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# Guidelines for Temperature Control Devices in Domestic Hot Water Systems

***A White Paper***

*Developed by the ASSE International Scald Awareness Task Group*

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## SECTION

# 1

# EXECUTIVE SUMMARY

The ASSE International Scald Awareness Task Group was formed to educate and give guidance to the general public and plumbing industry on potential scalding hazards associated with domestic hot water at the point of use.

Hot water from the tap accounts for more than 25 percent of all scald burns in children. The elderly and the physically impaired are at increased risk of scald burns also. The attempt to prevent these scald injuries was the driving force that brought about the invention of temperature control devices.

Each device covered by an ASSE product performance standard has specific applications as to where they are intended to be used. However, over the past few years, ASSE International has been receiving calls from inspectors, installers, and others asking if certain types of devices are approved to be used in certain installations. The Authority Having Jurisdiction (AHJ) has the final approval of all installations, but one must be aware of the manufacturer's installation requirements, which may exceed the prevailing code.

There also appears to be a misunderstanding of the use of devices listed to multiple standards. For these reasons, the ASSE Board of Directors thought it was best to write a white paper to serve as a reference tool for adding clarity to where the devices should be installed.

The Task Group's assignment was to develop a white paper that clearly explains where each temperature control device, within ASSE's portfolio of product performance standards, should be used, and create an understandable reference tool that everyone in the plumbing industry can use.

### **THE ASSE PRODUCT PERFORMANCE STANDARDS FOR THESE DEVICES ARE:**

**ASSE 1016-2011/ASME A112.1016-2011/CSA B125.16-11**, *Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations*

**ASSE 1017-2009**, *Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems*

**ASSE 1062-2006**, *Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings*

**ASSE 1066-1997**, *Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings*

**ASSE 1069-2005**, *Performance Requirements for Automatic Temperature Control Mixing Valves*

**ASSE 1070-2015/ASME A112.1070-2015/CSA B125.70-15**, *Performance Requirements for Water Temperature Limiting Devices*

**ASSE 1071-2012**, *Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment*

This paper is the fourth in a series of white papers produced by the ASSE International Scald Awareness Task Group. Each of the previous papers delve into a particular circumstance relating to the prevention of scald injuries.

- *Scald Hazards Associated with Low-Flow Showerheads: A White Paper*
- *Understanding Potential Water Heater Scald Hazards: A White Paper*
- *Adjustment of Automatic Compensating Valves to Prevent Potential Scald Hazards: A White Paper*

These previous papers, along with this current paper, are available as downloads online at [www.asse-plumbing.org](http://www.asse-plumbing.org).



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# PURPOSE

The primary purpose of this paper is to provide a simple-to-use and understandable reference guide that everyone in the plumbing industry (plumbers, installers, maintenance personal, specifiers, inspectors, engineers, educators, trainers, and code officials) can use in determining which device is correct for a particular installation.

In some applications, installing the wrong device or installing the device in the wrong location can lead to potentially serious scalding situations – it can be the same as if no temperature control device was installed, thus exposing the end user to potentially scalding hot water temperatures. Furthermore, installing the wrong device can lead to a false sense of security by the ultimate user. Therefore, it is extremely important to make sure that the proper device is installed in the proper location.

We hope the information in this paper will be a useful reference for determining the proper use and application of temperature control devices.

Upon completion of this paper, work began to develop a pocket-sized guide for the industry to use as a simple reference, rather than going through the standards to determine the proper applications of the various devices. A copy of this matrix can be found in Section 7 of this paper.

# APPLICATIONS

## Shower and Tub/Shower Combination Valves

- Shower valves shall be automatic temperature and/or pressure compensating valves intended to be installed at an individual shower or tub/shower combination.
- These valves must comply with **ASSE 1016-2011/ASME A112.1016-2011/CSA B125.16-11**, *Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations*.
- The user has access to flow and/or final temperature controls. No further mixing occurs downstream of the device.
- These devices are intended to control the water temperature to wall- or ceiling-mounted:
  - a. Hand-held showers;
  - b. Shower heads;
  - c. Body sprays, either in individual shower or tub/shower combination fittings; and
  - d. Tub spouts, when part of tub/shower combination fittings.
- There are three different types shower valves that meet this standard:
  - a. Pressure balancing
  - b. Thermostatic (mechanical and electronic)
  - c. Combination pressure balancing and thermostatic
- The showerhead flow rate must not be less than the manufacturer's published minimum flow rate for the valve (device).
- The temperature limit stop must be set at the time of installation, and may need to be periodically adjusted for variations in water temperatures.
- These devices provide both scald and thermal shock protection.

