KEY COMPONENTS FOR A STEAM TRAP STATION MANAGEMENT PROGRAM

>> Steam Best Practices

Sheet 4

Modern industry standards demand production reliability and efficiency in order to combat high energy costs and to reduce downtime. To meet these standards, it is imperative that companies have a proactive steam trap station management program built into their overall steam system management program. These programs should target a steam trap station failure rate of less than 3% annually and should target a steam trap station that proves reliable for at least 6 years.

The emphasis is on steam trap station management because steam traps are only one component in a steam trap station; visibility to the entire steam trap station is critical for the success of the program.

Poor management of steam trap stations is a major source of energy losses in the industry and can lead to significant increases in emissions in steam system operation. A successful steam trap station management program can identify defective components in the system and can accurately track the amount of energy consumed and emission produced within each steam. The return on investment in a complete and integrated steam trap station management program is typically less than 12 months.

Figure 1: Steam Trap Station Installation

OVERVIEW, STEAM TRAP STATION MANAGEMENT PROGRAM

Define the Goal

- Minimize energy loss and reduce energy usage.
- Keep failure rates below 3% annually.
- Increase system reliability.
- Reduce combustion emissions.
- Reduce production downtime.
- Improve steam quality.
- Improve safety.

Identify and Procure the Pieces

Define all of the components that make up the steam trap station suited for your application.

- Isolation valves
- Strainer
- Blowdown valves
- Steam trap
- Test valve
- Check valve (some applications)

PROGRAM PERSONNEL

Assemble the People

Involve people at all managerial levels within the organization.

- Management—for the allocation of resources
- Energy personnel
- Environmental personnel
- Maintenance management
- Maintenance personnel
- Utility personnel
- Plant engineers
- Corporate engineers
- Production personnel
- Quality and reliability personnel
- Safety personnel

Select a Leader

The team leader is responsible for the following:

- Managing and coordinating efforts among all team members, including team meetings
- Communicating goals and updates among all team members
- Defining the work efforts for the steam team
- Ensuring documentation is properly created and maintained
- Establishing appropriate benchmarks for the system

Develop a Training Matrix

Present a comprehensive layout for training the plant personnel on essential aspects of the steam system and its operation. Training topics may include:

- Steam trap components, operation, and maintenance
- Test methods
- Problem solving and root cause analysis
- Correct sizing and installation
- Condensate recovery methods

STEAM TRAP STATION PERFORMANCE

Establish Traceability for Steam Trap Stations

Identify all steam trap stations with a unique identification code, and capture important information related to each system for future reference. Ensure all relevant data is tracked and stored in a database for proper analysis. Examples of information to be recorded during a steam trap station survey include:

- Steam trap station number
- Steam trap details including manufacturer, model number, casting material, etc.
- Steam trap stations map
- GPS location numbers
- Picture of the steam trap station, if possible maximum and minimum steam pressure
- Maximum and minimum capacity
- Connection size
- Isolation valve type
- Type of condensate return system

Verify the Integrity of Steam Trap Installations

Incorrect steam trap installation is a major source of steam trap failures and can lead to high costs in repair and replacement. Visit the Swagelok Energy Advisors, Inc. website to request standard installation prints in AutoCAD format. Plant personnel should familiarize themselves with these standards to better understand proper installation techniques and practices for steam trap stations.

Figure 2: Steam venting due to steam trap station failure

Operational cost calculations take into account tank size, steam motive pressure, tank configuration, etc.; the calculations listed are based on assumed parameters that are considered conservative. Additional considerations include:

- *Condensate system: Gravity flow to condensate pumping system*
- *Condensate flow: 8,200 pph*
- *Condensate return line pressure: 25 psig*
- *Length of operation: 8,740 hours*

REQUIRED SYSTEM INFORMATION

To ensure installation and operation of your condensate pumping system are successful, the following parameters should be benchmarked:

- *Condensate flow rate: Maximum, Minimum, Normal*
- *Flash steam flow rate: Maximum, Minimum, Normal*
- *Condensate line: Pressure back to boiler plant*
- *Electrical requirements: Voltage available*
- *Pump: Operation at 1,800 rpm*

Establish the Performance Benchmark

Capture all components—steam traps, isolation valves, let down stations—of the steam trap station in an electronic database. A steam trap station survey should be performed either through an internal audit or through an external firm. At a minimum, the survey should analyze all of the data listed above for each steam trap station. Steam profiling or a steam balance should also be performed to capture the steam and condensate system dynamics. If the plant does the audit internally, the auditing personnel should be certified as a Level I or Level II Steam Trap Examiner.

