

## CHAPTER 5

# WATER HEATERS

### SECTION 501 GENERAL

**501.1 Scope.** The provisions of this chapter shall govern the materials, design and installation of water heaters and the related safety devices and appurtenances.

**501.2 Water heater as space heater.** Where a combination potable water heating and space heating system requires water for space heating at temperatures higher than 140°F (60°C), a master thermostatic mixing valve complying with ASSE 1017 shall be provided to limit the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less. The potability of the water shall be maintained throughout the system.

**501.3 Drain valves.** Drain valves for emptying shall be installed at the bottom of each tank-type water heater and hot water storage tank. Drain valves shall conform to ASSE 1005.

**501.4 Location.** Water heaters and storage tanks shall be located and connected so as to provide access for observation, maintenance, servicing and replacement.

**501.5 Water heater labeling.** All water heaters shall be third-party certified.

**501.6 Water temperature control in piping from tankless heaters.** The temperature of water from tankless water heaters shall be a maximum of 140°F (60°C) when intended for domestic uses. This provision shall not supersede the requirement for protective shower valves in accordance with Section 424.3.

**501.7 Pressure marking of storage tanks.** Storage tanks and water heaters installed for domestic hot water shall have the maximum allowable working pressure clearly and indelibly stamped in the metal or marked on a plate welded thereto or otherwise permanently attached. Such markings shall be in an accessible position outside of the tank so as to make inspection or reinspection readily possible.

**501.8 Temperature controls.** All hot water supply systems shall be equipped with automatic temperature controls capable of adjustments from the lowest to the highest acceptable temperature settings for the intended temperature operating range. In a water heating system where temperatures exceed 140 °F (60°C) a means such as a mixing valve shall be installed to temper the water for domestic uses.

**501.9 Installation by manufacturer.** The following is a reprint of GS 66-27.1, "Safety Features of Hot Water Heaters."

(a) No individual, firm, corporation or business shall install, sell or offer for sale any automatic hot water tank or heater of 120-gallon capacity or less, except for a tankless water heater, which does not have installed thereon by the manufacturer of the tank or heater an American Society of Mechanical Engineers and National Board of Boiler and Pressure Vessel Inspectors approved-type pressure-temperature relief valve set at or below the safe working pressure of the tank as indicated, and so

labeled by the manufacturer's identification stamped or cast upon the tank or heater or upon a plate secured to it.

(b) No individual, firm, corporation or business shall install, sell or offer for sale any relief valve, whether it be pressure type, temperature type or pressure-temperature type, which does not carry the stamp of approval of the American Society of Mechanical Engineers and the National Board of Boiler and Pressure Vessel Inspectors.

The following is a reprint of GS 66-27.1A, "Water Heater Thermostat Settings."

(a) The thermostat of any new residential water heater offered for sale or lease for use in a single-family or multi-family dwelling in the state shall be preset by the manufacturer or installer no higher than approximately 120°(or 49°C). A water heater reservoir temperature may be set higher if it is supplying space heaters that require higher temperatures. For purposes of this section, a water heater shall mean the primary source of hot water for any single-family or multi-family residential dwelling including, but not limited to, any solar or other hot water heating systems.

(b) Nothing in this section shall prohibit the occupant of a single-family or multiunit residential dwelling with an individual water heater from resetting or having reset the thermostat on the water heater. Any such resetting shall relieve the manufacturer or installer of the water heater and, in the case of a residential dwelling that is leased or rented, also the unit's owner, from liability for damages attributed to the resetting.

(c) A warning tag or sticker shall be placed on or near the operating thermostat control of any residential water heater. This tag or sticker shall state that the thermostat settings above the preset temperature may cause severe burns. This tag or sticker may carry such other appropriate warnings as may be agreed upon by manufacturers, installers and other interested parties.

**501.10 Fossil fuel equipment installation.** The installation of the following equipment and systems shall comply with the North Carolina Fuel Gas Code:

1. Fuel piping for any fossil-fuel-burning equipment.
2. Venting systems for fossil-fuel-burning equipment which is part of the plumbing system.

