TECH TIP #35

STEAM TRAP TESTING

Steam Trap Testing Methods

There is virtually no point in spending the time and money in creating a highly efficient steam system and then failing to maintain it at this same level. However, all too often leaking joints and valve stems are accepted as a normal operating condition of both steam and condensate systems.

Even a 1/8" diameter hole can discharge as much as 65 lb/hr of steam at 150 PSIG which represents a waste of approximately 30 tons of coal, 4,800 gallons of fuel oil or 7,500 therms of natural gas in a year (8400 hours).

Elimination of the visible leaks already mentioned is obviously reasonably straight forward. It is the invisible steam leaks through faulty steam traps that present a far more taxing problem. We know that the basic function of a steam trap is to discharge condensate and non-condensable gases in our systems and prevent live steam from escaping. Steam trap testing has brought about four different methods of testing. Let's look at all four methods and see what each will tell us about the condition of the steam trap.

Visual Testing

The first point that has to be understood when visually testing a steam trap is that it will be a very rare occasion where the only matter coming out of a steam trap will be water!! Almost always, there will be varying mixtures of flash steam and water and in some cases the visual discharge will be all flash steam. So the first thing to remember is that we do not want to look for water only, nor do we want to attempt to decide if we are seeing the appropriate amount of flash steam and water mixture.

Visual testing of steam traps works best on two types of trap operation due to the trap's inherent discharge characteristics. Those two traps are the Inverted Bucket (Density) and Thermodynamic (Kinetic Energy). These two traps operate in a cyclical manner being fully open, discharging, or fully closed. The open/closed operation is the key to correct visual testing and what the tester should be looking for to indicate a properly operating steam trap.

If there is installed in the piping ahead of the steam trap a wye ("Y") strainer with a blowdown valve, opening the blowdown valve and diverting all of the condensate away from the steam trap allows only steam into the trap.

Any steam trap type should close positively when it senses only steam. This additional step, diverting the condensate away from the trap's inlet, allows the tester to test any type of trap operation and receive 100% positive answers to the trap's condition.

Ultrasonic Trap Testing

Ultrasonic trap testing began with a screwdriver and has progressed to electronic sensing devices which amplify vibrations of flow. Flow of water and steam set up vibrations which are what we are looking for with ultrasonic testing. This form of testing works very well on traps that have cyclical discharge characteristics, like the kinetic energy Thermodynamic and the density operated Inverted Bucket. The open/closed operation provides a very positive answer to the trap's operation.

When testing other traps, like Float & Thermostatic and Thermostatic types which provide continuous modulating discharge, the tester again has to open the strainer blowdown valve and divert condensate away from the trap inlet so that the trap sees only steam. Again, if it is a properly operating trap, it will shut off completely. The ultrasonic testing device must be calibrated to eliminate external piping noises or other steam traps' discharge. When testing traps that are in close proximity, all traps except the one being tested must be isolated to remove any false signals from the other traps.

The ultrasonic testing method can provide very positive answers to a trap's operating condition as long as the operator doing the test has been trained, has developed some experience with the testing instrument and is able to identify the type of trap operation by visual inspection.

Temperature Testing

Temperature testing of traps involves measuring the temperature at, or close to, the inlet and outlet of the steam trap. Pyrometers, temperature sensitive crayons, paint, band-aids and thermocouples all have their advocates. Unfortunately, these methods are of limited use since the temperatures of condensate and flash steam on the downstream side of a correctly working steam trap are controlled by the pressure in the condensate return system. A very large percentage of steam traps in the USA are thought to discharge into "0" PSIG, atmospheric gravity returns, which means that the maximum temperature that could be expected is 212°F, regardless of the trap's operating condition.

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It does not necessarily mean that a trap has failed when an elevated temperature above 212°F is recorded downstream of a steam trap. More likely it means that the condensate return line is under a positive pressure, which means that the pressure/temperature relationship of steam must exist.

Thus if we were to record a temperature of 227°F on the outlet side of a trap, this tells the tester that the return system is at 5 PSIG saturated steam conditions, even though it was thought to be a "0" PSIG return system. There could be a failed open steam trap in the system that is causing this pressure or it could be purely the fact that the condensate return line was sized for water only and is not able to accommodate the flash steam volume without becoming pressurized. Temperature testing will identify a "failed closed" steam trap due to very low temperatures at the inlet of the steam trap. Temperature testing of traps to find failed open traps is by far the least accurate of all the testing methods available to users.

Conductivity Testing

A more recent development in trap testing uses the electrical conductivity of condensate. This involves the installation of a chamber (Fig. 33) containing an inverted weir upstream of the steam trap shown as follows.

With the trap working normally, condensate flows under this weir and out through the trap. There is a small hole at the top of the weir that equalizes the pressure on each side. A sensor is inserted in the chamber on the upstream side which detects the presence of condensate by completing an electrical circuit with the condensate. A portable indicator is plugged into the sensor and the indicator provides the ability to read a completed circuit on the sensor. If the trap becomes defective and begins blowing steam, equilibrium on either side of the weir becomes disturbed and the steam pressure on the inlet side of the chamber displaces the condensate below the sensor. The sensor is no longer surrounded by the conductive condensate and the electrical circuit is broken, providing a failed signal on the indicator.

A major advantage to this method is the very positive signal which can be interpreted without resorting to experience or personal judgment. It is possible to wire a number of sensor chambers to one remote testing point for ease of quickly testing larger numbers of traps. The latest designs of conductivity testing equipment have added a temperature sensor in the same chamber that will provide the ability to determine a failed closed trap.

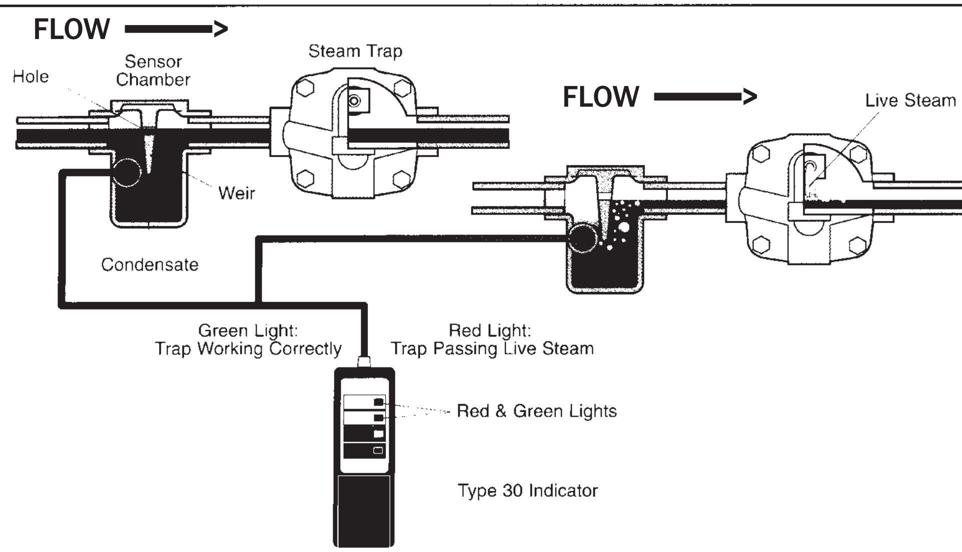

Figure 33
Conductivity Trap Testing System