Perform Regular Testing

Visual Inspection: Use a block and test valve to observe the actual steam trap discharge. This inspection method may not be robust enough to identify minor leaks and malfunctions. However, a steam trap that is leaking during the off cycle or that is severely leaking and completely failed is easily detectable. It is important to note that this test method changes the operating conditions of the steam trap by eliminating backpressure in the condensate return line, affecting the behavior of some steam trap designs.

Temperature Measurement: Use contact pyrometers or infrared detectors to measure upstream and downstream temperatures to determine if there is a blockage in the system—if there is a blockage, the steam trap will be cold. Further, it offers an estimated operating pressure by correlating the temperature to steam pressure.

Ultrasonic Detection: When operating properly, steam traps make distinctive sounds that are detectable with a high-frequency ultrasonic device. Ultrasound devices that detect these sounds are a simple means of testing steam trap stations.

Note: Proper training is required for all of the above tools and operations.

Figure 3: Visual testing for steam traps

Analyze Benchmark Data

Regularly review and analyze the data collected during benchmark testing to identify trends and problem spots that could lead to a loss of efficiency. The ultimate goal is to achieve less than 3% failure rate in the steam trap station population.

Data collected during benchmarking will provide baseline information on each of the steam trap stations and will make it evident which stations lead to the highest energy losses. Once identified, failing steam trap stations will be analyzed further to determine the root cause of loss of efficiency; corrective action can then be decided upon and implemented.

STEAM TRAP STATION IMPROVEMENTS

Perform Root Cause Analysis (RCA)

RCA is a problem solving method meant to help identify the source of a problem or event. In this application, RCA is used to find the cause of steam trap station component failure. In most cases, it is possible to quickly identify a failure and replace a component; however, the root cause of the failure may go unidentified. RCA helps plant personnel not only identify the failure, but also take steps to find the reason for the failure. That way, the source of the problem, rather than just the problem itself, can be addressed, and the likelihood of a similar failure in the future is drastically reduced.

Once a root cause is identified through the RCA, the team will determine an appropriate corrective action. The corrective action should directly address the root cause and reduce the occurrence of the original failure mode. It is understood that completely eliminating a failure mode through a single corrective action is not always possible. Should a similar failure occur again, the RCA exercise should be executed to determine the efficacy of the original corrective action and to define any additional action to be taken. It is expected that system improvements should continue to be implemented in order to maximize and maintain system efficiency.

Figure 4: Visual testing for steam traps

It is important to evaluate steam trap station vendors to ensure plant requirements are met. To do so, select 6-10 steam trap stations to monitor and evaluate for performance. Here are some suggestions related to the evaluation process:

- Choose manufacturers for the evaluation process, and implement a rigorous selection process for steam trap station evaluation and vendor selection. Even if the plant is using a specific manufacturer, there is always a need to reevaluate. The target is to select manufacturers with the least amount of steam leakage.
- Use steam traps with a universal mount design (5 minutes or less to change mounts).
- Use a test valve arrangement to inspect the steam trap discharge: steam, condensate, flash, etc.
- Identify the operational design of the steam traps: mechanical, thermodynamic, or thermostatic. Then, establish a standard for that design that can be used in different plant applications. NOTE: Take a video

record of proper steam trap operation as a benchmark, and use the video to train new personnel.

Figure 6: Steam trap station with universal connector and isolation valves

- Ensure proper steam trap sizing was implemented for the operation to reduce the chances of condensate backup in the system or excessive steam loss into the return system. In addition to pipe size, steam trap sizing should take into consideration:
- Steam control valves
- Steam piping
- Expansion
- Heat transfer
- Internal diameter of the steam trap discharge orifice
- Steam trap capacity (orifice size)—Only applicable for low-pressure heating systems; not common in industrial steam traps
- Condensate capacity
- Maximum orifice pressure rating
- Operating steam pressure
- Pressure differential
- Steam trap model

Maintain a Preventative Maintenance Routine

Do not let the program of continuous improvement come to a halt. Perform preventative maintenance on the components of the system based on these guidelines:

- Process steam traps: execute every three months
- High-pressure steam traps: execute every six months
- Low- to medium-pressure steam traps: execute every six months
- Building heating steam traps: execute twice a heating season

CONCLUSION

With the rising cost of fuel, it is critical for plants to reduce consumption and eliminate waste wherever possible. Effectively running a steam trap station management program is the best way to do just that. Implementing a system to proactively track performance and identify potential problems will ultimately lead to improved efficiency across the board.

ABOUT US

Inveno personnel are experts in the field of steam and condensate systems engineering with vast real-world experience and highly recognized professionals in the industrial arena. Our services include design, engineering, requests for quotations, standard operating procedures, root cause analysis, system optimization, steam balancing and project management. Inveno can review your entire steam and condensate system from steam generation to distribution to end user processes and condensate recovery.