Chicago Faucets White Paper Series

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The Scalding Truth:

What Assisted Living Facilities Need to Know about Protection Against Hot Water Burns

Accidental injuries are a common risk in the day-to-day operation of an assisted living facility. Grab bars, handrails, and slip-resistant flooring protect residents against injury from falling, but has your facility taken the necessary steps to prevent scalding in lavatories and showers? Scalding, after all, poses a greater danger to residents of an assisted living facility than to the general population because of the physical limitations of those residents. And with over 31,000 assisted living facilities in the U.S., there is now a large population at risk.

In the following pages, you will learn about the scald risks inherent in any plumbing system and some special challenges facing assisted living facilities. You'll also receive some suggestions that can help you protect the residents in your care.

Scalding: What Are The Risks?

According to the Centers for Disease Control (CDC), scalds account for 33%-58% of all hospitalizations for burns in the United States. The CDC further points out that adults over 65 have a worse prognosis and require more extensive medical treatment than younger patients after scald burns. This is particularly relevant for assisted living facilities, where many residents are elderly.

An example provided by the University of Michigan Health System illustrates the danger:

> *Emil Malaniak, a resident in a senior living facility, was showering when the warm water suddenly spiked to a scalding temperature. Unable to manipulate the shower valve, he attempted to shield himself with the shower curtain. But within seconds, he received second- and third-degree burns over his legs and feet, and later died from his injuries.*[1]

This incident and others spurred the University of Michigan Trauma Burn Center to launch a scald injury prevention campaign to help stop these preventable burn injuries.

Fortunately, scalds occur less frequently than in the past due to improvements in plumbing system design and equipment. Scalding remains a serious threat, however, which leads to the question, "How hot is too hot?"

Table 1 shows the time it takes different water temperatures to produce third-degree burns on "normal" skin

Although scald injuries can affect people of all ages, with older adults and those with disabilities the risks may be elevated. In the elderly, skin layers may be thinner, resulting in dramatically shorter time to third-degree burns. A condition in some people known as Congenital Insensitivity to Pain with Anhidrosis (CIPA) prevents them from feeling the effect of burning on the skin and can lead to very severe injury. And scalding is not the only risk. In the shower, a person suddenly exposed to extremely hot water tends to reflexively jerk away to avoid contact. With the elderly, this frequently leads to a fall.

Admission to a long-term or assisted living facility brings with it a certain expectation of safety for residents. Failure to protect residents from harm puts the facility at risk for loss of life and financial penalties resulting from legal action. So, how far should scald protection go? If a person can be scalded from a faucet or shower, what measures should the facility take to protect that person?

Your Responsibility to Act

An assisted living facility manager has a legal and ethical interest in assuring that measures to protect against scalding are in place. In Consumer Advocacy in Assisted Living, the authors point out:

> *"The term 'assisted living' is used to refer to many different types of facilities and settings. No agreed-upon model for assisted living and no federal standards or guidelines currently exist. Despite the lack of clarity, consumers exhibit strong acceptance of the ALF concept (e.g., a more flexible and homelike setting than the institutional environment of a nursing home)."* [2]

One of the primary questions facility managers will be asked with increasing frequency is, "Do you maintain proper water temperature for your residents when they are bathing or washing their hands?" To answer that question you will need to understand the basics of how hot water moves through the plumbing system to the "point of use"; that is, the point at which your residents interact with the system to shower, wash their hands, etc. The next section will help you understand those basics.

Temperature	Third-Degree Burns Within
156°F	1 Second
149°F	Water 2 Seconds
140°F	5 Seconds
133°F	15 Seconds

Understanding Plumbing Codes and Safety Guidelines

Many factors influence water temperature at the point of use, including the water heater setting, piping size and layout, water usage, and other variables. A properly designed, installed, and maintained system will deliver hot water without placing the user at risk for scalding.

A common misconception is that a water heater's thermostatic control allows the delivery of water at a safe, consistent temperature. Following the 140°F recommendation (see sidebar "Water Temperature and Infection Control") means that secondary controls downstream of the water heater must be used to ensure that water no hotter than 120°F is dispensed at the point of use for showering and handwashing. Therefore, water temperature must be controlled at both the source – the water heater – and at any point-of-use dispensing devices such as faucets and showerheads. You do not have to be a code or specification expert, but familiarity with a few fundamental guidelines can help you protect your residents.

