Steam Valve Testing

Steam Best Practices

Sheet 5

Internal steam valve leakage is one of the most difficult failures to analyze, costing plants millions of dollars a year. Testing the body temperature profile of the steam valve is only a small piece of the required investigation, and using this inspection alone will make it very difficult, if not impossible, to determine whether a steam valve is leaking. The most reliable test method for identifying internal steam leakage is ultrasound testing at high frequencies (above 25 kHz). Every test method has advantages and disadvantages, though high-frequency ultrasound is proven as an easy and accurate test method in 98% of applications. This Tech Sheet outlines proper test methods for improving the accuracy of test results and eliminating outside influences that can interfere with ultrasound testing.

STEAM VALVE INSTALLATIONS

There are several types of steam valve installations in industrial steam systems, the majority of which fall into the following categories:

- Steam isolation valve applications
- Steam warm-up valve applications
- Steam control valve applications

HIGH-FREQUENCY ULTRASOUND

Steam leakage will result in turbulence (velocity flow) crossing the valve seat that has failed, preventing the required shutoff. The leakage will generate a tremendous amount of high-frequency ultrasound. If the valve has internal leakage, it will contact the outside surface of the valve body and piping, resulting in ultrasound readings that will give the operator an indication as to the failure mode.months.

TESTING METHOD

The required testing points on the piping, upstream and downstream of the valve, will indicate whether there is competing ultrasound from sources other than the valve being tested. If competing ultrasound is found upstream and downstream, then the competing ultrasound will need to be tuned out. The valve body test point is downstream of the valve mechanism (ball, plug, cage, butterfly, etc.) and valve seat area.

The distance between testing points upstream and downstream on the piping will depend on the valve and piping size. As a general guideline, the first test point should be 10” away from the valve, and the second should be 24”. These dimensions can be altered depending on the piping configuration and sizing.

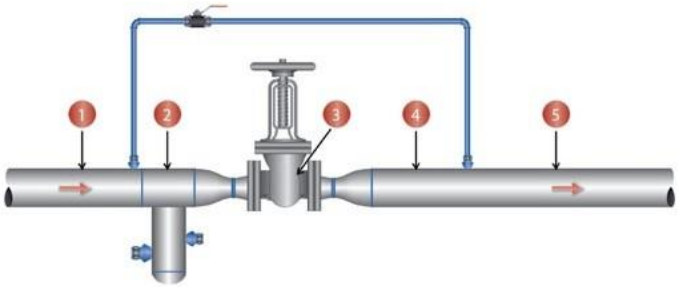

Figure 1: Testing points

STEAM ISOLATION VALVES

Steam isolation valves are used in the plant to isolate different segments of the steam system for different reasons. Internal leakage will prevent the steam system from being isolated and could possibly lead to a total plant shutdown. Personnel should determine which isolation valves are leaking before the plant outage in order to set a road map for repair.

Test Example 1
Ultrasound readings are directly related to the amount of steam leakage in a system: the higher the decibel reading during testing, the higher the degree of leakage in the system. The ultrasound reading at the outlet of the valve seat should be equal to or less than the readings upstream and downstream of the valve. In Figure 2, the valve was determined not to be leaking.

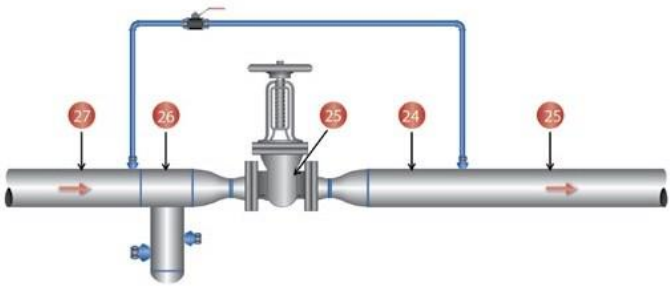

Figure 2: Main valve test with equal readings

Test Example 2
Figure 3 shows a high decibel reading at the outlet of the valve seat area, indicating that the valve is leaking steam.

