation.

3-5.6 Condensation Control. Ceiling cavities shall have a vapor barrier having a permenance no greater than 1 perm (dry cup method) on the interior side of (under) the insulation.

Exception: Ceiling panels faced with polyvinylchloride film of at least 4 mils (0.004 in., 0.10 mm) thickness shall be deemed to meet this requirement.

3-5.7 Insulation. Installed insulation shall be rated by the insulation manufacturer, prior to installation, a minimum of R-7 in ceiling cavity and a minimum of R-5 in wall and floor cavities.

CHAPTER 4 — PLUMBING SYSTEMS

4-1 Introduction.

4-1.1 Need for Chapter. Those members of the engineering profession and others associated with the design, manufacturing, installation, and inspection of recreational park trailer plumbing systems have been aware of the need for uniform technical standards leading to the safe and sanitary use of this special type of equipment. They have also recognized that because of conditions of transport and use, existing plumbing standards for permanent buildings are not completely applicable to recreational park trailers. It is with these factors in mind that chapter 4 of this standard has been developed.

4-1.2 Basis for Chapter. Much of the material in Chapter 4 has been taken from, or is based on, nationally recognized standards for plumbing materials, fixtures, fittings, and equipment. Applicable standards are shown in Appendix C. All standards are the latest edition.

4-2 Scope of Chapter.
4-2.1 Coverage of Chapter. Chapter 4 of this standard covers the plumbing materials, fixtures, fittings, and equipment installed within or on recreational park trailers.

4-2.2 Limitations of Chapter. Chapter 4 of this standard is not intended as a design specification or an instruction manual.

4-2.3 Alternate Materials, Equipment and Procedures. The provisions of this standard are not intended to prevent the use of any material, method of construction, or installation procedures not specifically prescribed by this standard, provided any such alternate is acceptable to the authority having jurisdiction. The authority having jurisdiction shall require that sufficient evidence be submitted to substantiate any claims made regarding the safety of such alternates.

4-2.4 Differing Standards. Wherever other nationally recognized standards for plumbing materials, fixtures, fittings, and equipment and this chapter differ, the requirements of the latter shall apply.

4-3 Definitions Applicable to Chapter 4.
Accessible, as applied to a fixture, connection, appliance, or equipment. Having access thereto, but such access may require the removal of an access panel, door, or similar obstruction.

Air Gap. The unobstructed vertical distance through the free atmosphere between the opening from any pipe or faucet supplying potable water to a tank, plumbing fixture, or other device and the flood-level rim of the receptacle.

Anti-Siphon Trap Vent Device. A device which automatically opens to admit air to a fixture drain above the connection of the trap arm so as to prevent siphonage, and closes tightly when the pressure within the drainage system is equal to or greater than atmospheric pressure so as to prevent the escape of gases from the drainage system into the recreational park trailer.

Approved. Acceptable to the authority having jurisdiction.

NOTE: In determining the acceptability of installation or procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with this or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation,

procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluation, which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

NOTE: This phrase is used in a broad manner since jurisdictions and approval agencies vary as to their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances the property owner or his designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Backflow. The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended source.

Backflow Preventer. A device or means to prevent backflow.

Body Waste. The discharge from any fixture, appliance, or appurtenance containing fecal matter or urine.

Branch. Any part of the piping system other than a riser, main, or vent stack.

Branch Vent. A vent connecting one or more individual vents with a vent stack.

Center. The midpoint between the right and left side of a recreational park trailer.

Check Valve. A mechanical valve that permits the flow of liquid in only one direction.

Combination Compartment. A shower stall or recess that provides for or includes the installation of a toilet and is of such size and proportions that it may not be occupied by more than one person.

Common Vent. A vent connecting at the junction of fixture drains and serving as a vent for more than one fixture.

Continuous Vent. A vertical vent that is a continuation of the drain to which it connects.

Continuous Waste. A drain from a maximum of two fixtures connected to a single trap.

Cross Connection. Any physical connection or arrangement between two otherwise separate systems or sources, one of which contains potable water

and the other either water, steam, gas, or chemical of unknown or questionable safety, whereby there may be a flow from one system or source to the other, the direction of flow depending on the pressure differential between the two systems.

Developed Length. That length of pipe measured along the center line of the pipe and fittings.

Diameter. The nominal inside diameter designated commercially.

Drain. A pipe that carries waste, water, or liquid-borne wastes in a drainage system.

Drain Hose. A hose used for connecting the liquid and/ or body waste drain outlet to a sewer inlet connection.

Drain Outlet. The lowest end of a main or secondary drain to which a sewer connection is made.

Drainage System. All piping within or attached to the structure that conveys body waste and/or liquid waste to the drain outlet or outlets.

Fixture Drain. The drain from a fixture's trap to the drain outlet or to the junction of the drain with any other drain pipe.

Fixture (Plumbing). Receptacles, devices, or appliances which are supplied with water or which receive liquid or liquid-borne wastes for discharge into the drainage system.

Fixture Supply. The water supply pipe connecting a fixture to a branch water supply pipe or directly to a main water supply pipe.

Flooded. The condition which results when the liquid in a container or receptacle rises to the flood level.

Flood Level. The level in the receptacle over which water would overflow to the outside of the receptacle.

Flush Tank. The portion of a toilet that is designed to contain sufficient water to adequately flush the fixture.

Flush Valve. A device located at the bottom of a flush tank for flushing a toilet.

Flushometer Valve. A device which discharges a predetermined quantity of water to a fixture for flushing purposes and is closed by direct water pressure.

Grade. See "Slope."

Horizontal Branch. A drain pipe extending laterally, which receives the discharge from one or more fixture drains and connects to the main drain.

Horizontal Pipe. A pipe or fitting that forms an angle of 45 degrees or less with the horizontal.

Individual Vent. A pipe or antisiphon trap vent device installed to vent a single

fixture drain.

Inlet Coupling. The terminal end of the water system to which the water service is attached. It may be a swivel fitting or threaded pipe end.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling of the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Liquid Waste. The discharge from any fixture, appliance, area or appurtenance which does not contain body waste.

Listed. Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

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

Main. The principal artery of the system to which branches may be connected.

Main Drain(s). The lowest piping of a drainage system which receives the liquid and/or body waste discharge from all the fixtures within the system and conducts these wastes to the drain outlet(s).

Manual Disconnect. A joint or connection that can be disassembled without tools.

Offset. A combination of pipe and/or fittings that brings one section of the pipe out of line but into a line parallel with the other section.

Pitch (or Grade). See "Slope."

Plumbing System. The water supply and distribution pipes, plumbing fixture and traps, soil, waste and vent pipes, and water-treating or water-using equipment.

Potable Water Storage Tank. A tank installed in a recreational park trailer for the purpose of storing potable water.

Primary Vent. The main vent of the vent system which is open to the outside atmosphere.

