As seen in: PM ENGINEER

How Low Can You [Really] Go?

By Bruce Fathers

To maximize master tempering valve selection, engineers need to understand minimum flow.

In the world of a plumbing systems design engineer, few tasks are as critical as properly selecting the thermostatic valve(s) that will temper water throughout a new facility. An engineer must consider many important factors when choosing large tempering valves or systems, commonly known as master mixers or Hi/Los.

At a bare minimum, all master tempering valves must be seal board-approved to ASSE 1017. Without this guarantee of performance, bather safety is put at risk. Beyond seal board approval, an engineer then considers maximum flow (at a given pressure drop), to assure a facility's tempered water requirements are met, and next minimum flow, to insure safe bathing during low demand periods (as few as one or two fixtures).

Other considerations include: the type of actuation technology employed to ensure optimal response time, the materials used to guarantee long life under adverse water conditions, and the built-in safety features that prevent unauthorized tampering.

However, the most critical performance criterion is temperature control across a broad range of flows and conditions, specifically at a manufacturers stated "minimum flow." All tempering valve manufacturers state a "minimum flow" value for individual valves and manifolded systems, expressed in gallons per

minute (gpm), or the metric counterpart, liters per minute (lpm). Generally, this "number" is used when evaluating overall valve performance and specification worthiness.

These stated values are typically very low (0.5-5.0 gpm), and imply temperature control and bather safety, but do they deliver on that promise? A critical question that must be asked is, "What do these values truly represent and how do they relate to the critical performance standards—ASSE 1016, ASSE 1017, ASSE 1069 and ASSE 1070?"

Before tackling that question, let's first review the basic operation of tempering valves and their relation to water flow. At the heart of every tempering valve is a thermostatic element (of varying types) that is responsible for sensing temperature/pressure and reacting to changes in order to maintain safe, blended water to the user. All elements perform best under high flow conditions because greater amounts of water improve thermal transfer, and thus, allow the element and its thermal mechanism to respond more quickly.

The primary issue with safe temperature control is found at low flow demand, when there is a reduced amount of water to surround and actuate the element. This is a greater issue with larger-size elements (and valves) because larger surface areas and smaller volumes of water slow the thermal transfer process. The problem is further exaggerated when slower reacting and less powerful technologies are utilized. Simply put, less flow usually equates to more unstable temperature control.

ASSE Emphasizes Minimum Flow

What do the new and revised standards say about minimum flow?

In the last two years, ASSE has revised its two major tempering valve standards (1016 and 1017) and added two more (1069 and 1070). New and some existing applications have driven new standard development. ASSE 1016 was becoming a certification catchall for more than it was originally intended. Because of the safety implications involved, the new and revised standards place a stronger emphasis on minimum flow testing.

ASSE 1016-1996, -2005

ASSE 1016-1996 is a bath and shower standard that has been historically adopted by other devices, such as those that control water to lavatories. Because showerheads are regulated to 2.5 gpm, the lowest flow required to pass ASSE 1016 is 2.5 gpm. More specifically, a compliant valve must hold ±3°F when subjected to pressure (types T/P, T, and P) and temperature changes (types T/P and T).

If flow is below 2.5 gpm, performance relies on the manufacturer's word or implication the valve(s) hold ±3°F when subjected to temperature and pressure changes. Just because a valve is ASSE-listed or compliant and states a minimum flow below 2.5 gpm, don't assume it meets the temperature control criteria of the standard. The key question to ask the manufacturer is how their valve performs (±3, ±5, ±10, ±20F, ±??) when tested according to 1016 at 0.5 gpm or 1.0 gpm. They should state this in writing and back up with test data.

This is particularly critical for lavatory tempering applications with single or multiple low-flow outlets. Lavatories in public restrooms and schools are often outfitted with 0.5 gpm aerators. Remember, an ASSE 1016-listed valve only ensures temperature control to 2.5 gpm. Anything less can result in dramatic changes to outlet temperature when pressure or temperature disturbances occur. ASSE 1016-2005 is now strictly a shower and bath/shower standard. ASSE 1070

Figure 1.

ASSE 1017 Minimum Flow Test		
Valve	Capacity at 10 psid	Minimum Flow tested
#1	15 gpm	7.5 gpm
#2	30	15
#3	60	30

was developed for lavatory applications and includes a manufacturer's "stated minimum flow" test.

ASSE 1017-2003

Because ASSE 1017 valves come in a wide range of sizes and flow capacities, there is no one-size-fits-all formula for performance. The capacity/control tradeoff (i.e., larger valves typically require larger elements that are less effective at lower flows) allows for more generous minimum flow requirements as valve capacity increases.

Minimum flow for any given valve is tested at 50% of its flow capacity at a 10-psi pressure differential (see **Figure 1**). Because of potential safety issues, ASSE 1017-2003, as originally published, required valves to be tested at the "manufacturer's minimum advertised flow" if that flow fell below the 50% at 10 psid (50/10) rule.

Since its release in 2003, that requirement has been recently removed for reasons unknown. The reversal has now been challenged because of severe safety and liability implications.

