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Evaluate Steam Traps for Repair or Replacement

All ECM content was independently developed and reviewed to be vendor, product and service provider-neutral.

Description

Inspect and repair steam traps to maintain efficient steam system operation. Evaluate existing steam traps and identify opportunities for replacing equipment.

Project Talking Points

- According to the U.S. Department of Energy, leaks in steam traps cause the loss of up to 20% of the steam generated by a typical boiler. Losses can vary widely.
- Steam traps in closed-loop steam systems regulate the flow of steam and prevent live steam from passing into the condensate return system. When traps fail, live steam migrates into the condensate system, overheating condensate piping and allowing steam to be lost through atmospheric vents.
- Preventing steam leaks will enhance both water and energy efficiency, improve heating system reliability and increase life expectancy of equipment. Occupant thermal comfort is safeguarded when a stable boiler operating pressure is maintained.
- Steam traps can fail over time, so assessment and repair are regular preventative maintenance tasks. According to the U.S. Department of Energy, low-pressure (below 30 psig) steam systems should have traps checked annually.

Benefits

- **Cost benefits**: Reduced water, chemical, sewer and energy costs due to reduced water consumption and reduced water heating associated with leaks. (See case studies for specific examples.) A more reliable steam system also decreases reactive maintenance, allowing for better use of FTE resources.
- **Environmental benefits**: Reducing energy use and associated emissions (connected to treating, supplying and heating potable water) always has an environmental benefit. Further, reduction in the amount of water used reduces chemical consumption for water treatment. Water conservation also protects the natural water cycle and decreases strain on the municipal water supply.

Social benefits: Improvements in safety and thermal management enhance patient and staff experience. Steam equipment operates more efficiently and requires fewer urgent maintenance calls when traps are proactively maintained. Money saved as a result can be applied to the health care mission of the hospital. **Purchasing Considerations**

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Add regular steam trap maintenance into the facility preventative maintenance plan. Either contract an external vendor or provide tools and education to complete inspections in-house.

How-To

1. Determine who's on the team: Commissioning agent (if applicable), building engineer and heating, ventilation and air conditioning (HVAC) maintenance personnel.
2. Perform a walk-through of the facility to document the location and type of all steam traps. Use a log to record the information gathered, including the following for each trap:
    - Location, noting ease of access for maintenance.
    - Type of trap (mechanical, thermostatic, thermodynamic).
    - Identify current steam traps and evaluate upgrade opportunities based on changes in steam trap technology.
    - Whether assessment equipment has been permanently installed to monitor performance.
    - Condition of steam trap. Inspect for corrosion, steam and other leaks.
3. Conduct a performance assessment using one of the following methods, as outlined in the U.S. Department of Energy document Federal Technology Alert: Steam Trap Performance Assessment:
    - Sight method: Observe the fluid downstream of the trap after a discharge. "Flash" steam (a "lazy, billowy plume") will indicate the steam trap is functioning properly. "Live" steam (a "sharper, higher velocity plume") will indicate a trap failure.
        - Inspect condensate tank and "flash tank" vent discharges for steam plumes.
    - Sound method (most reliable): Use a listening device to differentiate between the sound of normal operation and a trap failure.
    - Temperature method (least reliable): If the trap is significantly cooler than the temperature of the steam released by the boiler, it is likely flooded with condensate. If the temperature downstream of the trap is consistent with the temperature of the trap, this may indicate a steam leak as well.
        - To make this method more reliable, invest in or use a thermal imaging camera to evaluate the steam traps.
    - Conductivity method: A sensing chamber integrated into the steam trap, or just upstream of it, measures the difference between normal steam conductivity and conductivity in leak or blowout conditions.

4. If the trap has failed, identify whether it has failed in the open or closed position. Typical steam trap failure modes include:
    - Float and thermostatic: Closed
    - Inverted bucket: Open or closed
    - Bimetal thermostatic: Open
    - Impulse: Open
    - Thermodynamic disc: Open
5. Clean and repair all malfunctioning parts.

Document all steam trap maintenance activities in the steam trap log, and coordinate with energy conservation measures.**Case Studies**

- **Nazareth Hospital, Philadelphia, PA**
    - Conducted a comprehensive steam trap audit. Repaired or replaced faulty steam traps and sealed system leaks.
    - Retrofits and maintenance upgrades resulted in a 29-point improvement in ENERGY STAR® score, culminating in ENERGY STAR certification.

- **U.S. Veterans Administration (VA) medical centers**
    - A steam trap assessment was part of an integrated facility energy audit.
    - The assessment calculated both the steam trap performance level and the value of the lost steam. Malfunctioning traps were either repaired or replaced. Maintenance personnel were trained to perform ongoing monitoring and maintenance.
    - The retrofit was estimated to reduce steam losses by 50% to 75% percent.

Resources

Additional commissioning resources include:

- The American Society for Health Care Engineering:
    - Health Facility Commissioning Guidelines
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
    - Guideline 14: *Measurement of Energy and Demand Savings*
    - Procedures for Commercial Building Energy Audits
    - Service Life and Maintenance Cost Database
- California Commissioning Collaborative: California Commissioning Guide: Existing Buildings
- Federal Emergency Management Program (FEMA): Federal Technology Alert: Steam Trap Performance Assessment

- LEED for Existing Buildings: Operations + Maintenance
  - Energy and Atmosphere Prerequisite 1: Energy Efficiency Best Management Practices, Planning, Documentation and Opportunity Assessment
  - Energy and Atmosphere Prerequisite 2: Minimum Energy Performance
  - Energy and Atmosphere Credit 1: Optimize Energy Efficiency Performance
  - Energy and Atmosphere Credit 2.1: Existing Building Commissioning, Investigation and Analysis
  - Energy and Atmosphere Credit 2.1: Existing Building Commissioning, Implementation
  - Energy and Atmosphere Credit 3.1: Performance Measurement, Building Automation System (BAS)
  - Energy and Atmosphere Credit 5: Measurement and Verification
- LEED for Healthcare: New Construction and Major Renovations
  - Energy and Atmosphere Prerequisite 1: Fundamental Commissioning of Building Energy Systems
  - Energy and Atmosphere Prerequisite 2: Minimum Energy Efficiency Performance
  - Energy and Atmosphere Credit 1: Optimize Energy Efficiency Performance
  - Energy and Atmosphere Credit 3: Enhanced Commissioning
  - Energy and Atmosphere Credit 5: Measurement and Verification
- Oak Ridge National Laboratory: A Practical Guide for Commissioning Existing Buildings
- U.S. Department of Energy:
  - Commissioning Existing Hospital Buildings Aids Peak Energy Performance
  - Efficient Hospital Boilers Result in Financial, Environmental, and Safety Payoffs
  - Energy Smart Hospitals: Retrofitting Existing Facilities
  - Hospitals Realize Fast Paybacks from Retrofits and O&M Solutions
  - Hospitals Save Energy and Money by Optimizing HVAC Performance
  - Inspect and Repair Steam Traps

Regulations, Codes and Standards, Policies

There are no regulatory requirements that require steam trap maintenance.

ECM Synergies

- Establish baseline for current energy consumption.
- Practice preventive maintenance of major HVAC equipment.**ECM Descriptors**

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Energy, Water

Level: Beginner

Category List:
- HVAC
- Water

ECM Attributes:
- Optimize operations
- Repair or optimize existing systems

Improvement Type:
- Maintenance

Department**:**
- Engineering/facilities management