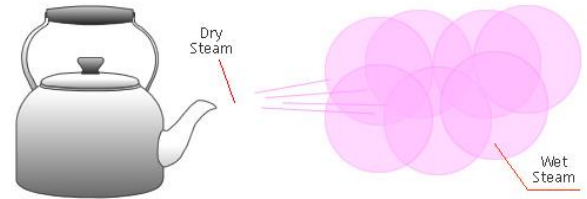


STEAM SAFETY

Steam has many applications. It can heat, do work, sterilize and move over long distances. Industrial applications where steam is often used include power, heating/cooling, tires, paper, food and beverage, wood products, pharmaceutical, refining and chemical.

- Steam is water that has been boiled into a vapor. Generally, when water is boiled into vapor, the volume increases by 1,600 times.
- Condensate is the steam cooled back into the liquid state.
- Condensate in steam systems can result in component collapse, cracks, ruptures, overstressed gauges, valve failure, heat exchanger tube failure and failure of pipe supports.

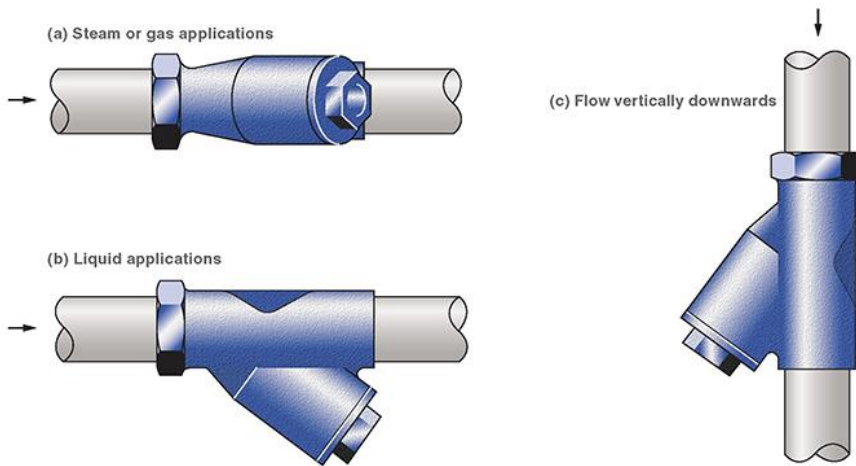


Most steam system failures are caused by water hammer where condensate exists with steam and causes:

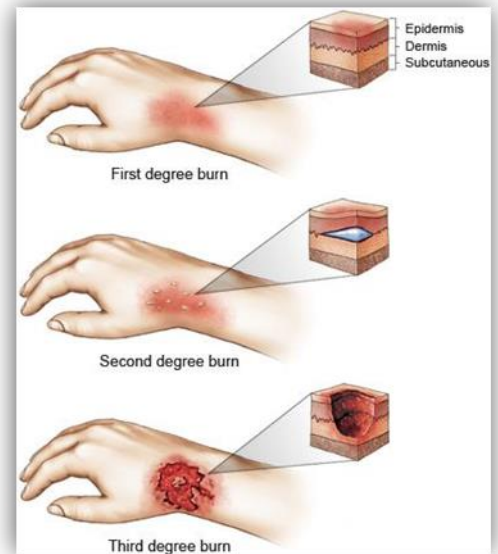
- Hydraulic shock – Often occurs because of sudden stopping of flow.
- Thermal shock – As steam collapses, condensate rapidly rushing in to fill the void.
- Flow shock – A consequence of steam rushing down a cold pipe and producing a large quantity of condensate at a high velocity.
- Differential shock – Occurs whenever steam and condensate flow in the same line, but at different velocities ultimately resulting in a slug of condensate impacting components which changes direction (tees, elbows, valves, etc.).

Safety Reminders

- Prior to starting up a cold system, implement procedures which should include:
 - Inspection of traps and of piping (sagging)
 - Sequences which allow for slow and gradual activation at reduced pressure (warm-up time is a function of the line volume and promotes less condensation formation)
 - Monitoring points
 - Identified and appropriate Personal Protective Equipment (PPE)
 - Clearly identified roles and responsibilities for all personnel involved
 - Emergency procedures (including first aid)
- Check and repair piping insulation. The insulation not only helps to save energy, it helps to reduce accumulation of condensation in the piping system.
- Where feasible, operate valves remotely using mechanical extension linkage, reach rods, or adequately controllable power-operated valves.
- Utilize warmup valves to equalize pressure and enable an easy opening of larger valves and reduce thermal shock.
- Provide drip legs and drains for all low points.
- Ensure strainers are properly oriented.



- Properly label steam and condensate lines.
- Utilize energy control procedures (lockout/tagout) prior to performing work.
- Evaluate the work area(s) for [Permit Required Confined Spaces](#).
- Prior to performing work, consider waiting for systems to cool to 140°F or less to minimize risk of a third degree burn. Exposure to 140°F water for only five seconds may result in a third degree burn.
- Identify and utilize appropriate PPE. Consider body parts which could be exposed and ensure proper protection. Consider openings where steam could become trapped, increase exposure duration and result in a more severe burn (e.g. through an open sleeve cuff). Consider applications where the PPE could become wet and lose insulating properties. Heat resistant PPE must be appropriately rated.



More Information

<https://www.tlv.com/global/TI/steam-theory/>

<http://www.spiraxsarco.com/Resources/Pages/steam-engineering-tutorials.aspx>