## Hot Water Distribution Systems

- Temperature actuated mixing valves for hot water distribution systems are used for controlling in-line water temperatures in domestic hot water systems.
- These valves must comply with **ASSE 1017-2009**, *Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems*.
- When used, these devices shall be installed at or near the outlet of the hot water source **ONLY**.
- These valves are designed to provide a relatively uniform water temperature to the hot water distribution system.
- As a side benefit, these valves allow the water to be stored at a higher temperature, extending the amount of hot water available, and also reducing the chance of legionella (ASHRAE Guideline 12).
- These valves are **NOT** intended for point of use applications.
- Valves must be sized to match the flow requirements of the system:

Flow Rate	Allowable Temperature Fluctuation
0-5 GPM	$\pm 3^{\circ}$ F
5-40 GPM	$\pm 5^{\circ}$ F
Over 40 GPM	$\pm 7^{\circ}$ F

- Further mixing downstream is allowed to provide final temperature control to protect against scalding.
- These devices used alone do not provide thermal shock protection or adequate scald protection.
- Installation note: to prohibit the cross-flow of hot or cold water through the valve, supplementary check valves are recommended for devices that do not include integral check valves.

## Individual Supply Fittings – TAFR Valves

- Temperature actuated, flow reduction (TAFR) valves, when used, shall be installed on the discharge outlet of the fixture fitting or integrated into fixture fittings.
- These valves must comply with **ASSE 1062-2006**, *Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings*.
- Intended for use in-line with, or integrated into, individual plumbing supply fittings such as shower heads, bathtubs, whirlpool bathtubs, utility sink faucets, kitchen sinks, and lavatory faucets.
- Designed to automatically reduce flow to a trickle within five seconds of outlet temperatures greater than a preset actuation temperature not to exceed 120° F (48.9° C).
- During the five (5) second response period, the bather may be exposed to temperatures in excess of the set point of the device.
- After actuation, the device shall reset and open automatically at a predetermined lower temperature, or with the use of a manual reset mechanism.
- These devices can be used on existing fixtures to provide scald protection – typically, where no other form of scald protection is provided.
- TAFR valves are not intended to be installed in place of devices complying with ASSE 1016, ASSE 1017, ASSE 1066, ASSE 1069, or ASSE 1070.
- These devices provide scald protection ONLY, and DO NOT provide thermal shock protection.

### **CAUTION:**

*These valves automatically reduce discharge flow to a trickle if water temperature exceeds a preset limit. This trickle can be as much as 0.25 GPM (0.95 L/m). When this device is installed on a bathtub spout and the outlet temperature exceeds the preset limit, and if the bathtub drain is closed, the bathtub could fill with extremely hot water from this allowable trickle.*

### **CAUTION:**

*Some ultra-low-flow showerheads may still have a full spray pattern when the flow through this TAFR device is reduced.*



## In-Line Pressure Balancing Devices for Individual Fixtures

- Automatic pressure balancing in-line valves are used to equalize incoming hot and cold water line pressures. This minimizes mixed water temperature variations due to pressure fluctuations when used in conjunction with a mixing valve or two handle valve set.
- These valves must comply with **ASSE 1066-1997**, *Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings*.
- They are not designed to limit the maximum outlet temperature at the point-of-use.
- These devices provide thermal shock protection for pressure disturbances ONLY, and DO NOT provide scald protection if the incoming hot or cold water temperature changes.

## Tempered Water Through a Single Supply Pipe

- Automatic temperature control mixing valves shall be installed and set to supply only tempered water to the end user, and automatically compensate for pressure and/or temperature variations in water distribution systems.
- These valves must comply with **ASSE 1069-2005**, *Performance Requirements for Automatic Temperature Control Mixing Valves*.
- These devices have the capability to significantly reduce the outlet flow in the event of a cold water distribution system failure.
- The device is equipped with an adjustable means to limit the setting of the device towards the hot position. The temperature limit stop must be set at the time of installation, and may be adjusted by the building owner or representative.
- The device is designed to be the final temperature control.
- Intended to control the water temperature to individual or multiple fixtures.
- NOT intended for individual showers or tub/showers.
- Intended to be installed where the end user does NOT have access to the temperature adjustment means.
- Designed to supply only tempered water to the end user.
- No further mixing downstream of the device.
- Typically installed for gang (multiple) showers and sitz baths.
- These devices provide scald protection and thermal shock protection.