Plumbing codes require a maximum water temperature for plumbing fixtures like sinks, showers, and bathtubs. These requirements are found in Chapter 4 of the Uniform Plumbing Code (UPC). The UPC is used throughout the United States as a basis of design.

UPC Section 407.3, "Limitation of Hot Water Temperature for Public Lavatories," is one of the pertinent standards for assisted living facilities. It states:

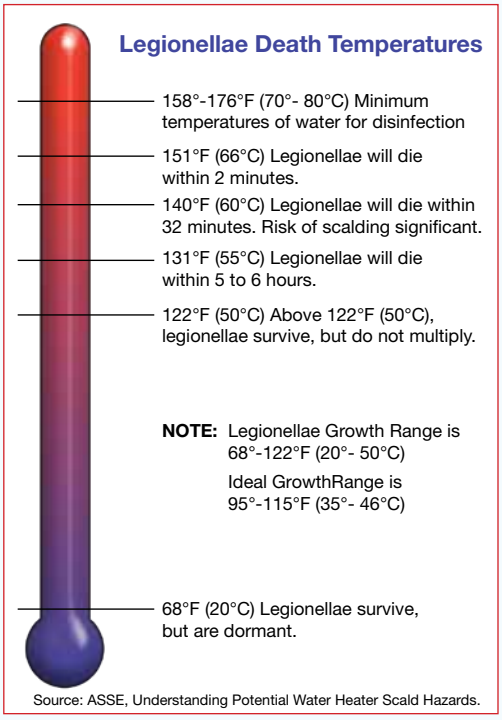
> *"Hot water delivered from public-use lavatories shall be limited to a maximum temperature of 120°F (49°C) by a device that is in accordance with ASSE 1070 or CSA B125.3. The water heater thermostat shall not be considered a control for meeting this provision." (emphasis added)*

Note the reference to "ASSE 1070". ASSE 1070/ ASME A112.1070/CSA B125.70, often abbreviated as ASSE 1070, is the performance standard for "Water Temperature Limiting Devices." It specifies the performance requirements of any components downstream from the water storage tank that are used to limit temperature. When used in accordance with UPC 407.3, a mixing valve may serve as a temperature limiter for lavatory sinks to reduce the risk of scalding. Think of the mixing valve as a cooling device, mixing enough cold water into a stream of hot water to lower the output at the point of use to a safe temperature (defined in the UPC as 120° or below).

Other hot water system control standards are covered in the "Knowing the Codes" section of this white paper. Read and familiarize yourself with them. You should also be aware of any manufacturer's installation requirements, which may exceed the prevailing code. The Authority Having Jurisdiction (AHJ) must give final approval of all plumbing installations.

Water Temperature and Infection Control

It may seem like the obvious solution to prevent scalding is to simply turn down the water heater temperature, but this would be a dangerous mistake. Reducing the temperature below 130°F makes the water heater a prime breeding ground for bacteria like Legionella, E. coli and pseudomonas. Reducing the water heater temperature can actually increase the risk of exposure to these bacteria, a particular concern in an assisted living facility where the population may be highly susceptible to infection. A water heater set at around 140°F helps prevent the development and spread of bacteria through the plumbing system.



Source: ASSE, Understanding Potential Water Heater Scald Hazards.

Controlling Water Temperature at the Point of Use

Typically, a mixing valve is used to mix hot and cold water at the point of use. Mixing valves come in two basic types, thermostatic or pressure-balancing, and a third type, thermostatic/pressure-balancing, which is a combination of the first two.

The most common type of mixing valve is the pressure-balancing valve, typically found in shower installations. This type of valve reacts to incoming hot and cold water supply pressure and maintains a pre-set ratio of mixed water at the outlet. Should the cold supply pressure

drop, the valve restricts the flow of hot water to prevent a sudden rise in temperature. A pressure-balancing valve does not restrict the maximum temperature at the outlet; rather, it maintains a pre-set mix of hot and cold water. In other words, if a user adjusts the shower to dispense only hot water, this type of valve will not temper the water to prevent scalding.

A thermostatic mixing valve may be installed with a sink faucet to sense incoming hot and cold water supply temperature and compensate for variations to maintain water temperature at the outlet. This valve reacts to the temperature, not the pressure of the water, allowing the manufacturer or installer to set a maximum outlet water temperature by adjusting the valve. Even though the building's water heater may be set to 140°F to protect against bacterial contamination, the thermostatic mixing valve can limit the water temperature at the showerhead, for example, to a maximum of 100°F (or any temperature that is considered safe). If the water temperature exceeds the pre-set limit, the valve closes, restricting the flow of water to prevent scalding.