Under the currently enforced revision, one must rely on the manufacturer's word if stated minimum flow falls below the 50/10 rule. For example, if a manufacturer states its minimum flow for valve #2 (**Figure 1**) is 5.0 gpm, then we know there is a 10 gpm discrepancy between where the valve is tested (to ASSE 1017) and the manufacturer's claim. The next logical question is: Does the valve actually meet the performance requirements when temperature changes occur, given the sizable difference? Again, just because a minimum flow value is stated does not guarantee the valve provides real temperature control at that flow. The manufacturer should be willing to provide back-up data to support its claims, if asked.

ASSE 1069-2005

The thermostatic standard for single-pipe supply tempered water applications, i.e., gang showers, requires valves to be tested to "the lesser of 2.5 gpm or manufacturer's specified minimum flow rate."

ASSE 1070-2004

ASSE's new thermostatic standard covers water tempering for sinks and faucets. ASSE 1070 requires product testing at "manufacturer's stated minimum flow" (section 3.5.2.d) to temperature control requirements of ±7°F.

Questions to Ask

So, when reviewing manufacturer's stated minimum flow, ask the following questions:

- What does the minimum flow value represent in terms of performance to the standard?
- Does the manufacturer specifically state the minimum flow performance relative to the standard, i.e., "minimum flow to ASSE 1017"?
- Does the application align with the products certification, i.e., public lavatory operates as low as 0.5 gpm and product is listed to ASSE 1016, which tests at a minimum of 2.5 gpm?
- Will the manufacturer back up its claims with test data?
- What thermal technology does the manufacturer use? Ask the manufacturer to explain why it's safer than others. Faster response equals greater bather safety.

Any valve can simply "pass" a low volume of water. The key is controlling temperature at low flow when there is a disturbance to the system. PME

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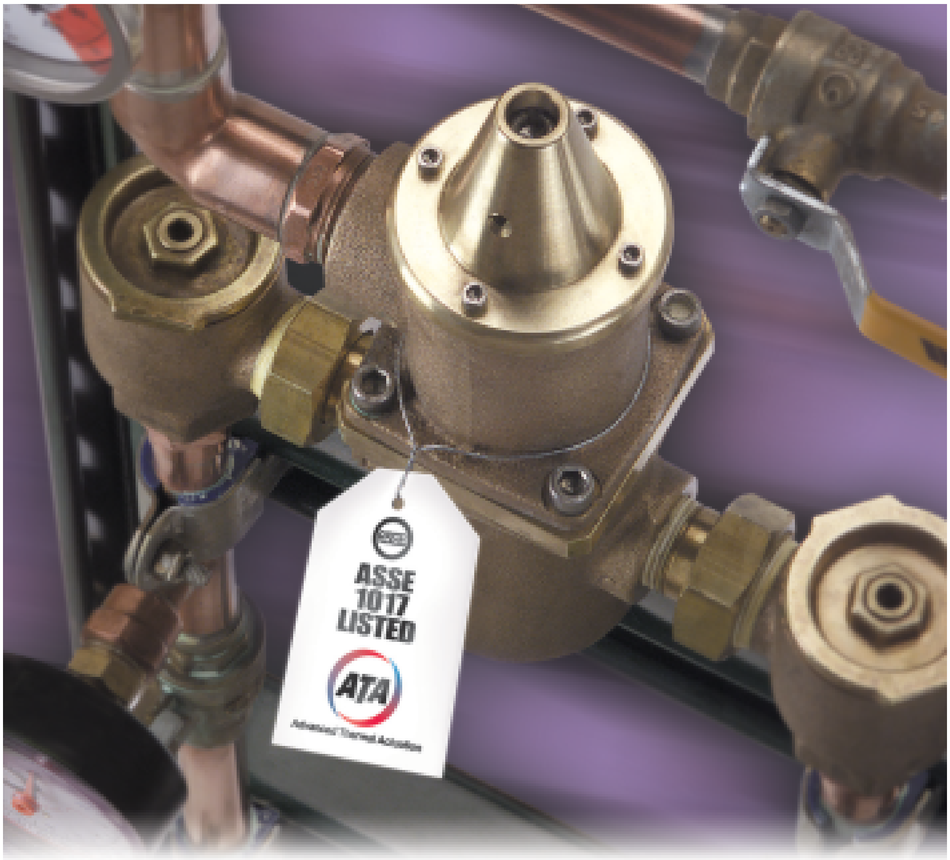

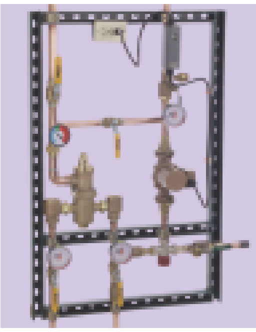

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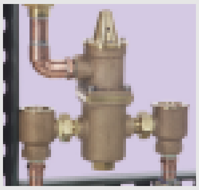

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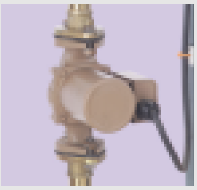

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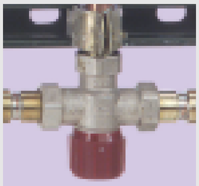

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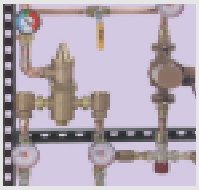

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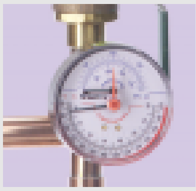

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