McDonnell & Miller
Hoffman Specialty

CounterPoint™

Volume 1 Issue 1 ITT Fluid Technology Companies January 1994

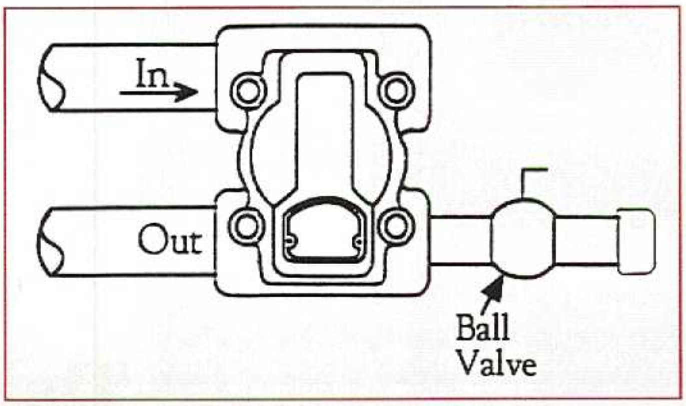
How Do You Know If An F&T Trap Is Working?

F&T traps discharge condensate at saturation temperature, so you can't tell by differential temperature across the trap whether they're working. If you're a good troubleshooter and you have a mechanic's stethoscope, you may be able to distinguish the gurgling sound a good trap makes when operating.

One sure way to check the condition of an F&T trap is to see if it discharges condensate, or live (not flash) steam. A simple ball valve attached to the unused outlet of a Hoffman F&T can be used as a simple trap check.

3/4" through 1-1/2" F&T traps have an "H" pattern connection feature. This offers four possible hook-up combinations for flexibility. When connecting an "H" pattern trap, two connections typically are plugged. If a short nipple, ball valve, elbow and pipe cap are piped in lieu of the plug in the outlet tap, you can test the trap in place.

If you pipe a ball valve in that extra outlet, you can test the trap by just opening the ball valve. You don't have to take the trap apart, and you don't even need a test station. Just open the valve. If condensate comes out, it's working.



If live steam (not flash) comes out, it's not working.

Other trap manufacturers use expensive sensor chambers or electronic test devices to accomplish the same thing. A simple ball valve will work more easily and cost effectively with a Hoffman trap.

Got a Winning Idea?

If you have a particularly good idea, a clever solution to a common problem, or just something worth sharing, write it up and send it to CounterPoint. If we print your article, you'll not only get a by-line seen by our 60,000 readers — you'll also win an autographed Walter Payton football, top quality B&G jacket, or other valuable prize. Send you articles to CounterPoint, B&G Advertising, 8200 N. Austin Ave., Morton Grove, IL 60053. Even if we don't print it, we will send you an ITT B&G hat for your trouble.

Lost Art and Two-Pipe Steam Seminars Set for 1994

Dan Holohan will be giving an expanded series of seminars in 1994 on The Lost Art of Steam Heating and Two-Pipe Steam Made Easy. The Lost Art of Steam Heating includes:

- One-Pipe/Two-Pipe Steam
- How To Know What You're Looking At
- Piping the Replacement Boiler
- Handling Condensate
- Trapping Steam
- Understanding the Dynamics of Air
- Piping Beyond the Boiler Room
- Taking the Mystery out of History

Two-Pipe Steam Made Easy, a brand new seminar for '94, will cover:

- How to Avoid Common Pitfalls
- How Steam Traps Work & How to Size
- Handling Returning Condensate
- Care & Feeding of Vacuum Systems
- How to Get Rid of Water Hammer
- How to Size, Layout and Check Piping
- Steam Heat Exchange Coils
- PRV Stations

Enrollment Fees:

	1 person	3 or more
1 Seminar	$149	$125/person
Both Seminars	$249	$199/person

For more details, call 1-800-860-0980.

1994 Steam Seminar Schedule

March 1-2	**Boston** Colonial Hilton	
March 8-9	**Syracuse, NY** Sheraton Inn Syracuse	
March 15-16	**Teaneck, NJ** Sheraton Hasbrouck	
March 22-23	**Philadelphia** Sheraton Plaza	
Sept. 20-21	**Washington D.C./ Baltimore**	*
Sept. 27-28	**Chicago**	*
Oct. 4-5	**San Francisco**	*
Oct. 11-12	**Seattle**	*

* Location to be announced.

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Volume 1 Issue 2

April 1994

We Built a Better Bear Trap

(Speaking of steam-heating customers, if you tell them this story, we'll be amazed if you don't get some nice business for your effort.)

When a thermostatic steam trap fails, it lets steam pass through the radiator and into the return lines. That's bad news because when a two-pipe steam system's supply and return lines approach the same pressure, the air will stop moving out of the radiators. You know what happens then? Your customers wind up with cold radiators and high fuel bills. And it only takes a couple of defective traps to ruin the steam distribution (and the fuel budget!) of an entire building.

Most thermostatic radiator traps fail from metal fatigue and water hammer. The metal fatigue part is easy to understand, especially when you consider the corrosive nature of condensate, and the fact that in a typical steam heating system, each radiator trap will open and close about 175,000 times a year. Add a bit of violent water hammer to the mix, and you can see why so many traps die an early death.

But since the traps don't all fail on the same day, the building owner usually doesn't make the connection between his broken traps (which he might not even know about!), his discomfort, and his high fuel bills.

This is where the opportunity lies. Smart contractors help the building owner make that connection. They show him how to solve both of his problems at the same time. Smart contractors know how to find business where others see only gloom.

Hundreds of smart contractors over the past year or so have been buying Hoffman Specialty's new **Bear Trap** right here at this counter. You see, the folks at Hoffman developed the **Bear Trap** specifically to resist wear and water hammer (in fact, its performance inspired its name). The Hoffman people built its element and seat from stainless steel and encased it in a water hammer-resistant cage that's designed to take a serious beating.

Before offering it to the trade, they put a bunch of **Bear Traps** on a test rack in their Chicago plant and cycled them open and closed every few seconds with a few pounds of steam pressure, lots of air and plenty of brackish condensate. They also hit them with water hammer because they knew that's exactly what would happen in the field. This went on day and night for years.

So far, they've cycled these traps open and closed more than ten million times, under real-world conditions, and they're still working. Imagine that. ***Ten million cycles, and they're still working!***

The folks at Hoffman are scratching their heads right now, not sure if they'll ever be able to kill these tough little traps. But we have a feeling they'll keep trying, and we promise to keep you posted on their progress.

Now, here's the point. Most ordinary steam trap elements last about three years. That's it. Because of this, most manufacturers warrant their traps for a single year.

We decided to do things differently. We're so sure of the **Bear Trap** (because of Hoffman's exhaustive engineering, and what we've seen on that test rack of theirs), that we've decided to triple the warranty most of the other guys offer.

How does this sound to you? We'll cover you for ***three full years*** on the **Bear Trap**. That's far beyond your warranty to your customer, and we think it's one heck of a selling point when you're talking to a building owner, don't you? It's nice to have an edge for a change, isn't it.

But maybe you need more convincing, so here: We offer the **Bear Trap** in an angle, a vertical and even a *swivel* pattern (all with interchangeable long or short nipples) so you'll be able to easily replace those old "left- and right-hand" offerings from Warren Webster, Dunham, and just about all of the manufacturers from the old days. We also figured out a way to make **Bear Trap**'s "Dura-Stat" element fit perfectly inside a Sarco, a Dunham-Bush and even a Barnes and Jones thermostatic radiator trap, so now you have a way to upgrade all those common brands of failed steam traps with tough, long-lasting **Bear Trap** elements. And you won't have to touch any ancient system piping to get the job done.

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Volume 1 Issue 3 July 1994

Hoffman F&T Traps Offer Something "Extra"

Float & thermostat steam traps play an important part in steam distribution. First, they let air pass by into the return lines. This is crucial because steam won't enter a pipe or a heater that's filled with air. If the air can't get out, the steam can't get in, and your customer will wind up with high fuel bills and very little heat.

After the air gets out, the trap closes against the steam, allowing it to give up its latent heat to the heater. Once that happens, the F&T trap opens to allow the condensate to quickly drain.

F&T traps set up the "high-pressure" and "low -pressure" sides of the system and allow the steam to flow. If a trap should fail, steam will enter an area where it doesn't belong. That usually leads to water hammer damage (with lots of noise!), and poor steam distribution.

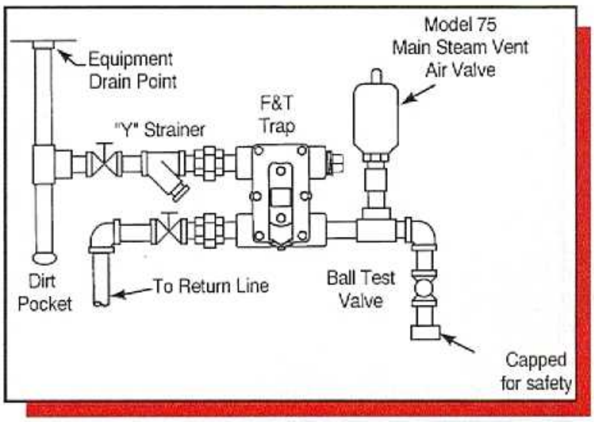
Since F&T traps work on water level and not temperature, it's very difficult to check their operation with a thermometer. The temperature of the condensate leaving the trap is usually the same as the temperature of the steam entering the trap.

The best way to check an F&T is to open a valve downstream of the trap's discharge and look at what comes out. Good traps discharge a mixture of water (condensate) and puffy flash steam. Failed traps discharge "live" steam and very little water.

For years, we've made our Hoffman F&T traps with two inlets and two outlets so you'll have more piping options.

You'll always wind up with an "extra" outlet, and many of our contractor friends use that outlet as a trap tester (to increase their trap repair business down the road). All you have to do is install a nipple and a valve in the spare outlet. Then, when you want to test the trap, just open the valve and watch what comes out. For safety, our friends install a plug in the outlet of the valve to make sure no one gets scalded, should the valve be opened accidentally.

The "extra" outlet is also a great place for a main vent. Keep in mind, F&T traps don't vent air to the atmosphere. They



just pass it down the line, usually to a vented condensate receiver.

But if there's a point where the return line drops below the inlet to the condensate pump's receiver, the piping will form a water leg through which air won't vent.

That's not a problem with Hoffman F&T traps, however, because you have that "extra" port working in your favor. Hoffman lets you vent right at the trap, and that gets the steam moving quickly throughout the building.

We recently redesigned our line of Hoffman F&T traps to include our new Durastat. The Durastat is at the heart of our thermostatic Bear Trap, the trap that resists water hammer and has gone through over 10 million cycles without a failure.

We also went to all-stainless steel internal parts and increased the capacities of our entire line. Hoffman F&T traps meet and in many cases exceed the ratings of traps offered by Spirax Sarco, Armstrong and Dunham Bush. In addition, we re-configured our 3/4"-2" sizes so you can use them as direct piping replacements for the Spirax Sarco offering.

In other words, Hoffman fits! And in more ways than one. We give you the advantage of that "extra" port for a trap tester or an air vent, plus the water hammer resistance of our stainless steel Durastat element, and all at a competitive price.

Fit Hoffman F&T traps into your next steam job. Take advantage of these extra features and the benefits those features bring to your customers. You'll stand out from the crowd!

Dan Holohan's "Complete School of Steam Heating" Fall '94 Schedule

Location	Lost Art of Steam Heating Seminar	Two-pipe Steam Made Easy Seminar
Columbia, MD		
Columbia Inn Hotel & Conf. Center	9/20/94	9/21/94
Rosemont, IL		
Ramada Inn Rosemont	9/27/94	9/28/94
Seattle, WA		
Meany Tower Hotel	10/4/94	10/5/94
San Mateo, CA		
Onmi Dunfey Hotel	10/11/94	10/12/94

For more information, prices or to enroll, call 1-800-860-0980.

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Volume 1 Issue 4 October 1994

How Much Water Should a Steam Heating System Need?

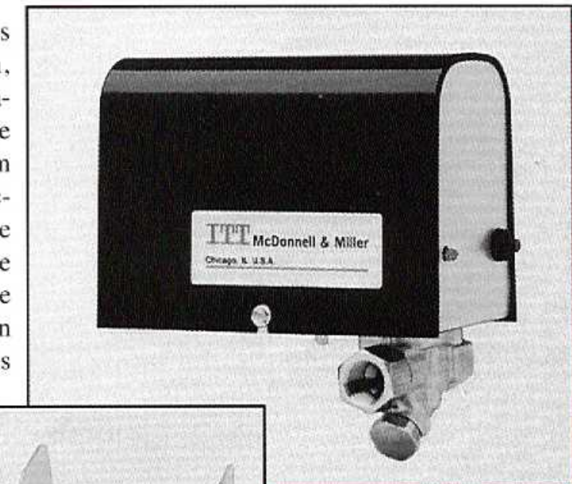
With steam heating systems, there's one thing you can count on: They will always need feed water. How much water they need depends a lot on the system's age and condition, but the feeding process never ends.

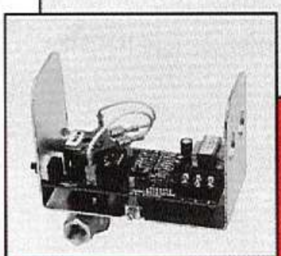
Where does the water go? It leaves the system through evaporation, through leaky air vents on the radiators and mains. This type of leakage is especially aggravated by steam pressure that's kept higher than necessary for the system (a condition we see all the time). And then there are the buried pipes. Even if there are just a few feet of buried return line on that job, there's a good chance it's leaking.

Some home owners like to feed their steam boilers by hand, but the vast majority of home owners choose the convenience and back-up safety advantages of an automatic water feeder. That's because their heating contractors took the time to explain things to them. For instance, suppose there's a leak in the system during the dead of winter when they aren't home. An automatic feeder will keep the boiler running at its safe, minimum water line, and keep the house warm. A feeder can also protect a steam boiler by keeping it fed with water should the gas valve lock itself in the open position.

How much water a boiler needs to keep operating depends on its firing rate, and this is very easy to calculate. It works like this: All boilers, regardless of their size, lose water to steam at a constant rate. Ideally, they should be fed at 1 gpm per 250,000 Btu/hr, Gross Load (D.O.E. Heating Capacity). So, if a boiler is rated for, say, 500,000 Btu/hr, and the water level should drop to the "feed" line, you should be adding about 2 GPM to keep the burner on.

In residential steam heating, you can do this very effectively with McDonnell & Miller's Uni-Match water feeder. The people at M&M came up with this feeder when the boiler manufacturers reduced the size of their replacement steam boilers. They designed the Uni-Match to protect those smaller boilers from nuisance, low-water shutdowns.