A combination thermostatic/pressure-balancing mixing valve, like the basic pressure-balancing valve, is typically found in showers. This valve uses both technologies described above to maintain balanced water pressure and a safe, comfortable water temperature at the point of use. This type of valve provides the highest level of user safety and comfort by compensating for both pressure and temperature variations.

Manual faucets and showerheads with integrated scald protection – in the form of a built-in thermostatic or thermostatic/pressure-balancing mixing valve – give a facility convenient protection against scalding at the point of use. Electronic faucets are available that include an integrated thermostatic mixing valve in the control box below the sink. Whether you choose manual or hands-free faucet activation, an integrated mixing valve eliminates the need to install a separate mixing valve below the sink, offers easy compliance with ASSE 1070 requirements, and simplifies installation and maintenance.

Further Resources

Besides reading this white paper and becoming familiar with codes and regulations in your area, areas to become familiar with for scald and other protection involve access to resources. Here are some for further review.

1. The Government Accountability Office (GAO) recently released a report revealing that thousands of "Critical Incidents" in assisted living facilities occur regularly with little accountability.[3] What's worse, more than half of the 48 states providing these services couldn't tell the GAO the number or nature of critical incidents in assisted living facilities. The Centers for Medicare & Medicaid Services (CMS) is charged with overseeing how states monitor such incidents. Yet, as evident from this report's findings, CMS guidance has not been strong or clear enough. The report highlights the necessity for stronger federal protections for assisted living residents and higher standards to ensure their safety.

   What Can You Do? Familiarize yourself with your state's regulations, and make sure they are followed closely within your facility. For scald protection, consult with manufacturers who make faucets and showers. They have resources to help you comply with state and federal regulations. They can also inform you about new technologies that make compliance easier than ever.

2. The American Burn Association offers a Burn Fact Sheet[4] that is a good resource for burn information, including scalding. Their website is a comprehensive reference for anyone who would like to learn more about the impact of burn injuries in the U.S., including statistics on hospitalizations for burns.

   What Can You Do? Visit ameriburn.org to view the Burn Fact Sheet and other helpful resources. (The direct link to the Fact Sheet is provided in the Notes at the end of this paper.) Contact your local health care facilities to see if they have programs for scald prevention. Many offer helpful guidelines and promotional materials like posters to remind your residents to be careful when using water.

3. The CDC (Centers for Disease Control and Prevention) is an excellent resource for facts related to scalding. Information pertaining specifically to scald hospitalizations for the elderly is provided in the CDC paper "Nonfatal Scald-Related Burns Among Adults Aged ≥65 Years – United States, 2001–2006".[5] The more knowledgeable you are, the better prepared you will be to assess your facility's needs and avoid scalding incidents.

   What Can You Do? Visit the CDC website at cdc.gov. Conduct a scald protection audit at your facility. A plumbing equipment manufacturer's representative can help you assess your plumbing system and uncover any steps you should take to protect your residents. Certification of your facility may, in fact, require such an audit; make sure you are aware of all requirements.

Conclusions

The information in this white paper will equip you to review your plumbing system and make informed recommendations for improved scald protection. You should also plan to conduct regular maintenance of the plumbing system. Regular inspection of mixing valves assures maximum valve life and can prevent valve failure that leads to a scalding incident. Factors like corrosive water conditions, unauthorized adjustments, or needed repairs can be detected during inspection. Keep in mind that the frequency of required maintenance depends upon local water conditions and the water usage at your facility.

According to the National Center for Assisted Living, more than 835,000 Americans now reside in assisted living facilities. The majority of these residents are age 85 and older. The association reports that after a median stay of around 22 months, "roughly 60% of residents will move out of assisted living to transition to a skilled nursing center." By taking proper scald prevention measures you can help keep these residents safe no matter how long they are in your care.

Knowing the Codes

Assisted living facilities are regulated by each state, with guidelines, requirements, and procedures for classifying assisted living facilities varying from state to state. Plumbing codes establish the quality, safety, and performance requirements of plumbing fittings used in public and private settings. Provided below is a brief review of the plumbing codes and standards that pertain to scald protection in your facility. For further guidance, consult a professional plumbing engineer who can recommend specific steps you can take to secure your plumbing system and protect your residents.

