



The Silent Temperature

UNIFORM PLUMBING CODE CONTINUES TO EVOLVE WITH REGARD TO TEMPERATURE IN WATER HEATERS

By Enrique Gonzalez

The *Uniform Plumbing Code (UPC®)* governs the construction, location, and installation of fuel-burning and other types of water heaters. The *UPC* defines a water heater, or water heating boiler, as an appliance designed primarily to supply hot water for domestic or commercial purposes and equipped with automatic controls limiting water temperature to a maximum of 210°F. The water heater thermostat is a device used to set the water temperature within the holding tank, and the *UPC* does not recommend or mandate a temperature setting for the thermostat, thus making it a “silent temperature” setting. The *UPC* does, however, contain regulations for minimum requirements that focus on the health, safety, and welfare of the public by mandating specific requirements for the water heater and plumbing fixtures.

The *UPC* addresses comprehensive installation requirements for water heater safety devices and water heater appliances while referencing

the appropriate nationally recognized standards where applicable. There are three water heater safety devices required by the code: the first being a temperature-limiting device designed to prevent the heated water from exceeding 210°F by automatically shutting down the energy source and preventing the water heater from becoming a steam-boiler; the second water heater safety device is a vacuum relief valve designed to prevent siphonage within the tank that can result in emptying of the tank (possibly creating steam in the tank), and can even cause the tank to collapse; the third safety device is a pressure relief valve designed to relieve excess pressure, usually at 150 psig for residential water heaters. Note that an expansion tank does not take the place of a pressure relief valve device, and that an expansion tank is required when a water system contains a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main.

A water heater designed for residential or commercial purposes is typically set at 120°F



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from the factory, but what temperature should the water heater be set to when installed? Again, the *UPC* is silent on the temperature setting for the water heater thermostat and states that water heaters shall be installed in accordance with the manufacturer's installation instructions. The water heater manufacturers typically recommend a thermostat temperature setting.

Unfortunately, there is no perfect temperature setting as an overlap of temperatures is required for the health, safety, and welfare of the end users. When the water temperature is set too low, the water can create a perfect environment for Legionnaires' disease. There are documented instances of health hazards associated with water storing vessels set at temperatures known to "amplify" bacteria growth. According to the ASHRAE Guide 12, legionellae have been recovered from cold water, and the temperature range favorable for amplification of bacterial growth is 77°F to 108°F. Furthermore, ASSE indicates that the temperature of the water within a water heater is recommended to be set between 135°F to 140°F in order to minimize the growth of harmful bacteria found in water. However, these high temperatures put the public at risk for scalding, thermal shock or both. According to the Engineering and Science Division of the United States Product Safety Commission, it takes one minute to receive a first-degree burn at 122°F, and it takes two seconds to receive a first-degree burn at 140°F.

It would seem logical to keep the water heater thermostat at its factory setting of 120°F to prevent scalding or thermal shock, but the water heater thermostat is not a reliable or accurate temperature control for regulating the water temperature leaving the water heater. In fact, the *UPC* prohibits the water heater thermostat from being utilized as a suitable control for meeting the water temperature limit provisions. The *UPC* addresses the need to prevent scalding and thermal shock for the end user by requiring water temperature limits for common fixtures.

The *UPC* is a breathing and living standard that continuously improves with the changing world by means of input and knowledge from the public and consensus bodies that incorporate necessary standards and code text. For example, in 1988 the *UPC* added code text for the protection against scalding and thermal shock: "Showers in all occupancies other than

dwelling units served by individual water heaters shall be provided with individual shower control valves of the pressure balance or the thermostatic mixing valve type unless the water temperature serving such showers is limited to 110°F. Multiple or gang showers may be controlled by a master thermostatic blender in lieu of individually controlled pressure balance or thermostatic mixing valves."

In 1991, the water temperature for showers was limited to 120°F. From 1991 through present day, the *UPC* has included the following text in all sections requiring temperature regulating valves: "The water heater thermostat shall not be considered a suitable control for meeting this provision."

The 2003 *UPC* added language to this section stating that such valves shall be in accordance with ASSE 1016. Furthermore, the 2009 *UPC* gave an option for the valves and stated that the individual control valves of the pressure balance, thermostatic, or combination pressure balance/thermostatic mixing valve type that provide scald and thermal shock protection be in accordance with ASSE 1016 or ASME A112.18.1/CSA B125.1.

The 2009 *UPC* added text for gang showers, where supplied with a single temperature-controlled water supply pipe, shall be controlled by a mixing valve that is in accordance with ASSE 1069. Furthermore, the 2009 *UPC* set water temperature limits to bathtubs and whirlpool bathtubs (120°F), for bidets (110°F), and for public lavatories (120°F). These temperatures were to be limited by devices that were in accordance with ASSE 1070 or CSA B125.3.

The *UPC* has evolved since its release in 1946 and will continue to be positively influenced by the public. Plumbing systems are regulated by the *UPC* year that was adopted by the local jurisdiction at the time of installation and there will be many plumbing systems predating the newly adopted codes as the code is updated every three years. The key to protecting the public's health, safety and welfare is through continuous improvement and knowledge. The *UPC* may be silent on certain provisions, but it cannot be overly restrictive and allows the local jurisdictions to mandate appropriate regulations as deemed necessary. 📄