McDonnell & Miller Uni-Match Water Feeder

The Uni-Match takes its signal from either a PS-800 probe-type, or a 67 float-type low-water cutoff. It has a timing circuit that makes it wait for a minute, has it feed for a minute, then wait for a second minute, and so on. This well-thought-out feed cycle gives the condensate a chance to return and greatly reduces the chance of a flooded boiler.

Here's an important thing you should know, though. When you're installing a Uni-Match feeder, you're going to find two separate orifices inside the box. One of those orifices is for a feed rate of 1 gpm, the other is for a feed rate of 4 gpm. There's an orifice already installed in the Uni-Match at the factory, and this one is set to feed 2 gpm. This orifice will satisfy any steam heating boiler with a gross rating up to 500,000 Btu/hr.

If you're working with a very small replacement steam boiler — say, one rated at 125,000 Btu/hr — you should use the 1 gpm orifice, which is good for boilers up to 250,000 Btu/hr. This smaller orifice will feed at a slower rate and lessen the chance that returning condensate will flood the boiler.

If you have a larger steam boiler, one rated up to 1,000,000 Btu/hr, switch from the factory-installed 2 gpm orifice to the 4 gpm orifice you'll find in the box. This larger orifice will let Uni-Match keep up with the needs of that bigger boiler and stop it from shutting down on low-water, should a leak develop in the system.

So how much water should a steam heating system need? It depends a lot on the system's age and condition. But when the boiler needs water, it's good to know the Uni-Match is there waiting *with the right amount, and at the right time.*

Ask your counterman to show you a Uni-Match water feeder, and tell your steam heating customers about the added security that automatic water feeders offer. They'll be glad you did, and so will you!

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Volume 2 Issue 1 January 1995

"Vapor/Vacuum" Dos and Don'ts

Back in the days of coal — and wood-fired boilers — heating contractors used vacuum air vents to help them get the maximum efficiency out of their steam heating systems. They called these old systems "Vapor/Vacuum," and the principle that made them work was a simple one: At very low pressure, steam takes up about 1,700 times more space than water. When that steam condenses, it will create a vacuum if air can't get back into the system.

The old-timers let the steam expand naturally. It pushed air ahead of itself, through the vacuum vents and out of the system. When the steam condensed in the radiators, it shrank to 1/1700th its size. Air couldn't reenter the system through the vacuum vents because they have tiny checks valves at their outlets.

If the piping was tight, a deep vacuum would form throughout the system. The nice thing about a vacuum is that it lowers the boiling point of water. If the old-timer set it up right, a vapor/vacuum system could continue to make steam, even after the water temperature dropped as low as 140 degrees! The old-timers could take advantage of every bit of heat from the coal or wood fire as it burned down to embers. They wasted nothing.

Nowadays, however, most of us fire our steam boilers with gas or oil. Coal- and wood-fired boilers are still around, but they're the exception to the rule. While gas and oil are convenient fuels, they're not a good choice for systems using vacuum vents because gas and oil burners cycle on and off.

This cycling creates problems in systems that have vacuum vents. The vacuum quickly forms when the burner shuts off. Any air that doesn't get vented on the first cycle expands greatly, blocking the movement of the steam "vapor" to the radiators. And because gas and oil burners shut off completely between firing cycles, there's no longer a hot bed of embers to keep the low temperature water boiling. When you mix vacuum vents with gas or oil, you usually wind up with uneven heat and callbacks. You also wind up with condensate that doesn't return quickly enough from the system, and that can lead to water level problems in the boiler.

Steam traps are crucial to old two-pipe, vapor/vacuum systems. It you suspect your steam traps aren't working as they should, test them with a contact thermometer or a temperature-sensitive crayon.

At Hoffman, we haven't made vacuum vents for one-pipe steam systems in about 15 years. Today, we make only one vacuum vent. It's a main vent we call #76. We continue to make the #76 because there are still many two-pipe, vapor/vacuum systems out there that run on coal.

If you have a two-pipe, vapor/vacuum system running on gas or oil, you should be using our #75 main vent near the end of each dry return. The steam will push the air through the radiators, into the dry return and out the #75. The system won't drop into vacuum. And as long as your radiator traps are working as they should, your old vapor/vacuum system will heat evenly at very low pressure. It usually takes no more than 12 ounces or so.

Steam traps are crucial to old two-pipe, vapor/vacuum systems. If you suspect your steam traps aren't working as they should, test them with a contact thermometer or a temperature-sensitive crayon. You should see 10- to 15-degrees drop in temperature across the thermostatic radiator trap if it's working.

If the traps are passing steam into the returns, you'll have uneven heat, high fuel bills, boiler water level problems and water hammer noise. Steam traps are every bit as important on those old systems as they are on more modern systems.

You can repair those old steam traps with Hoffman Bear Traps or Hoffman Durastat elements. Our replacement parts are built to last for many years under the toughest conditions. They fit most old-fashioned steam traps, and they pay for themselves in no time with fuel savings and even comfort. Your customers will think you're brilliant!

When you're faced with an old steam system, think Hoffman. We have the parts and the specialized knowledge you need to solve those tough problems. And we're always happy to help you because we appreciate your business. Thanks!

When you're faced with an old steam system, think Hoffman. We have the parts and the specialized knowledge you need to solve those tough problems.

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Volume 2 Issue 2 March 1995

How Motorized Valves Affect Steam Boiler Water Levels

Many older buildings are served by one- and two-pipe steam heating systems. Many of these systems work by "gravity return." This means they don't need a condensate- or boiler-feed pump to put the returning condensate back into the boiler.

Gravity return systems are simple and have remarkably long lives. Many have been in service for nearly 100 years. They work on a simple principle: If you let water stack in a vertical pipe, it will exert a pressure. These old systems use that pressure to help put the condensate back into the boiler.

Consider this. A steam heating system is like an old-fashioned balance scale. There's a "weight" of steam on both the supply and return sides. We call that weight "steam pressure," and it usually doesn't take much to make the system work. The pipe size determines the right steam pressure for any given system, and the original heating engineers made that decision years ago.

Whatever the pressure, when you make steam, you'll have more of it in the boiler than you will in the system piping. Steam is not like compressed air. The pressure is never the same throughout the system. It can't be, because steam condenses. You'll always have less at the ends of the mains than you do in the boiler.

And that's where the static weight of the returning condensate comes in. The original heating engineer figured this all out. In his gravity return system, he knew the weight of the condensate would combine with the "leftover" steam pressure at the ends of the mains. Together, the two forces would be enough to put the condensate back into the boiler.

Now, this is a beautifully simple balance of pressures that's worked well for years. But think about what happens when you add motorized zone valves to the mix. Let's say you start with all the zone valves open. The boiler makes a bit of pressure and steam moves out toward the radiators. One zone reaches its set temperature, and a thermostat in the living space shuts the motorized valve.

Here's the problem. At this point, there's still pressure in the boiler, but there's no longer any "leftover" steam pressure at the end of that zone's main. There can't be, because the motorized valve stopped it back at the boiler. Suddenly, all you have going for you to "balance the scale" is the static weight of the water in the returns. Unfortunately, it's not enough.

So what happens? The water backs out of the boiler and up into the closed zone. That gives the boiler two choices! It can either shut down on low water or, if there's an automatic water feeder, it can take on fresh feed water. Either option is bad for you because, eventually, that motorized valve is going to reopen. And when it does, you'll get a hefty dose of water hammer as steam meets the backed-up water in the main. Next, the backed-up water will rush into the boiler and flood it.

Contractors who are not that familiar with the ins and outs of steam heating usually blame either the low-water cut-off or the automatic water feeder for this problem. Neither is at fault, but since they're thinking that way, they'll never solve the problem.

If you put a check valve on the condensate return line, the water can't back out of the boiler. That's good! You'll think you solved the problem because the water will no longer disappear when a motorized zone valve closes. But, unfortunately, a check valve doesn't get you out of the woods, because the returning condensate can't open it. Remember, there's a limited amount of "weight" on the system side of the "scale" when that motorized valve closes. It's not enough to open the check valve.

Since the condensate can't get through the check valve, the boiler will take on fresh water through its automatic water feeder. It won't need as much as it did before, but it will still need some. After a few cycles, the boiler will find itself flooded again. And then there's the water hammer to consider whenever that valve reopens.

Don't be so quick to blame the feeder or the low-water cutoff if you're having water level problems. Take a hard look at those motorized zone valves. They are at the root of many steam problems. Don't let them fool you, too.

The only right way to use motorized valves on a steam heating system is to convert the system to pumped return. You do this by adding a boiler-feed pump to the main condensate return, and steam traps to the ends of the mains and the base of the riser drips.

The key to successfully troubleshooting any steam heating system is to keep your eyes open, and to keep thinking about the balance between the supply and return sides.

ITT McDonnell & Miller representatives are well-versed in steam heating. Call them when you're faced with a tough problem.

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Volume 2 Issue 3 June 1995

How Much Steam Pressure Do You Really Need?

When you're having a problem getting that old steam-heated building warm, your first reaction may be to raise the boiler pressure. Don't do it! Raising the pressure in an old steam system usually leads to more problems than most contractors can handle. Here's why.

Our old heating text books tell us that the engineers who worked during the Days of Steam Heating wanted to save money as much as we do today. Since it costs money to make steam, they designed their systems to run at as low a pressure as possible, usually not more than 2 psi - and that was in a big building!

They could get by with low pressure because they sized their pipes in a way that offered very little resistance to the flow of steam. This is why steam pipes are so big.

Typically, an engineer would measure the distance from the boiler to the furthest radiator in the building. He'd then double that distance to allow for frictional losses through fittings and valves (the resistance through a fitting is greater than it is through straight pipe). He'd calculate his total "equivalent" length and then go to his steam pipe-sizing tables. Next, he'd select a pipe size that offered a pressure drop of only one or two ounces per hundred feet of equivalent run.

That's not much pressure, and that's why that old steam system will run better if you turn the pressure down, not up. By turning the pressure down, you're placing the system in the design range the old engineer had in mind. For instance, in most cases, residential systems work best when they're running off a vaporstat set to cut-in at four ounces and cut-out at 12 ounces. Not much, is it?

If your system has a pressuretrol, it usually runs best when you set the control to the lowest possible numbers, usually 1/2 psi cut-in with a 1 psi differential. Do this, and watch the difference in system performance.

If, after setting the system to lower pressure, you find you're still not getting heat, check your air vents. They're probably clogged. Bad air vents will also cause the burner to short-cycle. It pays to check and, if necessary, replace those air vents every few years. Your customers will see the difference in fuel savings.

More good reasons to turn the pressure down . . .

High pressure wastes fuel.

That long-gone engineer sized those radiators to heat the room on the coldest day of the year with 1 psi or less pressure at the radiator. When you raise the pressure, you also raise the steam's temperature, and that, of course, overheats the room. Most people respond to a too-hot room by opening the windows. Lower the pressure, and you'll save fuel.

High pressure causes air vents to clog.

Remember, a steam system is an open system. It's constantly corroding, and bits of metal are always flaking off the pipes, the boiler and the radiators. When you raise the pressure, you drive those bits of metal toward the air vents, and that causes the vents to eventually clog. What comes next? Spitting vents that waste both water and steam.

> ***That old steam system will run better if you turn the pressure down, not up. By turning the pressure down, you're placing the system in the design range the old engineer had in mind.***

If you want to save maintenance dollars, lower the pressure.

High pressure can hold back condensate.

If the condensate doesn't return quickly enough to the boiler, the boiler will go off on low-water. If there's an automatic water feeder serving the system, the boiler may flood when the condensate finally does return. Either way, you wind up with nuisance service calls - calls you can help avoid by lowering the steam pressure.

High pressure can cause the radiator air vents to close and not reopen.

One-pipe steam air vents will close on steam temperature, but high pressure will often keep them from reopening - even after they've cooled. The result is little if no heat at the radiators and unhappy customers.

Trapped air will stop the movement of steam as effectively as a closed gate valve. If the steam pressure jams the vents closed, the air can't get out. Lower the pressure, and you'll release the air vents. The steam will move; the building will be warm. And you'll look like a hero!

High pressure encourages water hammer.

If condensate can't drain well, it will linger in the horizontal pipes and hammer when the steam reaches it. Water hammer is one of the most destructive forces we know of. It can break pipes and cause thousands of dollars in damage. It also guarantees callbacks if you're the unlucky contractor on the job. Lower the pressure to help prevent water hammer.

And use the best air vents. . .

We've been making Hoffman air vents for more than 80 years. Our "float & thermostatic" type vents respond to both steam temperature and spitting water. We check each vent with live steam to make sure it meets our specifications before we ship it to your wholesaler.

You can call or write your Hoffman representative, and he will provide you with our specifications. They show the venting rate of Hoffman vents in cubic inches of air per minute at the slightest pressure. They also list the "drop-away" pressures of Hoffman vents. These all important ratings show the exact point at which a Hoffman vent will reopen once it has closed. "Drop-away" pressure helps you fine-tune those old systems and really shine in your customers eyes.

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Volume 2 Issue 4 October 1995

How to Increase Your Profits with Low-Water Cutoffs on Hot Water Boilers

Most gravity steam boilers operate at 2 psi or so, and every one comes with a low-water cutoff. You probably can't imagine a steam boiler operating without that essential safety control. What would happen if the boiler ran out of water and the burner continued to fire? If you've ever seen a burned-out steam boiler, you know that the stakes are *very* high. And that's why every steam boiler comes with a low-water cutoff.

But now consider a hot water boiler. Most operate at *six times the pressure of the typical steam boiler,* yet most have no protection against a dangerous low-water condition. Some hot-water boilers have that crucial protection, but these are the larger boilers, 400,000 BTUH and higher. Why boilers of this size? Because it's the law. Contractors usually install these boilers in multi-family housing and commercial buildings — places where there are lots of people.

But what about smaller hot water boilers? You know, the kind you find in single-family homes. Plenty of people living there, but they don't have low-water cutoffs, do they? Why? Because in most states, there's no law that says you have to install them.

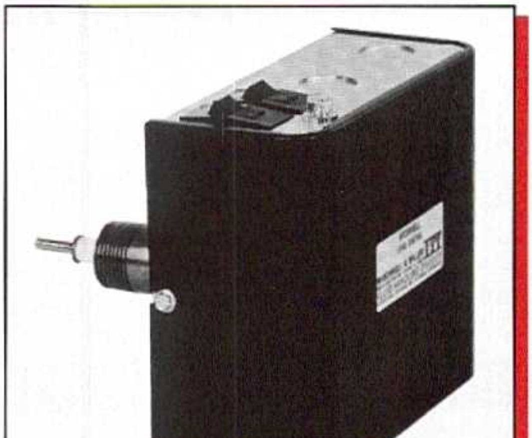
What's causing this shift in policy? We suspect it may have to do with the rapid growth of hydronic heating in certain areas of the United States. Did you know that the radiant-floor-heating market has been growing at a steady rate of about 30% a year for several years now? Many newer hydronic heating systems include at least some radiant floor heating. And when all or most of your system piping wind ups up *below* the boiler, it's time to start thinking seriously about potential system leaks, *and* about the people who are going to live in that house.

