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Installing new equipment or retrofitting old provides you with a great opportunity to simplify and optimize your steam trap PMs.

Even when a plant has a small population of steam traps-and little or no inspection taking place-significant money can be recovered by eliminating steam losses. Whether there is one trap failure out of 100 traps, or 10 failures out of 1,000, the same failure percentage exists. In any case, because of their relentless 24/7 nature, day after day after day, these failures are constantly eating away at an organization's profits. No steam plant operation can really afford such losses.

There are countless suppliers ready to sell you the most sophisticated stateof- the-art testing system available. But, can you really justify the expense? You probably have no idea of the magnitude of your losses in the first place. Although you may have a fair number of traps, you might only have a "run and fix it" maintenance system. If that's the case, whenever you identify a trap failure, it's probably because you just stumble on to it.

No doubt, you've heard the old saying, "you have to creep before you walk." It's a good one to keep in mind when it comes to steam trap testing. In other words, it's best to start out simple and grow into a super test system. Here's one way to do it.

The basic steam trap testing station

This type of station has no sophisticated components. They are all readily available and inexpensive. Chances are that most any maintenance department will already have them in

stock, ready to install.

I came across the steam trap test station layout detailed in the following box, in an old steam engine manual with an 1875 copyright date. This was the state-of-the-art 130 years ago. In 1875, people evidently had a need to test steam traps for the very same reasons we do today. Their simple solution may lack modern hi-tech glitter, but it is better to have low-tech know-how than no tech at all.

A Simple, But Effective, Steam Trap Test Station Layout

The testing station layout should appear in the following order, as the condensate travels from the steam-heated equipment outlet to the condensate return piping.

1. Steam side block valve
   - ✓ To shut off or isolate steam from the trap station
2. Steam wye strainer
   - ✓ To prevent scale or dirt from fouling the trap
3. Steam strainer blow-off valve with discharge to atmosphere
   - ✓ To blow the strainer clean—always include this part. Many omit this and regular strainer cleaning becomes a royal pain. Consequently, some maintenance staffers might prefer to check it off on the PM sheet and say it was done rather than slug it apart to clean it properly by hand. Always add about a 3" nipple to the blow-off valve as a safety measure to keep the stream focused in your pail or bucket.
4. An upstream union or set of flanges
   - ✓ To allow the trap to be removed or replaced easily.
5. The steam trap
   - ✓ Device that blocks steam but allows condensate to pass through
6. A downstream union or set of flanges
   - ✓ To allow the trap to be removed or replaced easily—the second union or flange set is to reduce maintenance time repair after repair, saving far more than the extra cost of the parts in repeated downtime
7. A test tee
   - ✓ To provide a point to test the trap in service
8. A test tee valve vented to atmosphere from the tee
   - ✓ To be able to observe the trap action while in operation—as a safety measure, add about a 3" nipple to keep the stream focused safely in your pail.
9. A check valve
   - ✓ Installed at this point in the station when the condensate return line is located higher than the trap, preventing back-flow into the equipment when equipment is not in operation.
10. A condensate return valve
    - ✓ To block return line back-feed flow and isolate condensate from the trap

Testing station installation

Since 80% of all the steam equipment is not in use at some time, you have ample opportunities to complete this modification. The other 20% may not be down long enough to work on it-or not down very often at all. Unfortunately, this 20% may very well cause 80% of your steam losses, primarily because of their long periods of continuous use and the inevitable wear that results from it. These pieces require some planned downtime and coordination that could have the biggest savings and result in the most improvement in their operation. It's best to tackle these

units first, which will help gain credibility in the program and recover pocket change to continue other installations.

Trap station set-up and uses
For normal steam trap operation…

- The steam side block valve is left open.
- The strainer blow-off valve is left shut.
- The test tee valve is left shut.
- The check valve should be set in the line to allow condensate to fl ow from the trap to the condensate block valve. This prevents condensate from other traps fl owing backward through the trap.
- The condensate return valve is left open.

The steam and condensate mixture fl ows through the block valve through the strainer leaving the dirt behind-and not into the steam trap.The steam trap blocks the steam and allows the condensate to pass through. The test tee, check valve and the condensate return see only condensate and some fl ash steam. The check valve prevents any back fl ow of condensate from the return system. Other traps discharging in the system and vertical rise of liquid can threaten to overpower a trap and force condensate backwards, especially when shut down.

For steam trap strainer cleaning…

- The steam side block valve is left open.
- The test tee valve is left shut.
- The condensate return valve is left open.
- A suitable container is placed to receive the fl ow from the strainer blow-off valve.
- The strainer blow-off valve is briefl y opened full and then shut.
- Dirt that was in the strainer is now in the container.