Relief Vent. An auxiliary vent which permits additional circulation of air in or between drainage and vent systems.

Secondary Vent. Any vent other than the primary vent or those serving a toilet or holding tank.

Shall. Indicates a mandatory requirement.

Siphonage. The loss of a water seal from fixture traps resulting from a partial vacuum in the drainage system which may be either of the following two types, or a combination of the two: (a) self-siphonage resulting from a vacuum in a fixture drain generated solely by the discharge of the fixture served by that drain, or (b) induced siphonage resulting from a vacuum in the drainage system generated by the discharge of one or more fixtures other than the one under observation.

Slope. A grade or fall of a line of pipe in reference to a horizontal plane. In drainage, it is usually expressed as the fall in a fraction of an inch (or mm) or percentage slope per foot (or meter) length of pipe.

Toilet - Flush (Water Closet). A toilet that conforms with ANSI A112.19.2M or Z124.4.

Toilet - Mechanical Seal. A toilet fitted with a water-flushing device and mechanically sealed trap.

Toilet - Recirculating Chemical. A self-contained, recirculating toilet in which the waste is chemically treated.

Toilet - Trap Arm. The piping between the toilet and its vent which receives the discharge from each individual toilet.

Trap. A fitting or device designed and constructed to provide a liquid seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

Trap Arm. That portion of a fixture drain between a trap and its vent.

Trap Seal. The vertical depth of liquid that a trap will retain.

Vacuum Breaker. A device that prevents back siphonage by allowing air into the system.

Vent Systems (Waste). A pipe or pipes installed to provide a flow of air to or from a drainage system to provide a circulation of air within such system to protect trap seals from siphonage and back-pressure.

Vertical Pipe. Any pipe or fitting which makes an angle of 45 degrees or less with the vertical.

Waste Holding Tank. A liquid-tight tank for the temporary retention of body and/or liquid waste.

Water Connection. The fitting or point of connection for the water distribution system designed for connection to a water supply.

Water Distribution System. The potable water piping within or permanently attached to the recreational park trailer.

Water Service Connection. The fitting or point of connection of the vehicle water distribution system designed for connection to a potable water supply.

Wet Vent. A vent which also serves as a drain for one or more fixtures.

Wet Vented Drainage System. The specially designed system of drain piping that also vents one or more plumbing fixtures by means of a common waste and vent pipe.

4-4 Plumbing System, General Requirements.
4-4.1 Minimum Requirements. Any plumbing system installed in a recreational park trailer shall conform, at least, with the provisions of this standard. Requirements for any size, weight, or quality of material modified by the terms "minimum," "not less than," "at least," and similar expressions are "minimum standards."

4-4.1.1 Connections to Drainage System. All plumbing fixtures, drains, appurtenances, and appliances designed or used to receive or discharge liquid waste or body waste shall be connected to the recreational park trailer drainage system in a manner provided by this standard.

4-4.1.2 Components. Plumbing materials, devices, fixtures, fittings, equipment, appliances, accessories and appurtenances installed in or attached to a recreational park trailer shall conform to minimum standards and shall be listed or shall be specifically approved by the authority having jurisdiction when listing by an approved listing agency is not available. All listed components shall be installed in accordance with the terms of their listing.

4-4.1.3 Component Installations. All design, construction and workmanship shall be in conformance with accepted engineering practices.

4-4.1.4 Alignment of Fittings. All valves, pipes and fittings shall be installed in correct relationship to the direction of flow.

4-4.1.5 Assembling of Pipe. All joints and connections shall be correctly assembled for tightness. Pipe threads shall be fully engaged with the threads of the fittings. Pipe threads and slip joints shall not be wrapped with string, paper, putty or similar fillers. Plastic pipe and copper tubing shall be inserted to the full depth of the fitting sockets.

4-4.1.6 Solder Fittings/Joints. Solder joints for copper tubing shall be made with approved or listed sweat solder type fittings. Surfaces to be soldered shall be cleaned bright. The joints shall be properly fluxed with non-corrosive, water soluble paste-type flux and made with approved solder that contains less than two-tenths of one percent of lead. The use of self-cleaning fluxes shall not be permitted.

NOTE: For purposes of this section, the term 'lead free' when used with respect to:
1. solders and flux, refers to solders and flux containing not more than two-tenths of one percent lead, and
2. pipes and pipe fittings, refers to pipes and pipe fittings containing not more than eight (8.0) percent lead.

4-4.1.7 Union Joints. Metal unions shall have metal-to- metal ground seats.

4-4.2 Prohibited Practices.
(a) Piping, fixtures or equipment shall be located so as not to interfere with the normal use or operation of windows, doors or other required facilities.
(b) Fittings, connections, devices or methods of installation that obstruct or retard the flow of liquid waste, body waste or air in the drainage or venting systems in an amount greater than the normal frictional resistance to flow shall not be used unless their use is acceptable in the standard or their use approved.
(c) Drainage or vent piping shall not be drilled and tapped for the purpose of making connections.
(d) Cracks, holes or other imperfections in piping and fittings shall not be concealed by welding, brazing or soldering or by paint, wax, tar or other leak-sealing or repairing agents.
(e) Galvanized pipe shall not be bent or welded.

4-4.3 Protective Requirements.
(a) Piping and electrical wiring shall not pass through the same holes in walls, floors, or roofs. Plastic piping shall be permitted to be installed not less than 2 in. (51 mm) from a double-walled flue and shall maintain a minimum 6 in. (152 mm) clearance from any open flame or single- walled flue.
(b) Heat Tape. A receptacle outlet for the use of a heat tape located on the underside of a recreational park trailer shall be within 2 feet of the water supply inlet. The receptacle outlet provided shall not be placed on a branch circuit that is protected by a ground fault circuit interrupter.

4-4.4 Plumbing System Hangers and Supports.
4-4.4.1 Strains and Stresses. Piping in a plumbing system shall be installed without undue strains and stresses, and provision shall be made for expansion and contraction.

4-4.4.2 Hangers and Anchors. Piping shall be securely attached to the structure by proper hangers, clamps or brackets which provide protection against damage from motion, vibration, road shock, torque in the chassis or other unusual conditions. Hangers and anchors shall be of sufficient strength to support their proportional share of the pipe and prevent rattling.

4-5 Plumbing Fixtures.
4-5.1 General Requirements.
4-5.1.1 Quality of Fixtures. Plumbing fixtures shall have smooth impervious finishes, be free from defects and concealed fouling surfaces, be capable of resisting road shock and vibration, and shall conform in quality and design to approved or listed standards.

4-5.1.2 Unobstructed Drain Fittings. The waste outlet of all plumbing fixtures, other than toilets, shall be equipped with a drain fitting that will provide an adequate unobstructed waterway.