1. ASSE 1016/ASME A112.1016/CSA B125.16 (a.k.a. ASSE 1016), "Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations", covers the delivery of water at the individual fixtures that are adjusted and controlled by the individual resident through specifically three valve types: 1) pressure balancing (P), 2) thermostatic (T), or 3) combination (T/P).

2. ASSE 1070/ASME A112.1070/CSA B125.70 (a.k.a. ASSE 1070), "Performance Standard for Water Temperature Limiting Devices", covers only a single valve type, very similar to an ASSE 1016 type T valve, with two exceptions. An ASSE 1070 device **limits** the water temperature and the ASSE 1016 valve **controls** the water temperature to a range (±3.6°F). The difference between the two standards reflects the increased risk of scald burns during showering versus that of handwashing or bathing.

   Take Away: Familiarize yourself with the type of faucets and other plumbing devices within your facility. Are the right valves being used in the right locations? A Real Property Inventory system, if you are using one, provides a good overview. You may also be using a Computerized Maintenance Management System (CMMS) for descriptions of procedures and practices used to track the maintenance of your assets and associated costs. The records from the maintenance and repair of your plumbing products give you information you need to make these determinations.

3. ASSE 1062, "Temperature Actuated Flow Reduction (TAFR) Devices for Individual Fixture Fittings", comes into play when showers do not meet the requirements of ASSE 1016, for instance, when an ultra-low-flow (ULF) showerhead may cause a mixing valve to malfunction. Installations like these can be provided with a temperature actuated flow reduction (TAFR) valve, a device that complies with ASSE 1062 and reduces the scalding risk.

   In such cases, a TAFR valve may be installed between the showerhead and the shower arm. The TAFR protects the bather from scald burns by reacting to the temperature of the water flowing through the device. When the water temperature exceeds the set-point (about 115 - 117°F), the valve closes and restricts the water flow, allowing the bather to adjust the controls to a cooler setting and reset the TAFR valve. The resetting process takes 15 - 20 seconds.

   Take Away: Plumbing systems do not remain constant. While you may have proper equipment in place, other variables require you to provide simple safeguards to avoid scalding incidents. You might ask your staff to test water temperatures before a resident with physical or cognitive impairment gets into a bathtub or shower. Some facilities do this on a regular basis: they send an attendant to monitor shower

temperatures during meals, so as not to disturb the residents. Checking up while the resident is in the room is also an excellent way to show care. Remember that regularly checking water temperature at the supply (water heater) and at all point-of-use devices are both critically important.

4. ASSE 1069, "Automatic Temperature Control Mixing Valves", may apply to an assisted living facility that offers plumbing fixtures such as sitz baths where the bather does not have direct control over the water temperature. These installations expose a single thermostatic mixing valve to a wide range of flow rates with tight temperature tolerances at low flows and do not allow further tempering downstream. Since the primary application for ASSE 1069 is showers, the temperature control requirement is the same as that of an ASSE 1016 type T valve, ±3.6°F.
5. ASSE 1066, "Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings", provides a means to balance the hot and cold water supply pressures in order to minimize mixed water temperature variations. No temperature limit stop or any form of adjustment is required. An ASSE 1066 compliant device controls pressure imbalances that lead to thermal shock; it does not provide scald protection.
6. ASSE 1071, "Temperature Actuated Mixing Valves for Plumbed Emergency Equipment", is not used for compliance in an assisted living facility. These devices are designed for use with plumbed emergency equipment, including eyewash and drench shower units. The temperature requirement varies depending on capacity. Also, hot water control has a tighter tolerance than cold water control.

Finally, in contrast to the standards discussed thus far, ASSE 1017, "Temperature Actuated Mixing Valves for Hot Water Distribution Systems", does not address final temperature control at fixtures and appliances. It is concerned with valves used at the source of hot water for distribution to the supply system. This standard allows wider variation of the outlet temperature at higher flow rates. Keep in mind that ASSE 1017 listed devices **should never be used to deliver water directly to the user**. These valves should be used in combination with ASSE 1016 and/or ASSE 1070 listed devices.

