• Ron George Design & Consulting • 3525 N. Dixie Hwy. Monroe, Michigan 48162 •

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Volume 1, Issue 2

# Code Pipeline

## Standard Updates from ASSE

The following American Society of Sanitary Engineering standards have updated and are now available at www.ASSE-Plumbing.org

**ASSE Standard #1001-2008**

ASSE Draft Standard #1001, *Performance Requirements for Atmospheric Type Vacuum Breakers*, has been approved by the Board of Directors as an ASSE Standard.

**ASSE Standard #1058**

The Board of Directors has approved stopping the development of ASSE Draft Standard #1058, *Performance Requirements for Vacuum Breakers Under Continuous Pressure (without leakage)*.

**ASSE Standard #1063-2008**

ASSE Draft Standard #1063, *Performance Requirements for Air Intake Valves*, has been approved by the Board of Directors as an ASSE Standard.

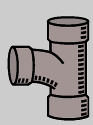
**ASSE Standard #1071-2008**

ASSE Draft Standard #1071, *Performance Requirements for Mixing Valves for Emergency Shower Equipment*, has been approved by the Board of Directors as an ASSE Standard.

**ASSE Standard #1072-2008**

ASSE Draft Standard #1072, *Performance Requirements for Barrier Type Floor Drain Trap Seal Protection devices*, has been approved by the Board of Directors as an ASSE Standard.◦

### Inside This Issue:





## California Formally Adopts NSF/ANSI Standard 61 and More Stringent Requirements for NSF/ANSI Standard 60 into Waterworks Standards

By: Greta Houlahan from NSF.org March 10, 2008

NSF International announced that the revised California Waterworks Standards, effective 3/9/08, will now formally require certification for all drinking water treatment and distribution products used by public water systems.

The Waterworks Standards provide criteria in the design, construction and operation of public water systems. NSF/ANSI Standard 60: *Drinking Water Treatment Chemicals -- Health Effects* includes requirements for chemicals that are used to treat drinking water, while NSF/ANSI Standard 61: *Drinking Water System Components -- Health Effects* includes requirements for all devices, components and materials that come in contact with drinking water.

***NSF/ANSI Standard 60***

Certification of products to NSF/ANSI Standard 60 has been required in the California Waterworks Standards since 1994. The new regulations will now also require all treatment chemicals to be tested on an annual basis by an ANSI-accredited certification organization.

Forty-five states require chemicals to comply with NSF 60 requirements, and 40 states require chemicals to be tested and certified by an ANSI-accredited organization. California, however, is the first state to require that chemicals be tested on an annual basis.

According to Dave Purkiss, General Manager of NSF's Standards 60 and 61 Certification Program, "These regulations were added when it was announced that an accredited certifier required retesting of certified chemicals only once every five years, a lag period considered too long by public health norms. The new requirement for annual inspections and annual testing of treatment chemicals to NSF/ANSI Standard 60 is a vital step in protecting public health."

"NSF has always conducted annual testing, but we are aware of other certification organizations that do not," said Purkiss.

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***NSF/ANSI Standard 61***

Certification of drinking water treatment and distribution equipment to NSF/ANSI Standard 61 has been specified by many water utilities in California for several years; however, the standard was not formally required in State regulations. The new edition of the California Waterworks Standards, which were effective on March 9, 2008, requires treatment and distribution equipment to be certified to NSF/ANSI Standard 61 by an ANSI-accredited organization. The State plumbing code has required that plumbing products be certified to NSF/ANSI 61 for several years.◦

## Domestic Hot Water Scald Prevention

By Ron George, CIPE, CPD

*President, Ron George Design & Consulting Services*

There are two types of hazards from domestic hot water systems: scalding and thermal shock. In the last few decades, the plumbing industry has come a long way in protecting people from these hazards.

In the past, doing a dance in the shower was a common occurrence when someone else in a building was using cold water during a shower, the cold water use elsewhere in the building would cause a pressure drop in the cold water system. The pressure imbalance would lead to a sudden decrease in the cold water pressure. The hot water system pressure would remain relatively constant therefore it becomes a higher pressure than the cold water pressure. The increase in the hot water pressure changes the proportion of hot to cold water ratio so the temperature from the shower changes and becomes hot for the bather. The reverse happens when there is increased usage of hot water - hot water pressure drops and there is a corresponding change in the mixed water ratio causing a burst of cold water. This sudden change in temperature at the showerhead is referred to as thermal shock. One danger of thermal shock is that it may cause the affected bather to react suddenly, resulting in a slip-and-fall injury. It is also common for someone to experience thermal shock and experience a slip and fall. Often, when the person in the shower falls from thermal shock, it is common for them to hit or grab the shower controls on their way down turning the controls to hot and causing a scalding injury. In some extreme cases the person is incapacitated by the fall and cannot get out of the flow of hot water.

