

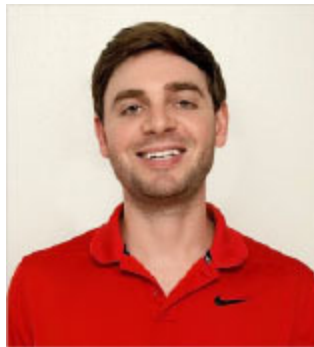
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Best practices for reliable steam and hot oil systems

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Business Update



Thermal maintenance systems are critical infrastructure in many industrial facilities. Failures in thermal maintenance systems can lead to plugged piping, unplanned shutdowns, product quality issues and safety incidents. Steam and hot oil are the most common heat transfer media used in industrial thermal maintenance systems and most failures are preventable with proper engineering and maintenance practices.

Steam

Steam is a widely available heating medium commonly used at temperatures between 212°F and 400°F. It transfers heat efficiently because of the latent heat released during condensation. As a result, condensate management is one of the most important factors affecting steam system performance. Dry steam is essential for efficient operation. Wet steam reduces heat transfer efficiency and increases the risk of corrosion, flooded coils, trap failures and water hammer.

Steam: Guiding principles

Steam should always be pulled from the top of headers to prevent condensate and debris from entering downstream circuits. Condensate should return efficiently to avoid flooded coils, trap failures and poor heating performance. Drip legs should be installed before PRVs, control valves and vertical rises. Steam traps should be sized for startup conditions, which are often several times greater than normal operating loads. Vacuum breakers should be installed on coils and exchangers to prevent backflow during shutdown. Proper boiler water treatment and steam quality are also essential for minimizing corrosion and premature equipment failures.

Hot oil

Hot oil systems extend the operating temperature range to approximately 650°F to 700°F depending on the thermal fluid. They are well suited for high temperature or critical heating applications but require greater system complexity and fluid management. Oxidation is one of the largest threats to hot oil system performance and is often caused by air or moisture entering the system. Oxidized fluid can lead to sludge formation, fouling, poor heat transfer and unplanned shutdowns.

Hot oil: Guiding principles

Thermal fluid should be tested annually for viscosity, acidity, oxidation markers and particulate loading. Facilities should avoid mixing thermal fluids without manufacturer guidance because incompatible additive packages may accelerate fluid breakdown. Strainers protect pumps from large debris, but they are not filtration systems. Slipstream filtration systems continuously remove fine contaminants and degradation products that impact fluid quality.

Excessive heater film temperatures can rapidly degrade thermal fluid even when bulk operating temperatures remain within specification. Heaters should be sized for actual demand plus reasonable future growth. Oversized heaters may operate inefficiently at low fire, reducing thermal stability and efficiency. Pumps should be selected based on total system demand rather than heater requirements alone. Valve stems should be oriented sideways or downward to prevent leaked oil from saturating insulation and creating an ignition hazard.

Prevention is key

Many recurring thermal maintenance failures originate from small design mistakes or undocumented field modifications made over time. Common audit findings include improperly selected pumps or traps, missing insulation, flexible hoses used as expansion joints and system expansions completed without hydraulic review.

Damaged or water saturated insulation can also increase heat loss and accelerate corrosion under insulation. Whether using steam or hot oil, long term system performance depends on disciplined engineering practices, preventive maintenance and routine system audits. Facilities that prioritize condensate management, fluid quality, insulation integrity and proper equipment sizing can significantly reduce downtime, improve energy efficiency and extend equipment life.

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