The live steam and condensate mixture effectively scours the strainer screen and fl ows rapidly to the container. Such debris could plug or damage the trap if the strainer were not installed. Many traps are factory-installed with strainers and no blow-off plugs. As a result, lengthy equipment shutdown and dismantling are required just to clean the screen. Adding the blow-off valve allows online cleaning without incurring any equipment downtime.

For trap operational testing…

- The steam side block valve is left open.
- The strainer blow-off valve is left shut.
- The condensate return valve is shut.
- The test tee valve is opened.

The steam and condensate mixture fl ows through the steam side block valve, strainer and into the trap when the equipment is operating normally. The condensate return valve is left shut to prevent condensate from other sources interfering with the test.The test tee valve is left open and any fl ow is seen and caught in a suitable container.

The steam trap is supposed to block steam and pass condensate. Simply put, if there is steam going into the container, the trap is leaking and should be replaced. Be careful, as there now are two types of steam here. If you don't know what to look for, you will do a lot of unnecessary work. Hot condensate from any trap has a fl ash steam component. This fl ash steam has little pressure and fl ows away in a lazy, wispy meandering motion. Live steam that has passed through a failed trap, however, produces a cone-shape fl ow with a steady velocity. This is the point where you call it a trap failure.

Thermodynamic traps may throw you a bit of a curve because of their quick pulsing operation. Quick machine-gun pulses will produce a steam cone. Wait and observe closely during the brief off time. If the cone doesn't exist, the trap is OK.

Diagnosis of just what has failed in the trap depends on the trap design and operational conditions. Don't worry about that, at this point. Replace this money waster and carefully inspect it on the rebuild bench later. That's where and how you'll learn about what fails and why. Fast trap replacement can be achieved using traps that have a body mounted in the line and active parts that can be completely replaced by switching covers, modules or capsules, leaving the body in the line untouched. In many cases, you may be able to shut the steam and condensate valves, open the test tee valve to relieve any pressure, remove and replace the cover, module or capsule, shut the test tee valve and open the valves again, all without affecting the process.

Once you have all the traps working, keep an eye on the return line pH and the amount of amines you are feeding into the system. If a trap suddenly blows through, the pH will drop and the amines (your return line treatment) will go up to try to keep the pH in the proper range. That's the little red fl ag that tells you to go check for a leaky trap if you are between PMs. The live steam keeps the amines in vapor form, and will vaporize any that are left in the return line path all the way to the return tank vent, effectively blowing your treatment to the four winds.

A trap that tests "OK" when the discharge is vented to atmosphere, but blows through for some reason, may have excessive back pressure causing it to perform improperly. Our basic trap station configuration can give you a place to screw a pressure gauge and a steam pigtail into the test tee and open the test tee valve. Without closing any other valves, the gauge should show you what is happening with the back pressure. The gauge reading should be under 20% of the main line pressure. Usually, when new equipment is added to the original return lines, the existing piping becomes too small for the heavier condensate load. Steam trap manufacturers have engineering experts who can help you with the upgrade at no cost to you.

Steam fl ow measurement…an added bonus

The previously detailed steam trap test station can be used to measure the actual load that the equipment is experiencing.

F = V/(T/60)

	Example 1	Example 2
V = 1 US Gallon	1 US gal	1 US gal
T = seconds	30 seconds	120 seconds
F = gallons per minute	= 1/(30/60)	= 1/(120/60)
	= 1/(.5)	= 1/ (2)
	= 2 GPM	= 0.5 GPM

Take the GPM value and convert it to pounds per hour with the following, since 1 US Gallon of water weighs 8.338 pounds.

	Example 1	Example 2
= (GPM x 60) x 8.338	= (2 x 60) x 8.338	= (0.5 x 60) x 8.338
= Flow in pounds per hour	= (120) x 8.338	= (30) x 8.338
	= 1000.56 lbs/hr	= 250.14 lbs/hr

Now you know the steam load of the equipment under test.

Close the return line block valve and open the test tee valve. Allow the fl ow to drain into a pail for a couple of minutes. This eliminates any condensate that fills the piping, and the fl ow will then only be the amount of condensate that has passed through the trap under load.

Collect the fl ow into a second empty container of a known volume Make it easy for yourself by using a 1-gallon can and note the time it takes to fill it. Now, take the container volume (V) and the time (T) it took to fill it, and plug it into the following formula:

Conclusion

It was decided 130 years ago that this trap station was important enough to put in print. Thanks to a bunch of long-dead individuals, this is quite a gift across time-and, if we take the time to heed it, one that will keep on giving when it comes to stopping steam losses.

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