

What is Steam Locking in a Steam Trap Installation?

In today's steam world, steam locking is very seldom detected. Almost always the problem is blamed on a steam trap malfunctioning. Steam locking was originally written about in detail in 1939. Currently, there is very little 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 inches or longer from the discharge of the condensate outlet of the process, steam locking will occur. A steam trap 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-condensable gas or air. If the steam trap senses steam (vapor) is present, the steam trap will shut off to prevent steam from passing through. After the steam trap has closed to prevent steam loss, the long horizontal pipe (26 inches or longer) will be momentarily full of steam.

Condensate will not be able to flow to the steam trap due to its 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. The steam trap senses the condensate and discharges it.

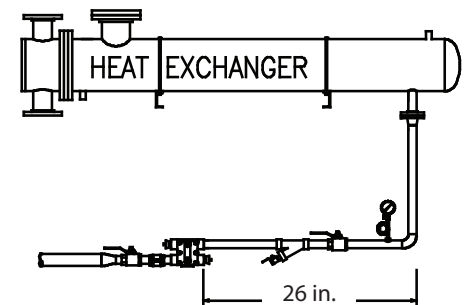
During the period of steam locking of the steam trap or drainage system, condensate will back up into the heat transfer, drip leg or any other device the steam trap is draining.

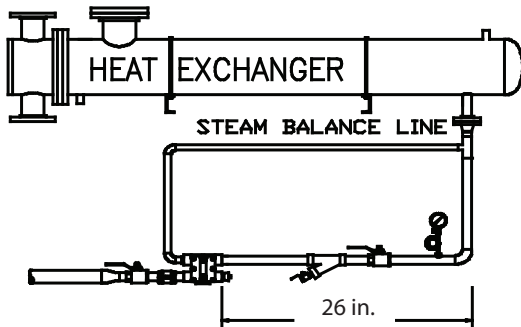
The condensate back up in the process due to steam locking will have the following effects:

1. Waterhammer
2. Loss of temperature
3. Process control fluctuation
4. Premature heat transfer failures

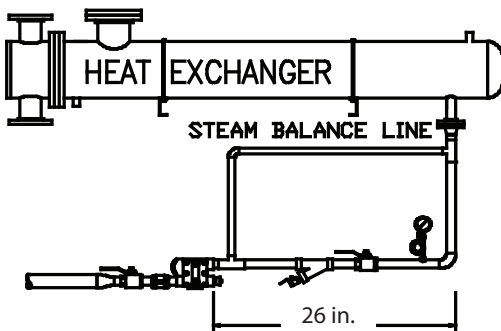
Telltale signs

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





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



Steam balancing on a steam trap with a connection port.

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

Condensate backing up from steam locking can cause freezing in areas where outside temperatures will be below 32°F (0°C).

How can you determine if steam binding is occurring?

Use a test valve before the steam trap. There will be very little or no flow at the initial opening of the valve followed 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 inches.
2. If this is not possible due to installation constraints, then add a steam balancing line as shown in the piping configuration below. The CAD drawings indicate a simple addition of a balance line that can eliminate the production of or any system problems with steam locking.
3. 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 an internal bleed incorporated into the steam trap design.