4-5.1.3 Fixture Connections. Fixture tailpieces and continuous wastes in exposed or accessible locations shall not be less than No. 20 Brown and Sharpe gauge seamless drawn brass tubing or other approved pipe or tubing materials. Fixture connections shall be constructed according to the requirements for

drainage piping. Each fixture tailpiece, continuous waste, or waste and overflow shall be not less than 1 1/2 in. (38 mm) for sinks with garbage disposal units, dishwashers, clothes washing machines, and laundry tubs, and not less than 1 1/4 in. (32 mm) for all other fixtures except toilets.

4-5.1.4 Length of Tailpiece. The vertical distance from the fixture outlet to the trap shall not exceed 24 in. (610 mm). The horizontal distance from the fixture's outlet to the trap shall not exceed 30 in. (762 mm).

4-5.1.5 Concealed Connections. Concealed slip joint connections shall be provided with adequately sized unobstructed access panels and shall be accessible for inspection and repair.

4-5.1.6 Directional Fittings. An approved or listed "Y" or other directional-type branch fitting shall be installed in every tailpiece or continuous waste that receives the discharge from food waste disposal units, dishwashing or other force discharge fixtures or appliances (see also 4-7.5.4).

4-5.1.7 Installation.
(a) Access. Each plumbing fixture and standpipe receptor shall be located and installed in a manner to be accessible for usage, cleaning and repair.
(b) Alignment. Fixtures shall be set level.
(c) Support. Wall-hung fixtures shall be rigidly attached to walls by metal brackets or supports so that excessive force is not transmitted to the piping connections. Flush tanks shall be securely fastened to toilets or to the wall with corrosion resistant materials.

4-5.2 Toilets.
4-5.2.1 Recirculating or Mechanical Seal Types. Recirculating or mechanical seal toilets shall be permitted to provide for storage of liquid and body waste as an integral part of the unit. When a mechanical seal toilet does not contain storage for retention of liquid and body waste, it shall be connected to an approved waste holding tank.

4-5.2.2 Water Closet (Flush Toilets). Flush toilets shall not be installed in a system that incorporates a body waste holding tank.

4-5.2.3 Floor or Tank Connections. Toilets, when directly connected to a waste holding tank or drainage system, shall be securely bolted to either the tank or other approved fitting. Bolts used to attach the toilet to the flange shall be of brass or equally corrosion resistant material, and shall not be less than 1/4 inch (6 mm) in diameter. Screws or bolts used to attach the flange to the floor shall be of brass, zinc or cadmium plated steel or other approved corrosion resistant material, and shall not be less than 1/4 in. (6 mm) in diameter. A watertight seal shall be made between the toilet and flange or other approved fittings by the use of a gasket or sealing compound.

4-5.3 Shower Stalls.
4-5.3.1 Shower Stall Receptors. Each compartment stall shall be provided with an approved water-tight receptor with sides and back extending 1 in. (25 mm) above the finished dam or threshold. In no case shall the depth of a shower receptor be less than 2 in. (51 mm) or more than 9 in. (229 mm) measured from the top of the finished dam or threshold to the top of the drain. The wall area shall be constructed of smooth, noncorrosive, and nonabsorbent waterproof materials to a height not less than 70 in. (178 cm) above the top of

the drain, or to the ceiling if less than 70 in. (178 cm) above the top of the drain. Such walls shall form a water-tight joint with each other and with the receptor or shower floor.

4-5.3.2 Drain Connection. The joint around the drain connection and around the toilet outlet in combination compartments shall be made water-tight by a flange, clamping ring or other approved or listed means.

4-5.3.3 Shower Doors and Tub and Shower Enclosures. Shower doors and tub and shower enclosures shall be constructed so as to be waterproof and, if glazed, shall be glazed with safety glazing materials conforming to ANSI Z97.1, The Standard for Transparent Safety Glazing Material Used in Buildings. Hinged, swinging shower doors shall open outward.

4-6 Water Distribution Systems.
4-6.1 Materials.
4-6.1.1 Piping Materials. Water pipe shall be of standard weight brass, galvanized wrought iron, galvanized steel, Type K, L or M copper tubing, listed plastic or other approved or listed material.

4-6.1.2 Fittings.
(a) Appropriate fittings shall be used for all changes in size and where pipes are joined. The material and design of fittings shall conform to the type of piping used.
(b) Fittings for screw piping shall be standard weight galvanized iron for galvanized iron and steel pipe, and of brass for brass piping. They shall be installed where required for change in direction, reduction of size, or where pipes are joined together.
(c) Fittings for copper tubing shall be cast brass or drawn copper sweat solder pattern or flare type.
(d) Faucet fittings shall be accessible for removal and repair.

4-6.1.3 Hot-Water Supply. Each recreational park trailer shall be provided with a hot-water supply system.

4-6.1.4 Prohibited Practices.
(a) Used piping materials shall not be permitted.
(b) Plastic pipe, tubing and fittings shall not be used in water systems containing water heating devices unless such pipe and fittings are listed for use in hot water systems.

4-6.2 Installation of Piping.
4-6.2.1 Screw Pipe. Iron pipe-size brass or galvanized iron or steel pipe and fittings shall be joined with approved or listed standard pipe threads fully engaged in the fittings. Threads for screw pipe and fittings shall conform to the approved or applicable standard. Pipe ends shall be reamed out to size of bore, and all chips and cutting oil shall be removed. Pipe joint compound or thread lubricant shall be insoluble in water, shall be non-toxic, and shall be applied to male threads only.

4-6.2.2 Flared Fittings. A flaring tool shall be used to shape the ends of flared tubing to match the flare of fittings.

4-6.3 Line Valves. Valves, other than those controlling a single fixture, when installed in the water supply distribution system shall, when fully opened, have

a cross-sectional area at least equal to the nominal size of the pipe in which the valve is installed.

4-6.4 Drainage Provisions. The water distribution system shall be installed to provide for gravity drainage of the system and water storage tank.

4-6.5 Water Supply.
4-6.5.1 Sizing of Water Supply Piping. Piping systems shall be sized to provide an adequate quantity of water to each plumbing fixture at a flow rate sufficient to keep the fixture in a clean and sanitary condition without any danger of backflow or siphonage. The size of water supply piping and branch lines shall not be less than shown in Table 4-6.2.4.

NOTE: A water heater or ice maker shall not be counted as a water-using fixture when computing pipe sizes.

TABLE 4-6.5.1

Minimum Size Tubing and Pipe for Water Distribution Systems*

	Tubing	Pipe

4-6.5.2 Potable Water Storage Tanks. If the tank is installed in such a manner that it is subject to road damage, it shall be protected. Each non-pressure or gravity tank shall be equipped with a vent at the top of the tank to assist in filling and drainage.