STANDARD NUMBER	SCALD PROTECTION	THERMAL SHOCK PROTECTION	DOWNSTREAM MIXING ALLOWED	INSTALLED AT	FINAL TEMP ADJUSTMENT	APPLICATION
ASSE 1016	YES	YES	NO	Point of use	YES	Individual shower or combination tub/shower valves *
ASSE 1017	NO	NO	YES	At, or near, source	NO	Temperature control for hot water distribution systems ONLY. Additional downstream safety devices required.
ASSE 1062	YES	NO	NO	Point of use	NO	Temperature actuated flow reduction device. These valves are intended for use in-line with, or are integrated into, individual plumbing supply fittings such as showerheads, bath, utility faucets, sink and lavatory faucets.
ASSE 1066	NO	YES	YES	Ahead of the control valve(s)	NO	In-line ahead of individual terminal fittings such as shower fittings, bath, utility, sink or lavatory faucets.
ASSE 1069	YES	YES	NO	Where the bather has no access to the temperature adjustment means	YES	Single-pipe gang showers, sitz baths
ASSE 1070	YES	NO	YES	Near, or integral to, plumbing fixture fittings	NO	Controls and limits outlet water temperature to fittings such as sinks, lavatories, bidets or bathtubs.
ASSE 1071	YES	NO	NO	At the "plumbed emergency equipment"	Yes	As part of "plumbed emergency equipment" systems that comply with ANSI Z358.1

Source: ASSE, Guidelines for Temperature Control Devices in Domestic Hot Water Systems.

FOOTNOTES

1. http://media.wattswater.com/ScaldingUofM.pdf

2. https://www.americanbar.org/content/dam/aba/administrative/law_aging/2012_aging_arth4837_csmradvcyasstlvg_tb.authcheckdam.pdf

3. https://www.gao.gov/products/GAO-18-179

4. http://ameriburn.org/who-we-are/media/burn-incidence-fact-sheet/

5. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5836a1.htm

REFERENCES

American Burn Association, Burn Incidence and Treatment in the United States: 2016, http://ameriburn.org/who-we-are/media/burn-incidence-fact-sheet/

ASSE, Guidelines for Temperature Control Devices in Domestic Hot Water Systems white paper, http://www.asse-plumbing.org/downloads/ASSE_Guidelines_For_Temp_Control_Devices.pdf

ASSE, Adjustment of Automatic Compensating Valves to Prevent Potential Scald Hazards white paper, http://www.asse-plumbing.org/downloads/CompensatingValvesScaldHazards.pdf

ASSE, Understanding Potential Water Heater Scald Hazards white paper, http://www.asse-plumbing.org/WaterHeaterScaldHazards.pdf

ASSE standards: 1016, 1017, 1062, 1066, 1069, 1070, 1071

IAPMO, Uniform Plumbing Code (UPC), Chapter 4, http://www.iapmo.org/Pages/ReadUniformCodesOnline.aspx

University of Michigan Health System, U-M Health System launches anti-scald campaign press release, http://media.wattswater.com/ScaldingUofM.pdf

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Nonfatal Scald-Related Burns Among Adults Aged ≥65 Years — United States, 2001-2006, CDC, Sept. 18, 2009, https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5836a1.htm

GLOSSARY

ABA: American Burn Association, an association that is dedicating their efforts and resources to promoting and supporting burn-related research, education, care, rehabilitation, and prevention. The ABA has more than 2,000 members in the U.S., Canada, Europe, Asia, and Latin America. Members include physicians, nurses, occupational and physical therapists, researchers, social workers, fire fighters, and hospitals with burn centers. Their multidisciplinary membership enhances their ability to work toward common goals with other organizations on educational programs.

ANSI: American National Standards Institute is the voice of the U.S. standards and conformity assessment system that empowers its members and constituents to strengthen the U.S. marketplace position in the global economy while helping to assure the safety and health of consumers and the protection of the environment. The Institute oversees the creation, promulgation, and use of thousands of norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment, from dairy and livestock production to energy distribution, and many more. ANSI is also actively engaged in accreditation, assessing the competence of organizations and determining conformance to standards.

ASME: American Society of Mechanical Engineers is a not-for-profit membership organization that enables collaboration, knowledge sharing, career enrichment, and skills development across all engineering disciplines, toward a goal of helping the global engineering community develop solutions to benefit lives and livelihoods. Founded in 1880 by a small group of leading industrialists, ASME has grown through the decades to include more than 130,000 members in 151 countries. Thirty-two thousand of these members are students.

