By John Barba

John Barba is the contractor training & trade program manager with Taco, Inc. He can be reached at johbar@taco-hvac.com.

DETECTIVE BARBA AND THE MYSTERIOUS CASE OF THE BANGING ZONE VALVES

In our last episode, we put forth the proposition that not all circulators are created equal. There are circulators with flat curves and ones with steep curves. There are circulators with multiple curves that are all steep, and ones with multiple curves that are all flat.

There are also variable speed circulators with curves that are fixed, albeit funny looking; and variable speed circulators with curves that actually adjust to what the system really needs.

None of them, however, are a "plug 'n play" or a "one size does it all" circulator. That's more wishful thinking than anything else.

To illustrate, we explored the "Mysterious case of the banging zone valves." As you'll recall (in Part 1 of the series, last issue) a contractor did a complete boiler change out, replacing the boiler and all the trim. It was a zone valve job, and he installed a new, "only-pump-you'll-ever-need-'cause-it-replaces-all the-others" three-speed circulator.

The system heated just fine, but the zone valves, which used to be quiet as a church mouse, now banged like an all-percussion marching band.

Why? And how can we make 'em stop?

The answer, friends, can be found between the flanges.

ENOUGH WITH THE BANGING, ALREADY!

So, mystery solvers, how do we make the banging stop?

Two solutions jump to mind. One is simple. One is silly.

Let's start with silly.

Solution 1: Install a pressure differential bypass valve

Why is this silly? Because it's the most labour-intensive (and as a result, most costly) and the least effective. To install a pressure differential bypass valve you have to drain the system, alter the boiler piping to accommodate the valve, pipe the valve correctly and set the valve up properly (not a "gimme" by any means).

That's a lot of time, material and effort for what amounts to just masking the fact that the wrong pump was installed in the first place.

So let's check out Solution 2

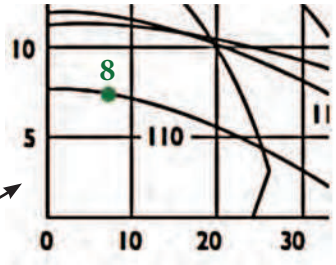
Universal Hydronics Formula

GPM = BTUH ÷ (T × 500)

THE SITUATION

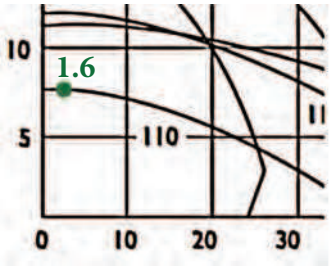
The old circulator was a three-piece Taco 110, a high-flow, low-head, flat-curve circulator. The total heating load of this job was 80,000 BTUH, and by applying the universal hydronics formula we know the total required flow rate for the job is eight gpm. Let's presume each zone is roughly equal in overall load, at roughly 16,000 BTUH apiece (1.6 gpm each).

With all zones calling, here's where the system operated when the 110 was in service:



That's about eight gallons per minute at roughly seven feet of head pressure.

Now let's look at what happened when only one zone called:



The flow rate changed drastically, from eight gallons per minute to around 1.6, but the head pressure (pressure differential) is only about 7.5 feet. That's only a half a foot of change, meaning the zone valves were closing against, at most, 7.5 feet of head. In terms of pressure, that's only 3.25 PSI worth of pressure differential, and not enough to cause any zone valve to bang.

Now, you fellow hydronics detectives will remember the key: There was a new circulator installed with the new boiler. It was a three-speed Taco 0015 because, after all, a three-speed circulator's the only one you'll ever need, right?

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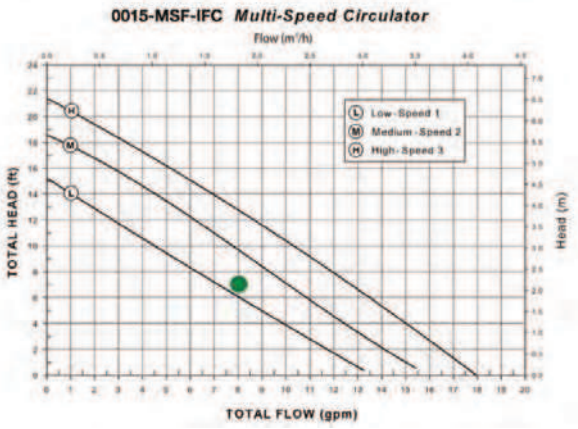
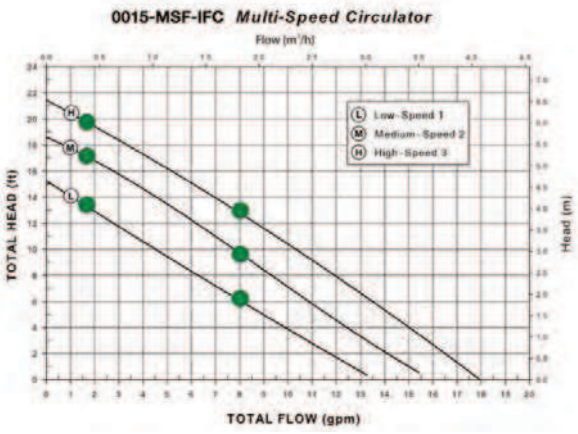
And if the job requires a total of eight gpm at roughly seven feet of head, the 0015 looks perfect, no?

All ya gotta do is slap it in! If you're one of those perfectionist types, you'd go ahead and set it to medium speed. But if you're just being sure, high speed is the way to go. What in the name of NCIS could go wrong?

Well, if your only threshold is no one complaining about freezing to death, there's no problem. It says here this system's going to deliver all the heat your customer could want at medium or high speed. And you can bet dollars to donuts it would work most of the time at low speed, as well.





SOLUTION 2:
Install a flat-curve pump

This is the solution that actually solved the problem, although it took some convincing. The installing contractor was told by both his rep and wholesaler that he was going to install a bypass valve and figured he'd have to eat the cost.

When it was suggested that the simplest, most logical, least expensive and most effective solution would be to swap out the three-speed steep-curve pump for a flat-curve model, there was a bit of skepticism.

"That can't be it. That's such old technology. It's been around forever!"

It sure has, but the laws of physics have been around even longer.

No problemo!

That is, if we can ignore the banging.

Why does it bang? Take a gander...

Remember, with a fixed-speed circulator the system will always operate on the pump curve.

Always.

Note where the operating points are at each of the three speeds, and note the corresponding head pressures. We know the zone valves didn't bang at around 7.5 feet of head pressure differential (that's where we were with the old circulator), so it's likely there was no banging with all zones calling and the 0015 set at low speed. However, with only one zone calling, you can see the spot where the system curve intersects the pump curve is up around 13 feet of head – nearly double the head produced by the old circulator.

Welcome to Bang City.

At medium speed the intersection point is around 17 feet and at high speed it's around 20 feet. Those are higher rent neighbourhoods in Bang City.

Now, in this example, the installer interpreted the clues correctly and rightly concluded the 0015 was the culprit. However, the escape from Bang City went badly awry when he swapped out one brand of three-speed for another.

Different brand, same issue. With this type of pump, problems start as more zones close. The system moves up the pump curves and the zone valves close against greater pressure differentials, and they are not going to be quiet.

On the face of it, either the 0015 or the 15-58 should be a perfect fit for this job, since their performance curves cover the flow and head requirement. And all the sales guys say that since it has three speeds, it's the only pump you'll ever need and it makes pump selection "easy."

Well, the easy answer is often the cleverest. Unfortunately, it's also often wrong.