4-6.5.3 Labeling of Potable Water Tank Inlets. Each inlet to a potable water tank shall have an affixed label which shall read:

WARNING: POTABLE WATER ONLY.
SANITIZE, FLUSH, AND DRAIN
BEFORE USING.
SEE INSTRUCTIONS MANUAL.

Instructions for proper sanitizing of water distribution systems shall be consistent with those recognized by the U.S. Public Health Service and shall be furnished with each vehicle.

4-6.6 Water Service Connections, Outlets and Backflow Prevention.
4-6.6.1 Water Service Connection. Each recreational park trailer with a water distribution system sized as required in Table 4-6.2.4, which may be connected to an outside source, shall be equipped with a 3/4 in. (19 mm) swivel female hose water service connection. A matching cap or plug shall be provided to close the water inlet when it is not in use and shall be attached in a secured manner.

4-6.6.2 Prohibited Connections.
(a) The installation of potable water supply piping or fixture or appliance connections shall be made in a manner to preclude the possibility of backflow (see 4-6.6.4).
(b) No part of the water system shall be connected to any drainage or vent

piping.

4-6.6.3 Water Outlets.
(a) Unless they are individually protected by a listed backflow preventer or anti-siphon device, the outlets of faucets, spouts, and similar devices shall be spaced at least 1 in. (25.4 mm) above the flood level of the fixture.
(b) Valved hose outlets shall be installed to preclude a cross connection. It shall be permitted to use vacuum breakers, hose length, or use of a permanently secured retaining device. When using hose length or a retaining device, the extreme end of the assembly must be a minimum of 2.0 inches (50.8 mm) above the flood plane of the closest fixture.
(c) An outside shower hose assembly shall have a vacuum breaker to preclude cross connection unless the extreme end of the assembly is more than 12 inches (204.8 mm) above the ground in it's free hanging position.

4-6.6.4 Backflow Preventer. When pressurized or non-pressurized water storage tanks or reservoirs (except water heaters) for storing potable water are connected to the water distribution system of recreational park trailers, which have a water service connection for an outside source of supply, they shall have an approved or listed check valve or other approved or listed-type backflow prevention device installed in the water supply piping adjacent to the water service connection.

4-6.7 Safety Devices.
4-6.7.1 Temperatures and Pressure Relief Valve. Every water heating system shall be protected against over temperature and over-pressure by an approved, listed, and adequately sized temperature and pressure relief valve. Such valves rated at not more than 150 psi (1034 kPa) and 210°F (98.9°C) shall be acceptable for the protection of systems constructed of materials authorized by 4-6.1.

4-6.7.2 Relief Valve Drain. The relief valve, if located inside the recreational park trailer, shall be equipped with a full size drain, able to withstand 225°F (107°C) which shall extend outside, with the end directed downward, except that no drain shall be required if the relief valve discharges into an area sealed off from the inside of the vehicle and drained and ventilated to the outside. The discharge end of the drain shall not be equipped with a thread or other means of capping or plugging. The threaded discharge of a relief valve not equipped with a drain shall be provided with a means to make capping or plugging difficult.

4-6.7.3 Air-Pressurized Water Storage Tanks. Water storage tanks, except water heaters, which may be pressurized by air, shall be equipped with a listed air pressure relief valve set to open at not more than 125 psi (862 kPa) or the tank manufacturer's recommended working pressure, whichever is lower. The air pressure relief valve shall be located above the maximum water level of the tank.

4-6.7.4 Water Supply Protection. Water supplies connected to automatic clothes washers and to dishwashers shall be protected by an approved or listed fixed vacuum breaker.

4-6.7.5 Flushometer Valves or Manually-Operated Flush Valves. An approved or listed vacuum breaker shall be installed and maintained in the water supply line on the discharge side of a toilet flushometer valve or manually- operated

flush valve. Vacuum breakers shall have a minimum clearance of 6 in. (152.4 mm) above the flood level of the fixture to the critical level mark unless other wise permitted in their approval.

4-6.7.6 Flush Tanks. Toilet flush tanks shall be equipped with an approved or listed anti-siphon ball cock which shall be installed and maintained with its outlet or critical level mark not less than 1 in. (25.4 mm) above the full opening of the overflow pipe.

4-7 Drainage Systems.
4-7.1 Materials.
4-7.1.1 Pipe. Drainage piping shall be standard weight, galvanized steel, galvanized wrought iron, brass, copper tube DWV, listed DWV plastic or other approved or listed material.

4-7.1.2 Fittings.
(a) Drainage fittings shall have a recessed drainage pattern with smooth interior waterways of the same diameter as the piping and shall be of a material conforming to the type of piping used. Drainage fittings shall be designed to provide for 1/4 in. per ft. (21 mm per meter) grade in horizontal piping.
(b) Fittings for screw pipe shall be cast iron, malleable iron, brass, or approved or listed plastic with standard pipe threads.
(c) Fittings for copper tubing shall be cast brass or wrought copper.
(d) Fittings for plastic piping shall be made to approved or applicable standards.
(e) Brass adapter or wrought copper fittings shall be used to join copper tubing to threaded pipe.

4-7.2 Size of Drainage Piping. Except as otherwise required by this standard, drain pipe sizes shall be determined by the total number of fixtures connected to each drain.
(a) One and one-quarter in. (11/4 in.) (32 mm) minimum diameter piping shall be required for one and not more than three individually vented fixtures.
(b) One and one-half in. (1 1/2 in.) (38 mm) minimum diameter piping shall be required for four or more fixtures individually vented.
(c) Nominal three in. (3 in.) (76 mm) minimum diameter piping shall be required for toilets.

4-7.3 Slope and Support.
4-7.3.1 Slope of Horizontal Drainage Piping. Horizontal drainage piping, except fixture connections on the inlet side of the trap, shall have a uniform slope of not less than 1/8 in. per ft. (10 mm per meter) toward the recreational park trailer main drain outlet.

4-7.3.2 Drain Piping Supports. Drain piping shall be secured at not more than 4 ft. (121 cm) intervals, unless different spacing is recommended by the piping manufacturer, to keep the pipe in alignment and carry the weight of the pipe and contents.

4-7.4 Offsets and Branch Fittings.
4-7.4.1 Changes in Direction. Changes in direction of drainage piping shall be made by the appropriate use of approved or listed fittings, and shall be of the following angles: 11 1/4, 22 1/2, 45, 60 or 90 degrees; or other approved or listed fittings, or combination of fittings with equivalent radius or sweep.

4-7.4.2 Horizontal to Vertical Connections. Horizontal drainage lines, connecting with vertical pipes, shall enter through 45 degree "Y" branches, sanitary "T" branches, or other approved or listed fittings or combination of fittings having equivalent sweep. No fitting having more than one branch at the same level shall be used unless the fitting is constructed so that the discharge from any one branch cannot readily enter any other branch.