## Temperature Control Devices with Downstream Mixing Permitted

- Water temperature limiting devices are intended to limit the hot or tempered water temperature supplied to fittings for fixtures such as sinks, lavatories, bidets, or bathtubs to reduce the risk of scalding.
- These devices must comply with **ASSE 1070-2015/ASME A112.1070-2015/CSA B125.70-15, *Performance Requirements for Water Temperature Limiting Devices.***
- These devices are intended to supply tempered water to plumbing fixture fittings, or be integral with plumbing fixture fittings supplying tempered water.
- These devices shall have:
  - a. Fixed (non-adjustable) temperature setting; or
  - b. Temperature setting that can be:
    - i. Adjusted and locked in position; or
    - ii. Adjusted with the use of a tool to protect against adjustment by the user.
- Further mixing downstream is allowed.
- These devices have an integral water temperature limiting capability. The user control allows the outlet temperature to be adjusted up to a maximum temperature of 120° F (49° C).
- These devices provide scald protection ONLY, and DO NOT provide thermal shock protection.

## Mixing Valves for Plumbed Emergency Equipment

- Temperature actuated mixing valves are intended to be used as a component that can provide tepid water for emergency eye wash, eye wash/shower, drench showers, and combination units that comply with the requirements of ANSI Z358.1.
- These valves must comply with **ASSE 1071-2012**, *Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment*.
- These valves, by themselves, do not meet the requirements of ANSI Z358.1.
- These valves consist of a hot water inlet, a cold water inlet, a mixed water outlet, a temperature controlling element, and a means for adjusting the mixed water outlet temperature while in service.
- These valves also have a means to limit the maximum outlet temperature under normal operating conditions.
- Provisions shall be made so that the temperature cannot be inadvertently adjusted.
- These valves shall include a means of preventing cross-flow.
- Ideally, these devices are intended to be installed as close as possible to the plumbed emergency equipment.
- These valves provide scald protection ONLY, and DO NOT provide thermal shock protection.
- These valves provide cold water bypass flow in the event of a hot water failure.

### **NOTE:**

*Emergency plumbed equipment must be flushed frequently, per industry standards, to minimize stagnant water.*

# DEVICES LISTED TO MULTIPLE STANDARDS

There are many devices in the marketplace that are listed to multiple standards (e.g. ASSE 1017, ASSE 1069, and/or ASSE 1070). Devices listed to multiple standards are approved for each particular application in accordance with the listing relevant to its use. While these devices listed to multiple standards are designed to be installed in more than one application, a single device should not be installed to control the entire temperature of the distribution system while simultaneously serving the needs of a fixture(s).

When a device listed to multiple standards is installed at the point of source or supply (at or about the water heater) as a temperature control device for a potable water distribution system, it is considered to be an ASSE 1017 device. It does **NOT** negate the requirement of an ASSE 1016, ASSE 1069, or ASSE 1070 type device, where required, to control the water temperature at the point of use.

Dual listed devices should be installed in accordance with one of the listed standards. When installed in a particular location, the device should not be used to satisfy the requirements of multiple listings. Each device should be installed within the scope and application of one of its respective standards.

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# QUESTIONS & ANSWERS

In this section, we will introduce some hypothetical situations where the choice of the proper temperature control device may not be absolutely clear. We will suggest a device and explain the rationale for the choice – there may be other solutions available.

1. A high school wants to add a shower room with four metered showers. Consistent with conservation requirements, they want to provide 105° F water to the metering valves. What device can be used?

*One solution is to install a device listed to ASSE 1069, in accordance with the manufacturer's installation instructions, with a single pipe system to all of the showers with a metering or on/off control at each shower.*

2. A plumber has a customer who has small children and wants to protect the hot water to their bath tub. Since there is no access to the two hand valve supply pipes, he wants to install a device at the water heater to limit hot water to 110° F. What can he use to provide anti-scald protection?

*One solution is to install a tub/shower combination valve listed to ASSE 1016 at the bath tub with the limit stop set to 110° F.*

*Another solution would be to install a device listed to ASSE 1070 on the hot water supply to the bath tub with the temperature limit set to 110° F.*

*Another solution is to install a device listed to ASSE 1062 on the bath tub spout.*

- \* *Installing a device listed to ASSE 1017 at the water heater will not provide adequate scald protection.*

3. A hospital has several sitz baths located in individual cubicles. Can these be supplied from a single, central ASSE 1070 control valve supply fixture?