Even a simple baseboard-loop system can have several feet of piping that dips under a concrete slab to clear a doorway. That piping's out of sight and prone to corrosion and leakage; in most homes, there's nothing to protect the boiler from a low-water condition. Maybe you're thinking the feed valve will protect the boiler if something goes wrong? If you are, consider this situation.

Suppose the burner locks into the firing position and doesn't drop out when it should. Anything from a stuck-open gas valve to a faulty control can cause this problem. Once the burner locks in and keeps firing, the temperature and pressure inside that boiler will build until the relief valve opens. In most homes, this happens at 30 psi.

So the relief snaps wide and unloads a furious blast of steam. Once the immediate danger passes, the valve quickly seats itself. In most homes, they seat at about 26 psi. But remember, the burner continues to fire.

And then in a few moments, the relief valve roars open again, dumping even more steam into the boiler room. Unless someone notices, this will continue until there's little or no water in the boiler.



Now consider this. While this is happening, the system pressure *never drops below 12 psi*. Because it doesn't, the feed valve can *never* feed. And if the feed valve shot water into the boiler, there's no telling what could happen.

Take it a step further. Suppose the burner is behaving and things are working as they should, except there's a leak in a buried pipe, and the system is losing water constantly. Since the system pressure is below the feed valve's setting--which is, say 12 psi--the feed valve *will* feed. It will allow in gallon after gallon of fresh, cold water. When the boiler heats that raw water, the system will receive a massive injection of oxygen, and before long, the ferrous parts of the system will corrode and fail. The fuel bills will also soar, and if the water in your area is hard, the boiler will fill with lime, and it too may fail. Your customer will have no warning that this is happening.

Can you see how low-water cutoffs are in the best interest of your hot-water heat customers? *It's to your great advantage to mention them to your customers*, especially if you're replacing their boiler. When they realize a low-water cutoff is in their best interest, most home owners say, "Sure, install it!" This is especially true when you're replacing their boiler, because the cost of the low-water cut off seems modest compared to the cost of the complete job.

Think about it. If you mention it to them as an option, explaining the facts about feeders and boiler protection, *they might just say Yes!* And if they do, you'll make more money on that job while you're protecting that family from potential danger.

And if they say No, you're *still* better off. You've raised an issue with a solution that's in their best interest. You've shown you care about their safety.

When you sell with your customers' best interests in mind, you separate yourself from other contractors in a big way. This caring approach and awareness of the workings of hydronic systems make you more professional in the customer's eyes. And the best part: you'll probably increase your profit on *every* job you do.

McDonnell & Miller
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Volume 3 Issue 1 January 1996

Tips on Balancing One-Pipe Steam Systems

Since George D. Hoffman invented the first float-and-thermostatic, steam air vent in 1912, we've learned a thing or two. We'd like to share with you a few one-pipe-steam balancing tips we've picked up along the way.

Vent the mains quickly. If you want the steam to arrive at *all* the radiators at about the same time, you must vent the mains quickly. Steam is a gas, and it will always look for a way out of the system. When it leaves the boiler, it heads toward the air vents. The bigger the air vent, the more inclined steam will be to head that way. If your system heats unevenly, install a Hoffman #75 main vent near the end of the main and marvel at the difference it makes.

The #75 vent should be at least 15 inches back from the end of the main, and six to ten inches up on a nipple to keep it away from any end-of-main water hammer.

The bigger the hole, the faster the venting, so it pays to install a tee with a three-quarter-inch tapping for the vent near the end of the main. Don't try to get by with a tiny hole drilled into the main.

Install a Hoffman "Y" strainer vertically before the main vent. We don't have to tell you how dirty an old steam system can be. Since the steam is moving at high velocity (typically, about 25 mph in a one-pipe system), it picks up particles of rust and sediment. Eventually, this stuff winds up inside the main vent. Before long, the main vents clog and can't shut. They spit water and let steam pass to the atmosphere. This creates water-level problems at the boiler.

Vent the radiators based on their size. If your goal is to get all the radiators hot simultaneously on the coldest day of the year, you'll have to handle the air in a special way. First, as we said before, vent the mains quickly. That's important. Then vent the radiators in relation to their *size*, not necessarily their location in the building.

The main vents will make sure steam reaches each radiator at about the same time. Since big radiators contain more air than small radiators, big radiators should have larger air vents than small radiators. Hoffman's 1-A vent, with its adjustable venting rate, is an excellent choice for systems with radiators of different sizes.

Insulate the steam lines. When steam condenses and turns back into water, it stops moving. That's why the old-timers spent so much time insulating their steam mains. They wanted the steam to condense in the *radiators*, not in the basement piping.

If someone removed the asbestos insulation, you must replace it with a more suitable material if you want a balanced system.

Uninsulated steam pipes have about five times the heat loss of insulated steam pipes.

Wrap the pipes well so the steam has a chance to get where you want it to go.

Clean the system. If the boiler water is dirty, the steam will carry water with it when it heads off into the piping. This leads to water level problems at the boiler, sure, but it also creates balancing problems throughout the system.

The steam gives up its latent-heat energy to the mist of water that's traveling with it. That stops the steam dead in its tracks. The far radiators remain cold while the radiators near the boiler room get warm. The burner often short-cycles when the steam quality is poor. This, too, leads to balancing problems.

Check the boiler manufacturer's cleaning instructions. It can take a day or two to get a boiler's water back in "clean-steam" shape, but this is often the only solution to those balancing problems.

Lower the steam pressure. Steam heating systems ride a wave of pressure from the "cut-in" to the "cut-out" setting of the pressuretrol or the vaporstat. The system *must* cycle up and down on that wave because that's how the air vents work.

Steam pushes the air from the vents; the vents then shut on temperature. When the steam condenses, the vents are supposed to open to allow venting to continue. But if the system pressure is too high, the air vents might stay closed. Since air can't escape from a closed air vent, the radiators stay cool, and the system goes out of balance.

The air vents and the pressuretrol or vaporstat work together to move the air from the system. If you set the "cut-in" setting at one-half psi on a pressuretrol or at about four ounces on a vaporstat, you'll never lock the air vents closed.

The "cut-out" pressure should be as low as possible. There is no reason to raise the steam pressure any higher than it has to be. High-pressure steam actually moves more slowly than low-pressure steam.

So when you're trying to balance that one-pipe system, lower the pressure.

Proper near-boiler piping also plays a huge role in the one-pipe-steam balancing act. Always follow the boiler manufacturer's specifications carefully.

Your Hoffman representative is well versed in steam-heating-system problems and their solutions. If you need help, call and ask for their advice. They're always there for you!

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Volume 3 Issue 2 April 1996

The Top-Ten Dumb Things Contractors Do With Steam Heating Systems

Just in From the Main Office in Chicago, Illinois

 # 10. They come to believe they're just working on a *part* of the system. You're never working on just a part of a steam system. When you touch one part, you affect all the other parts. Always try to back up and see the *system*. You may be there just to replace the boiler, but the people are going to be calling *you* when that new boiler won't heat their building. Think big!

#9. They remove the insulation. Steam is a gas that quickly condenses into a liquid when it hits cold pipes. Surprised? If a pipe is insulated, the steam is five times less likely to condense. Whoa! And that's why there's insulation on the pipes. If you want the steam to reach those far-off radiators, you have to insulate those pipes.

#8. They don't figure the time it takes to clean the system. Steam systems are wide open to the atmosphere, and that means they are constantly corroding. That corrosion works its way down into the boiler and causes the water line to bounce and surge. This, of course, leads to water-level problems and equipment failure. If you're installing a new boiler, you'd be wise to figure into your price the time it's going to take to clean that system. If you don't figure it into your price, you'll get to do it for free.

#7. They pretend the vacuum pump isn't important. By using a vacuum pump, the original engineer was able to undersize every pipe, valve and fitting in that building. He got away with this because he had a pressure-to-vacuum differential across his system. The steam moved quickly from the boiler to the radiators. Without the vacuum pump, though, you're forced to run higher-than-normal pressure. That leads to uneven heating, high fuel bills, water hammer and equipment failure. If there's a vacuum pump and it's broken, we can help. Domestic Pump makes a fine line of vacuum pumps, and our rep will be glad to accompany you to that problem job.

#6. They line-size steam traps and PRVs. Why do contractors do this? Because it looks cool! The trouble is, it doesn't work so well. We can't think of a single situation where the steam traps or pressure-reducing valves should be the same size as the lines they're piped into. They will *always* be smaller. If you line-size a trap or a PRV, it will just barely open during operation. That leads to "wire-drawing" (erosion of the metal seat), and premature death. If you're not sure of the size, call your McDonnell & Miller/Hoffman rep.

"You should ***always*** walk through the system and imagine yourself as air. Could ***you*** get out of those pipes? If you can't get out, neither can the air."

#5. They oversize the replacement boiler. Oversized boilers short-cycle. This leads to high fuel bills, equipment failure and angry customers. The only correct way to size a replacement steam boiler is to measure all the radiation in the building. The boiler's ability to make steam has to match the system's ability to condense steam. Don't size a new boiler based on the size of the old boiler. That boiler may date from the days of coal firing. And if it does, there's a good chance it's twice as large as it should be. Why leave all that money on the job? Don't be lazy; go measure those radiators.

#4. They don't think like air. Where there is air, steam will not go. You should *always* walk through the system and imagine yourself as air. Could *you* get out of those pipes? If you can't get out, neither can the air. Trapped air leads to uneven heating and high fuel bills. Air is one of the simplest problems to diagnose. Ask your counterman to show you the complete line of Hoffman air vents. Each box holds a solution.

#3. They install one-pipe steam vents on two-pipe steam radiators. When thermostatic radiator traps fail, the steam moves into the return lines and pressurizes them. That traps air in the radiators, keeping them from heating. If you install an air vent on that two-pipe radiator, the air will get out, and the radiator will heat, for sure! But since there's steam in the return lines (because of the failed traps), the condensate won't get back to the boiler until the end of the cycle. That leads to severe water hammer and water level problems at the boiler. If you want your steam traps to last longer, ask your counterman about Hoffman Bear Traps. We build them for the long run.

#2. They try to use just one steam trap for the whole system. Steam traps belong on every two-pipe system that has dry returns, and on any system that has a condensate- or boiler-feed pump. The traps keep the steam from entering the return lines, and that goes a long way toward balancing the steam distribution. If you try to get by with just one big trap at the inlet to the condensate- or boiler-feed pump, you'll have a building that never heats well.

#1. When they get frustrated, they raise the steam pressure. Most buildings will heat beautifully with two-psi steam pressure or less. The steam pressure you need varies with *pipe size*, not building size. The correct steam pressure for the job was set on the day the original engineer sized the piping system. If you find you have to run the pressure higher than two psi, you probably have trapped air or failed steam traps.

#1A. (A Bonus!) They don't call their McDonnell & Miller/Hoffman rep! Who knows more about steam heating than the representatives for McDonnell & Miller/Hoffman? We've been in the business since the days when this stuff was first thought up. Hey, we helped think it up! If you're having a problem, do the smart thing and call us first.

McDonnell & Miller
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Volume 3 Issue 3 September 1996

Ten Reasons Why Steam-Heating Boilers Flood

Having problems with that steam-heating boiler's water line? Is that boiler constantly flooding? Is your customer complaining about not having enough heat when the boiler does flood?

Before you get mad at the automatic water feeder, take some time to look at the possible causes of that flooding problem. Good troubleshooters *never* make decisions until they've examined all the clues.

Here are ten of the most common reasons why steam-heating boilers flood:

1. The water line surges. And when it does, it turns the automatic water feeder on and off. Surging begins when the boiler water gets dirty or oily. Much of the dirt and oil will lay on the surface of the boiler water. When the steam tries to break free, it lifts the water, creating the surging. You can see this in the gauge glass.

Since steam systems are open to the atmosphere, you need to clean them from time to time. Get rid of the surging, and you'll usually get rid of the flooding.

2. The water's pH is too high. When steam condenses, it produces carbonic acid, which can eat its way through wet-return lines. Service technicians often add chemicals to steam boilers to keep the pH from sinking too low. But if the pH gets too high it can be just as bad. A pH that is too high causes foaming, and foaming leads to trouble. Too much water flows from the boiler with the steam. That loss of water calls the automatic feeder into action. When the condensate returns, the boiler floods.

A good pH for a steam system ranges between 7 and 9. When the pH reaches 11, the water will foam. This is why old-timers added vinegar to the boilers. Vinegar is acidic, and that helps to bring the pH down.

3. The boiler has a tankless coil, and it's leaking. The city water pressure will always be greater than the pressure in a steam heating system. Even the smallest lead in a tankless coil will flood a boiler.

Close the cold-water valve leading to the coil for a few hours and watch the gauge glass. If the flooding stops, you've probably found the culprit. Replace the tankless coil.

4. The system has a gravity return, and motorized zone valves. When a motorized zone valve closes on a boiler that's under pressure, the water will back into the return line of the closed zone. That brings on the automatic water feeder. The next time the motorized zone valve opens the condensate returns from the system and floods the boiler.

Install quarter-inch bleed lines around the tops of the motorized zone valves. The bleed lines will let through enough pressure to keep the water from backing out of the boiler, but it won't allow enough steam by to overheat the zone.

5. The boiler is overfired. If the flame is too big, the exit velocity of the steam will carry water from the boiler into the system. The automatic water feeder will replace the "missing" water before it has a chance to work its way back into the boiler. When it does, the boiler will flood.

Fire boilers to the connected piping-and-radiation load. No more, and no less.

6. The automatic water feeder is positioned too high on the boiler. In an attempt to cover a tankless coil during the summer, some installers will tamper with the McDonnell & Miller Quick-Hook-Up fitting. They'll add nipples and elbows, and cause the feeder to feed at a point that's too high on the gauge glass.

Normally, the feeder should open when the water line drops to a point just above the low-water cutoff's operating position. If the feeder adds too much water (because it sits too high on the gauge glass), the returning condensate will flood the boiler every day.

7. The feed line is clogged with sediment. If you're using a float-operated feeder/cutoff combination such as McDonnell & Miller's 47-2, a plugged feed line can create a back-pressure that will keep the feed valve from shutting tightly. City water pressure will bleed through and flood the boiler.

You can diagnose this problem by doing a broken-union test (M&M shows you how in their instructions). If you find a plugged feed line, replace it.

McDonnell & Miller's Series 47-2 combination mechanical water feeder/low water cut-offs.