4-7.4.3 Horizontal to Horizontal Connections and Vertical to Horizontal Connections.
(a) Horizontal drainage lines connecting with other horizontal drainage lines or vertical drainage lines connecting with horizontal drainage lines shall enter through 45 degree "Y" branches, long-turn "TY" branches, or other approved or listed fittings or combination of fittings having the equivalent sweep.
(b) A single-entry, short-turn "TY" shall be permitted to be used as a final termination if it is mounted directly to the fullway termination valve on one side and has a manual disconnect on the other. A double-entry, short-turn "TY" shall by permitted to be used as a horizontal-to-horizontal drainage fitting provided it is a final termination collector fitting and provided it is approved as a component part of a listed waste valve termination assembly.

4-7.5 Fixture Drainage Connections.
4-7.5.1 Toilet Connection. The drain connection for each toilet shall be 3 in. (76 mm) minimum inside diameter and shall be fitted with an iron, brass or listed plastic floor flange adaptor ring securely screwed, soldered or other wise permanently attached to the drain piping in an approved manner and securely fastened to the floor using brass or other equally corrosion-resistant materials.

4-7.5.2 Dishwashing Machine Drain Connections. Dishwashing machines shall not be directly connected to any waste piping, but shall discharge the waste through a fixed air gap installed above the machine. The drain connection from the air gap shall be permitted to connect to an individual trap, to a directional fitting installed in the sink tailpiece or to the opening provided on the inlet side of a food waste disposal unit or through a fixed air gap supplied as an integral part of a listed dishwasher machine.

4-7.5.3 Prohibited Drain Connections. The drain from a dishwashing machine shall not be connected to a sink tailpiece, continuous waste line or trap on the discharge side of a food waste disposal unit.

4-7.5.4 Clothes Washing Machine Drain Connections. Clothes washing machines shall drain either into a properly vented trap, into a laundry tub tailpiece with water-tight connections, into an open standpipe receptor or over the rim of a laundry tub.

4-7.5.5 Standpipes for Clothes Washing Machines. Standpipes shall be 1 1/2 in. (38 mm) minimum, nominal iron pipe size, or 1 1/2 in. (38 mm) outside diameter nominal brass tubing not less than No. 20 Brown and Sharpe gauge. Receptors shall discharge into a vented trap or shall be connected to a laundry tub tailpiece by means of an approved or listed directional fitting. Each standpipe shall extend not less than 18 in. (46 cm) or more than 30 in. (76 cm) above its trap and shall terminate in an accessible location not lower than the top of the clothes washing machine. A removable tight-fitting cap or plug shall be installed on the standpipe if a clothes washing machine is not installed.

4-7.5.6 Prohibited Drain Connections. Clothes washing machine drains shall not be connected to the tailpiece, continuous waste or trap of any sink or dishwashing machine.

4-7.6 Traps.
4-7.6.1 Traps Required. Except as permitted in 4-7.6.2, each plumbing fixture shall be separately trapped by approved or listed water seal traps. All traps shall be vented.

4-7.6.2 Traps for Dual Fixtures. A two-compartment sink, two single sinks, two lavatories or a single sink and a single lavatory, with waste outlets not more than 30 in. (76 cm) apart and flood level rims at the same level, may be connected to one trap and shall be permitted to be considered as a single fixture for the purpose of drainage and vent requirements.

4-7.6.3 Installation of Traps. Traps and connected tailpieces or continuous wastes shall be designed and installed so they can be separated without the removal of the strainer by the use of two or more mechanical joints.

4-7.6.4 Prohibited Traps. Full "S" traps, bell traps, drum traps, crown vented traps, and any trap that depends upon concealed interior partitions for its seal are prohibited. Fixtures shall not be double trapped.

4-7.6.5 Trap Seals. Each trap shall have a water seal of not less than 2 in. (51 mm) and not more than 4 in. (10 cm) and shall be set true to its seal.

4-7.6.6 Trap Size. Traps shall not be less than 1 1/4 in. (32 mm) in diameter. A trap shall not be larger than the waste pipe to which it is connected.

4-7.6.7 Accessibility of Traps. Traps shall be accessible for removal, repair and inspection.

4-7.7 Trap Arms.
4-7.7.1 Grade of Trap Arm. The piping between a trap and the fixture tee or the vented waste line shall be graded 1/4 in. per ft. (21 mm per meter) and in no event shall have a slope greater than its diameter. The vent opening at fixture tees shall not be below the weir of the trap outlet.

4-7.7.2 Trap Arm Offset. The piping between the trap and vent may change direction or be offset horizontally with the equivalent of not more than 180 degrees.

4-7.7.3 Length of Trap Arm. The distance between a trap and its vent or vented waste line shall be in accordance with Table 4-7.7.3. Not more than one trap shall connect to a trap arm.

TABLE 4-7.7.3

Maximum Distance of Fixture Trap from Vent*

4-7.8 Wet-Vented Drainage System.
4-7.8.1 Horizontal Piping. All parts of a wet-vented drainage system, including the connected fixture drains, shall be horizontal except for the wet-vented vertical riser and the final section consisting of an appropriate horizontal-to-

vertical fitting with a connecting pipe which shall be permitted to turn vertically to enter the top of the waste holding tank. Where required by structural design, wet-vented drain piping shall be permitted to be offset vertically when other vented drains or relief vents are connected to the drain piping below the vertical offsets.

4-7.8.2 Size. Except as permitted in 4-8.3.4 a wet-vented drain pipe shall be at least one pipe size larger than the largest required trap. Not more than three fixtures shall be permitted to connect to a wet-vented drainage system.

4-7.9 [RESERVED]

4-7.10 Cleanouts.
4-7.10.1 Cleanout Fittings.
(a) General. Cleanouts shall be installed if the drainage system cannot be cleaned through fixtures or vent openings.
(b) Design for Cleaning. A cleaning tool shall not be required to pass through more than 360 degrees of fittings, excluding all parts of removable traps, to reach any part of the drainage system.

4-7.10.2 Access to Cleanouts. Cleanouts shall be accessible through an unobstructed minimum clearance of 6 in. (15 cm) directly in front of the opening. Each cleanout fitting shall open in a direction opposite to the flow or at right angles to the pipe. Cleanouts that are not provided with access covers shall be extended to a point above the floor or outside of the recreational park trailer, with pipe and directional fittings installed, as required for drainage piping.

4-7.10.3 Cleanout Plugs and Caps.
(a) Materials. Plugs and caps shall be brass or approved or listed plastic, with screw pipe threads.
(b) Design. Cleanout plugs shall have raised heads except that plugs at floor level shall have counter-sunk slots.

4-7.11 Waste Holding Tanks.
4-7.11.1 Installation of Waste Holding Tanks. Waste holding tanks shall be securely installed in such locations as to be removable for service, repair or replacement without the necessity of removing permanent structural members.