*Yes. If the sitz bath has final adjustment capabilities of the water temperature at the point of use, the proper device is one listed to ASSE 1070.*

*If the sitz bath uses only tempered water, the proper device is one listed to ASSE 1069.*

4. A doctor wants to have access to temperature adjustment at a scrub sink he uses. Can a wall mounted 1016 valve be used to provide this requirement?

*No. A device listed to ASSE 1070 is to be used on surgical scrub sinks.*

5. A plumber wants to install a device listed to multiple standards at the water heater and set the limit stop to 110° F to not only control the temperature of the water distribution system, but also to avoid the potential of scalds at the downstream fixtures. Is this a correct installation?

*No. A device listed to multiple standards when installed to regulate the building's distribution system temperature should not be considered an ASSE 1069 or ASSE 1070 safety device. Mixing valves, whether listed to ASSE 1017 or multiple-listed to ASSE 1017, ASSE 1069 or ASSE 1070, installed at a water heater to regulate distribution temperature serve as ASSE 1017 point of source applications ONLY. In this situation, the device will not be able to provide the required scald protection since the device in this application only provides temperature control. Further point of use temperature control devices must be installed as required.*

## SECTION 6

# DEFINITIONS

### Hot Water Source

*Point at which hot water is generated.*

### Point of use

*The final outlet of the water system just prior to discharge to atmosphere. (ASSE International Plumbing Dictionary, 6th Edition)*

### Scalding

*Hot water exposure for a time period long enough to cause a thermal injury. Scald burn injuries can increase in severity at higher hot water temperatures or with longer exposures to a given hot water temperature. (Scald Hazards Associated with Low-Flow Showerheads: A White Paper. ASSE International, March 2012)*

### Thermal Shock

*A significant sudden change in temperature from hot to cold or cold to hot, or hot to hotter that causes a bather to violently react, which can lead to a slip and fall injury. (Scald Hazards Associated with Low-Flow Showerheads: A White Paper. ASSE International, March 2012)*

## WATER

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### Cold Water

*Water at temperatures of 40° F to 70° F (4° C to 21° C). (ASSE International Plumbing Dictionary, 6th Edition)*

### Hot Water

*Water at a temperature of not less than 120° F (49° C). (ASSE International Plumbing Dictionary, 6th Edition)*

### Tempered water

*A mixture of cold and hot water to produce warm water suitable for use. (ASSE International Plumbing Dictionary, 6th Edition)*

### Tepid Water

*A mixture of water, 60° F to 100° F, primarily used with emergency equipment. (ANSI Z358.1)*



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# MATRIX

STANDARD NUMBER	SCALD PROTECTION	THERMAL SHOCK PROTECTION	DOWNSTREAM MIXING ALLOWED	INSTALLED AT	FINAL TEMP ADJUSTMENT	APPLICATION
<b>ASSE 1016</b>	YES	YES	NO	Point of use	YES	Individual shower or combination tub/shower valves *
<b>ASSE 1017</b>	NO	NO	YES	At, or near, source	NO	Temperature control for hot water distribution systems ONLY. Additional downstream safety devices required.
<b>ASSE 1062</b>	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.
<b>ASSE 1066</b>	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.
<b>ASSE 1069</b>	YES	YES	NO	Where the bather has no access to the temperature adjustment means	YES	Single-pipe gang showers, sitz baths
<b>ASSE 1070</b>	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.
<b>ASSE 1071</b>	YES	NO	NO	At the "plumbed emergency equipment"	Yes	As part of "plumbed emergency equipment" systems that comply with ANSI Z358.1

*\*Refer to Model Codes - UPC-408.3 or IPC - 424.3 or IRC- P2708.3 or NSPC-1015.6*

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# TASK GROUP MEMBERS

ASSE International expresses its sincerest gratitude to all of the members of this Scald Awareness Task Group for their dedication and contributions to this project.

A total of 21 industry professionals contributed both time and expertise to the development of this paper. The group is comprised of manufacturers, engineers, industry association members, master plumbers, general interest individuals, inspectors, building officials, and labor representatives. Some of the participants requested that their name and/or company name/affiliation not be mentioned in the paper.

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