### History of hot water system controls

In the early 20th century, two-handled bathtub and shower valves were common and contributed to thermal shock and scalding incidents on a regular basis. To address the problem, some manufacturers developed single-handled shower valves. Early designs of these valves did not have maximum temperature limit stops, and some did not have pressure compensation. So they provided very little protection against thermal shock. In 1939 Symmons Industries Inc. pioneered the pressure balancing shower valve to address the thermal shock issue. The early valves provided thermal shock protection but not anti-scald protection. In later years, manufacturers added set screws, limit stops and cams to allow the valves to be set to limit the amount of rotation toward the hot water, thereby providing a safe temperature for showering or bathing.

The severity and risk associated with scalding increases drastically with relatively small increases in water temperature. An anti-scald shower valve will only protect a bather if the maximum temperature limit stop or set screw is adjusted when the valve is installed. It is very important that the installing contractor make sure the water heater is set to the proper temperature and water is flowed to the tub/shower valve in order to set the maximum temperature limit stop to a maximum of 120 degrees Fahrenheit with the use of a thermometer. Most valves need to be adjusted seasonally to compensate for seasonal differences in the incoming cold water temperature, which can affect the mixed water temperature.

The federal plumbing specification, WW P 541, was the minimum standard for plumbing products used by the federal government. The federal specifications were the first to mandate single-handled shower mixing valves for federal government projects. Early valves came in three categories: type P, pressure balancing, type T, thermostatic and type M, mechanical mixers. The mechanical mixer was simply a single-handed valve that opened with cold water and added hot water as the valve rotated open. Although some manufacturers had the required devices available, they were not commonly used, because the cost for the new technology was higher than a conventional mechanical mixer.

In 1973, the American Society of Sanitary Engineering (ASSE) developed the 1016 standard to address requirements for showers to protect against thermal shock and scalding. The standard called for a maximum temperature limit stop of 120 F and has evolved to include type P, type T and type TP (combination thermostatic/pressure balancing) valves. Type P devices have a pressure balancing piston or diaphragm that equalizes the pressure between the two inlet ports and maintains the same outlet temperature, as long as the incoming temperatures remain the same. Type T devices have a temperature-sensing element that adjusts the inlet ports to maintain a relatively constant outlet temperature. Type TP devices have pressure-sensing and temperature-sensing elements and can compensate for both temperature and pressure changes.

The ASSE 1016 standard does not address mechanical mixers or two-handled shower or tub/shower controls. In-line devices such as the ones covered in the ASSE 1070 standard for thermostatic mixing valves limit the water temperature of the hot water supply, but they do not provide thermal shock protection, since additional unprotected cold water can be mixed in downstream of the device which is mounted in-line in the domestic hot water branch piping near the point of use.

The scald burn studies done by doctors Moritz and Henriques showed that it took approximately eight minutes of exposure to temperatures in the range of 120 F for adults to develop a serious scald burn: Someone exposed to water at 120 F would have up to eight minutes to get out of harm's way before an injury started to develop. (It should be noted that children and infants

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skin is thinner and could develop burns sooner than eight minutes.) The 120-degree temperature limit has become an industry standard for scald prevention in showers and combination bathtub/showers. The American Society of Plumbing Engineers (ASPE) is nearing completion of a standard on temperature limits for domestic hot water fixtures. The new standard will cover temperature limits for a wide variety of plumbing fixtures. There will even be a few fixtures that will have temperature limits below 120 F.