8. The feeder-bypass valve isn't holding. The bypass around the feeder lets you fill the boiler quickly, but if the shutoff valve in that line doesn't hold tightly, the boiler will keep taking on water until it floods.

Here again, the broken-union test gives you a quick way of finding out whether that important valve is doing its job. If it's not, replace it.

9. The piping around the boiler doesn't meet the boiler manufacturer's specs. Modern boilers make steam very quickly. The piping around the boiler is very important to the production of dry steam. If this piping is wrong, the boiler will throw water into the piping. The automatic water feeder will then replace that water. Before long, the boiler will be flooded.

Take the time to check the piping on the job against what the boiler manufacturer calls for. If it doesn't meet the specs, you'll have to repipe that boiler. This is tough medicine, but it's often the only cure.

10. Someone is adding water when you're not there. Never dismiss this as a possible cause. If someone adds water to the boiler in the middle of the steaming cycle, the returning condensate will bring the level water up even higher, and the boiler will flood.

Talk to the home owner or building superintendent. Make sure they understand how a steam boiler works, and what it needs in the way of feed water.

Your McDonnell & Miller representative is always willing to help you solve your steam-heating problems. Call them the next time you need help.

McDonnell & Miller
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Volume 3 Issue 4
December 1996

The Art of Making New Boilers Work With Old Systems

Replacing an old steam boiler with a new, efficient lower water content boiler has become an art form. You, the contractor, are charged with all the responsibility of having to connect this new replacement boiler, which contains less water, has a smaller steam "separating" chamber and makes steam more violently, into a system of piping and radiation that can be 70 to 80 years old!

As the old boiler made steam, its water line would start to drop down as the water was being converted into steam. This steam, which headed out to the system would then condense back into water and gravity drain back to the boiler.

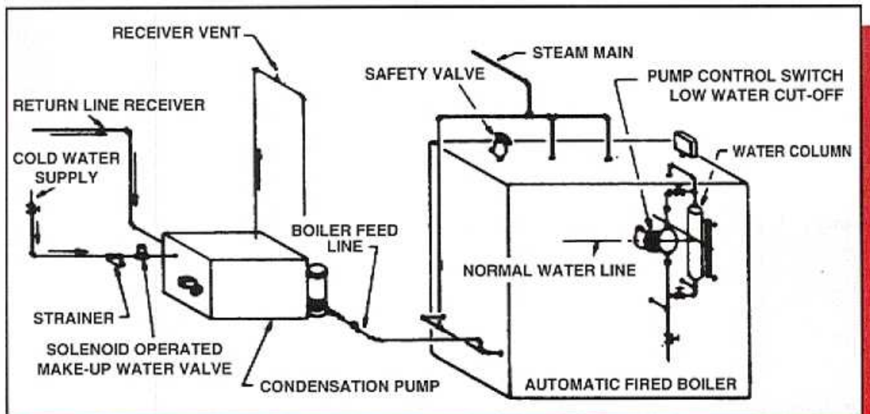
Whether the condensate returned in 5 minutes or 20 minutes, the old boiler held so much water that its water line never dropped to the automatic feeder's feeding level. But replace that old boiler with one of these modern boilers and see what happens.

The problem originates from the physical size of these replacement boilers. Not only do they hold less water, but the steam separating chamber, which is used to separate the steam from the water in the boiler, is also smaller. This allows some of the water to leave the boiler prematurely. It gets carried out with the steam in a mist-like spray. This is why near-boiler piping has become so critical.

The time it takes for the condensate to return to the boiler, also known as the system time lag, is also very important. If it is too slow for the new boiler, it can cause the low water cut-off to either shut off the burner, or activate the automatic feeder and bring in more water. Of course when all the condensate finally returns, the boiler's water line is too high and the boiler floods.

BOILER FEED UNITS

Steam systems found in apartment buildings, churches and schools with gravity returns and automatic feeders are especially famous for causing replacement boilers to flood because of this "system time lag" problem. The best way to solve this type of situation is to install a Hoffman boiler feed unit.



Arrangement for supplying make-up water to the boiler feed receiver using a solenoid operated valve.

Boiler feed units are sized according to the steaming rate of the boiler vs. the system's time lag (which is different for every system!). Also remember we're not talking about all the water in the replacement boiler—only the amount found between the normal water line and the low water cut-off level.

These units come with large receivers that act like reservoir tanks which are intended to hold the water needed by the new smaller boiler. These tanks have pumps attached to them which are typically controlled by one of McDonnell & Miller's series of pump controllers—such as the 150MD—which are piped onto the boiler.

This pump controller monitors the water line in the boiler and activates the pump whenever the water line drops too low. Once the water line is brought back to the right level, the pump controller turns the pump off preventing the boiler from flooding. Modern boiler design has caused many contractors to install these boiler feed units so that the new boiler will work properly with the original system.

OPEN TO THE ATMOSPHERE!

When you install a boiler feed unit into a system that previously was a closed gravity return system, you've changed the operating characteristics of that system. The most significant change is to the return lines. They ALL have to drain into the feed tank. And this tank is vented to the atmosphere with a vent pipe because it can't withstand any pressure inside itself.

This means you need to install Hoffman F&T traps (float & thermostatic) at the base of every riser that drips into a wet return line and at the end of every steam main. You need these traps because without them, there is nothing to stop the steam from working its way through the piping and eventually showing up at the receiver's vent pipe.

Before, when the returns drained directly into the boiler, they were exposed to the back pressure of the boiler which created a balance between the pressures on the supply and the return. With the vented receiver, there is no back pressure on these return lines, only the pressure from the supply. And this steam pressure will be more than happy to blow through the water seals and eventually show up at the receiver's vent pipe. Of course creating water hammer along the way!

If you are adding a boiler feed unit to a two pipe system that already has radiator traps, it is important that those traps are working properly. If not, steam will pass into the returns, create water hammer and eventually blow out of the vent pipe. That's because the dry returns also drain into the feed tank.

When you need a boiler feed unit think Hoffman! We have a complete line of boiler feed tanks and condensate handling equipment. If you need more information or have any questions with a particular steam system, call your Hoffman/McDonnell & Miller Steam Team representative.

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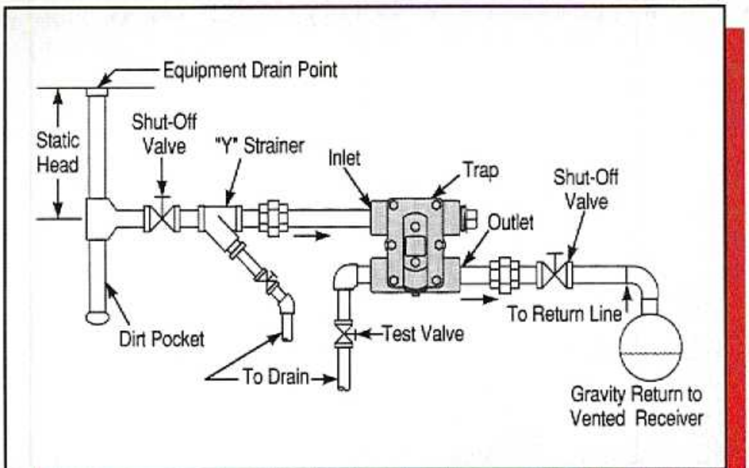
Sizing & Selection of F&T Traps



Applications such as the end of main drips, unit heaters, heat exchangers and make-up air coils are perfect for F&T traps.

The F&T difference

F&T, or float and thermostatic, traps handle condensate, air and steam differently than other traps. The thermostatic element is like the element found in radiator traps. It is normally open and its function is to pass air and other non-condensable gases into the return line. Once steam arrives at the trap, this element snaps shut preventing steam from passing into the return lines, and its job is finished until the next cycle. The float part of the trap now takes over and drains condensate as it forms. The float is attached, by a lever, to a plug which seats against the discharge orifice. It is normally in a closed position, until the condensate starts to arrive. Naturally the temperature of the condensate makes no difference to the float, so as soon as condensate enters the trap body, the float lifts the plug from its seat and starts to drain. It handles light and heavy loads very well by having the float modulate as the load changes.

Fast air removal

Because an F&T trap is great for handling large volumes of air, it is very beneficial for the quick distribution of steam. Air is such a great insulator that it can greatly reduce the rate of heat transfer of heating equipment and slow down the distribution of steam throughout a system. Applications such as the end of main drips, unit heaters, heat exchangers, make-up air coils and anything else that requires air to be removed quickly are perfect for this trap.

Checking F&T traps

Because the trap discharges condensate at saturation temperature, it can be misleading to use the temperature coming out of the trap to check proper operation. Also, because the condensate will be at saturation temperature, a percentage of the condensate discharging from the trap will flash back into steam. So the best method for checking good traps is visual inspection of the discharge coming from the trap. But don't be fooled by the flash steam that may discharge from the trap. A good trap will discharge water with a small percentage of flash steam while a bad trap will have virtually no water while it passes steam with a noticeable hissing noise and plumes of white clouds. Hoffman F&T traps come with 4 ports, 2 inlets and 2 outlets. Instead of plugging the second outlet, create a test station by installing a short nipple, service valve and a cap. Then when you want to check the trap, simply take off the cap, open the service valve and monitor its discharge.

Trap sizing

The sizing of F&T traps is very important for proper operation and longevity of the trap. Many times these traps are line-sized, that is, steam pipe size becomes the size of the F&T trap. The problem with this method is the steam pipe is sized to handle steam while the trap is intended to handle only air and condensate, not steam. And remember, low pressure steam takes up approximately 1700 times the volume that a comparable amount of water needs. That's why steam pipes are so big. The best way to make sure a trap will be applied properly is to calculate the actual condensate load the trap is going to handle, apply the proper safety factor, and select the lowest pressure differential that will occur across the trap. This is important because if you select a trap that can handle the condensate load, but at a greater pressure differential than it will actually encounter, the condensate won't drain from the trap. Instead, it will back up into the coil or heat exchanger causing water hammer, reduced heat output and possible damage to the heating unit.

An example would be selecting an F&T trap for a make-up air coil. If the coil has a control valve on the steam supply line, when the valve closes there will be no steam pressure on the inlet side of the F&T trap. The only pressure differential that exists will be the vertical distance from the bottom of the coil to the inlet of the trap.

Ideally the trap should be at least 15" below the coil which will give you a 1/2 lb. pressure differential. Select a trap that can pass the condensate load (with the proper safety factor) at the 1/2 lb. pressure differential and you will be assured of complete condensate drainage every time.

Hoffman's Float & Thermostatic traps are part of the Bear Trap family. They are made of heavy duty castings with all stainless steel internals, and their capacities meet or exceed the competition. What's more, Hoffman F&T traps come with our unique "Dura-Stat"® thermostatic element. If you have any questions regarding trap sizing and applications call your local Hoffman/McDonnell & Miller Representative. Our representatives are well "primed" on all steam subjects. Ask about our new Series I in-line F&T traps.

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Multiple Issues With Multiple Steam Boilers

When an old steam boiler finally needs to be replaced, you are presented with the opportunity of using either one large boiler or multiple smaller boilers to replace the original one. As you might expect, there are advantages and disadvantages to either way. Unlike hot water applications, multiple steam boilers can be very tricky, so you cannot take the same approach as you would with multiple water boilers.

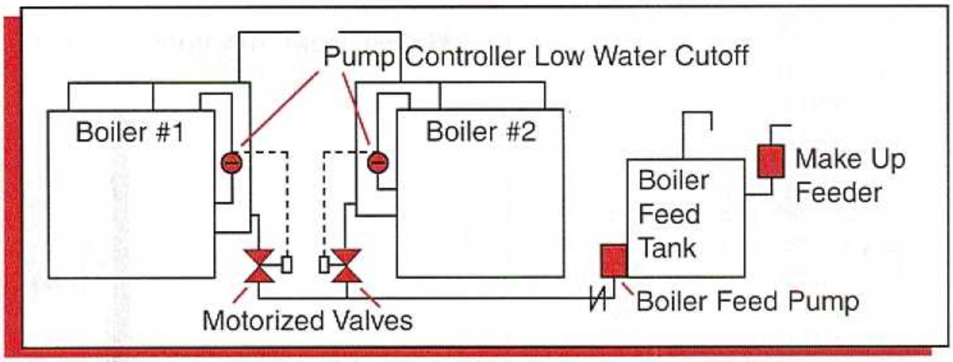
The near-boiler piping becomes very critical. In multiple boiler applications, each boiler should be piped as if it were the only boiler in the system, so each boiler should have a riser(s) piped into its own header and equalizing line. The header collects all the steam and water that has come out of the boiler through its riser(s), and the steam, being "lighter," will run along the top of the header and enter the vertical tee which leads to a common header; the heavier "wet" molecules are carried along the header and into the equalizing line back to the boiler. When piped this way, with the pipe sizes recommended by the manufacturer, each boiler will do a good job of delivering dry steam to the common header. If you pipe each boiler's riser into the common header without the benefit of its own header and equalizing line, you'll create wet steam, water hammer, water line problems with each boiler, and a very unhappy customer who has to push the reset button on each boiler's manual reset low water cut-off control.

It is very difficult to return condensate to a multiple boiler system without the use of a boiler feed pumping system. Each boiler is under different pressures even though they are all piped to a common header. That's because steam is dynamic, and is always moving, condensing, and dropping in pressure. But some people, confusing steam with other gases like air and propane gas, believe that after you fill the system and pressurize it, the pressure will be the same throughout. It can't, so multiple boiler systems should employ a boiler feed system, including an M&M make-up water feeder, to return water to the boilers. Once you decide to use a boiler feed system, don't try to pipe one pump controller (such as the M&M 150MD) onto a common equalizing line. The reason: the pump controller doesn't know the level of the water in each boiler, only the level where it is located.

Besides, when the pump moves water, where does the water want to go? Naturally, the water takes the path of least resistance so it enters the boiler with the lowest pressure. But this is typically the "off" boiler which doesn't need any water, and the "on" boiler, which has the greatest demand for water, gets little or no water. The "on" boiler will then shut off on low water, and as the steam condenses, the boilers will equalize. This raises the water line in all the boilers, reducing the steam separating chamber within each boiler, and affecting the quality of steam being supplied to the system.

The best way to return condensate in a multiple boiler system is for each boiler to have its own pump controller piped onto an equalizing column. Each controller is wired back to either its own feed pump or its own motorized feed valve. If motorized valves are used, once the valve opens, its end switch makes contact, activating a common feed pump. Now the water can only enter the boiler that really needs more water. This maintains the proper water line in each boiler, improving the quality of steam and the efficiency of your multiple boiler system.

