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 (454 L) 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 multifamily dwelling in the State shall be preset by the manufacturer or installer no higher than approximately 120°F (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 multifamily 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 multifamily 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.
WATER HEATERS

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 NFPA 70. Gas-fired water heaters shall conform to the requirements of the International Fuel Gas Code.

502.1.1 Elevation and protection. Elevation of water heater ignition sources and mechanical damage protection requirements for water heaters shall be in accordance with the International Mechanical Code and the International Fuel Gas Code.

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 not less than 30 inches by 30 inches (508 mm by 762 mm) where such dimensions are large enough to allow removal of the largest component of the appliance.

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 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. The support shall be a minimum of a 2-inch (51 mm) thick solid base, 2-inch (51 mm) thick formed concrete, or stacked masonry units held in place by mortar or other approved method. The water heater shall be supported not less than 2 inches (51 mm) above grade.

502.7.4 Drainage. Below-grade installations shall be provided with a natural drain or an automatic lift or sump pump. Existing installation that can be terminated outdoors must terminate outdoors. Where the installation is such that outdoor termination is impossible, indoor termination is allowable.

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 approved by the plumbing official, provided they are vented and supplied with adequate combustion air.

Exception: When a closet, having a weather-stripped 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 within 3 feet (914 mm) of 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 as the water heater served.  

503.2 Water circulation. The method of connecting a circulating water heater to the tank shall provide 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 NFPA 70. 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 Requirements for discharge piping. The discharge piping serving a pressure relief valve, temperature relief valve or combination thereof shall:  

1. Not be directly connected to the drainage system.  

2. Discharge through an air gap located in the same room as the water heater, either on the floor, into an indirect waste receptor or outdoors.  

3. Not be smaller than the diameter of the outlet of the valve served and shall discharge full size to the air gap.  

4. Serve a single relief device and shall not connect to piping serving any other relief device or equipment.  

5. Discharge to the floor, to the pan serving the water heater or storage tank, to a waste receptor or to the outdoors.  

6. Discharge in a manner that does not cause personal injury or structural damage.  

7. Discharge to a termination point that is readily observable by the building occupants.  

8. Not be trapped.  

9. Be installed so as to flow by gravity.  

10. Not terminate more than 6 inches (152 mm) above the floor or waste receptor.  

11. Not have a threaded connection at the end of such piping.  

12. Not have valves or tee fittings.  

13. Be constructed of those materials listed in Section 605.4 or materials tested, rated and approved for such use in accordance with ASME A112.4.1.  

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 material thickness of not less than 0.0236 inch (0.6010 mm) (No. 24 gage), or other pans approved for such use.  

Exceptions:  

1. Electric water heaters may rest in a high-impact plastic pan of at least 1/16 inch (1.6 mm) thickness.  

2. Water heater mounted on concrete floor for floor drains.  

504.7.1 Pan size and drain. The pan drain shall not be less than 1/2 inches (38 mm) deep and shall not be obstructed by the appliance. The pan shall be drained by an indirect waste pipe having a minimum diameter of 1 inch (25.4 mm). Piping for safety pan drains shall be of those materials listed in Table 605.4.  

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  

[E] 505.1 Unfired vessel insulation. Unfired hot water storage tanks shall be insulated to R-12.5 (h · ft² · °F)/Btu (R-2.2 m² · K/W).