**Table 1 - Water Temperature Effects on Adult Skin**

(Source: Report prepared by Dr. Moritz and Dr. Henriques at Harvard Medical School in the 1940's)

| Temperature (Degrees Fahrenheit) | Type of Burn Injury 1st Degree Burn | 2nd Degree Burn |
|---|---|---|
| 111 | 270 Minutes | 300 Minutes |
| 113 | 120 Minutes | 180 Minutes |
| 116 | 20 Minutes | 45 Minutes |
| 118 | 15 Minutes | 20 Minutes |
| 120 | 8 Minutes | 10 Minutes |
| 124 | 2 Minutes | 4.2 Minutes |
| 131 | 17 Seconds | 30 Seconds |
| 140 | 3 Seconds | 5 Seconds |
| 151 | Instant | 2 Seconds |

In the mid-1970s, the U.S. Consumer Product Safety Commission (CPSC) published a report titled, "A Systematic Program to Reduce Incidence and Severity of Bathtub and Shower Area Injuries." The CPSC report prompted the American Society of Testing Materials (ASTM) to develop ASTM F444 and F445. ASTM F444 included performance requirements related to protection of showers from scalding, while ASTM F445 addressed "thermal shock preventing mixing valves" or pressure balancing valves. Since then, the scald provisions in the ASTM standards have been incorporated in the ASSE 1016 standard for shower and tub/shower valves.

By 1987, most of the model codes covering the United States included protection against thermal shock and scalding with references to ASSE 1016 with a maximum temperature limit stop set to 120 degrees Fahrenheit. Today almost all codes in the United States and Canada have thermal shock and scalding protection.

By the mid-1990s, barrier-free proponents added requirements in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) that were adopted in the ANSI standard A117.1. The water delivered to "shower and bathtub/shower facilities" had to be "thermal shock protected to 120 F maximum." Some local health departments have set minimum and maximum temperatures that are slightly different, with tighter tolerances, for hospitals, nursing homes and other facilities for persons with limited mobility or senses.

### ASSE hot water system control standards

***ASSE 1016 - Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations***

Because showering occurs in a confined space while standing on a wet floor surface with a large portion of the body in contact with flowing water discharged from a fixed showerhead, a significant hazard is present. In addition to the risk of scalding, reacting abruptly by moving away from the flowing water can cause a serious injury from a slip or fall. ASSE 1016 valves are designed to protect against thermal shock and scalding. The standard called for a maximum temperature limit stop of 120 F and includes pressure balancing, thermostatic and combination pressure balancing/thermostic valves. Pressure balancing devices have a pressure balancing piston or diaphragm that equalizes the pressure between the two inlet ports and maintains the same outlet temperature, as long as the incoming temperatures remain the same. Thermostatic type devices have a temperature-sensing element that senses the mixed water in the mixing chamber and adjusts the inlet ports with a bi-metallic thermal element, liquid paraffin wax piston or other type of thermal sensing element to maintain a relatively constant outlet temperature. The combination thermostatic and pressure balancing type devices have temperature-sensing and pressure-sensing elements and can compensate for both temperature and pressure changes. During the standard update process, the development of the type TP devices in the 1990s highlighted the need for a new standard because the tests for the different types of devices were different; however manufacturers resisted creating a new standard and splitting it into three separate standards. The problem was the ASSE 1016 standard was already accepted in most of the model codes. Manufacturers would have to go back to the model plumbing code organizations and state codes and have the new standards accepted. This would have been extremely expensive and in jurisdictions where they are slow in updating to the latest edition of the code, whichever type of shower valve that kept the ASSE 1016 number would have had an advantage over the other types of valves as far as code acceptance. The compromise was to have one standard with three different types of valves and three different tests with one standard number.

***ASSE 1062 - Temperature Actuated Flow Reduction Devices***

Older showers with two-handled valves or single-handled mechanical mixers that do not meet the requirements of ASSE 1016 do not provide scalding or thermal shock protection. These two-handled installations can be provided with a temperature actuated flow reduction (TAFR) valve, a device that complies with ASSE 1062 and reduces the scalding risk but does not provide thermal shock protection. The TAFR valve is installed between the showerhead and the shower arm. In combination tub/shower installations, a TAFR can be screwed into the tub spout. The TAFR senses the water flowing through the device. When the water temperature exceeds the setpoint (about 115 - 117 F), the valve closes and only allows a trickle of flow. The trickle of flow is designed to allow the bather to readjust the controls to a cooler setting and to let the cooler water reset the TAFR valve. The resetting process takes about 15 - 20 seconds, but that is a small inconvenience, considering that the device can protect the bather from severe scald burns.

***ASSE 1066 - Individual Pressure Balancing Valves for Individual Fixture Fittings.***

To reduce the risk of thermal shock in older two-handled shower valve installations, an ASSE 1066 in-line pressure-

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balancing valve can be installed in the hot and cold water supply lines to the faucet. This device controls pressure imbalances that lead to thermal shock; it does not provide scald protection.