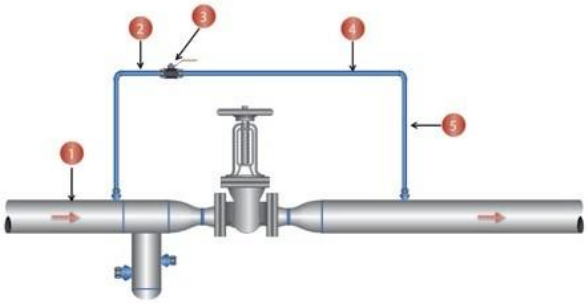

Figure 3: Main valve leaking

Test Example 3
Figure 4 has a higher decibel reading, indicating that the ultrasound is coming from downstream of the valve in the piping system.

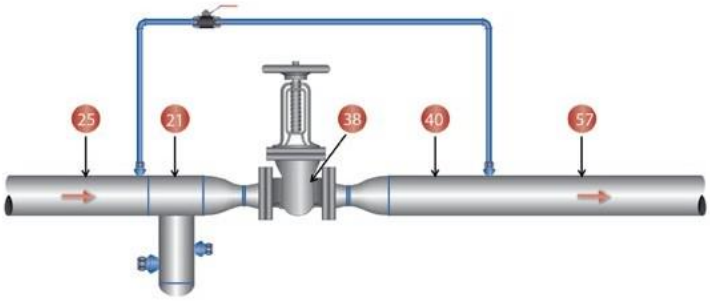

Figure 4: Downstream ultrasound

BYPASS ULTRASOUND

To test bypass valves, use the same procedures outlined above, as shown in Figure 5.

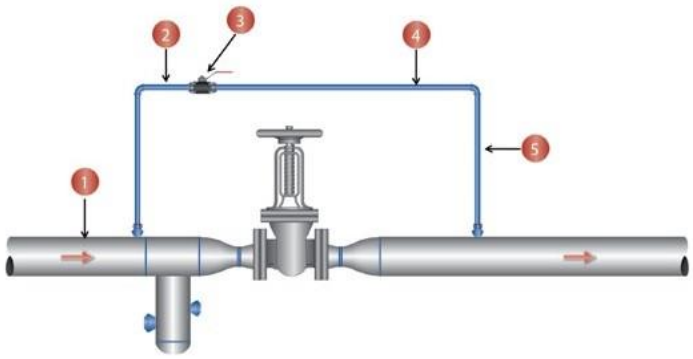

Figure 5: Testing bypass valves

CONTROL VALVES

The following are ways to test a control valve:

- Check the steam control valve for leakage
- Determine the breakaway point or flow on a steam control valve at its opening.

The first method uses the same techniques as testing steam isolation valves and bypass valves for leaks. With the valve in the off position, test each point for leaks.

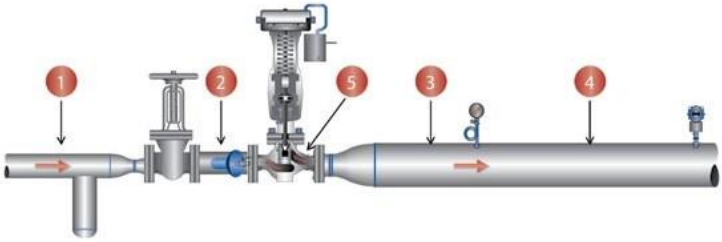

Figure 6: Control valve testing

The second test is used to determine the opening of a control valve where actual flow starts to occur, or the breakaway point. It follows the same procedures used to determine an internal leak. As the tester starts to apply an input control signal (4-20 ma or 3-15 psig), the degree of the control signal that has to be applied before the valve will be opened is tracked, allowing the operator to determine at which point flow (steam) is released to the process. See Figure 6.

When setting up a control system, consider the breakaway point or steam flowing point for the valve. The steam flow may not occur until at least a 4.3 ma signal is sent to the valve, which will affect the control PID function.

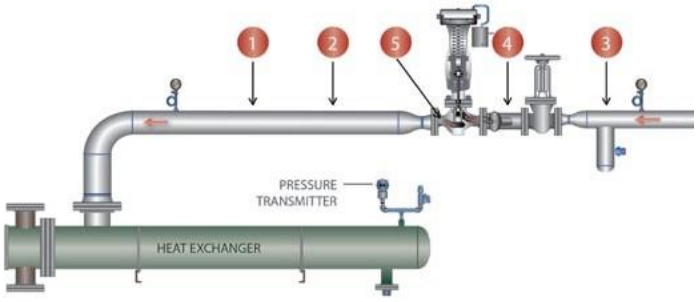

Figure 7: Steam process control valve testing

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