Finally, when each boiler is piped into a common header, there will be times when one or more will be "off" because of a light load on the system. Unfortunately,



the steam doesn't know where it is supposed to go, so some of it enters the "off" boilers and condenses. Condensate accumulates and floods the "off" boilers. The easiest and most cost effective method for addressing this situation is to pipe "overflow" traps (usually 3/4" F&T traps) into each boiler's equalizing line a couple of inches above the operating water level. Then, when the condensate starts to build up in an "off" boiler, it enters into the trap and drains into the boiler feed receiver.

If you have any questions regarding this or any other steam issue, give your local Hoffman/McDonnell & Miller Steam Team representative a call.

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McDonnell & Miller
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CounterPoint™
Volume 5 Issue 1 *www.hoffmanspeciality.com* • *www.mcdonnellmiller.com* February 1998

10 Reasons Why Steam Heated Buildings Heat Unevenly

1. The air can't get out of the system fast enough.

Where there is air, steam won't go. It is very important to quickly remove the air from the system allowing the steam to travel to the radiators. Main vents are vital to proper distribution. When you are out on a job, make sure to look for steam main vents in the basement.

2. The boiler is piped incorrectly.

A modern steam boiler requires the near-boiler piping to help produce "dry" steam for the system. The boiler's steam chamber is smaller and the supply riser holes are smaller, and this affects the boiler's ability to separate the water from the steam, so the manufacturer wants to use the header and equalizing line piping to "catch" this water and prevent it from heading out into the system with the steam. When piped incorrectly, the steam is forced to carry water with it as it leaves the boiler. Naturally, the water condenses the steam before it reaches the radiators.

3. The boiler is undersized or underfired.

A steam boiler's job is to produce enough steam to fill the entire piping system and all the radiation. The job of the cold pipes and cold radiators is to condense this steam, but if the boiler can't produce enough steam to overcome this mass of cold iron, the steam will not be able to make it out to the furthest radiators. This is why you must size the boiler to the connected load and then make sure the burner is fired to that load.

4. The steam traps have failed.

Two-pipe systems have radiator traps and float and thermostatic traps. Their job is to pass air and condensate into the return piping while preventing the steam from getting past the radiators and ends of the mains. When these traps fail in the closed position, the air can't get out, so the steam can't get in. But when they fail in the open position, the steam passes into the return lines. Once there, it pressurizes the returns to the same pressure as the supply lines, and with no difference in pressure, the steam stops moving. You have to make sure the steamtraps are working properly for the system to operate efficiently.

5. The insulation has been removed from the pipes.

Steam mains were insulated so steam could reach all the radiators. When asbestos insulation is removed, the exposed steel piping becomes one very large radiator, and this additional load condenses the steam before it can reach all the radiators. If you see pipes that have had their insulation removed, suggest re-insulating them or make sure the new boiler is sized for this additional load.

6. The steam pipes are pitched incorrectly.

When originally installed, steam mains and horizontal runouts had certain pitches to them that allowed the condensate and steam to co-exist in the same pipe. Over the years, the building settles and pipe hangers loosen up, changing the pitch of the pipes, and allowing condensate to collect in pockets along the piping. These puddles will condense the steam as it passes by, creating uneven heat throughout the building. Make sure the steam mains and runouts maintain proper pitch.

7. The quality of the steam is bad.

If the boiler water is dirty or has a film of oil on its surface, the boiler will make "wet" steam. Because water droplets "rob" the steam of its latent heat, steam is condensed in the piping before it reaches all the radiators. Check the quality of the boiler's water by looking at the boiler's gauge glass. When the boiler is making "dry" steam, the top portion of the glass will be dry. While the boiler is operating, raise the water line to within one inch of the top of the gauge glass—if water pours over the top of the gauge glass, the boiler water is dirty and needs to be cleaned.

8. The wet return lines are partially plugged.

If the steam system has wet returns and the complaint is uneven heating, make sure the returns aren't plugged. If they are, the condensate will back up the return drips trying to overcome the additional pressure drop created by the plugged returns. Condensate will back up into the main vents closing them off before all the air is removed from the mains, and this can create very uneven distribution of the steam throughout the system.

9. Someone has set the pressuretrol too high.

Radiator steam vents have a rating that's known as "drop-away" pressure. This rating has to do with the maximum system pressure at which the vent's float can drop down to re-open when the steam condenses in the radiator. If someone raises the pressuretrol setting beyond the vents "drop-away" rating, it is possible to close all the radiator vents in the system, and this leads to uneven distribution of heat throughout the building. Always check the pressuretrol setting on the boiler as well as the "drop-away" rating of the vents in the system.

10. You haven't contacted your local Hoffman/McDonnell & Miller Steam Team representative about any of your steam heating questions or problems. They are well primed on any steam heating subject and they are willing to share this information with you. All you have to do is give them a call.

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Volume 5 Issue 2 www.hoffmanspeciality.com • www.mcdonnellmiller.com November 1998

Don't Get Caught in the "MasterTrap"!

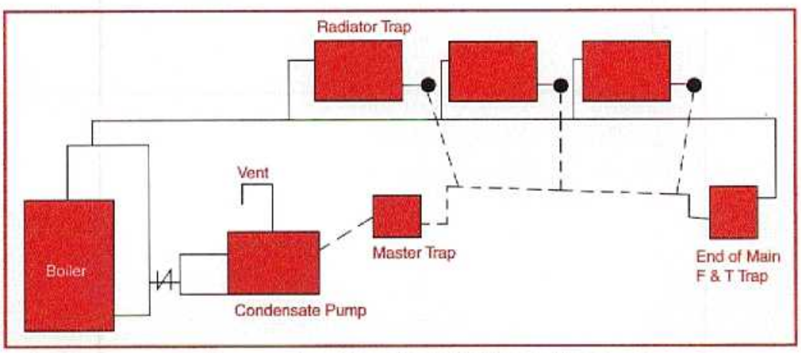
Recently a contractor needed help with a job involving an old two-pipe steam system. It was a real adventure. The mistake he made was classic and one worth sharing with you. He described the problems he was having with the system: "The building was heating unevenly and banging. I visited the building and discovered that steam was pouring out of the vent pipe on the condensate pump."

He figured the banging was caused by all the excess steam coming from the receiver vent, and the uneven heating was caused by the steam heading toward the vent line on the receiver instead of traveling towards the radiators. He installed a float and thermostatic Bear Trap right in front of the receiver's inlet which stopped the steam from blowing out the vent line, but the heating system continued to bang and heat unevenly. In fact, if anything, after installing the trap the uneven heating became worse and the banging seemed louder! He was under the gun because he assured the customer that he knew what the problem was, and that he also knew the solution. At that point, the contractor called his Hoffman representative for help.

We hear and see the contractor's problem all the time. Other than preventing the steam from blowing out the receiver's vent pipe, his approach does nothing to fix the real problem and it will likely make the problem worse! To understand why his solution will not work, you must first understand how a two-pipe trapped system is designed to work.

Steam is produced in the boiler and then heads out towards the radiation. In front of the steam is air, which is always present and needs to be vented before the steam will enter the mains and radiators. In a one-pipe system, the air is vented through the main vent and the individual radiator vents. However, with a two-pipe system there are radiator traps installed on the outlet side of each radiator. These traps perform several functions.

- They are normally open to vent air from the radiator and pass it into the return system.
- They snap shut in the presence of steam, preventing it from getting into the return piping.
- They open to drain the condensate that forms when the steam in the radiator condenses.



The air that passes into the return piping is eventually vented out of the system through the condensate pump's vent pipe. The system is designed to operate with steam in the supply pipes and radiators, and only with air and condensate in the returns. As the condensate forms in the mains and radiators, the traps open and allow it to gravity drain back to the vented receiver. Once there, the float in the receiver rises and turns on the pump. The condensate is forced back into the boiler to start the cycle all over.

The big difference between what we just described, and what our contractor friend saw, is the steam blowing out the receiver's vent pipe. The first question the contractor should ask is: What would allow steam to show up at the condensate receiver's vent pipe? Remember that one of the functions of a steam trap is to trap steam! When it doesn't, there is nothing to prevent the steam from crossing over into the return side of the system and once there, the pressure in the return piping will start to approach the same pressure as in the supply mains. This will stop the steam in its tracks because it needs this pressure differential to move. It's like turning the circulator off in a forced hot-water system and expecting the system to still operate. Try to think of a two-pipe system as a ladder. One side of the ladder is the supply and each rung is a radiator with a steam trap. The other side of the ladder sees only the air and condensate from each rung.

When our contractor friend installed the "master trap" in front of the condensate receiver's inlet, he only made a bad situation worse. The float and thermostatic (F&T) trap made sure that the returns would be pressurized. There was no pressure differential across the system's original F&T traps, and this caused the condensate to back up in the distribution mains, causing more problems. The solution to this system's problem—and many others that plague two-pipe steam systems—is to replace the radiator traps that have failed in the open position.

If you are experiencing problems with a steam system, or have any steam questions, give your Hoffman/ McDonnell & Miller Steam Team representative a call.

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Volume 6 Issue 1 **www.hoffmanspeciality.com • www.mcdonnellmiller.com** May 1999

Curing A Spitting Problem

The saga of a spitting radiator vent is very common, but the cause is often misunderstood. To start, let's review the operation of a one-pipe radiator vent, which should:

1 Be a Float and Thermostatic style vent, which is normally open so the steam entering the system pushes the air ahead of it out of the radiators.

2 Close shut in the presence of steam. There is a diaphragm bellows at the base of the vent where the float and pin sit. As steam approaches the vent, the surrounding temperature increases, causing the alcohol and water mixture in the diaphragm to flash into vapor. The corresponding increase in mixture volume causes the diaphragm to expand, driving the pin into the port opening at the top of the vent. The vent closes, preventing steam from leaking.

3 Open to break any vacuum that forms when the steam in the radiator condenses, as well as vent any air that is still in the radiator. For this to happen, the system pressure must be very low. Each steam vent has a pressure rating known as "drop-away" pressure. This "drop-away" pressure is the maximum pressure the float inside the vent can drop down against to re-open the vent.

4 Close in the presence of water. If some water made its way into the radiator or if someone left the make-up water valve open by accident, the float inside the vent would "float" the pin into the port opening, closing the vent. These float vents have a syphon tongue which is hinged at the bottom of the vent in the 1/8" nipple where the air, water and steam pass each other. The tongue ensures any water entering the vent shell drains out of the body and doesn't hold the vent closed.

Probably the most important detail and least understood subject that governs the success of one-pipe steam systems is velocity. The main in a one-pipe system supplies steam to up-feed risers, which in turn feed the radiators on each floor. The piping system that feeds these up-feed risers is referred to as the horizontal run-outs. What occurs inside this piping is critical to the operation of the system. Steam heads towards the radiator while the condensate gravity drains back into the main. As long as the velocity of the steam doesn't exceed a critical point, everything co-exists perfectly. But if the steam's velocity crosses that critical point, the velocity is so high the condensate can't drain back. The steam carries this condensate back up the risers, causing gurgling and sloshing noises in the piping and the condensate eventually spits out the radiator's vent valve!

Old pipe sizing handbooks featured charts showing the required pipe sizes based upon the connected load and the designed pressure drop. In these pipe charts, there was a column dedicated to the size of the horizontal run-outs and up-feed risers. The pipes selected for these columns were solely based upon this critical velocity limitation.

Whenever you are faced with solving the problem of a spitting radiator vent, think about how the system was supposed to work and ask yourself what's changed. Here is a list of some of the more common causes of spitting radiator vent valves.

- Check the size of the horizontal run-out, vertical up-feed riser and the supply radiator valve vs. the connected radiation load and make sure they are adequate.
- Make sure the run-out pitch meets the recommended minimum(1/2" per foot, and if the run-out exceeds 8', use the next larger pipe size).
- Make sure the radiator valve is completely open. If it's partially closed, or if the disc falls off the seat, the diameter of the opening is reduced and the velocity increases dramatically!
- Check to see if the insulation has been removed from the piping. Cold pipes create a lot more condensate.
- Make sure the radiator is pitched slightly towards the supply valve. The condensate should drain when the system shuts down.
- Replace the vent if dirt, scale and rust prevent the vent from seating tightly.
- If someone re-locates the radiator, make sure the new piping adheres to the same rules as when the system was first installed.
- A large radiator with a large capacity vent may cause the radiator vent to spit. A fast vent can allow too much steam into the radiator. This creates too much condensate, which is trying to drain out the supply valve while more steam is trying to enter. Instead of one quick vent, try two smaller capacity vents, installed one above the other.

PIPE SIZES - ONE PIPE STEAM

CAPACITY SQ. FT. UP & DOWN FEED SUPPLY RISERS

COL. A	COL. B	COL. C	NOTE
SIZE OF PIPE	UP FEED	DOWN FEED	COL B. IS BASED ON MAXIMUM ALLOWABLE VELOCITY FOR UP FEED RISERS ON ONE PIPE SYSTEMS. COL. C IS BASED ON PRESSURE DROP OF ONE OUNCE FOR 100' EQUIVALENT LENGTH.
1"	45	56	
1¼"	98	122	
1½"	152	190	
2"	288	386	
2½"	464	635	
3"	799	1163	

HORIZONTAL BRANCHES TO RISERS - SQ. FT.

SIZE OF PIPE	1"	1¼"	1½"	2"	2½"	3"
HORIZONTAL BRANCH TO RISER UP TO 8' LONG	28	62	93	169	260	475
HORIZONTAL BRANCH TO RISER UP TO 8' to 12' LONG	—	28	62	93	169	260
HORIZONTAL BRANCH TO RADIATOR INLET UP TO 8' LONG	28	62	93	169	260	475
VALVE SIZE	28	62	93	169	—	—

If you have questions or problems with any steam related systems, call your McDonnell & Miller or Hoffman Steam Team representative. They have the solutions to your problems.

Compliments of:

McDonnell & Miller
Hoffman Specialty
CounterPoint™
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Problems When a Steam Trap Passes Steam

When a trap has failed to the point where it passes steam, it is easy to ignore or place on our never-ending list of "things to do." After all, what harm is it causing besides wasting a few dollars worth of steam? The process is still being heated. However, a failed trap may be costing you more than just the loss of a small amount of steam. It may be costing you a lot more.