4-7.11.2 Liquid Waste Holding Tank.
(a) Minimum size of inlet connections shall be determined by the total number of connected fixtures in accordance with 4-7.2. The inlet and/or vent fitting shall not extend downward into the tank more than 1/2 in. (12.7 mm).
(b) Drain opening shall be 1 1/2 in. (38 mm) minimum pipe size located at the lowest point in the tank. A listed fullway termination valve shall be directly connected to the tank or installed in the drain pipe of the tank.
(c) The tank shall be vented at the highest point in the top of the tank by one of the following methods:
1. A 1 1/4 in. (32 mm) minimum diameter individual vent pipe extending undiminished in size through the roof.
2. A continuous vent serving as a drain for not more than three fixtures provided the drain portion is increased one pipe size larger than the largest required trap.

4-7.11.3 Body Waste Holding Tank.

(a) Toilet connections shall be 3 in. (76 mm) minimum pipe size and shall extend vertically. The inlet fitting shall not extend downward into the tank more than 1 1/2 in. (38 mm). The toilet connection shall be designed to receive or conform in an approved shape to a closet flange of standard dimensions or other approved fitting.
(b) Drain opening shall be a 3 in. (76 mm) minimum pipe size outlet located at the lowest point in the tank. A listed fullway termination valve shall be directly connected to the tank or installed in the drain pipe of the tank within 36 in. (91 cm) of the tank drain outlet.
(c) The tank shall be vented at the highest point in the top of the tank by one of the following methods:
1. A 1 1/4 in. (32 mm) minimum diameter individual vent pipe extending undiminished in size through the roof.
2. A continuous vent serving as a drain from one additional fixture provided the drain portion is increased one pipe size larger than the largest required trap.
3. Two or more vented drains when at least one is wet-vented and each drain is separately connected to the top of the tank.

4-7.11.4 Connections Between Holding Tanks. No drain connection shall be made between liquid and body waste holding tanks upstream of fullway termination valves.

4-7.11.5 Operation and Location of Fullway Termination Valves. Fullway termination valves shall be designed for manual operation from outside the recreational park trailer and have no extension or activating device within the vehicle.
Exception: Remotely controlled terminal valves shall be allowed. If used they shall comply with the following:
1. The remotely operated valve(s) shall be capable of manual operation.
2. The valve control shall be installed outside the living volume of the recreational park trailer with a security lockout.

4-7.12 Drain Outlets.
4-7.12.1 Size of Drain Outlets.
(a) A drain outlet used for the discharge of body waste shall be nominal 3 in. (76 mm) minimum pipe size.
(b) A drain outlet used for the discharge of liquid waste shall be 1 1/2 in. (38 mm) minimum pipe size.

4-7.12.2 Location of Main Drain Outlet(s). Each recreational park trailer shall have a main drain outlet(s) which shall terminate at any point in the rear half of the vehicle, on the left (road) side or at the rear left of the longitudinal center of the vehicle, within 18 in. (46 cm) of the outside wall and shall direct its discharge toward that side or toward the rear within an angle of 90 degrees formed between that side and the rear end of the vehicle or vertically downward. When less than 18 in. (46 cm) above the ground, the drain outlet(s) shall be permitted to terminate vertically when it is equipped with a manual disconnect type coupler and a companion elbow hose adapter.

4-7.12.3 Drain Outlet Caps. Each drain outlet shall be equipped with a water-tight cap which shall be attached to the vehicle or drain piping.

4-7.12.4 Clearance from Drain Outlets. Drain outlets shall be provided with a minimum clearance of 11/2 in. (38 mm) on three sides from all parts of the

vehicle and with clearance directly in front of the outlet to permit connection of a drain hose or cap.

4-7.12.5 Coupling Devices. Where drain outlets are equipped or arranged for hose coupling devices, such devices shall be of the manual disconnect type.

4-8 Vents and Venting.
4-8.1 General. Each plumbing fixture trap shall be protected against siphonage and back pressure. Air circulation shall be ensured throughout all parts of the drainage system by means of vents installed in accordance with the requirements of this section and/or as otherwise required by this standard. Except as specifically provided elsewhere in this standard, vent pipes shall not be used as waste or drain pipes.

4-8.2 Materials.
4-8.2.1 Pipe. Vent piping shall be standard weight galvanized steel, galvanized wrought-iron, brass, copper tube DWV, listed DWV plastic or other approved or listed materials. (See Appendix D.)

4-8.2.2 Fittings. Appropriate fittings shall be used for all changes in direction, size or shape, and where pipes are joined. The material and design of fittings shall conform to appropriate national standards. (See Appendix D.) Listed rectangular tubing shall be permitted to be used for venting. Suitable listed transition fittings shall be used.

4-8.3 Size of Vent Piping.
4-8.3.1 Individual Vents.
(a) Unless protected by an anti-siphon trap vent device (see 4-8.5), a 1 1/4 in. (32 mm) minimum diameter vent pipe shall be required for all individually vented fixtures with 1 1/2 in. (38 mm) or smaller traps.
(b) The continuous vent of wet-vented drainage systems shall be 1 1/4 in. (32 mm) minimum diameter.

4-8.3.2 Common Vents. When two fixture traps located within the distance allowed from their vent have their trap arms connected separately at the same level into an approved double fitting, an individual vent pipe may serve as a common vent without any increase in size.

4-8.3.3 Intersecting Vents. Where two or more vent pipes are joined together, no increase in size shall be required; however, the largest vent pipe shall extend full size through the roof.

4-8.3.4 Flush Toilet Venting. The trap arm piping for each flush toilet shall be vented by 1 1/2 in. (38 mm) minimum diameter vent or rectangular vent of venting cross section equivalent to or greater than the venting cross section of a 1 1/2 in. (38 mm) diameter vent, connected to the trap arm within the distance outlined in Table 4-7.7.3 for 3 inch (76 mm) trap arms. The connection shall be accomplished by one of the following methods:
(a) A 1 1/2 in. (38 mm) diameter (minimum) individual vent pipe or equivalent connected to the trap arm and extended undiminished in size through the roof,
(b) A 1 1/2 in. (38 mm) diameter (minimum) continuous vent or equivalent connected to the trap arm piping through a 2 in. (51 mm) wet vented drain.

4-8.4 Vent Connections and Grades.
4-8.4.1 Horizontal Vents. Each vent, other than a wet- vented drain, shall

extend vertically from its fixture "T," or point of connection with the waste piping, to a point not less than one (1) vent pipe diameter above the flood level of the fixture it is venting before offsetting horizontally or being connected with any other vent pipe. Vents for horizontal drains shall connect to the drain piping downstream of the trap. Vents, other than wet-vented drains, shall connect above the centerline of horizontal drain piping.

4-8.4.2 Grades. Vents shall be level or so designed to drain back to the drainage system by gravity.

