Sulphur

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Maintaining the flow

Experience at a shipping terminal taught sulphur distributor Martin Gas Sales that a bolt-on thermal maintenance system can have important life cycle advantages over gut tracing or welded jacketed pipe. **Henry P. Gaines**, PE, VP of Controls Southeast, Inc. tells the story.

Major sulphur distributor Martin Gas Sales markets and transports liquefied petroleum gas and sulphur, and processes sulphur for dry and liquid fertilizer. Martin Gas is the largest independent distributor of sulphur in the USA with over one million tons handled every year. It now operates three US Gulf liquid sulphur terminals with docks connected to massive holding tanks. The Neches River terminal near Beaumont, Texas, went into operation in August 1992. The Tampa, Florida, terminal became operational in January 1996, and the new Stanolind Cut terminal, also near Beaumont, Texas, opened in 1999.

At all three locations, long pipelines transfer liquid sulphur from ships and barges to and from the holding tanks. More piping carries sulphur from trucks to the tanks. Between all the heated storage and transport vessels, thermal maintenance in the pipes and valves is essential to keep the sulphur flowing and the entire operation moving.

Sulphur stays molten only within a temperature range of 246-320°F (119°C to 160°C). Outside that tight temperature band, its viscosity increases rapidly and soon becomes totally immovable. To keep the product flowing, a thermal maintenance system is required to make up the heat lost to the environment. "We try to maintain everything from 260 to 280°F," explains Martin Gas project engineer Keith West.

The Neches River terminal originally stored 27,000 long tons of sulphur in three heated tanks and had around 1,000 feet (305 m) of 10 inch (25.4 cm) pipe running from the barge dock to the tanks. Another 500 ft (152 m) of 4 to 6 inch (10-15 cm) pipe linked the tanks to trucks. The sulphur terminal was originally designed with inexpensive gut tracing in all the transfer pipes. It also used fabricated jackets and tube tracing to maintain the temperature of more than 50 valves controlling sulphur flow.

Cross-contamination

Gut-traced pipe was simple to install. A 2 inch (5 cm) steam line inside a 10 inch product pipe kept the surrounding sulphur hot and flowing. Unfortunately, a leak in the hidden steam pipe caused big cross-contamination problems for the entire system. Mr West explains, "If your steam line breaks, you get water in the sulphur line. If the pressure in the product line is greater than that in the tracing line, you get sulphur in the steam line."

Water in the sulphur pipe could possibly ruin the product and create corrosive and potentially hazardous fumes. Conversely, sulphur in the steam line clogged the steam traps, and the sulphur in the product line inevitably cooled. The sulphur soon formed an insulating plug 4 or 5 ft long.

"Now you've got a barge or ship sitting there and no way to get product on or off," says Mr West. "The amount of money saved by gut tracing is nothing compared to money you could lose in customer disappointment and missed schedules."

Sulphur lines at the Neches River terminal froze once or twice a year. Restoring process flow with electric blankets could take anywhere from a few hours to a full week. "It could be a nightmare," admits Mr West. The audible steam leak had to be found by cutting access windows in the big sul-

At Martin Gas' new Beaumont facility, ControHeat bolt-on jackets, like the ones pictured on the Flowserve Mark III centrifugal pump, the 12 inch Tufline butterfly and plug valves adjacent to the sulphur storage tank, and the Hyspan ball joints will be used to maintain temperature on all the process equipment. All of the 6 in., 10 in. and 12 in. transfer lines will be heated with a ControTrace thermal maintenance system.

phur pipe. Once the steam line was repaired, the windows in the sulphur pipe had to be welded shut, leaving several potential leak points in the product line. In a worst-case scenario, sulphur in the steam line could reach the boiler and require a costly boiler teardown.

Jacketed valves

Maintaining temperature within sulphur valves was equally important, and equally difficult. Some valves at the Neches River facility were specially jacketed by the manufacturer, while others were heat-traced in the field by Martin Gas. Mr West recalls, "In Beaumont, we wrapped steam tubing around the valves. It didn't work at all. The valves were constantly freezing up." Replacing valves jacketed by the manufacturer imposed additional penalties in money and time. A typical 3 inch manufactured jacketed valve could cost $600 while a standard unjacketed valve might cost only $300 to $400. In addition, waiting time for a manufactured jacketed valve is sometimes 16 to 20 weeks, so several expensive jacketed valves had to be kept in inventory to prevent lengthy downtime. Martin Gas was not alone in its thermal maintenance problems. Mr West recalls another company's Texas sulphur terminal fared even worse with gut-traced lines.

Expensive welded jacketed pipe offered few advantages. Mr West explains, "With jacketed pipe, the heating source is on the outside and the product on the inside. Once again, you've got the possibility of cross-contamination." Labour-intensive blister pipe, where a split steam pipe is welded all along a process line, is more reliable but very expensive.