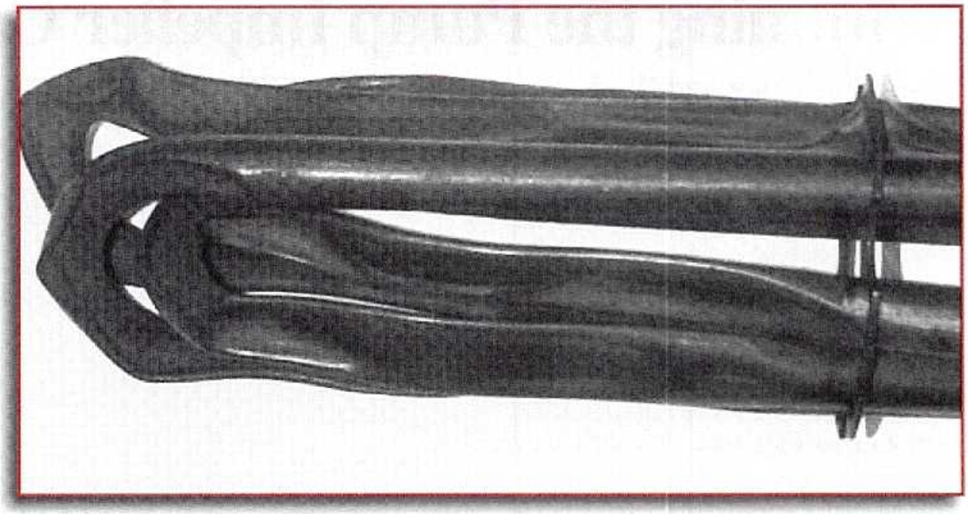
The Cost of Lost Steam

Let's examine how a trap passing steam can affect your whole system. First, determine how much the lost steam costs. Since the steam is being lost at saturation conditions (0 psig from the vented receiver) we can determine the amount of Btu's that are no longer recoverable. 0 psig steam contains 970 Btu/lb. So, for every pound of steam we don't recover, we lose 970 Btu's. But we're losing more than just that latent energy. We are also losing sensible energy. Having lost that pound of steam, we must now replace it with a pound of water and we have to add energy to the new water just to bring it up to saturation condition (for water it is approximately 1Btu/lb°F). Let's say the water we are introducing is 60°F. Because we lost our steam through a vented receiver, we have to raise its temperature to 212°F. And because the steam we lost had already been treated, there is the additional cost of treating the new water.

Other Effects of Bad Traps

Knowing this information we are able to calculate the loss associated with losing steam through a bad trap. However, there are other indirect costs related to the failed trap that are more difficult to calculate. One is the damage caused by water hammer. As steam enters a condensate return line, there is the chance steam will mix with the condensate and some of the condensate may flash into steam and re-collapse into condensate, causing water hammer and equipment damage.

A failed trap can pressurize the return main resulting in insufficient differential pressure across other traps draining into the same



Picture of Tubes Damaged by Water Hammer

main as the failed trap. Consequently, condensate will back-up in the processes the traps are associated with. Then someone will wrongly diagnose these traps as being defective, possibly even replacing a good trap and still not getting the desired results. Frustrating! Because the trap has no differential pressure due to the pressurized condensate line, there is also the possibility of water hammer occurring in the heat transfer device that cannot drain. Again, the mixing of steam and condensate can cause water hammer.

Higher Steam Temperatures Problems

This is not the last of the problems that a trap passing steam can cause. With steam passing through the trap, the return condensate is at a higher temperature, which sounds like we are saving energy by not having to add as much sensible heat to the condensate to bring it back up to saturation conditions. But the warmer the condensate is, the more flash steam there will be. Even worse, the pumps will handle hotter condensate, and this can have a negative effect on the pump seals. And, the higher the temperature, the less NPSH (Net Positive Suction Head) we will have available at our pump suction—the less NPSH available, the greater the chance for cavitation to occur in our pump.

So, the indirect cost of a trap passing steam may be great. The best solution is to understand the operation of your traps, survey and test them on a regular basis, and repair or replace traps when they fail. The cost will always be justifiable.

So the next time you have problems, look at the whole system. Rember that even if the process is still working, a bad trap may actually cause other, more serious problems.

For help with any and all steam problems, contact your local McDonnell & Miller sales representative. They have the answers to all of your questions.

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Volume 7 Issue 1 **www.hoffmanspeciality.com • www.mcdonnellmiller.com** April 2000

Do's & Don'ts For One-Pipe Steam Systems

We have been asked numerous questions about all types of steam systems over the years. The subjects range from what causes water hammer in steam systems, to the proper sizing of traps and pressure reducing stations, to selecting boiler feed tanks and condensate pumps. The following is a list of some common "do's" and "don'ts" when working on a one-pipe steam system.

DON'T size a replacement boiler by using the heat loss calculation method, the label method, the "looks a lot like" method or any other rules of thumb method.

DO size a replacement boiler by counting all of the radiation in the house. The total becomes the Net EDR (equivalent direct radiation) rating of your replacement boiler. Steam doesn't care about heat losses—or anything else—except the amount of cold metal attached to the boiler. If the boiler is too small, part of the building will never heat. If it is too big, the new boiler will short cycle like mad, consume bodacious amounts of fuel and create service calls.

DON'T assume that you can pipe the boiler exactly the same way as the old boiler.

DO pipe the boiler according to the instructions from the boiler manufacturer. New boilers are very different from older boilers. The sections are narrower, the exit holes are smaller and there are fewer of them, and the steam chest is almost non-existent. So pipe them according to the directions and you will save yourself a lot of headaches.

DON'T just throw in a couple of bottles of cleaning chemicals when you are finished piping the new boiler.

DO skim the boiler according to the boiler manufacturer's instructions. Oil from the foundry as well as the cutting oils used out in the field will create surface tension on the top of the water in the boiler. This sets up a foaming/priming condition that creates very wet steam. The results are water hammer, lack of heat and unhappy customers.

DON'T use small radiator vents as end-of-main vents! Worse, don't use a pipe plug.

DO use the largest main vents that you can get. By venting the air from the main separately and quickly, you will significantly improve the balance of the system. By using a large vent, the steam will head toward the end of the main before it starts filling the risers. This provides balance to a one-pipe system.

DON'T size the horizontal run-out to a one-pipe riser based on the inventory method of pipe sizing.

DO use a steam pipe-sizing chart that tells you the exact pipe size needed to support the amount of radiation connected to that riser. The pipe that connects the steam main to an up-feed riser is called a horizontal run-out. Its job is to simultaneously supply steam to the riser while allowing condensate, which is coming back from the radiators, to gravity drain back into the steam main. If the steam is moving too fast, the condensate won't be able to drain back into the main: instead, the steam will drive it towards the radiator vents.

DON'T use adjustable vents on radiators based upon the radiator's location.

DO use adjustable vents based upon the size of the radiator. When coal fired systems were converted to oil or gas, they found the system operated differently. To adjust to this new "on & off" type system, they had to balance the air venting of the larger radiators versus the smaller radiators. It had nothing to do with the location of the radiator. That problem was eliminated by installing at least one large-capacity main vent at the end of each main. Then the adjustable vents would simply control the venting rate of the larger radiators compared to the smaller radiators.

DON'T raise the setting of the pressuretrol, thinking it will solve a heating problem!

DO keep the pressuretrol or vaporstat set as low as possible because:

- Low pressure steam moves faster than high-pressure steam. If you want the steam to reach the end of the main quickly, lower the pressure and make sure you install a large capacity main air vent.
- All radiator vents have a "drop-away" pressure rating. This is the maximum pressure that the float inside the vent can fall down against, re-opening the vent. If the pressuretrol setting is too high, once the vent closes it won't be able to re-open to vent any remaining air in the radiator.
- One-pipe steam radiators were sized to heat the house on the coldest day of the year with less that 1 psi of steam. For every square foot of EDR, the radiator will emit 240 BTU/H when the room temperature is 70°F and the steam temperature is 215°F.

If you have any questions regarding steam systems, please contact your local Hoffman Specialty/McDonnell & Miller representative. Your Steam Team representative has been thoroughly trained in the art of steam heating.

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When a Bucket Trap Just Won't Do!

Inverted bucket traps—or "bucket traps"—have been around a long time in the steam trapping business. They are rugged in design and can withstand demanding applications, but are sometimes used in applications that just aren't "friendly" for this style trap. A bucket trap likes to operate with a constant load, and doesn't operate well under fluctuating loads.

All steam traps must be capable of performing the following functions:

❶ **Vent air from the space so that steam can enter.**

❷ **Hold steam in the space until all of the latent heat has been removed from the steam.**

❸ **Remove all the condensate that forms in the space when the steam condenses.**

Bucket traps are good at performing two of these functions: numbers 2 and 3. A bucket trap does not vent air from the steam space quickly, and does not work well under varying loads—it prefers to "see" a constant load. What is a varying load? A typical heating system which cycles on and off by a thermostat or outdoor reset control is an example of a varying load. When the system turns on, the load is great because the pipes and radiators have to warm up. Once they have warmed up, the load is reduced. This fluctuating load creates fluctuating condensate loads. Bucket traps aren't the best choice to handle these changing loads. Every time the system turns off and the steam condenses, air rushes back into the system, breaking the vacuum. On the next call for heat, this air must be vented before steam can enter. Unfortunately, the bucket trap can't vent this air quickly.

Steam heat exchangers and steam make-up air coils incorporating modulating control valves are also modulating loads. When the control valve modulates the steam supply, it is responding to a change in the load. It also changes the pressure in the steam space, which affects the pressure differential across the trap. As the differential changes, the capacity of the trap is affected. These conditions work against the bucket trap's operation.

Hoffman F&T Series I trap

Because a bucket trap cycles open and closed, a bucket trap works best when there is a constant, steady load which rarely fluctuates. The bucket, which is actually upside down (inverted) in the trap, has a specific weight to it. This bucket is attached to the trap's cover by a lever. At the other end of the lever is a plug, which is driven into the seat of the trap when it closes. The trap is normally open because the weight of the bucket pulls the plug off its seat. When steam arrives at the trap, it is directed through a passageway into the open end of the bucket. As more steam enters the bucket, it becomes buoyant and begins to float, closing the trap. The steam eventually condenses, the bucket loses its buoyancy and falls, pulling the plug away from its seat. Re-opened, the condensate is allowed to drain into the return piping. To work properly, the trap body needs to be primed with condensate. If the trap loses its prime, when the steam enters the trap, it will by-pass the inverted bucket and flow into the return.

What causes a bucket trap to lose its prime? A trap in an application with a modulating load can lose its prime. Under the light load, the steam that enters the trap will actually re-evaporate the condensate in the trap body to steam. Now, without any condensate in the trap, steam will pass through the trap and into the return.

What type of trap should be installed in a modulating application? A float & thermostatic (F&T) trap is best for this application because as the name implies, it consists of a float and a thermostatic element. The thermostatic element is designed to handle a large volume of air, and the float can handle modulating condensate loads. These two conditions occur in every steam heating system and in every modulating control valve application.

Hoffman Specialty offers an Inline Float & Thermostatic trap. The benefit of this style trap is the inlet and outlet connections are on the same plane, just like a standard bucket trap. So if you encounter an existing application using a bucket trap and the system is experiencing some of the problems outlined here, you can upgrade the installation with minimal piping changes to an Inline F&T trap.

For more information on steam traps or answers to any steam heating questions, contact your local McDonnell & Miller/Hoffman Specialty Steam Team representative, or visit our websites at www.hoffmanspecialty.com or www.mcdonnellmiller.com.

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Replacing A Steam Boiler - Successfully!

When an existing steam boiler fails and needs replacing, obviously a new one must be installed. And that's when the adventure begins. The first thing to do is find out why the old boiler failed:

- Was it an 80-year boiler on its last leg?
- Were the controls installed properly?
- Were the controls maintained according to the manufacturers' recommendations?
- Was the boiler bringing in bodacious amounts of fresh water?
- Is your customer accustomed to the nuances of a steam system or is he a new homeowner who doesn't know that steam boilers require "hands on" attention?

You need to find the answers to these questions before you install the new boiler so that the boiler failure won't happen again. (If it fails again, watch how quickly the homeowner's steam system becomes *your* steam system!)

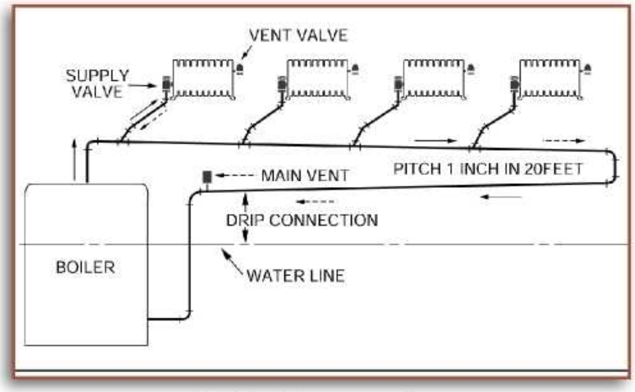
Sizing the Replacement Boiler

Proper sizing of the new boiler plays a major role in the success of your replacement job. It is very important to ensure that the new steam boiler has the same capacity in producing steam as the system you are connecting it to has in condensing the steam. This is the one fact that trips up many contractors.

Steam systems are nothing like hot water systems when it comes to providing heat. In a hydronic system, the boilers, pipes and radiation are filled with water. The boiler heats the water, which is then circulated out to the radiation. There, it gives off some heat to the room and drops a few degrees in temperature. The water then comes back to the boiler where it is heated and re-circulated back out to the system.

In a steam system, all the pipes and radiators are filled with air. The only water in the system is found in the boiler and any piping below the boiler water line. The steam boiler heats up the water until it changes from hot boiling water into steam. It does this by adding latent heat to the boiling water. Latent heat is a measurement of energy that isn't sensed by a thermometer – it's what steam heating is all about. The water, now in this vapor-like state, heads out into the system. The key is to realize that this steam wants to change back into water. And when it does, it gives back the latent heat that was needed to change the water into steam. This occurs when the hot steam enters cold pipes and radiators. This is the reason why the new steam boiler must be sized according to the amount of radiation that is connected to the piping system. To heat every radiator in the house, the boiler has to produce enough steam to fill the piping network and all of the radiators.

Regardless of the size of the old boiler, you should always walk around the house with a clipboard and add up the EDR ratings of every radiator. When you are done, you will know the exact size boiler required for this home. If you select the replacement boiler by reading only the rating plate of the old boiler, the success of the job and your company's reputation are in the hands of the installer who came before you. In addition, many homeowners believe that when they purchase a new steam boiler, they are also getting a new steam system. Their old system could have been experiencing problems for years, all because of the incorrect size of the old boiler. If you come in and select the replacement boiler based on the old one, you may then have to live with a very unhappy customer. It happens often.



Typical steam system

When a replacement steam boiler is oversized, it can create many problems. It will force too much steam into the piping system, creating velocity problems, spitting steam vents, and water hammer noises, and causing the boiler to short cycle. Remember that the homeowner doesn't know about the need for proper boiler sizing. He hears the boiler constantly cycling on and off. All he knows is that his radiator vents are suddenly spitting water all over the walls and floor, and he believes that his house might explode from the water hammer noises. You – and your customer – can avoid these problems by taking the time to properly select the replacement steam boiler.

If you have any questions regarding steam systems, contact your local Hoffman Specialty/McDonnell & Miller Representative. Your Steam Team Representative has been thoroughly trained in the art of steam heating.

