PSE's Newsletter
Steam System Best Practices
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What is Steam Locking or Binding in a Steam Trap Operation?

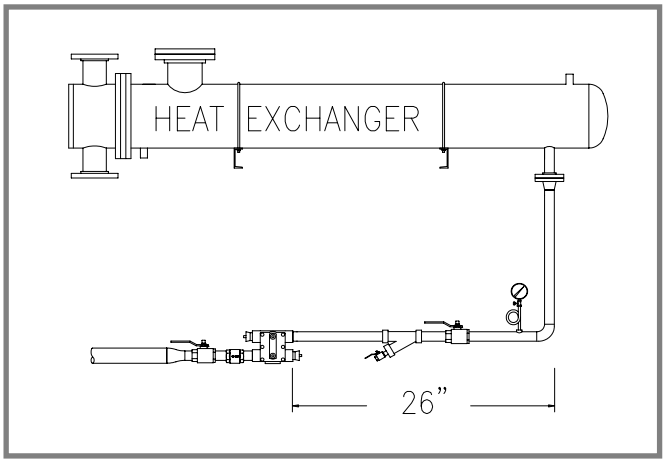
Steam locking is very seldom detected in today's steam world, almost always the problem is blamed on a steam trap malfunctioning. Steam locking was originally written in detail in 1939, but currently there is very little or no information available for the steam user regarding this common steam system problem.

What is steam locking?

If a steam trap is installed with a length of horizontal pipe (26") or longer (from the discharge of the condensate outlet of the process) steam locking can and will occur. A steam trap is in good operational condition will only open to pass any condensate and will close when steam enters the steam trap. A steam trap is a simple device; it senses three things, steam, condensate and non-condensables gas or air. If the steam trap senses steam (vapor) is present, the steam trap will shut off or prevent steam from passing through the steam trap. After the steam trap has closed to prevent steam loss, the long horizontal pipe (26" or longer) will be momentarily full of steam.

Condensate will not be able to flow to the steam trap due to inability to displace the steam vapor. After a period of time, the steam in the horizontal pipe will condense due to heat losses of the pipe and the condensate will flow to the steam trap. Then; the steam trap senses the condensate being present and discharges the condensate.

During the period of steam locking of the steam trap or drainage system, condensate will back up in the steam heat transfer, drip leg or any other device the steam trap is draining.



The condensate backing up in the process due the steam locking will have the following effects:

- Waterhammer
- Loss of temperature
- Process control fluctuation

- Premature heat transfer failures

Telltale signs

Waterhammer is typically present in steam binding situations. The waterhammer can and will cause premature failures in heat transfer components. The end result of waterhammer is downtime and loss of reliability of the equipment.

Temperature fluctuation in the process is another indication which is cause by condensate backing up into the process. Condensate only has sensible heat; which is very low in Btu content verses steam, which has very high heat content.

Condensate backing up can cause freezing in areas where outside temperatures will be below 0^{o}C.

How can you determine is steam binding is occurring?

Using a test valve before the steam trap, there will be no or very little flow at the initial opening of the valve preceded by a very large increase in flow of condensate. Essentially, the opening of the test valve releases the steam binding and allows condensate flow to the steam trap. This can also be done by opening any drain valve between the steam trap and process condensate outlet.

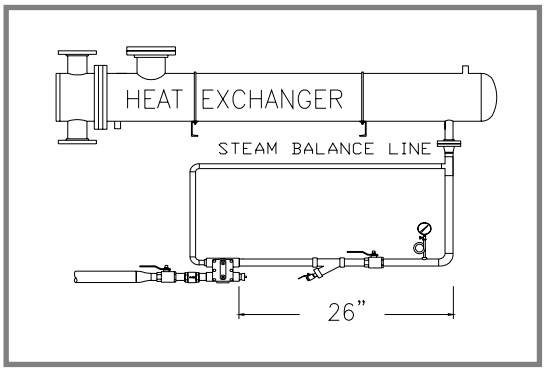
Temperature profiling of the application will also provide the variances of temperature which is an indication of steam binding or locking.

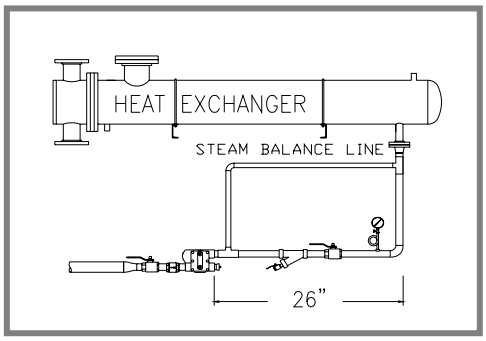
How to resolve:

1. Keep all horizontal lines from the process outlet to the steam trap less than 26”.

2. If this is not possible due to installation constraints, then add a steam balancing line in the piping configuration shown below. The below AutoCAD drawings indicates a simple addition of a balance line that can eliminate the production or system problems with steam locking.

3. Balancing line for a steam trap with out a connection port on the steam trap body.





4. Steam balancing on a steam trap with a connection port.

5. Another method is to use a steam trap fitted with a steam lock release. An adjustable needle valve is incorporated in the steam trap which connects the steam space to the condensate outlet or a internal bleed incorporated into the steam trap design.