***ASSE 1017 - Temperature Actuated Mixing Valves for Hot Water Distribution Systems.***
Thermostatic mixing valves complying with ASSE 1017 are designed to control temperature from +/- 3 - 7 F, depending on the size, when flowing at the required flow rate. It should be noted that ASSE 1017 has no test for compensation during pressure fluctuation, so in order to minimize pressure fluctuations between the hot and cold water lines; the mixing valve needs to be located at the hot water source. If there is a circulating pump in the system, care should be taken to make sure a mixing valve is piped properly. The tempered water return pipe should split after the tempered water circulating pump and one line should be routed to the cold water inlet of the water heater with a balancing valve to throttle this flow. The other valve should be routed to the cold water inlet of the ASSE 1017 thermostatic mixing valve. This piping arrangement allows the mixing valve to mix 100 degree return water with 140 degree hot water to get 120 tempered water deliver to the tempered water system when there is no flow from any of the fixtures. If there is no flow, no cold water can mix with the hot water to temper the hot water. If the tempered water return pipe is only routed back to the water heater, and there is no flow from a fixture, the circulating pump will force hot water to leak through or blow by the clearances in the mixing valve causing the tempered water line to rise to the full water heater outlet temperature setting. If the tempered water return line is only routed back to the cold water inlet or mixing valve return inlet, then the cooler tempered water return water will leak through or blow by the clearance in the mixing valve and the tempered water system temperature will eventually drop to ambient temperature. This would provide an opportunity for thermal shock as the hot water arrives at a shower after the system has cooled down.

***ASSE 1069 - Automatic Temperature Control Mixing Valves.***
The ASSE 1069 Automatic Temperature Control Mixing Valves are designed for gang shower applications such as those in a school, prison or health club with On-Off controls at each shower station. A single thermostatic mixing valve is exposed to a wide range of flow rates. This valve standard was developed to deal with a wide range of flows with tight temperature tolerances at low flows. If only one shower is flowing, the flow rate could be as low as two gallons per minute. In larger installations, it may be necessary to install a hi-low system that incorporates two or more thermostatic mixing valves. A smaller valve is used to compensate and maintain temperature during low flow conditions, and multiple valves work together as the flow rate increases.

***ASSE 1070 - Water Temperature Limiting Devices***
In-line devices such as the ASSE 1070 thermostatic mixing valve limit the water temperature of the hot water supply to a shower valve, but they do not provide thermal shock protection, since additional unprotected cold water is mixed in downstream of the device. This device limits the water temperature to fixtures such as sinks, lavatories or bathtubs and reduces the risk of scalding. The device shall be either the final temperature regulation or have water further tempered downstream of the device with the addition of cold water.

**Water heater thermostats**
I cringe every time I hear a radio talk show host or some one tell people to turn their water heater thermostats down to prevent scalding. Turning the thermostat down will not prevent scalding. I see the same misguided advice dispensed in newspaper handyman columns that talk about water heaters or home safety. Water heater thermostats cannot be relied upon to control the hot water temperature to a hot water system. Although water heater manufacturers recommend that installers set thermostats at 120 - 125 F, and although most of them ship the water heaters at lower temperature settings, it is impossible to accurately control the water heater temperature with a water heater thermostat. The plumbing engineering community continues to recommend storing hot water at 140 degrees Fahrenheit and mixing the hot water with an ASSE 1017 thermostatic valve to deliver hot water to the plumbing system at about 120 degrees Fahrenheit. This reduces the threat of Legionella bacteria growth in the tank, and allows a smaller water heater than one with a lower stored temperature.

Hot water systems are designed and water heaters are generally sized to store hot water at 140 F. When the thermostat is set at a lower temperature, the water heater has a reduced capacity to deliver hot water. As a result, when users run out of hot water, and the water heater thermostat is re-adjusted to a temperature above 120 F, this increases the temperature to a scalding temperature and in some cases it could be adjusted even higher than the original setting. The water heater will continue to store and deliver water at scalding hot temperatures. The solution is using a thermostatic mixing valve not tinkering with the water heater burner controls.

