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Testing traps pays dividends

Temperature, sound, visual inspection offer varying effectiveness, results.

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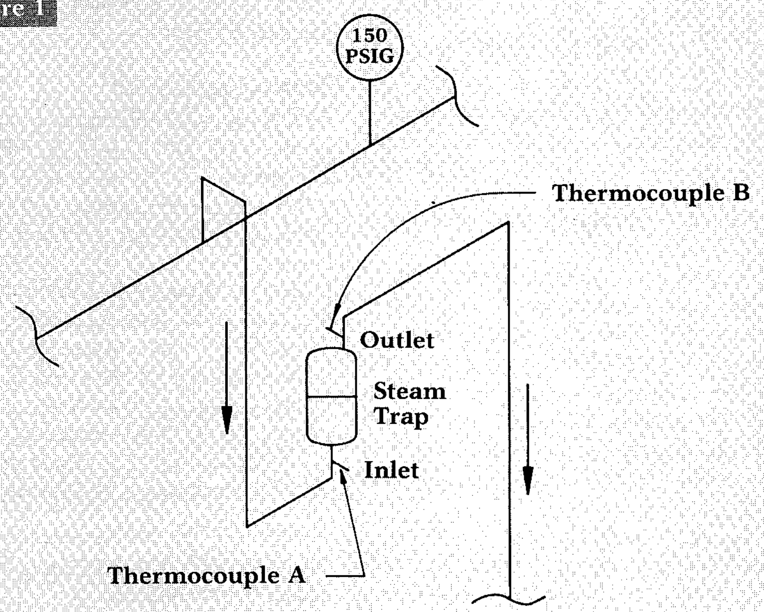
Figure 1



Test No.	Condition	Thermocouple A	Thermocouple B
1	Radiation load only	362° F.	210° F.
2	Constant condensate discharge	362° F.	245° F.
3	Intermittent condensate discharge (Normal operation)	362° F.	211° F. Valve Closed; 221° F. Valve Open
4	Steady blowthrough of live steam	362° F.	212° F.

■ The ability to accurately evaluate steam trap operation can pay dividends in energy conservation, save countless maintenance hours, and reduce steam system unscheduled downtime due to trap failure.

An investment in learning about trap testing will typically pay a rapid return. For example, estimated payback for replacement of a steam trap that is leaking steam at even a small rate can be as short as several months. For a larger leak of perhaps 60-70 pounds per hour, estimated payback may be only a matter of weeks.

Techniques for trap testing

Because the material of steam traps is opaque — iron, steel, or stainless steel—it is not possible to directly observe a trap's internal operation and determine whether it is functioning properly in service. Over time, 3 primary trap testing techniques have evolved for field work. These techniques are temperature, sound, and visual inspection. An overview of the strengths and weaknesses of these test methods will provide the reader with a measure of their effectiveness for trap testing.

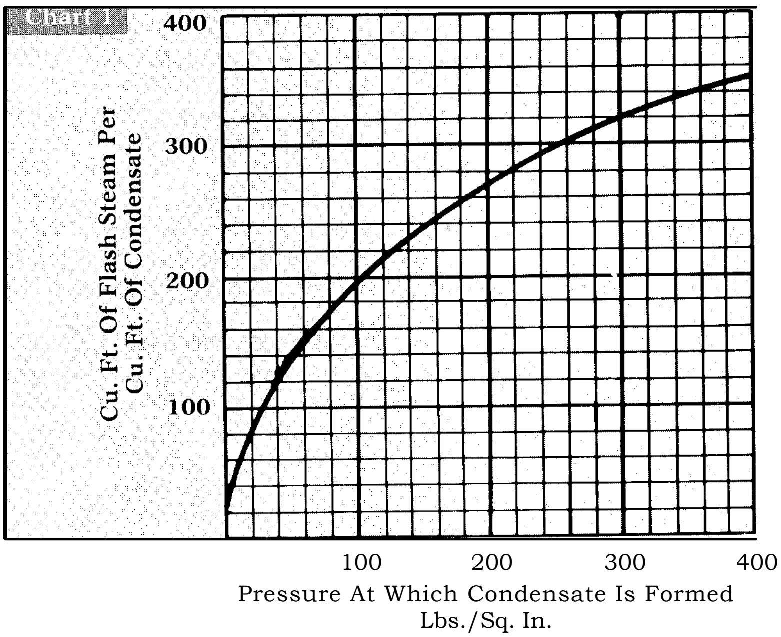
Temperature testing

The simplest and least effective means of testing steam traps is the temperature technique. This method utilizes a heat-sensing device—infrared viewer, thermographic unit, pyrometer, thermocouple, or heat-sensitive tape or crayon—to measure the external temperature of the inlet and outlet pipes to indicate the system's upstream and downstream pressures.

Testing steam traps by the temperature method is capable of determining whether a trap is hot or cold, but should NOT be depended upon as the sole means of determining trap operation.

The theory of temperature testing assumes temperature downstream of the trap will increase when a trap is blowing steam. Several examples will show why this theory is not reliable.

Figure 1 shows a steam trap on a 150-psig steam system with thermocouples placed on the inlet and outlet pipes. Test numbers 1 and 4 reveal nearly identical downstream temperatures whether the trap is functioning normally or steadily blowing live steam. These results can occur because the failed trap is not blowing



Volume of flash steam formed when one cubic foot of condensate is discharged to atmospheric pressure.

enough steam to pressurize the piping downstream of the trap.

Test numbers 2 and 3 show the temperature increasing downstream of the trap as hot condensate is discharged. The temperature rise is traceable to the large volume of flash steam formed by the hot condensate (refer to Chart 1). According to the temperature testing method, these properly functioning traps would appear to have failed.

The temperature testing method can also prove inaccurate when used to monitor other applications. On a manifold setup, for example, although back pressure may rise because of faulty traps, it will rise on all traps on the system—the good ones as well as the bad. In piping systems where return piping size is large enough, on the other hand, a failed trap may cause no rise in back pressure, and the unchanging temperature differential will give no clue to the failure.

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Sonic testing

A more accurate method of testing traps is through the use of sound. An ultrasonic stethoscope or mechanic's stethoscope equipped with headphones can be used for this purpose. Even a screwdriver, with the metal tip pressed against the trap cap, will transmit sound to the tester's ear.

The sonic testing method requires a trained ear to detect the differences between a trap discharging normally and one that has failed open. The tester must also be familiar with the operating principles of various types of steam traps. For instance, a normally operating inverted bucket trap can be heard as a definite burst of sound when the bucket sinks and opens the trap valve.

The normal operating sounds of a float and thermostatic trap are more difficult to distinguish, as it is a constant flow device with a more gentle cycle rate than an inverted bucket or disc trap. A subcooling thermostatic trap is similar in operation to the float trap. It may have either a bellows or a bimetallic spring as the actuation device, opening and closing the trap according to a set temperature differential.

Visual testing

Another highly accurate approach to steam trap testing is the visual method. Like the sonic testing procedure, visual testing requires considerable experience and training.

On lines that return condensate to the boiler, a 3-way valve or a pair of test valves is required, so the condensate-return line can be shut off and the trap allowed to discharge to atmosphere, see Figure 2.

It is important, but difficult, for the tester to be able to differentiate between flash steam and live steam, which is created when the trap fails to open. For this reason, a combination of visual testing and sonic evaluation is recommended whenever practical.

Testing essential

Reliable evaluation of steam trap operation is necessary for traps to work at peak efficiency. Trap testing is a key element in a complete energy management program and an essential skill for protecting your investment.

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