Steam Systems in FMCG facilities

Is your facility generating just the right amount of pressure?

Steam systems are used widely throughout the manufacturing industry and can be an effective method for process heating, but inefficiencies in the production and distribution systems can have a major impact on installation and operating costs as well as limit the life span of the components.

Some of the benefits of using steam include even heating, small pipe sizes due to high heat capacity, and no pump requirement as these systems rely on pressure drops for movement. Steam can also be generated using a variety of fuel sources such as LPG, coal, electricity, paraffin, or diesel, depending on what is available. Regardless of the fuel source, the steam reticulated within the space is non-flammable and toxin free unlike some of the other heating options.

Steam systems are generally more complex than certain other plant utilities due to the elevated temperature and pressure that these systems run at.

Careful consideration needs to be made of the materials used as these systems need to be flexible to allow for expansion, and hence movement, of components as they reach temperature. Furthermore, all pipe work must be sufficiently supported to avoid condensate accumulation and pipe failure. For longer runs, there are various types of expansion loops that can be added to accommodate lengthening in the run.

While many are tempted to over specify pipe materials and thicknesses in an attempt to mitigate any risks associated with the increased pressure and temperature of the system as well as issues caused by improper handling of the condensate in the system, these issues could all be avoided, or hugely reduced, by an appropriate system design. Well-designed steam systems represent significant cost savings both in the short and long term as correctly sized components are installed and the system is less susceptible to damage as a result of corrosion and water hammer over its lifetime.

Designers cannot neglect the impact of proper condensate handling when designing these systems as it cannot be completely avoided. Not only does condensate impact the performance of the system but if not managed properly, will result in increased wear on the pipework and components especially corrosion, erosion, and water hammer.

Firstly, the production portion of the system should be designed to ensure steam is high quality and that it is adequately dried before being introduced to the distribution portion. Once in the distribution portion, pipework should be designed based on best practices relating to condensate. This includes sloping of runs, steam traps placed throughout the system at regular intervals and low points and branching than minimises condensate carryover.

Condensate pickup by the steam reduces heat transfer efficiency while accumulation will increase friction losses through the pipework as the effective diameter is reduced. Steam systems are not as forgiving as other utility installations and poor design can impact quality and operating expenses.

Unless there is a contamination risk, condensate is generally returned to the boiler. These return systems have several benefits such as cost savings both in reduced water use and energy, and in reducing the amount of treatment required as the condensate is distilled water. Systems that discharge condensate to effluent can be made more efficient by first feeding the condensation through a heat exchanger to return some of the heat to the system.

The best designs are meaningless if not installed correctly. Best practice includes supply of isometric drawings showing the full routing of the pipework with all penetrations, supports, valves and steam traps indicated.

Further detail on insulation and other components should also be noted. Pipe routing is vitally important to the efficiency of the system and should be fully developed before installation as this has a huge impact on longevity while location of components must be appropriate to avoid unnecessary damage in the system and poor-quality steam at the point of use.

When considering steam systems in the food manufacturing environment the following needs to be assessed. Will the steam be directly injected into the product? If so, the required steam quality needs to be evaluated. Additional steam filtration may be required along with the use of stainless-steel pipework after the last point of filtration to the point of use.

When using stainless steel pipes for steam systems the design needs to be adapted accordingly as stainless steel is a very poor conductor of heat thus making the stresses due to heat in the pipes more complex than in carbon steel applications. Due to the high temperature and pressure, the regulatory requirements for these systems are more stringent.

Qualified technicians and installers must be used in order to get the installation signed off and the system must be professionally tested before use. On completion of commissioning, the client should be presented with a Steam Installation Dossier including the following documents:

- Certificates of Manufacture
- Certificates of Pressure Test
- Certificate of Calibration
- As Built Drawings
- Approved Inspection Authority Report
- Non-Destructive Testing Report
- Welding Documentation
- Material Certificates

These documents show a full history of testing from the material, through production to installation and commissioning to ensure that the system and components are compliant and meet standards.

In closing it is critical to understand the steam user requirements at the different points in the plant, design the system appropriately, and ensure the installation, commissioning, and handover are done to a high standard to confirm the system is compliant with the regulations.

To contact Astratek Manufacturing Engineers for assistance and advice regarding Steam System Design and Installations for your FMCG facility you can scan the QR code and complete the online form or e-mail us at info@astratek.co

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