Tech Sheet #ST112

Impact of Improper Piping in Steam Systems

For steam systems, it is crucial that proper piping practices are followed to avoid long-term complications and potentially catastrophic results. When the steam system is not piped properly it often results in water-entrained steam and poor condensate drainage in the steam system. The following is a list of the most common issues caused by wet steam and condensate. The issues can be mitigated by following the proper piping recommendations described in FCI Tech Sheet #ST 110.

Water Hammer

If the condensate stream is allowed to build to sufficient levels in the pipe, waves are formed by relatively high-velocity steam passing over the surface of the condensate. These waves can rise and block the entire pipe creating a slug of condensate. With system pressure upstream of this slug, and collapsing steam downstream, the slug is accelerated in the pipe. A great deal of damage can be done to piping and equipment when a slug is forced to stop or change direction.

Pipe Erosion

Condensate and water entrained steam are the most common causes for steam pipe erosion. Keeping the steam dry and ensuring steam velocities are not excessively high will significantly reduce the amount of erosion in the pipe.

Shortened Equipment Life

Wet steam can cause excessive wear and tear on steam equipment like control valves, flow meters, etc. Corrosion is also a concern with pipe and equipment. Water droplets can carry dissolved oxygen, which is highly corrosive to metals, like carbon steel. Water hammer can also cause damage to system equipment.

Reduced Heat Transfer

Wet steam has a lower heat transfer coefficient than dry steam and is therefore less efficient at transferring heat. This can lead to reduced efficiency in processes that rely on steam for heating.

Long Startup Times

During startup, high condensate loads are created when steam condenses after encountering cool piping and equipment. At the same time, the high condensing rate leaves little steam pressure in the piping. If the system is well designed, gravity pulls condensate into the drip leg. On supervised startups, a valve is manually opened to drain, and gravity alone is adequate to drain

condensate. On automatic startups, however, there may not be sufficient differential pressure to provide flow through a steam trap orifice. In these cases, the drip leg must be sufficiently long to provide the necessary static head to push condensate through the steam trap.

Production Losses

Low-quality steam and poor condensate drainage will have a direct impact on production. Having wet steam or condensate backup, production equipment will be affected by the loss of heat transfer and therefore reduce the amount of production output. Longer startup times mentioned earlier will also cause a delay in production startup.

Safety

Safety is a huge concern when it comes to improper piping. Water hammer and pipe erosion can cause a lot of damage to infrastructure and, in extreme situations, personnel injury or death.

To reduce the occurrence of these common issues, a steam system should be piped properly to prevent water-entrained steam and poor condensate drainage. FCI Tech Sheet #ST110 describes the proper piping recommendations to help achieve a properly piped system.