ASSE: American Society of Sanitary Engineering – ASSE International maintains nearly 50 product performance standards, ranging from double check and reduced pressure backflow preventers to dielectric pipe unions, with many more in the development stages. ASSE's product standards are minimum performance requirements for component parts of the plumbing system. ASSE also has eight professional qualifications standards,

jointly developed with the International Association of Plumbing and Mechanical Officials (IAPMO), including the ASSE/IAPMO/ANSI Series 5000, Cross-Connection Control Professional Qualifications Standard, and the ASSE/IAPMO/ANSI Series 6000, Professional Qualifications Standards for Medical Gas Systems Personnel.

CDC: Centers for Disease Control and Prevention is one of the major operating components of the Department of Health and Human Services. CDC works 24/7 to protect America from health, safety, and security threats, both foreign and in the U.S. Whether diseases start at home or abroad, are chronic or acute, curable or preventable, human error or deliberate attack, CDC fights disease and supports communities and citizens to do the same.

CSA: Canadian Standards Association Group is a global provider of testing, inspection, and certification services for products from a wide range of market sectors, and a leader in safety and environmental certification for Canada and the U.S. As one of the largest standards development organizations in North America, they understand the recognized benchmark that a standard sets – a benchmark that products can be tested and certified to – opens international doors for those products. Their CSA certification mark appears on billions of products worldwide.

E. coli: Escherichia coli is part of the normal human intestinal flora. E. coli has been studied intensively in genetics and molecular and cell biology because of its availability, its small genome size, its normal lack of pathogenicity (disease-causing ability), and its ease of growth in the laboratory. Most strains of E. coli are harmless. However, some strains of E. coli are capable of causing disease, sometimes disease of deadly proportions.

GAO: Government Accountability Office is an independent, nonpartisan agency that works for Congress. Often called the "congressional watchdog," GAO investigates how the federal government spends taxpayer dollars. The head of GAO, the Comptroller General of the United States, is appointed to a 15-year term by the President from a slate of candidates Congress proposes.

IAPMO: The International Association of Plumbing and Mechanical Officials has been protecting the public's health and safety for ninety years by working in concert with government and industry to implement comprehensive plumbing and mechanical systems around the world. As a membership-based association, IAPMO is proud to utilize an open consensus process in the development of their flagship Uniform Plumbing Code® and Uniform Mechanical Code®. These codes are established through scientific research, debate, and analysis, strengthening their position at the forefront of the plumbing and mechanical industries. The IAPMO Group is a complete service organization, providing code development assistance, industry-leading education, plumbing and mechanical product testing and certification, building product evaluation, and a manufacturer-preferred quality assurance program. Each component of the IAPMO Group works toward playing an integral part in protecting the health of people everywhere.

Legionella: A genus of aerobic, motile, non-acid-fast, non-encapsulated, gram-negative bacilli (family Legionellaceae) that have a non-fermentative metabolism and require L-cysteine HCl and iron salts for growth. The bacterium is found naturally in fresh water, spreads in air, and is pathogenic for humans. Over 40 species have been identified; the type species is Legionella pneumophila. Exposure to Legionella may lead to Legionnaire's disease (Legionellosis).

Mixing Valve: A device used to combine hot and cold water and provide tempered water to a point-of-use fitting such as a showerhead or faucet.

Pressure-balancing Mixing Valve: A device that is used to regulate water pressure, typically in a shower or tub, by reacting to water pressure changes and maintaining the pressure ratio; includes a mechanical stop for selecting a pre-set maximum temperature limit.

Scalding: Having or producing the feeling of being burned. A burn caused by a hot liquid or a hot, moist vapor.

Thermostatic Mixing Valve: A device that is used to prevent a sudden, dangerous water temperature increase in a shower or faucet by reacting to water temperature changes; includes a mechanical stop for selecting a pre-set maximum temperature limit.

Thermostatic/Pressure-balancing Mixing Valve: A device that is used to regulate water temperature and pressure, typically in a shower or tub, by reacting to water pressure and water temperature changes; includes a mechanical stop for selecting a pre-set maximum temperature limit.

UPC: Uniform Plumbing Code, an attempt to minimize public risk by specifying technical standards of design, materials, workmanship, and maintenance for various systems. The main aims of the Uniform codes are: 1) to ensure that planners, administrators, and plumbers develop the required competency to ensure that the codes are applied and upheld; 2) that standards are set to ensure that plumbing assemblies, materials, and technologies are safe and effective; 3) to ensure that plumbing installations meet these standards, and 4) to ensure safety and effectiveness continuously through the proper maintenance of these installations.