Jacketed Piping and Fittings – A Versatile Method of Temperature Control

Over thirty years the requirements of the processing industries with regard to process equipment have been critically important to A&B Process Systems. The company has developed expertise in many areas of design, fabrication, installation and automation and is renowned for its' capabilities with stainless steels. One area of expertise is in the design, fabrication and installation of jacketed piping (tubing) and fittings, often needed by the food, dairy and confectionery industries. This type of stainless steel process piping may be installed into existing process systems, being attached to floors, walls and ceilings at the site. A&B can also design, fabricate and install new systems incorporating jacketed piping and these may be modular or skid-mounted systems if required.

What is a jacketed system and when is it used?

The major components of a process system are stainless steel tanks, vessels, pumps and valves and these components are usually interconnected by stainless steel piping. In the food, dairy and confectionery industries changes in temperature in the product stream, as it flows through the system, can lead to either thermal damage or rapid increases in viscosity, partial crystallization and possibly solidification. To avoid or minimize these problems and maintain the required temperature in the stainless steel piping, a "jacket" can be attached. The result is a concentric tube-in-tube arrangement, allowing a fluid to flow across the outer surface of the process piping and transfer heat to (or from) the product stream.

The confectionery and breakfast cereal business sectors are the most common hygienic applications of "jacketed pipe and fittings" for processing that primarily involves sugar slurries in a wide range of concentrations as well as chocolate tempering. Concentrated sugar slurries used to produce " hard candy" often require steam jacketing to insure against formation of sugar crystals that complicate the process itself and adversely affect seal performance in the pumps and valves.

What materials can be used in jacketed piping systems?

The stainless steels are often the preferred materials of construction for process equipment used by the food, dairy and confectionery industries and this includes any jacketed piping and fittings. However, at the elevated temperatures necessary in some of the processes, a more corrosion resistant material is required to convey products such as certain sauces, syrups and salty mixtures. In such cases the design engineers at A&B Process Systems will design and fabricate the inner piping from a specialty alloy such as AL6XN, Hastelloy®C22 or Hastelloy®276.

What heating media are used?

The fluid in the outer tube usually flows counter current to the product stream to obtain a more efficient transfer of heat and the temperature of the fluid ranges from 34 to 205ºF. When the higher temperatures are required heated water is usually preferred, the maximum temperature

being the practical limit for non-pressurized hot water supply systems. Steam may also be used as the heating medium and special oils are available if it is necessary to maintain the temperature of the product stream above 250ºF. In certain processes the medium in the outer tube is used to cool the product stream and is then a chilled water/glycol mixture.

How are the jacketed tubes fabricated?

The piping lines, tees and elbows are fitted with a stainless steel sleeve of appropriate pressure rating. The jacketed sections are welded in place and hydrotested to insure the required quality. Flexible hose jumpers route the heating media around the connections to the components in the system. It is important to use jacket entrance fittings to allow (a) entrained air to be vented and (b) proper drainage for maintenance.

What are “fittings” in this process equipment?

The fittings are various types of flanged or clamp connections. The fittings are not jacketed (with the exception of tees and elbows) and therefore the piping system is designed with a minimum number of connections. An adequate number of “union” fittings are provided to allow for ease of disassembly in the case of a catastrophic failure of the heating media delivery system. Should this occur, the product in these lines may solidify and it is necessary to manually disassemble the system to allow product removal and cleaning.

Which processing industries require jacketed piping and fittings?

The food, dairy and most commonly the confectionery industry often use this method in the production of a variety of foods, e.g., sauces, cereals, syrups, creams and chocolate. The transfer of any liquid, the viscosity of which changes rapidly with temperature, may require the use of jacketed piping and fittings It will be applicable to any industrial process that favors using steam and steam-heated liquids to control temperature.

Can jacketed piping be fitted to existing process systems?

Jacketed piping can be retrofitted into existing systems. However, with large process systems high labor requirements can make retrofitting cost prohibitive and it is usually advantageous to install a new system. A “walkthrough” of the existing process system will enable the engineering staff at A&B Process Systems to estimate the relevant costs for each approach and to recommend a course of action. Detailed design engineering can be provided that allows for pre-fabrication of jacketed fittings and “ spool” piping that easily accommodates and accelerates installation requirements. Insulation, when required, is best provided after installation of the process system at the project site.

Is jacketed piping more expensive than other options, e.g., insulated piping?

Although the installed costs will vary with material specifications and the labor required, jacketed piping is usually more expensive than heat tracing and insulation. This will be true for both modifications to an existing system and the design, fabrication and installation of a new

system. However, the better control of the temperature afforded by the jacketed piping avoids damage to the product stream, damage that may result in the loss of that product and/or adverse impact to flavor profiles. The process system incorporating jacketed piping is more efficient and the annual production is increased, thereby offsetting the higher capital costs, i.e., a shorter ROI.

Furthermore, the installed jacketed piping system is very durable, more resistant to rough handling and easier to keep clean, since absorption of moisture is not a problem.

Who is A&B Process Systems?

A&B Process Systems is recognized throughout North America for the design, fabrication and installation of stainless steel tanks, vessels, auxiliary equipment and stainless steel piping, including the high purity and hygienic piping required by the food, pharmaceutical and bio-pharmaceutical industries. The company's reputation has been built upon the capability to produce high quality products to meet the performance requirements in a timely manner. A&B's success is a direct result of the in-house resources, the design engineers, fabrication engineers, welders and QA/QC professionals. The company has four plants in Stratford, Wisconsin, with approximately 80,000 square feet of manufacturing capability and plasma cutting, automated seam welding, GMAW, GTAW and orbital welding capability are available when needed. An extensive range of processing equipment may be fabricated in these facilities to meet customer requirements. The Automation and Controls Group at A&B Process Systems designs user-friendly controls in concert with the design and fabrication of the process system. The company also offers an experienced management team, capable of coordinating all aspects of a particular project, e.g., site preparation, selection and scheduling of general contractors, cost estimation, delivery and installation of the new equipment.