### SECTION 502 INSTALLATION

**502.1 General.** Water heaters shall be installed in accordance with the manufacturer's installation instructions. Oil-fired water heaters shall conform to the requirements of this code and the *International Mechanical Code*. Electric water heaters shall conform to the requirements of this code and provisions of the *ICC Electrical Code* listed in Chapter 13. Gas-fired water heaters shall conform to the requirements of the *International Fuel Gas Code*.

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**502.2 Rooms used as a plenum.** Water heaters using solid, liquid or gas fuel shall not be installed in a room containing air-handling machinery when such room is used as a plenum.

**502.3 Water heaters installed in attics.** Attics containing a water heater shall be provided with an opening and unobstructed passageway large enough to allow removal of the water heater. The passageway shall not be less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the water heater. If 6 feet (1829 mm) of headroom is provided along the centerline of the passageway from the opening to the water heater, the length of the passageway is permitted to exceed 20 feet (6096 mm) in length. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the water heater. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches (508 mm by 762 mm) where such dimensions are large enough to allow removal of the water heater.

**502.4 Seismic supports.** Where earthquake loads are applicable in accordance with the *International Building Code*, water heater supports shall be designed and installed for the seismic forces in accordance with the *International Building Code*.

**502.5 Water heaters installed in garages.** Water heaters having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the garage floor. Appliances shall be located or reasonably protected, so that they are not subject to physical damage by a moving vehicle.

**Exception:** Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

**502.6 Installation in crawl spaces.** Under-floor spaces containing appliances requiring access shall be provided with an access opening and unobstructed passageway large enough to remove the largest component of the appliance. The passageway shall not be less than 22 inches (559 mm) high and 36 inches (914 mm) wide, nor more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the equipment. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending 4 inches (102 mm) above the adjoining grade and having sufficient lateral-bearing capacity to resist collapse.

The clear access opening dimensions shall be a minimum of 22 inches by 30 inches (559 mm by 762 mm), where such dimensions are large enough to allow removal of the largest component of the appliance.

### Exceptions:

1. The passageway is not required where the level service space is present when the access is open and the appliance is capable of being serviced and removed through the required opening.

2. Where the passageway is not less than 6 feet high (1829 mm) for its entire length, the passageway shall not be limited in length.

## 502.7 Under-floor and exterior grade installation.

**502.7.1 Exterior grade installations.** Equipment and appliances installed above grade level shall be supported on a solid base or approved material a minimum of 2 inches (51 mm) thick.

**502.7.2 Under-floor installation.** Suspended equipment shall be a minimum of 6 inches (152 mm) above the adjoining grade.

**502.7.3 Crawl space supports.** In a crawl space, a minimum of 4 × 8 × 16 inch (102 × 203 × 406 mm) block or brick supports shall be held in place with mortar. Formed concrete or approved prefabricated steel units are acceptable.

**502.7.4 Drainage.** Below-grade installations shall be provided with a natural drain or an automatic lift or sump pump.

**502.8 Prohibited installations.** Water heaters (using solid, liquid or gas fuel) with the exception of those having direct vent systems, shall not be installed in bathrooms and bedrooms or in a closet with access only through a bedroom or bathroom. However, water heaters of the automatic storage type may be installed as replacement in a bathroom, when specifically authorized by the plumbing official, provided they are properly vented and supplied with adequate combustion air.

**Exception:** When a closet having a weatherstripped solid door with an approved closing device has been designed exclusively for the water heater and where all air for combustion and ventilation is supplied from outdoors.

## SECTION 503 CONNECTIONS

**503.1 Cold water line valve.** The cold water branch line from the main water supply line to each hot water storage tank or water heater shall be provided with a valve, located near the equipment and serving only the hot water storage tank or water heater. The valve shall not interfere or cause a disruption of the cold water supply to the remainder of the cold water system. The valve shall be provided with access on the same floor level within 3 feet (914 mm) of the water heater served.