Bolt-on barges in Martin Gas

Engineers found a cost effective solution to their thermal maintenance problems in another of its sulphur transport applications. Around the time when the Neches River facility opened, Martin Gas commissioned the inland liquid sulphur barge MGM 101, which had a bolt-on thermal maintenance system from Controls Southeast Inc (CSI). Sulphur lines on the barge are surrounded by ControTrace bolt-on pipe heating elements, and valves are kept hot by ControHeat jackets. Unlike gut-tracing or welded jacketed pipe, the bolt-on jackets on sulphur lines eliminated the risk of cross-contamination. "You'd have to rupture both the product line and the ControTrace at the same spot to have a chance of getting product into the heating medium. That is very unlikely, if not impossible," explains Mr West. The bolt-on thermal maintenance system aboard the barge used hot oil instead of steam as a heat transfer medium. In service, the bolt-on system on the MGM 101 was trouble-free.

Beaumont terminal retrofit

In 1994, Martin Gas retrofitted its facility near Beaumont, Texas, with ControTrace pipe elements and ControHeat valve jackets and eliminated stoppages due to cross-contamination and line freezes.

Martin Gas engineers connected the bolt-on thermal maintenance system to the 110 psi saturated steam system at the Neches River facility and abandoned the gut tracing lines altogether. Standard valves at the Texas facility were also jacketed with bolt-on jackets. The bolt-on valve and pipe jacketing avoided the need to install expensive welded jacket or blister pipe and to stock costly jacketed replacement valves.

"We discovered by using bolt-on jackets, access to the valve for service was much faster and easier. Also because the jackets bolt onto the component, we could install the equipment before the arrival of the jackets, which really helped us meet start-up deadlines", recalls Mr West.

Some 1400 ft of 12 inch sulphur transfer line from the storage tanks to the barge loading area is jacketed with a ControTrace thermal maintenance system from Controls Southeast, Inc. in Charlotte, N.C.

New terminals

The performance of the bolt-on thermal maintenance system in the existing terminal and aboard the barge led Martin Gas to specify bolt-on thermal maintenance systems for its new Florida and Texas facilities. "Since we installed this system at our first Beaumont terminal, we've never had a problem," concludes Mr West. He estimates maintenance costs for the bolt-on system at the first Texas terminal were less than half those associated with simple gut tracing.

Sulphur lines were installed at the new Tampa Marine Terminal in late 1995. The terminal has two 15,000 long ton sulphur tanks connected to the docks by a 12 inch (30 cm) pipe. The 660 ft (201 m) long pipeline is covered with steam-heated ControTrace panels. Each 40 ft (12 m) long panel is made up of two elements butt-welded end to end with a steam inlet at one end and an outlet at the other.

CSI provided its engineering expertise to help Martin Gas design and install the thermal maintenance system. The system specifies steam traps between each 40-ft panel. "We could go 200 ft between traps", acknowledges Mr West, "but we felt it was better to go with extra traps and fittings rather than risk problems".

The ControTrace panels are bolted in place around the sulphur line but cover only a small portion of the pipe surface. Heat is transferred to the product pipe wall to keep the sulphur molten. Two bolt-on panels cover just 8 inches (20 cm) of the pipe's 40 inch (102 cm) circumference.

CSI uses finite difference modelling techniques. These techniques determine the required surface area coverage specific to the process requirements and ensure the resulting design is capable of melt-out in the event of an unscheduled outing. Unlike jacketed pipe, the thermal maintenance system itself is easy to maintain, according to Mr West. "With the ControTrace panels, you can just take the insulation off for service. The panels are easily repairable, and installation-wise, it's a lot cheaper to trace the lines." A bolt-on thermal maintenance system typically costs about 25% less than jacketed pipe and significantly less than blister pipe.

The Tampa terminal has around 25 valves ranging from 4 to 12 inches (10 to 30 cm) in size, each with ControHeat jacketing. These jackets enable Martin Gas Sales to use standard valves available from any industrial supply house. The unmodified valve and its bolt-on jacket generally cost less than manufactured jacketed valves.

"Initially, you may save a little money with the ControHeat jacket and a regular valve. But you're going to have to replace a valve at some point, and when you do, you're going to save a lot of time and money."

Because of the success of the bolt-on thermal maintenance system at the Neches River and Tampa terminals, it was part of the original plans for the newest Martin Gas facility. The new Stanolind Cut terminal in Texas has two 15,000 long ton sulphur tanks connected to a dock by 1,400 ft of 12 inch pipe. Another 400 ft of 6 inch pipe ties the tank to trucks. The new facility also has about 25 valves and several pumps. The new sulphur terminal started operations in 1999. All the pipes and valves are kept operating by a bolt-on thermal maintenance system.

Martin Gas has come to rely on bolt-on thermal maintenance technology in its sulphur operations. The removable system has matched the performance of fabricated pipe and valve jackets at lower installed cost, and maintains a temperature-sensitive product in transit. S