Quick Reference Card
Typical Condensate Return System Optimizations

Problem	Potential Cause	Optimizations
Stalled Heat Exchanger (due to insufficient pressure differential across the steam trap)	High back pressure due to: • Pipe elevations • Undersized pipes • Blowing steam traps • Addition of new condensate return flows to the same pipe Reduced inlet pressure due to: • Modulating steam supply • Plugged strainer • Decrease in steam supply pressure • Oversized Equipment	• Reduce or eliminate back pressure • Use good piping and design practices (Size and install heat exchangers, piping, and valves properly) • Use good maintenance practices (clean strainers before control valve and steam trap) • Install an Armstrong Double Duty steam trap or pumping trap • Install a safety drain trap and vacuum breaker • Install an Armstrong Posi-Pressure system • Install an open receiver and condensate pump • Clean strainers before control valve and steam trap in order to eliminate restricted flow and excessive pressure drop
	An incorrect trap: • Thermostatic traps, orifice traps, etc. piped onto heat exchangers	• Use correct trap for application
Water Hammer **Pressure differential in the system caused by:** • **Hydraulic shock** • **Thermal shock** • **Differential Shock**	• Sudden valve closing or change of direction	• Close valve more slowly • Substitute silent or non-slam check valves for swing checks, • Install shock arrestors
	• Bi-phase flow transportation • Mixing cold and hot condensate and/or steam	• Return separately pumped condensate (cold) and steam trap (hot) condensate • Return separately low pressure (LP) (cold) and high pressure (HP) (hot) condensate • Install purge pipes or mixing thermal siphon (MTS) on drip traps • Install flash tanks or open receivers • Repair blowing or plugged traps
Condensate Contamination	• Intalled heat exchanger • Water hammer • Improper start-up and operating procedures (not enough time for warm-up) • Contaminated by cooling water, chilled water or glycol when using the same heat exchanger, coil, or jacketed vessel • Boiler water and steam quality issues	• Eliminate the root cause for contamination: • See solutions for stall and water hammer • Repair leaking pipes in heat exchanger • Repair pump seals • Manage contaminated condensate: • Install Polisher (treat the contamination) • Use as hot water • Recover the heat and then drain condensate to sewer
Flash Steam Venting	• High pressure condensate discharge to open receiver	• Install flash tank(s) (increase the back pressure to the existing system) and route to a lower pressure steam header or a specific user • Install a thermal compressor (keep the same back pressure to the existing system) to boost the vent/flash steam pressure to a higher pressure • Condense the flash steam – direct and indirect condensers
	• Blowing steam traps	• Repair/replace steam traps

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Best Practices Piping

- Remove condensate downstream of heat exchanger to prevent stalling, keep tube bundles dry, and reduce corrosion.
- Size piping and valves properly.
- Ensure slow closure of valves.
- Install spring-loaded, center-guided, non-slam, or silent check valves that close before flow reversal.
- Use water hammer arrestors.
- Re-design or re-pipe the system to return hot and cold condensates separately.
- If hot flashing condensate must be discharged into a cool condensate line, it should be discharged through a mixing thermal siphon (MTS), or through a purge pipe in the direction of condensate flow and away from the pipe wall.
- Install flash tanks or open receivers.
- Always have separate lines for dry-closed and pumped condensate return systems. Avoid mixed-condensate systems.
- In installations with high- and low-pressure systems, have two separate dry-closed return lines.
- Avoid lifting condensate lines.
- Add horizontal expansion loops when possible. Try to avoid going up or down. If there is an elevation in condensate line, this is a likely area for erosion.
- Use downward slopes which are critical in keeping condensate lines clear—and also helps prevent corrosion and water hammer.
- All condensate lines should be with a correct slope in direction of the boiler house. Per ASME 31.1 and 31.3, lines that contain a steam/water mix, or require draining periodically, should be pitched downward approx. ¼ inch per foot in the direction of flow.
- Insulate all lines. Armstrong uses the 3E Plus insulation thickness computer program to calculate pipe radiation losses. This program is available as a free download from the links menu and can be used in either I.P. or S.I. units.
- Maximize the size of the header for highest possible flash rate and acceptable velocities (recommended 3000 fpm (15 m/s), not to exceed 5000 fpm (25 m/s)).
- Minimize the length of lines to traps, and long vertical drops to the traps must be back-vented.
- Install proper drip leg ahead of control valves to prevent differential shock from occurring when the control valve is opened after a period of closure.
- Add sample points throughout the condensate system to quickly access condensate for testing.
- Add piping to isolate and safely divert the contaminant when needed.

Armstrong *provides intelligent system solutions that improve utility performance, lower energy consumption, and reduce environmental emissions while providing an "enjoyable experience."*

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