Written by MT Staff
Monday, 01 September 1997 19:26

Faulty steam traps waste energy, they contribute to pipe erosion when contaminants are allowed to pass downstream, and they can add to environmental pollution and negatively affect product quality.

Steam traps should be inspected routinely. Inspection frequency is often determined by application. For example, steam systems used only for facility heating may be inspected annually and systems that use steam as part of a manufacturing process may be inspected biannually or quarterly, depending on the impact of steam on the process.

Some steam trap users replace trap elements annually. This can be costly and ineffective because traps can fail or leak at any time. Conversely, many traps will work for years before the elements need to be replaced.

As with any predictive maintenance program, knowledge of the system is critical. Before inspection begins, a map or diagram of the location of all steam traps and valves in a facility should be available. All traps should be tagged, coded, and referenced on the diagram. In addition, trap type, size, manufacturer, and application should be noted.

In addition to inspections, data should be collected to provide historical information about the steam system. This is useful in spotting recurring problems and possible clues about trap misuse, and in recording costs and savings incurred. Commercial steam management software is available.

Inspection methods

Once the records are in order, various inspection methods should be considered. The most common are visual, acoustic stethoscope, temperature, and ultrasound.

Visual inspection is effective if test valves are installed on the traps. This method assumes that an inspector can recognize the difference between a steam leak and steam produced by the effect of condensate venting to the atmosphere. In addition, venting to atmosphere affects the parameters of the closed system.

Low-frequency acoustic listening devices can be useful. However, because these devices sense all types of sound in a steam system, isolating a leaking trap, especially in a manifold, can be confusing.

The two most commonly recommended inspection instruments for steam traps are portable infrared thermometers and ultrasonic testers. Many trap inspectors use temperature devices to provide a close estimation of pressures on valves, traps, and coil heaters. They are also useful for spotting conditions such as heat loss, insulation problems, overheating, overloads, and cooling failures. These instruments should be used with ultrasound because temperature readings alone can be misleading. The many variables in a steam system, such as backpressure, can make readings based on temperature alone unreliable.

Of all the methods, ultrasound is the most recommended and most reliable. Ultrasound is a shortwave, high-frequency signal that does not travel far from its source. By listening to the ultrasonic components of a working steam trap, a user can isolate the signal and easily identify operational sounds.

Ultrasonic testers translate high-frequency emissions generated from the mechanical and fluid flows of traps into the audible range where they are heard through headphones and seen as intensity levels on a meter. Some units have frequency tuning to filter out additional signals and to tune in to the sounds of steam and condensate.

Testing steam traps with ultrasound provides results in real time. It isolates the area being tested by eliminating confusing background noises. A user can quickly adjust to recognizing differences among various steam traps.

Listening to traps

Although there are a variety of traps, for purposes of inspection there are two main types: continuous flow and intermittent (on/off).

On/off traps have a basic hold-discharge-hold pattern. Typical of this type are inverted buckets, thermodynamic, and thermostatic (bellows and bimetallic) traps. Continuous-flow traps discharge condensate continuously. The most common are float and thermostatic traps.

Each type of trap has a unique sound pattern. Inspectors should listen to a number of traps to determine normal operation in a particular situation before proceeding with a survey. Generally, when a trap is checked with ultrasound, a continuous rushing sound indicates live steam passing through.

Inverted bucket traps normally fail in the open position because the trap loses its prime. This condition means a complete blow through, not a partial loss. The trap will no longer operate intermittently. Aside from a continuous rushing sound, another clue for steam blow through is the sound of the bucket clanging against the side of the trap. Leaking steam has a continuous, slight hissing sound. An early warning signal of potential leakage or blow through in this type of trap is linkage rattling, which indicates looseness that can lead to steam loss.

Thermodynamic traps work on the difference in dynamic response to velocity change in flow of compressible and incompressible fluids. As steam enters, static pressure above the disk forces the disk against the valve seat. The static pressure over a large area overcomes the high inlet pressure of the steam. As the steam starts to condense, the pressure against the disk lessens and the trap cycles. A good disk trap should cycle 4 to 10 times a minute.

A thermodynamic trap usually fails in the open position, allowing continuous blow through of steam. A trap operating in good condition will have a distinctive shutoff between discharges, but a leaking trap will never shut and will produce a slight hissing sound. A worn disk produces a very rapid rattling sound that has been described as motor boating or machine gunning. This condition allows steam to leak through and is a predictor of more severe problems.

Thermostatic traps (bellows and bimetallic) operate on a difference in temperature between condensate and steam. They build up condensate, so when the temperature of condensate drops to a certain level below saturation temperature, the trap opens. By backing up condensate, the trap tends to modulate open or closed depending on the load. These traps have a hold-discharge-hold pattern. They can take a long time before discharging when there is little condensate buildup. At times of high condensate, such as at startup, they will stay open continuously. Therefore, it is best not to test these traps during startup. When closed, these traps are silent; a slight hissing sound indicates leakage. Blow through has a high-amplitude rushing sound.

A bellows trap does not function properly if the bellows becomes compressed by water hammer. A leak prevents the balanced pressure action of these traps. When either condition occurs, the trap fails in its natural position, either open or closed. If the trap fails closed, condensate backs up and no sound is heard. If the trap fails open, continuous rushing of live steam is heard.

When exposed to heat from steam, bimetallic traps have plates that set and discharge as they cool in the presence of condensate. An improper set prevents the plates from closing completely and allows steam to pass through. It produces a constant rushing sound.

Float and thermostatic traps contain two elements: a ball float and a thermostat. When the trap is operating properly, the trap ball floats up and down on a bed of condensate that keeps the discharge valve open. A modulating sound of the discharging condensate will be heard. The trap normally fails in the closed position. A pinhole leak produced in the ball float will cause the float to be weighted down, or water hammer will collapse the ball float. Because the trap is totally closed, no sound is heard.

In addition, the thermostatic element in the float and thermostatic trap should be checked. If the trap is operating correctly, this element is usually quiet. If a rushing sound is heard, either steam or gas is blowing through the air vent and the vent has failed open. If the mechanical linkage loosens, it will affect the operation of the discharge valve and can lead to steam leakage. This condition is heard as a clanging, rattling sound. **MT**

Information provided by Alan S. Bandes, UE Systems, Inc., Elmsford, NY; (800) 223-1325; e-mail ue@worldnet.att.net .