**503.2 Water circulation.** The method of connecting a circulating water heater to the tank shall provide proper circulation of water through the water heater. The pipe or tubes required for the installation of appliances that will draw from the water heater or storage tank shall comply with the provisions of this code for material and installation. Installation shall comply with the manufacturer's instructions.

## SECTION 504 SAFETY DEVICES

**504.1 Antisiphon devices.** An approved means, such as a cold water "dip" tube with a hole at the top or a vacuum relief valve installed in the cold water supply line above the top of the

heater or tank, shall be provided to prevent siphoning of any storage water heater or tank.

**504.2 Vacuum relief valve.** Bottom fed water heaters and bottom fed tanks connected to water heaters shall have a vacuum relief valve installed. The vacuum relief valve shall comply with ANSI Z21.22.

**504.3 Shutdown.** A means for disconnecting an electric hot water supply system from its energy supply shall be provided in accordance with the ICC *Electrical Code*. A separate valve shall be provided to shut off the energy fuel supply to all other types of hot water supply systems.

**504.4 Relief valve.** All storage water heaters operating above atmospheric pressure shall be provided with an approved, self-closing (levered) pressure relief valve and temperature relief valve or combination thereof. The relief valve shall conform to ANSI Z21.22. The relief valve shall not be used as a means of controlling thermal expansion.

**504.4.1 Installation.** Such valves shall be installed in the shell of the water heater tank. Temperature relief valves shall be so located in the tank as to be actuated by the water in the top 6 inches (152 mm) of the tank served. For installations with separate storage tanks, the valves shall be installed on the tank and there shall not be any type of valve installed between the water heater and the storage tank. There shall not be a check valve or shutoff valve between a relief valve and the heater or tank served.

**504.5 Relief valve approval.** Temperature and pressure relief valves, or combinations thereof, and energy cutoff devices shall bear the label of an approved agency and shall have a temperature setting of not more than 210°F (99°C) and a pressure setting not exceeding the tank or water heater manufacturer's rated working pressure or 150 psi (1035 kPa), whichever is less. The relieving capacity of each pressure relief valve and each temperature relief valve shall equal or exceed the heat input to the water heater or storage tank.

**504.6 Relief outlet waste.** The outlet of a pressure, temperature or other relief valve shall not be directly connected to the drainage system.

**504.6.1 Discharge.** The relief valve shall discharge full size to a safe place of disposal such as within 6 inches (152 mm) of the floor, outside the building or an indirect waste receptor. The discharge pipe shall not have any trapped sections and shall have a visible air gap or air gap fitting located in the same room as the water heater. The outlet end of the discharge pipe shall not be threaded and such discharge pipe shall not have a valve or tee installed. Relief valve piping shall be piped independent of other equipment drains or relief valve discharge piping to the disposal point. Such pipe shall be installed in a manner that does not cause personal injury to occupants in the immediate area or structural damage to the building.

**504.6.2 Materials.** Relief valve discharge piping shall be of those materials listed in Table 605.5 or shall be tested, rated and approved for such use in accordance with ASME A112.4.1. Piping from safety pan drains shall be of those materials listed in Tables 605.4 and 702.1.

**504.7 Required pan.** Where water heaters or hot water storage tanks are installed in: (a) remote locations such as a suspended ceiling, (b) attics, (c) above occupied spaces or (d) unventilated crawl spaces, the tank or water heater shall be installed in a galvanized steel pan having a minimum thickness of 24 gage, or other pans approved for such use.

**Exception:** Electric water heaters may rest in a high-impact plastic pan of at least  $\frac{1}{16}$  inch (1.6 mm) thickness.

**504.7.1 Pan size and drain.** The pan shall be not less than 1.5 inches (38 mm) deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a minimum diameter of 1 inch (25 mm).

**504.7.2 Pan drain termination.** The pan drain shall extend full size and terminate over a suitably located indirect waste receptor or floor drain or extend to the exterior of the building and terminate not less than 6 inches (152 mm) and not more than 24 inches (610 mm) above the adjacent ground surface.

## SECTION 505 INSULATION

**505.1 Unfired vessel insulation.** Deleted.

