



When it's hot, it's hot When it's not, you wait

How long should it take for the water at a hot water faucet to actually become hot?

Most building codes require commercial buildings having more than four floors, or hot water distribution pipe run lengths greater than 30 metres (100 ft), to incorporate a means to keep the water in hot water distribution pipes hot at all times.

Without such a system, it could take 10 minutes – or possibly even longer – to get hot water from a faucet, especially if the faucet happens to be furthest from the water heater. Worse yet is the large amount of municipally-treated water that had cooled in the distribution piping that would be needlessly run down the drain until recently-heated water finally reaches the tap. Beyond the time and waste concerns stands an even

continued on page 44



••• LAYING OUT THE SYSTEM

The re-circulation design flow of each branch should be determined based on the anticipated heat loss through the branch. Balancing valves may then be used to ensure that this design flow is available to each branch in the loop.

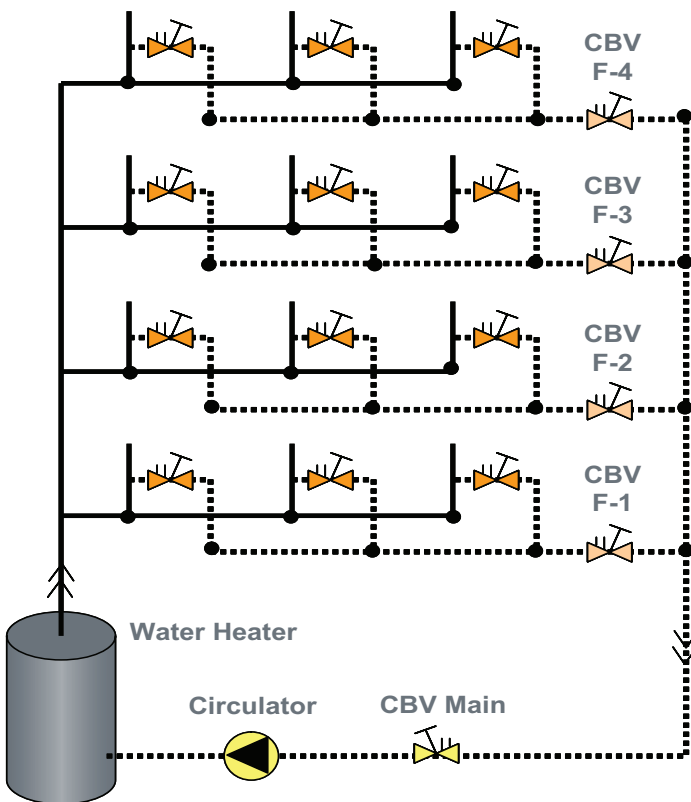
Let's consider the simple example of a four-storey condominium building with three units per floor.

A hot water faucet in each unit, furthest from the riser, is equipped with a return line fitted with a balancing valve. Let's assume that a unit recirculation design flow of 0.5 gpm has been determined necessary to compensate heat loss.

Starting with the fourth floor, each unit is balanced against the furthest, then all third floor units are balanced, followed by the second floor, and finally the first floor. Then the floors are all balanced against each other via CBV F-1, F-2, F-3, and F-4. Finally, the overall system design flow is set using CBV Main.

When balancing is complete, the flow through each unit CBV will be equal at 0.5 gpm, and all floor CBVs will be equal at 1.5 gpm, with a total of 6 gpm through CBV Main.

With 6 gpm of flow through the balanced system, the temperature of the hot water in the branch of every unit will be maintained.



Without recirculation system balancing, the most disadvantaged branch would receive the least flow, whereas the most advantaged branch would receive the majority. Unless the system is balanced, hot water users on the most disadvantaged branch would still have long wait times.



greater potential issue. The partially-cooled hot water could harbour and cultivate harmful bacteria, such as Legionella.

A common method to ensure that the water in hot water distribution piping remains hot is to recirculate cooled water back to the water heater for reheating. This is accomplished by installing a dedicated return line between the water heater and furthest hot water faucet in the branch, and using a centrifugal pump to drive the cooled water back to the water heater.

Whenever we have more than one branch of hot water distribution piping is when the recirculation balancing act begins. *enl*



A small dedicated return system.

Controlling system operation

After the system is balanced, it is common to control the circulator with an aquastat reading the temperature of the water return.

When the return temperature reaches the high setpoint, the circulator is stopped. As the water cools below a low setpoint, the circulator is started, and so the system cycles to maintain the recirculation water temperature between the high and low setpoint.

Additionally, the circulator may be equipped with a timer, to stop the circulator during normal sleeping hours, and restart it in advance of the first anticipated morning use.

With the system properly balanced and controlled:

- Occupants enjoy instant hot water at the tap, first use, and all throughout the day.
- Building managers receive fewer complaints of long waits for hot water.
- Building owners experience lower metered water charges.
- Municipal potable water consumption (and corresponding waste water treatment) should be reduced.



Fixed-orifice circuit balancing valves

For hot water recirculation system balancing, as with hydronic system balancing, fixed-orifice circuit balancing valves (CBV) can help speed the balancing process. These balancing valves have the benefit of a fixed flow co-efficient (Cv) for flow calculation purposes. This fixed Cv is used to determine the differential pressure reading that corresponds to the required design flow, regardless of the system head available to the valve. Then the CBV need only be adjusted until that differential pressure is obtained.

In contrast, the Cv of a variable-orifice valve changes with handle setting, requiring constant recalculation of the differential pressure to flow relationship as the valve is throttled, generally taking about twice the time to set each valve.

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