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CounterPoint™
Volume 9 Issue 2 www.mcdonnellmiller.com • www.hoffmanspecialty.com November 2002

Why residential boilers need LWCO's

There are both legal and practical considerations that create the need to install a low water cut-off (LWCO) device on a residential hot water boiler. Jurisdictions have adopted codes which state when an LWCO must be installed, while the practical side is based upon system conditions.

ASME

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code has been universally adopted as the minimum requirement for the manufacture, installation and maintenance of boilers. Section I, for power boilers, requires low water protection. Steam heating boilers of any size, regardless of where they are installed, must have a low water cut-off per ASME Section 4. For hot water boilers, the same code only requires that hot water boilers with input greater than 400,000 btu must have a low water cut-off. In lieu of an LWCO, coil type boilers above 400,000 btu input, which require a flow of water to prevent overheating, shall have a safety device (typically a flow switch) to prevent burner operation when the flow of water is inadequate.

CSD-1

120V LWCO (RB-122)

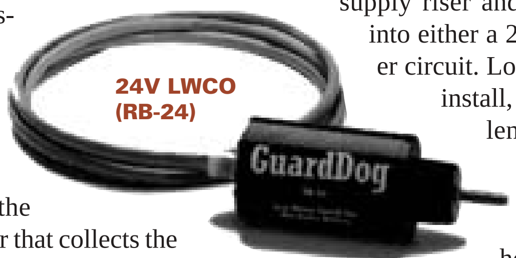
CSD-1-2002 is an additional ASME standard for Controls and Safety Devices for Automatically Fired Boilers. As in Section 4, CSD-1 Part CW-120a requires at least one LWCO on all steam boilers. However, the requirement (Part CW-130a) for hot water boilers has the words added, "…except those installed in residences (as defined by the authority having jurisdiction)…" This requires that any hot water boiler, regardless of size, not installed in a residence, must have a low water cut-off.

IMC

The Internal Mechanical Code (IMC) is a new standard that is being adopted by jurisdictions. It is a consolidation of codes written in the past by BOCA, SBCC, and other independent code councils. Section 1007.1 of the IMC states "All steam and hot water boilers shall be protected by a low water cutoff control." If it's a hot water boiler, it must have a low water cut-off.

The Fill Valve

There has always been a controversy about whether to keep the fill valve open or closed after initially filling a hot water heating system. If the valve is closed and there is a leak in the system, no water is added to the system if a leak develops. Because the fill valve has a strainer that collects the debris (sand, silt, minerals, rust, etc.) that is present in the water which can clog the strainer, leaving the valve open is no guarantee that water will flow through if a leak occurs.



24V LWCO (RB-24)

Piping Elevation

Some systems have piping for radiators, snow melt and tankless water heaters below the minimum safe water level of the boiler. Boiler manufacturers and organizations such as ANSI and the National Fuel Gas code have recognized this. Each has added a section in their literature or standards that indicates that if a hot water boiler is installed above the level of radiation, then a low water cut-off should or shall be installed.

For many years, industry leaders have identified the need for low water cut-offs on hot water boilers. They agree that the only way to detect a low water condition is with a low water cut-off device. No other safety device can determine if water is present.

In 1997, McDonnell & Miller introduced the Series RB line of probe type low water cut-offs. Designed for use in residential boiler applications, they feature a green "power on" LED, a "low water condition" red LED, and high sensitivity for use in a broad range of liquids. The Series RB can be installed in either the boiler tapping or supply riser and are easy to wire into either a 24V or 120V burner circuit. Low cost and easy to install, they are an excellent choice as the device to sense a low water condition in a hot water boiler.

Remember, even with the many other safety devices (temperature limits, pressure relief valves, flow sensors, etc.) installed on a hot water boiler, the low water cut-off is a low cost component which will protect the boiler and system from damage if a low water condition occurs.

For more information on low water cut-offs, or answers to any boiler control questions, contact your local McDonnell & Miller/ Hoffman Specialty Representative, or visit our web sites.

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Volume 10 Issue 1 **www.mcdonnellmiller.com • www.hoffmanspecialty.com** September 2003

Frequently Asked Questions

Following are just a few of the many frequently asked questions posted on the McDonnell & Miller and Hoffman Specialty websites.

Q In an old house with steam heat, just part of the radiators were getting warm, so I drained the system and refilled with water. Now the water was spurting out of the radiators. So I drained the system again and I took off all the pressure valves on each one to hopefully release any vacuum. When done I put all the valves back on and refilled the water level again, but the water is still spurting out of the radiators. Can you give me any advice?

A The steam system is supposed to be filled only up to the halfway point on the boiler gauge glass. If you put too much water in the system, or if you're trying to operate it at a higher pressure than needed you'll get leaks. You may need to install a boiler feeder. For complete information on boiler feeder selection and installation, visit www.mcdonnellmiller.com, or contact your local M&M Representative.

Q When should I use a secondary (redundant) low water cut-off?

A We recommend that secondary (redundant) low water cut-off controls be installed on all steam boilers with heat input greater than 400,000 Btu/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low-water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.

Q What is the best way to test a steam trap?

A There are several methods that can be used depending on the type of trap you have:

- The most accurate test for all types is visual inspection of what is coming through the trap
- Install a test valve in the trap outlet tapping
- Listen to sounds in the trap while using an automotive type stethoscope or an ultrasound device (traps that are blowing steam will have a hissing sound and traps that are passing condensate will have a gurgling sound)
- Instantaneous thermometers work well on thermostatic traps
- Use a stethoscope to listen as bucket traps and thermodisc traps cycle open and closed

Q What is the difference between a probe-type boiler control for a hot water boiler and one for a steam boiler?

A Probe-type boiler controls designed for steam boilers include a time delay function to guard against rapid cycling. The water line in a steam boiler will often fluctuate due to burner operation or header location. This fluctuation in water level will cause a probe-type boiler control to cycle in between "in water" and "out of water" several times a minute, or "rapid cycle." To guard against this situation, a steam boiler control will include a time delay feature which requires the probe to be out of water for a period of time (often 10 seconds) before it registers "out of water." This is known as "delay on break" (DOB). Also in reverse, as water is returning to the probe, the steam boiler control has a "delay on make" (DOM) time delay of 15 seconds. This allows for additional condensate to return to the boiler so the probe is completely submerged before the burner is allowed to fire. Hot water probe-type boiler controls require no time delay because the entire system including the boiler is completely filled with water, hence there is no fluctuating water line.

M&M LWCO's

Q Can a manual reset low water cut-off (LWCO) be used with a water feeder?

A No. After going into "low water," a manual reset unit locks out, causing the water feeder to remain in feed position until the manual reset button has been depressed. Under normal operation, if a water feeder is wired and controlled with the low water cut-off, the water feeder will continue to add water to the boiler until it receives a signal from the low water cut-off indicating that the boiler has sufficient water (probe is in water). However, as stated above, a level control with a manual reset will not signal the water has returned to the probe until the manual reset button is depressed, resulting in a flooded boiler.

For help with any hydronic or steam heating question, contact your local McDonnell & Miller/Hoffman Specialty Representative, or visit the websites.

To view more FAQs, go to www.mcdonnellmiller.com or www.hoffmanspecialty.com, click on "FAQs", and then enter a key word in the search box.

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Boiler Maintenance Can Heat Up Your Sales

It's interesting that the same people who change their smoke detector batteries every year and their car oil every 3,000 miles will let their boilers go year after year without even a thought of preventive maintenance. Yet when the boiler breaks down in the middle of winter after decades of faithful service, you are the one who gets an emergency phone call from the surprised homeowner.

One way to avoid these emergency calls and to generate additional business is to develop a regular boiler preventive maintenance service for your customers. In addition to saving your customers money on fuel consumption and costly parts replacements, regular maintenance can also prevent potentially hazardous conditions. The following "refresher" tips are designed to help you deal with problem areas for different types of boilers and create your own boiler maintenance program.

Hot water, steam, gas-fired, and oil-fired boilers all have special maintenance requirements. In particular, oil-fired boilers need more frequent inspection. And, if the boiler is also used to heat domestic water, it's operating year 'round and should be inspected at least twice a year. In general, a thorough boiler inspection/maintenance program involves checking:

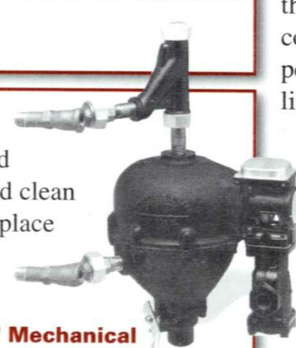
- The fuel system - for proper operation, leaks and controls
- The combustion system - for boiler and exhaust leaks and signs of overheating
- Heating system - for leaks, uneven heating and zone balancing
- The circulator pump - should run quietly
- The water - should be clean
- Gauges - they may not be accurate, so compare them to a standard gauge
- Expansion tanks - check the pressure
- Controls - follow the manufacturer's recommended procedures
- Safety devices - safety relief valves, temperature and pressure controls, low water and flow-sensing devices all need special inspection

Don't forget the controls and safety devices

There are many types of controls and safety devices used with boilers that require maintenance as well - check the manufacturers' recommended maintenance procedures. Some general guidelines to follow:

- Probe-type low-water cutoffs should be removed and inspected, and the probes cleaned or replaced annually

M&M RB-122 LWCO



- Mechanical feeders - remove and clean the strainer and clean the cartridge, and replace them if necessary

M&M Series 47 Mechanical Feeder / LWCO

- Float-type controls - remove and inspect the float mechanism, and clean and replace it if necessary

M&M Series 150 Float-Type Control

- Forced circulation copper boilers have flow switches - remove them for inspection and cleaning annually. Check for deterioration of the paddles and replace the paddles if necessary since they can affect the operation of the flow switch.

M&M FS4-3 Liquid Flow Switch

It takes some effort to remove and clean the probes, low water cutoffs, float-type controls and flow switches, but if you don't perform this important procedure, you're likely to get a call-back during the busy heating season. Be sure to inspect the controls and safety devices, and your customers will appreciate your diligence when they realize that their boilers operate more effectively and efficiently, especially in the cold winter months when lack of maintenance is most likely to cause problems.

These tips should help you keep your customers happy while generating new business for your company.

For more information on boiler controls, or answers to any steam or hot water heating question, contact your local McDonnell & Miller/Hoffman Specialty Representative, or visit our websites at www.mcdonnellmiller.com or www.hoffmanspecialty.com.

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Volume 11 Issue1 www.mcdonnellmiller.com • www.hoffmanspecialty.com June 2004

How To Run A Condensate Zone Off A Steam Boiler

Some nagging questions and helpful answers

Can I run a hot water zone off an existing steam boiler without a heat exchanger?

Yes, but there is a limit to how much radiation you can support from your steam boiler.

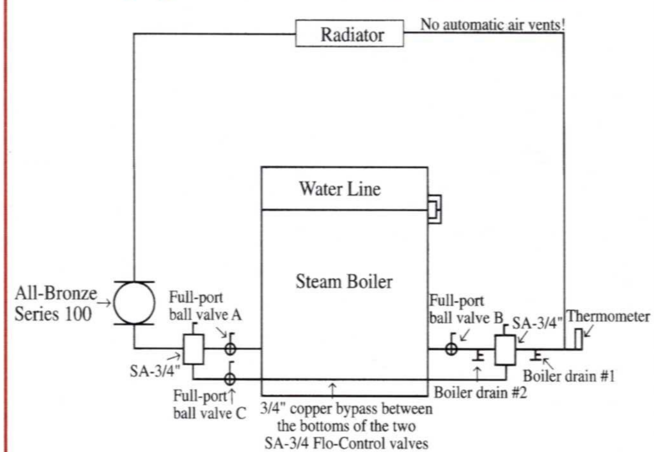
Boiler manufacturers list two capacity outputs on every steam boiler. The first output is called the DOE (Department of Energy) Capacity. It can also be referred to as the boiler's Gross Output. The other rating is the boiler's Net Capacity. The difference between these two capacities is about 33-1/3%. Gross Output, the higher of the two, includes capacity to pick-up the system when you first turn it on as well as the load of keeping the piping network warm. The Net Capacity is the available energy to heat the radiation and keep the house warm. Once the system has warmed up, the boiler has this extra 33 -1/3% capacity available and this becomes the limiting factor for how much radiation can be supported for the hot water zone. You have the option of running the zone in a priority condition if the load is greater than the pick-up factor but this means no heat in the steam system while the hot water zone operates.

What keeps the water "up" in the piping and radiation?

Atmospheric pressure, which is pushing down on the water in the steam boiler, keeps the water "up" in the radiation. At sea level, the atmosphere is pushing down on everything with a pressure of 14.7 pounds per square inch. One pound of pressure per square inch can lift water 2.31 feet.

In theory, the atmosphere can support water to 34' but 30' is the practical limit. In a steam system, because atmospheric pressure is pushing the water up, you never should use any vents in the condensate zones off of the boiler because when a vent opens, the condensate will fall down into the boiler and flood it.

Piping a Hot Water Zone Off a Steam Boiler



What happens if I add the hot water zone loads to the size of my replacement steam boiler?

If you oversize your steam boiler, you'll have all kinds of problems such as water hammer, surging water lines and uneven heating! You'll be "shoving" too much steam into a system that was designed for a lesser load.

How should I pipe the hot water zone off the steam boiler?

You should have the supply and return connections located below the water line of the boiler (see illustration). Ideally, they should be located so that there will be a good, cross-sectional flow of water through the boiler. This is to make sure the water doesn't "short-circuit" through the boiler and not pick up enough BTUs. Also the circulator should be located on the supply side (below the water line of the boiler), pumping away from the boiler and out to the radiation so that all of the circulator's pressure differential will be added to the system, not subtracted. This will help prevent the water from flashing into steam and causing water hammer.

Are there any other piping details to consider?

When piping the hot water zone off the boiler, you should pipe a by-pass around the boiler to limit the temperature of the water that will circulate out to the radiation. When the boiler is producing steam, the water temperature is the same as the steam. At one psi of steam pressure, the water temperature will be 216°F; at two psi, the temperature is 218°F and so on. The problem with water being this hot is that, when the circulator shuts off because the zone is satisfied, there is a good chance that some of the water up in the zone will "flash" into steam. Remember that there are no pressure-reducing valves in these types of systems. Therefore, the water at the top of the system is under no pressure. And since water can flash into steam at 212°F at zero psi whenever the circulator turns off, you can get "banging" in the hot water zone and a flooded steam boiler in the basement!

If you have any questions when installing a steam system, call your local McDonnell & Miller Representative. They are well versed in all areas related to steam.

