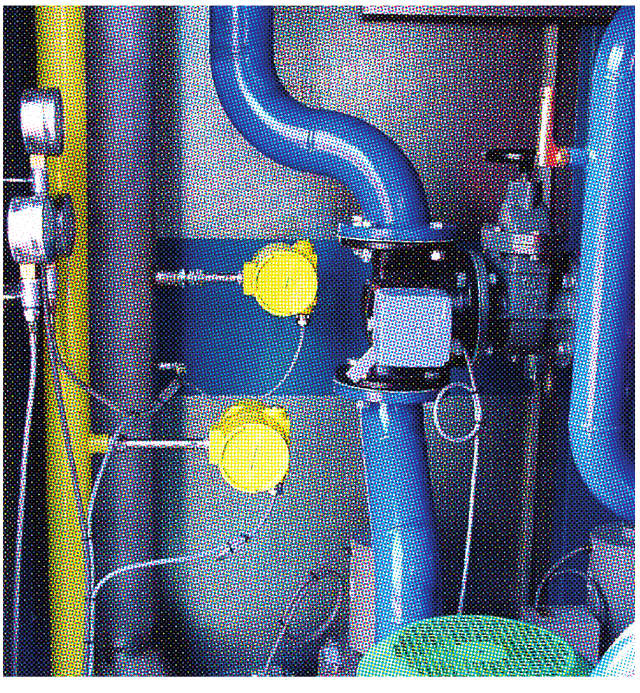
Hydrocarbon recovery system relies on high accuracy mass flowmeters

Loading and unloading of liquids at tanker terminals, refineries, and chemical plants releases large flows of hydrocarbon gas vapour that must be captured to protect the environment. Qlear Energy & Environment, BV, of The Netherlands, has developed a vapour recovery system specifically for this purpose.

The recovered hydrocarbon gas is then used to fuel turbine engines to generate electricity. Qlear's VPS Plus systems have been installed at several European independent storage companies, including Vopak, LBC and ST Services, and oil companies, such as Total Fina Elf, DSM, and Shell. The VPS is housed in a transportable container and can be set up in two days.

Donald Coster, Business Unit Manager of Qlear, says that highly accurate thermal mass flowmeters are key to operating the system at peak efficiency.



After 3 years of successful operation, Qlear continues to use the FCI Model ST98 mass flowmeter in its vapour recovery systems. The instruments have typical accuracy 1% of reading, +0.5% of full scale, and repeatability of 0.5% of reading. The two meters shown here are monitoring gas inflow to a turbine to generate electricity. One flowmeter monitors input from the hydrocarbon recovery system and the other (yellow pipe) from the standby fuel.

Vapour recovery

Hydrocarbon storage tanks are fixed roof tanks with an over- and vacuum-pressure relief valve. During loading operations, this valve relieves high internal pressure conditions that can cause the tank to rupture. When the tank is unloaded, the relief valve prevents the internal pressure from becoming too low and creating a vacuum that causes the tank to implode. This valve must breathe to atmospheric pressures, while not accepting any back pressure.

During loading or unloading operations, hydrocarbon vapour can be released directly to the atmosphere. To prevent this, Qlear's system is connected to the pressure relief valves to capture hydrocarbon vapour.

The captured vapour is used to fuel a turbine engine, which drives an electrical generator. Unfortunately, the caloric value of the hydrocarbon vapour may fluctuate so a standby fuel, such as propane or LPG, is kept ready for automatic injection into the turbine when the hydrocarbon energy content is low.

The metering problem

Efficient turbine operation requires that the vapour gas inlet flow be continuously and accurately monitored, both from the recovery process and the back-up fuel. Mr. Coster explained that Qlear initially used rotary flowmeters, but experienced problems from contaminants in the vapour. There was also a high pressure drop over the rotary meter, which caused unstable engine characteristics.

In addition, the limited turndown of the rotary flowmeters caused control problems because the volume of the vapour inlet may vary from the unloading of one truck at 100 tons per hour up to a giant oil carrier unloading at 10,000 tons per hour.

After an extensive test program, thermal dispersion mass flowmeters were chosen to replace the rotary flowmeters. Mr. Coster says the new flowmeters from FCI with a turndown ratio of 100:1 helped simplify engine control. There are no orifices, traps, pivots, or bearings to foul or fail. The pressure drop was calculated to be less than 1 milliBar and the non-moving part design resulted in a maintenance free installation.

The typical sensing element contains two thermowell-protected resistance temperature detectors (platinum RTDs). When placed in the process, one RTD is heated and the other RTD senses the process temperature. The temperature differential between the two RTDs is related to the process medium. Denser media cause increased cooling on the heated RTD and a reduction in the temperature differential.

For more information about FCI's thermal flowmeters, visit www.fluidcomponents.com