Water heater thermostats were never intended to provide precise temperature controls for hot water systems. For example: the thermostat dial calibration test of ANSI Z21.10.1-1998, which is the applicable standard for gas-fired water heaters, allows the temperature to vary 10 degrees above or below the thermostat setting. I have talked to water heater manufacturers that have indicated that the controls can vary as much as 15 to 18 degrees Fahrenheit above or below the set point of he thermostat. The thermostat is inserted into the lower portion of a water heater tank and turns the fuel supply to the heater on and off. Most newer water heater thermostat dials have no way to know what the temperature in the tank is. There are letter designations, numbers, or words like, warm, hot and very hot. There is generally never a fixed temperature indicated on the dial.

Theoretically, if the water heater thermostatic element is set at 120 degrees Fahrenheit, the burner would come on when the temperature at the thermostat reaches about 105 degrees Fahrenheit. The burner stays on until the water around the thermostat element near the bottom of the heater reaches about 135 degrees Fahrenheit (about 30 degrees higher than when the burner came on and 15 degrees above the theoretical set point of the thermostat).

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# Upcoming Events:

## 2008 ASPE Convention and EPE Show

Long Beach, California
October 25-29, 2008

The American Society of Plumbing Engineers (ASPE) is the international organization for professionals skilled in the design, specification and inspection of plumbing systems. ASPE is dedicated to the advancement of the science of plumbing engineering, to the professional growth and advancement of its members and the health, welfare and safety of the public.

The Society disseminates technical data and information, sponsors activities that facilitate interaction with fellow professionals, and, through research and education, expands the base of knowledge of the plumbing engineering industry. ASPE members are leaders in innovative plumbing design, effective materials and energy use, and the application of advanced techniques throughout the world.

Convention and Technical Symposium The Society hosts biennial Conventions on even numbered years and Technical Symposia on odd number years for professional plumbing engineers, designers and contractors to improve their skills, learn original design concepts and make important networking contacts to help them stay abreast of current trends, codes and technologies. In conjunction with each Convention there is the Engineered Plumbing Exposition, the greatest, largest gathering of plumbing engineering and design products, equipment and services. Everything from pipes to pumps to fixtures, from compressor to computers to consulting services is on display to allow engineers and specifies to view the newest and most innovative design materials available to them. In addition, the Society conducts a number of one- and two-day technical and professional development seminars in conjunction with the Chapters, each year.◦

www.aspe.org/new/Conv_Symp/conv-symp2008.php


Long Beach Convention Center

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Most people don't realize that the maximum temperature limit test of the ANSI Z21.10.1 Gas Water Heater Standard allows the outlet water temperature of the water heater to rise 30 F above the thermostat setting. This provision in the standard accounts for the phenomenon known as "stacking" or "thermal layering". The hot water is less dense and rises to the top of the hot water tank. The cooler water drops to the bottom of the tank. Stacking or layering occurs when hot water rises to the top of the heater due to recurring short duration heating cycles caused by a frequent number of small quantity hot water uses. This phenomenon can occur in any type of storage water heater and generally is more significant in vertical heaters.

At the top of a water heater that is theoretically set for 120 F to prevent scalding, the temperatures can easily reach 150 to 165 degrees Fahrenheit. These extremely high temperatures will cause third degrees burns and severe scald injuries in an instant upon contact with the skin. This is why I highly recommend installing the proper type of an ASSE 1017 thermostatic mixing valve on the outlet piping of a water heater to limit the hot water distribution temperatures to a maximum safe delivery temperature of 120 F. If high temperature hot water uses are required in a building, I recommend installing an ASSE 1070 thermostatic mixing valve on the local branch piping serving a fixture or group of fixtures. The mixing valve can then reduce the hot water temperature to a safe temperature.

I hope that these hot water system design recommendations will keep you out of hot water.◦

*Ron George is President of Ron George Design & Consulting Services. His company specializes in plumbing, piping, fire protection and HVAC system design. He also provides plumbing and mechanical code consulting and plumbing product standard consulting services and he also provides forensic investigations and litigation support for plumbing and mechanical system failures.*

## IAPMO Commits to 'Greener' Codes

pmengineer.com, February 1, 2008

In late January the International Association of Plumbing and Mechanical Officials (IAPMO) held an emergency meeting of its Committee for the Awareness and Understanding of a Sustainable Environment (C.A.U.S.E.) in Honolulu.

IAPMO committed to push forward a minimum 10% mandatory reduction in energy usage and water savings through code changes that require sustainable construction practices over the next three years. The changes will be in the Uniform Plumbing Code, Uniform Mechanical Code and Uniform Solar Code.◦

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