4-8.5 Anti-Siphon Trap Vent Devices.
4-8.5.1 General. An anti-siphon trap vent device shall be permitted to be used only as a secondary vent in accordance with the following:
(a) An anti-siphon trap vent device shall be installed in accordance with the terms of its listing.
(b) One anti-siphon trap vent device shall be permitted to serve not more than two fixtures.
(c) Anti-siphon trap devices shall not be used as a primary vent for toilets or holding tanks.
(d) When a fixture drain or main drain bypasses the toilet and/or holding tank, there shall be a primary vent.
(e) Anti-siphon trap vent devices shall not be used on more than two consecutive fixtures before being vented to outside atmosphere.
(f) Two fixtures protected by one anti-siphon trap vent device shall be drained by a common 1 1/2 in. (38 mm) minimum drain.
(g) The device shall be installed in an accessible location that permits a free flow of air.

4-8.6 Vent Terminations.
4-8.6.1 Roof Extension. Except as otherwise permitted in this standard, each vent pipe shall pass through the roof and terminate vertically, undiminished in size, not less than 2 in. (51 mm) above the roof. Vents terminating on curved roof areas must pass through the roof at a point as high as practical.

4-8.6.2 Waste Holding Tank Vent Openings-Location. Waste holding tank vent openings shall not be less than 3 ft. (0.9 m) from any motor-driven air intake that opens into habitable areas.

4-8.6.3 Flashing. The opening around each vent pipe shall be made water-tight by an adequate flashing or flashing material.

4-8.6.4 Vent Caps. Vent caps, if provided, shall be of the removable type without removing the flashing from the roof.

4-9 Plumbing System Tests.
4-9.1 Water Piping System Tests. All pressure water piping in the water distribution system shall be subjected to a pressure test. An adequate and accurate pressure gauge or bubble-type leak detector shall be used on all tests. Tests shall be performed to one of the following methods, as appropriate. When any substance other than potable water is added to the water distribution system, that substance shall be identified for use in a potable water system.

NOTE: Warning Ethylene glycol, methanol based antifreeze, or other poisonous chemicals shall not be used.

4-9.1.1 Pressurized System Test. The test shall be performed by subjecting the pressure water piping system to either air or water pressure for 10 minutes without leakage or loss of pressure by:
(a) Filling the entire piping system including the water heater storage tank and the pressurized potable water storage tank with water and pressure testing with air or water at 100 psi (689 kPa).
(b) Removing the water heater storage tank and the pressurized potable water storage tank from the piping system and pressure testing with air at 100 psi (689 kPa).
(c) Testing the entire piping system, including the water heater storage tank and the pressurized potable water storage tank with air only at 30 psi (207 kPa).
Exception: PVC and CPVC systems shall be tested to parts (a) and (c) only.

4-9.2 Tests for Drainage and Vent Systems. The waste and vent system shall be subjected to one of the three following tests without evidence of leaks.
(a) Water Tests. Before plumbing fixtures are connected, all of the openings into the piping shall be plugged and the entire piping system subjected to a static water test for 15 minutes by filling it with water to the top of the highest vent opening.
(b) Air Tests. After all fixtures have been installed, the traps filled with water, and the remaining openings securely plugged the entire system shall be subjected to a 2 in. (51 mm) (manometer) water column air pressure test.
(c) Fixture Flood Level Tests. The recreational park trailer shall be in a level position, all fixtures shall be connected, and the entire system shall be filled with water to the flood level rim of the toilet bowl. (Tub and shower drains shall be plugged.) After all trapped air has been released, the test shall be sustained for not less than 15 minutes. The waste piping above the level of the toilet shall be tested and show no indication of leakage when the high fixtures are filled with water and emptied simultaneously to obtain the maximum possible flow in the drain piping.

4-9.3 Liquid Waste System Tests. When a recreational park trailer is equipped with a liquid waste holding system, it shall be subjected to a static water test without evidence of leaks for fifteen (15) minutes by filling the system with water to the level of the lowest connected trap arm.

4-9.4 Flow Tests. The plumbing fixtures and connections shall be subjected to a flow test without evidence of leaks or retarded flow by filling them with water and then simultaneously emptying them.

CHAPTER 5 - CONSTRUCTION REQUIREMENTS

5-1 General Requirements
5-1.1 Recreational Park Trailers exceeding eight feet, six inches (8' - 6") in width while in the travel mode shall be constructed in accordance with the requirements of this chapter.

5-1.2 Nothing in this chapter shall prohibit alternate methods of construction which can be proven by test or calculation to meet the loading requirements of Section 5-3.

5-1.3 All construction methods and workmanship shall conform with accepted engineering practices.

5-2 Materials
5-2.1 All lumber used in structural applications shall be graded by an association or independent grading agency.

5-2.2 Trusses shall be tested or calculated to meet the requirements of this Chapter. All lumber used in trusses shall bear grade marks prior to cutting.

5-2.3 All materials shall be installed in accordance with the manufacturer's installation instructions where available.

5-3 Structural Design Requirements.
5-3.1 Recreational park trailers exceeding eight feet, six inches (8' - 6") in width while in the travel mode shall be designed and constructed as a completely integral structure capable of sustaining the load requirements of the Chapter. Additional removable framing may be incorporated to transmit dynamic loads incurred while in transit if the use of such supports is fully described in the owner's manual or other documentation provided to the purchaser.

5-3.2 Sizes and connections for structural members not specified in this Chapter shall be designed in accordance with generally accepted engineering practice.

5-3.3 Structural components which are not constructed as specified in this Chapter shall be designed to sustain the following loads at a minimum:

Floor Design Live Load 30 p.s.f.
Roof Design Live Load 20 p.s.f.

5-3.4. Allowable Deflection. Structural components which are not constructed as specified in this Chapter shall be designed to provide the following maximum live load deflection.

Floor components - L/240
Roof components - L/180
Load Bearing Wall Headers - L/180

5-4 Floor Construction

5-4.1 General. Floor assemblies which are not verified by test or calculation shall be constructed as specified below. Fastening shall be in accordance with the fastening schedule at the end of this
Chapter.

5-4.2 Floors shall be constructed of wood members mounted on a steel frame. The wood members shall be not less than 2" x 4" (nominal) spaced at 16" on centers maximum for longitudinal joists or 2" x 6" (nominal) if spaced at 24" on centers maximum for longitudinal or transverse joists.

5-4.2.1 Wood members shall be #3 S.P.F. South grade or better.

5-4.2.2 Steel frames shall be constructed from the following materials as a minimum for floor assemblies with transverse joist orientation:
Main rails - 8" x 6.5# I-beam spaced not less than 75" apart.
Cross members - 1 1/4 x 2 x 1 1/4 13 ga. "C" or "Z" section steel.

Outriggers - 14 ga. "Z" section steel with 1-1/4" minimum top and bottom flanges with six inch (6") minimum depth at the main rails.