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Volume 12 Issue 1 www.mcdonnellmiller.com • www.hoffmanspecialty.com January 2005

How to Increase Your Profits with LowWater Cutoffs on Hot Water Boilers

Most gravity steam boilers operate at 2 psi or so, and every one comes with a low-water cutoff. You probably can't imagine a steam boiler operating without that essential safety control. What would happen if the boiler ran out of water and the burner continued to fire? If you've ever seen a burned-out steam boiler, you know that the stakes are very high. And that's why every steam boiler comes with a low-water cutoff.

But now consider a hot water boiler. Most operate at six times the pressure of the typical steam boiler, yet many have no protection against a dangerous low-water condition. Some hot-water boilers have that crucial protection, but these are typically larger boilers, 400,000 BTUH and higher. Why boilers of this size? Because it's code. Contractors usually install these boilers in multi-family housing and commercial buildings places where there are lots of people.

But what about smaller hot water boilers? You know, the kind you find in single-family homes. Plenty of people living there, but many don't have low-water cutoffs, do they? Why? Because in some states, there's no law that says you have to install them or you've chosen not to comply with your state's code. Be aware that most states now require low-water cutoffs on all boilers regardless of size or type. At about $100.00, a low-water cutoff is an inexpensive insurance policy protecting you and your customers.

What's causing this shift in policy? We suspect it may have to do with the rapid growth of hydronic heating in certain areas of the United States. Did you know that the radiant-floor-heating market has been growing at a steady rate of about 30% a year for several years now? Many newer hydronic heating systems include at least some radiant floor heating. And when all or most of your system piping winds up below the boiler, the boiler manufacturer requires you to install a low-water cutoff. It's time to start thinking seriously about potential system leaks, and about the people who are going to live in that house.

Even a simple baseboard-loop system can have several feet of piping that dips under a concrete slab to clear a doorway. That piping's out of sight and prone to corrosion and leakage; in most homes, there's nothing to protect the boiler from a low-water condition. Maybe you're thinking the feed valve will protect the boiler if something goes wrong? If you are, consider this situation.

Suppose the burner locks into the firing position and doesn't drop out when it should. Anything from a stuck-open gas valve to a faulty control can cause this problem. Once the burner locks in and keeps firing, the temperature and pressure inside that boiler will build until the relief valve opens. In most homes, this happens at 30 psi.

M&M low water cutoffs: RB-122 (120V - left) and RB-24 (24V - right)

So the relief snaps wide and unloads a furious blast of steam. Once the immediate danger passes, the valve quickly seats itself. In most homes, they seat at about 26 psi. But remember, the burner continues to fire.

And then in a few moments, the relief valve roars open again, dumping even more steam into the boiler room. Unless someone notices, this will continue until there's little or no water in the boiler.

Now consider this. While this is happening, the system pressure never drops below 12 psi. Because it doesn't, the feed valve can never feed. And if the feed valve shot water into the boiler, there's no telling what could happen.

Can you see how low-water cutoffs are in the best interest of your hot-water heat customers? It's to your great advantage to mention them to your customers, especially if you're replacing their boiler. When they realize a low-water cutoff is in their best interest, most homeowners say, "Sure, install it!" This is especially true when you're replacing their boiler, because the cost of the low-water cut off seems modest compared to the cost of the complete job.

Think about it. If you mention it to them as an option, explaining the facts about feeders and boiler protection, they might just say "Yes!" And if they do, you'll make more money on that job while you're protecting that family from potential danger.

And if they say "No," you're still better off. You've raised an issue with a solution that's in their best interest. You've shown you care about their safety.

When you sell with your customers' best interests in mind, you separate yourself from other contractors in a big way. This caring approach and awareness of the workings of hydronic systems make you more professional in the customer's eyes. And the best part: you'll probably increase your profit on every job you do.

For more information on boiler controls or answers to any steam or hot water heating question, contact your local McDonnell & Miller/Hoffman Specialty representative or visit our websites at www.mcdonnellmiller.com or www.hoffmanspecialty.com.

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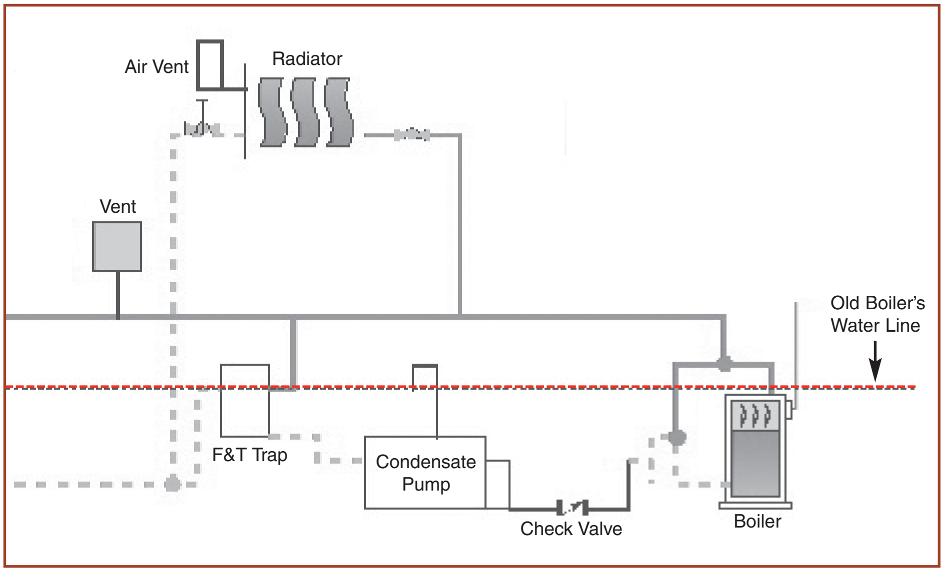
Volume 12 Issue 2 www.mcdonnellmiller.com • www.hoffmanspecialty.com October 2005

Creating a "False Water Line"

The next time you are faced with replacing an old steam boiler that was attached to a "two-pipe air vent" system, try the old-timer's trick. Remember that the replacement boiler is smaller in size and holds less water, thus requiring a boiler feed tank that acts as a reservoir for the new boiler. The feed tank helps prevent the boiler from shutting down due to a low water condition, or flooding the boiler if a feeder is present. With the boiler feed tank, all the system surges take place in the receiver, allowing the boiler to maintain a steady water line.



Typical False Water Line Installation

Boiler feed units

When you install a boiler feed unit, all the returns must drain into this receiver. The only way water can now enter the boiler is by turning the feed pump on with a pump controller located on the boiler. This receiver is vented to the atmosphere because it can't withstand any pressure, so all those former wet returns now have no backpressure from the boiler to offset the pressure from the supply side. Now the steam can reach down into those former wet returns and shove all that water back and forth in the piping, eventually showing up at the vent pipe, filling the boiler room with steam. Of course, the water hammer is incredible.

F&T traps

The answer to this problem is to install F&T (float & thermostatic) traps at the base of each riser drip and at the end of each main as well as radiator traps on each radiator. These traps will prevent the steam from entering into the return lines and pouring out of the receiver's vent line. Unfortunately, sometimes it isn't economically feasible or even possible to install all those traps, and installing one "master" F&T trap at the inlet to the receiver may not prevent the steam from showing up at the vent pipe. And it does nothing to prevent the steam from still reaching all the way down into those former wet returns, creating water hammer and other problems. Remember, the returns are now isolated from the boiler's back pressure because they all drain into the vented receiver.

The false water line

There is a way of getting the new installation to work: create a "false water line." This technique allows you to keep the old wet returns pressurized and full of water the way they were in the original system. One method to accomplish this is to use a 2" F&T trap and hang it right near the boiler feed unit. Mount the trap so that its location closely mimics the old boiler's water line. The trap should have two inlet and two outlet tappings. Combine all the wet returns from the system into one common line, and pipe this line into one of the trap's inlet connections. Then run a steam line from the steam main over to the other inlet connection of the F&T trap. This equalizing line puts pressure on the backside of the wet returns, keeping them wet and pressurized, and the pressure balances off the steam pressure from the supply side. Now, pipe a line from one of the trap's outlet connections to the feed tank's inlet connection. As the condensate forms in the system, the F&T trap will open to drain this returning condensate back into the receiver. It is important that the new water line be high enough to cover everything that was originally covered by the old boiler's water line. It should not be too high since there is a chance the water could flow back into the main, causing water hammer and damage to the system's main vents.

For answers to any steam or hot water heating question, contact your local McDonnell & Miller/Hoffman Specialty Representative, or visit our websites.

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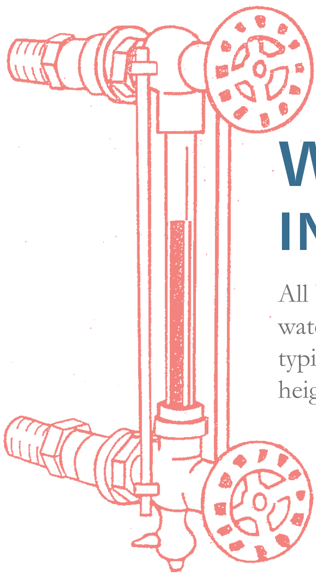
Helpful HVAC design information from ITT Residential & Commercial Water



WHAT IS THE NORMAL WATER LINE IN A STEAM BOILER?

All boiler manufacturers identify the "normal water line" in their instruction manuals. It is typically denoted as "NWL" and describes the height in inches from the bottom of the boiler up to this line. By not paying attention to the NWL, you can set yourself up for a whole lot of headaches. The manufacturers today know that for their boilers to provide good "dry" steam, they have to rely on the boiler's near-boiler piping to help "shake out" any water that has come out of the boiler with the steam.

MOST MANUFACTURERS LIST THE HEIGHT OF THE BOILER'S HEADER PIPING ABOVE THE NWL AS AT LEAST 24" BECAUSE:

1) They want to minimize the amount of water that can climb up the supply riser(s) with the high velocity steam that is leaving the boiler, and

2) as the equalizer drip line fills with water on start-up (because the steam is condensing in the near-boiler-piping), they don't want this water to back up into the header piping. If this happens, the header piping's internal diameter is drastically reduced which immediately increases the steam's velocity which can cause more problems. The higher velocity steam will literally "suck" additional water right up out of the boiler and out to the system. This water-laden steam will condense prematurely because the water will rob the latent heat from the steam causing uneven distribution of heat throughout the building. It will cause the steam vents to spit condensate. It will create water hammer because condensate will slam into elbows, tees and anything else in its way. This high velocity steam will also create a low water condition back in the boiler because of all the water that left the boiler prematurely. The only time the NWL is the normal water line is when the boiler is off and cold. (Figure 1)

"NWL is only normal when the boiler is off and cold."

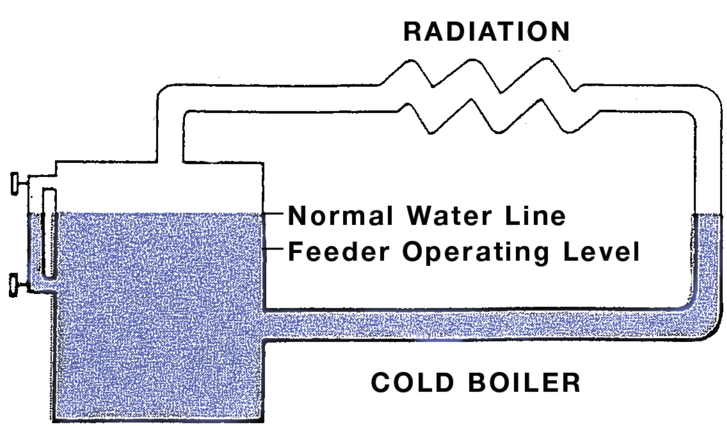


Figure 1

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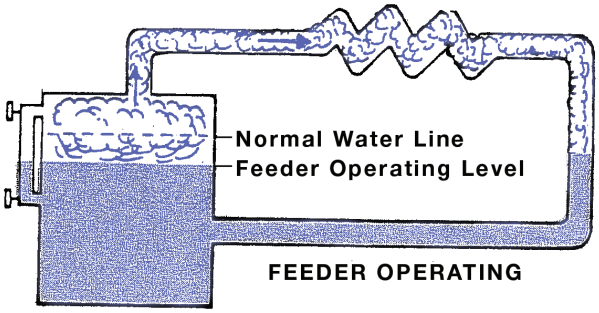


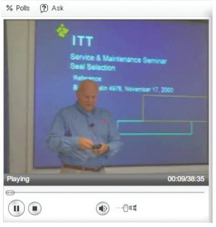
Figure 2

As soon as the boiler starts to make steam, the water line has to change because some of the water is changing its state from a liquid to a gas (Figure 2). How fast the water changes into steam is a function of the boiler's BTU/H capacity. An easy rule of thumb to refer to when attempting to calculate the boiler's steaming rate is 0.5 gpm for every 1000 square feet of Equivalent Direct Radiation (EDR). This means water is being taking out of the boiler in the form of steam at a rate of 0.5 gpm for every 1000 square foot rating of the boiler. If you have a residential steam boiler capable of providing 500 square feet of steam, water is leaving the boiler at a rate of 1/4 gpm for every minute the boiler is firing. If a boiler firing cycle lasts 15 minutes and the condensate hasn't started to return, 3.75 gallons of water will have left the boiler. That is a substantial amount of water that is no longer in the boiler.

We know how the NWL is established, but how it is set in a boiler? The only way to set the proper NWL is by manually filling the boiler to the proper level. Some believe that an automatic water feeder is responsible for maintaining this water line, but a feeder's only function is to maintain a safe minimum water level working in conjunction with the low water cut-off. You don't want a customer thinking that an automatic water feeder is convenience item lest they forget about the importance of regularly checking their boiler!

If you have any questions regarding low water cut-offs, automatic water feeders and steam boilers, contact your local ITT McDonnell & Miller Representative. They are well trained on steam subjects.

B&G TRAINING VIDEOS NOW ONLINE



A series of informative training videos created to help HVACR professionals design, operate and better understand hydronic and steam systems is now available free of charge from Bell & Gossett.

Covering a variety of topics ranging from primary/secondary pumping to seal selection, the 12 educational training videos were created by the staff at Bell & Gossett's Little Red Schoolhouse. Since 1954, more than 55,000 engineers, contractors and installers have been trained in the Little Red Schoolhouse's learning center, while another 135,000 professionals have received training through B&G's 'traveling classroom program.'

Now, 12 training videos are available online at: *http://itt.mediasite.com*

Topics include:

- Seal Selection
- Troubleshooting with Pump Curves & Pressure Gauges
- Steam Boilers
- Variable Speed Demonstration
- The Pump Graveyard
- Control Valve Service
- Introduction to Steam Systems
- Steam Regulators: Part 2
- Proper Balancing
- Primary/Secondary Pumping
- Air Control and Air Elimination
- Compression Tank Location

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