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Hospital Hot Water

Designing a system that will provide hot water out of the faucet in less than three seconds.

By J. Larry Rains, Jr.
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Have you ever wanted to design a domestic hot water system that worked — one that provided 105- to 110-degree hot water in two seconds after the faucet was turned on, that does not use balancing valves and, best for last, is cheaper to build when compared to the traditional two pipes (hot and hot water return system) installation? Welcome to Jump Routing.

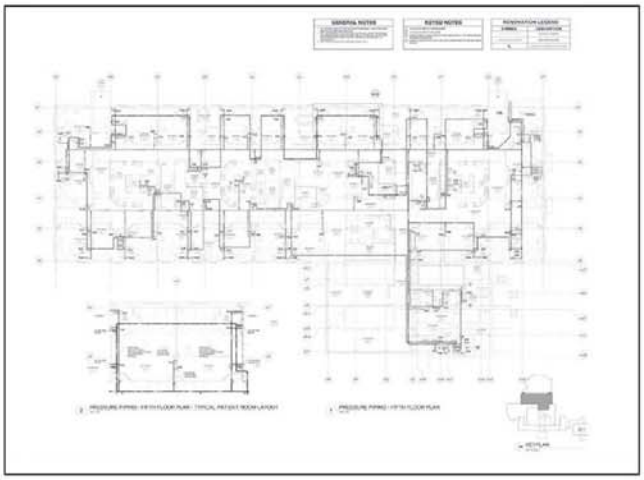
We named the design "Jump Routing" because it simply jumps from one fixture to the next with right angles. It is not routed down the corridor to match the cold-water standard installation. Instead, it is routed from one fixture to the next. The design requires the hot water supply main to be located a maximum of 10 feet horizontally from the fixture drop. This provides the two- to three-second delivery time once a fixture faucet is turned on.

The system starts at the heaters. Say you have a six-story hospital; you would run the hot and cold mains to a vertical riser to supply each floor horizontally. From the riser, the cold water would be routed in the traditional down the corridor tree pattern design. The hot water from this point is different; it starts by routing within 10 feet of the closest fixture, then to the next closest fixture, and so on. We go clockwise to make it simple.

Once you complete the clockwise route and all the fixtures have a hot water drop, you head for the HWR riser. Each drop to a fixture contained a shut-off valve in the horizontal line just prior to the drop for code compliance. The traditional cold water shutoff is still in the corridor serving one or more fixtures in the space.

The hot water piping is still sized based on the fixture value you placed on it, and as you drop off to feed the fixtures, the main size reduces based on fixture units. Once you have completed the route back to the vertical risers, you place your hot water return pump at this location and prior to connecting to the vertical hot water return riser. The line size here is generally ¾ inch to 1 inch. The HWR pump flow is calculated based on maximum of 5,000 BTU/hr loss across the loop.

Example of pump flow: 1,000-foot pipe x 30 / 5,000 = 6 gpm pump flow; head is minimal, usually 15 feet to 18 feet. Generally we try not to use a pump smaller than 8 to 10 gpm; a little more never hurt anything. All you are trying to do at this point is move the water at 2 feet per second (fps) when there is no draw from an open fixture. The return systems are generally designed and sized at 5 psi loss / 100 foot run with a maximum of 7 fps velocity. If your floor is fairly large, you may want to divide it into two loops or more. Each floor or loop should be designed in a similar fashion, and each zone should contain an HWR pump to make this design work satisfactorily. The pump is the key here with several beneficial factors.

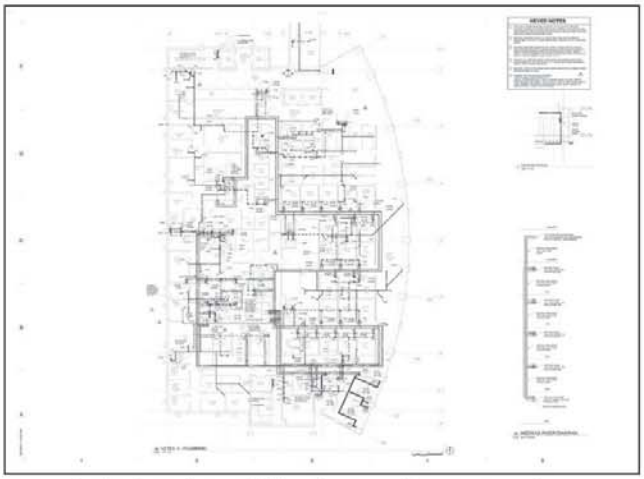


First, we all know Legionella is a concern, and something we all have to deal with if we design any building, especially a health care facility. All you have to do is review the current FGI guidelines for hospitals; it is now your responsibility to provide a system that is as free of Legionella as possible. The system I'm describing does just that.

By keeping the water moving, the chlorine has less time to dissipate into the copper piping system. We all know heating water in a heater reduces the amount of chlorine that is sent out to the fixtures. If we keep it moving, each time a faucet is activated we are refreshing the chlorine in the system.

Now think about this: we are moving the hot water at 115 to 120 degrees around the HW system on each level. We are 15-feet total pipe distance from the fixture, and if your system is designed at 7 FPS

Hot Water



max velocity, how long will it take to get hot water to the outlet? Two seconds once the faucet is opened, three on a bad day.

Say you have a riser with one loop on each floor with a small HWR pump at each connection to the riser. We would place a cumulative sized HWR pump at the heaters to serve the overall system.

Example: If the upper three floors were 10 gpm each, we have a 30-gpm pump at the water heaters. In any case, the head should not be more than a 15- to 18-foot loss, due to the low flow velocity. One of the biggest benefits is you have eliminated the balancing valves that very few contractors have a clue how to set. So you say, "Have test and balance guys to set it." This generally doesn't work either from my experience. You give them flows for each leg, and they try to set it accordingly, but the installers did not pipe the system as you designed, so now everything is questionable three weeks before the job opens up; and the HW system is still not up to par for state health final inspection.

It is time to get our heads out of the sand and design a system that is specifically installed to accomplish one given task. That is, hot water out of the faucet in less than three seconds. It also keeps chlorine in the system to combat the Legionella from growing.

If installed as designed, you have a main flowing hot water at 10 foot horizontally from the fixture drop, and a 5-foot or 6-foot drop to the fixture vertically. Okay the system is designed for 7 fps flowing, 16 feet /7 =2.28 seconds to the outlet. Sounds pretty good to me, and I don't think an owner would be unhappy with those kinds of results.

On one project of 240,000 square feet, we laid out both systems and conducted a life-cycle cost analysis (LCCA). To our surprise the loop design was $124,000 cheaper than the first cost due to less piping and not to mention 53 balancing valves in the traditional system. There was one small drawback; it took 99 years for pay back on the fourth hot water return pump in the loop system. Energy cost for the fourth HWR pump was $1,300 additional yearly energy cost. At $124,000 initial savings, I can live with that.

To date, we have employed four of these systems in the three hospitals with very happy DPOs and staff end-users. I have attached a few examples of the design to share with the need of the whole. This system works as designed, but does require the contractor's understanding of how to install and why. They cannot locate the hot water main 32 feet from the fixture because the duct guy got there first. The system will not work like that. The best course is to explain the system and the importance of the main routing at the pre-bid meeting.

The installation cannot be deviated from in the field by subs that have no idea what or why the system is called out to be installed in this manner. I have used the terminology "fighting Legionella" in my presentations, which generally gets their attention. Deviations are not allowed. The pipe can be closer, but not farther away from the fixture as called out in the construction documents. Should you have questions, please feel free to reach out to me. ●

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