Spacing of Outriggers and Cross members - Outriggers and Cross members shall be placed at the following minimum spacings:

Floor joists 20" or less on centers - 96" on centers minimum
Floor joists over 20" on centers - 48" on centers minimum

5-4.2.3 Steel frames shall be constructed from the following materials as a minimum for floor assemblies with longitudinal joist orientation:
Main rails - 8" x6.5# I-beam spaced not less than 75" apart.
Cross members - Open web steel truss joists constructed as follows at 48" on centers maximum:

1-1/4 x1-1/4 x13" ga. steel angle top and bottom members with six inch (6") minimum depth at the main rails.

5/16" (minimum) steel rod web members installed at no more than 45o from vertical.

Optionally, cross members may be constructed of 1-1/4" x 6" x 1-1/4" "Z" section or "C" section 13 ga. steel.

Outriggers - 14 ga. "Z" section steel with 1-1/4" minimum top and bottom flanges spaced at 48" on centers maximum with six inch (6") minimum depth at the main rails.

5-4.2.4 Subflooring shall be plywood, oriented strand board, particle board or equivalent which is rated for the application and installed in accordance with the manufacturer's recommendations. Minimum subflooring thickness shall be in accordance with the following chart:

Max. Joist Spacing	Plywood/O.S.B.	Particle Board
16" o.c.	1/2"	5/8"
20" o.c.	5/8"	11/16"
24" o.c.	3/4"	13/16"

5-5 Wall Construction.
5-5.1 General. Load bearing wall assemblies shall be of sufficient strength and rigidity to transfer all vertical loads to the floor.

5-5.2 Framing. Load bearing wall assemblies which are not verified by test or calculation shall be constructed as specified below and fastened in accordance with the fastening schedule at the end of this Chapter.

5-5.2.1 Minimum 2" x 3" (nominal) studs of #3 or Stud grade SPF South or better spaced no more than 16" on centers with not more than 84" in unsupported height.

5-5.2.2 Minimum 2" x 4" (nominal) studs of #3 or Stud grade SPF South or better spaced no more than 24" on centers with not more than 96" in unsupported height.

5-5.2.3 All 2" x 3" (nominal) load bearing wall assemblies shall be constructed

with at least two top plates, each no less than 1-1/2" thick by the width of the studs, except that units constructed with the concentrated loads from the roof located within 1-1/2" of the wall stud locations shall be permitted to be constructed with single 3/4" thick top plates. Top plates shall be #3 or Stud grade SPF South or better.

All 2" x 4" (nominal) or larger load bearing wall assemblies shall be constructed with at least one top plate which shall be no less than 1-1/2" thick by the width of the studs, except that units constructed with the concentrated loads from the roof located within 1-1/2" of the wall stud locations shall be permitted to be constructed with single 3/4" thick top plates. Top plates shall be #3 or Stud grade SPF South or better.

5-5.2.4 All load bearing wall assemblies shall be constructed with at least one bottom plate no less than 3/4" thick by the width of the studs.

5-5.2.5 Openings in load bearing wall assemblies which exceed 32" in width for walls constructed of 2" x 3" (nominal) lumber, or which exceed 48" for walls constructed of 2" x 4" (nominal) or larger lumber, shall be framed with doubled studs. The inner stud shall extend from the bottom of the header to the wall bottom plate and the outer studs shall extend from the top plate to the bottom plate.

5-5.2.6 Headers over openings in load bearing walls constructed of 2" x 3" (nominal) studs shall be least one (1) piece 1-1/2" thick #3 or Stud grade SPF South lumber on edge and one (1) piece 3/4" thick #3 or Stud grade SPF South lumber. A filler may be inserted between the members to bring the header to the same thickness as the stud wall.

5-5.2.7 Headers over openings in load bearing walls constructed of 2" x 4" (nominal) or larger studs shall be least two (2) pieces of 1-1/2" thick #3 or Stud grade SPF South lumber on edge, separated by appropriate filler pieces to bring the header to the same thickness as the stud wall.

5-5.2.8 Headers shall be at least as deep as the following chart:

Max. Span	2" x 3" Walls	2" x 4" or Larger Walls
48"	5.5"	3.5"
72"	7.25"	5.5"
96"	9.25"	7.25"
120"	N/A	9.25"
144"	N/A	11.25"

5-6 Roof Construction
5-6.1 General. Roof assemblies which are not verified by test or calculation shall be constructed as specified below. Fastening shall be in accordance with the fastening schedule at the end of this Chapter.

5-6.2 Roof framing shall consist of certified and listed trusses installed in accordance with the terms of their listing.

5-6.3 Roof assemblies shall be constructed with edge rails at least 3/4" thick. The minimum of the edge rail shall be the depth of the truss heel or 3-1/2", whichever is less.

5-6.4 Roof sheathing application shall conform to the requirements of the roof finish material manufacturer's installation instructions.

5-7 Test Procedures
5-7.1 All test procedures shall be conducted in accordance with accepted engineering practices and shall be observed by a Registered Professional Engineer or Architect or an independent third party agency. Test procedures and test results shall be certified by the observing professional or an independent third party agency.

5-7.1.1 Ultimate Load Tests. Ultimate Load tested materials or assemblies shall sustain an ultimate load of the Dead Load plus 2.5 times the Design Live Load.

5-7.1.2 Proof Load Tests. Proof Load tested materials or assemblies shall sustain a proof load of the Dead Load plus 1/75 times the Design Live Load for a duration of three (3) hours with residual deflection which is equal to or less that the allowable deflection when measured within twelve (12) hours after the load is removed.

Fastening Schedule

NOTE: Unless tested or calculated, all fasteners shall be long enough to permit at least one (1) inch penetration into the second member or as specified by the manufacturer of the product. Splitting of members shall be minimized by staggering all fasteners in the direction of the grain and by keeping all fasteners well in from the edges of the member.

APPENDIX A

This Appendix is not a part of the requirements of this document but is included for information purposes only.

A-3-4.2 Because some smoke detectors are activated by the gases released when cooking food and may false alarm, the smoke detector manufacturer should be consulted regarding the detector's suitability for operation in close proximity to cooking processes.
APPENDIX B

Typical Example of Gas Piping System Sizing
for a Recreational Park Trailer

NOTE: All Dimensions and Measurements in U.S. Measurement.
For SI Equivalents: 1 BTUH - 1055 kJ; 1 ft. = 0.305m; 1 in. = 25.4 mm.

A typical recreational park trailer showing location of alternate gas supply inlet connections, gas piping system (including sample lengths), and gas appliances (including assumed BTUH gas demand of each).

To determine the required gas supply pipe sized for each piping section of the typical example diagrammed in B-2.4.4, assuming a combination LP-Gas/natural gas supply system, take the following steps:

B-2.4.4 Example of Gas Pipe Sizing.