Technical Publication

Thermal Flow Meter with Multi-Calibration Groups Simplifies Portable Monitoring System for Flare Gas Units

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Fig. 1: Natural Gas Compressor Station Booster

Natural gas pipeline booster compressor stations require careful monitoring, maintenance and emissions reporting to ensure the safe, efficient and environmentally compliant processing and transport of natural gas from production fields and refineries over long distances to end users. This process starts when the gas is refined and first cleaned to remove liquids, impurities and any solids that damage equipment in the transportation process or at end-user facilities (Fig. 1).

Booster or compressor stations play an essential role in the natural gas pipeline network. Once the gas is cleaned, then it is typically compressed and sent out through the pipeline, but distance, friction, elevation differences and other factors reduce pressure and then slow the movement of the gas. Multiple pipeline compressor stations must be placed carefully along the pipeline route to maintain sufficient pressure and flow to transport the gas to end users.

Natural gas production fields, refineries and booster stations are a complex network of pipes flowing raw gas first to scrubbers, filters and then onto the compressors. There is also always some amount of waste gas that is unusable for assorted reasons, which must be flared for safety reasons and must be reported to various local, state and federal regulators who are concerned about greenhouse gas emissions (GHG) and the global warming phenomenon.

For all these reasons, from plant efficiency to plant safety to plant emissions, the measurement of gas sent to flare units is extremely important. This task requires rugged, high accuracy flow instruments featuring global safety and measurement approvals to ensure the pipeline network maintains the pressure and flow of gas to end market users.

The Problem

Hoover Energy, located in Artesia, NM, develops and operates portable flare gas monitoring skid systems that report flare unit activity to ensure operators that their equipment is functioning as intended by process and plant engineers to meet all safety and environmental monitoring regulations (Fig. 2). Hoover Energy specializes in gas flow and temperature measurement and related instrumentation, as well as industrial electrical equipment, communications and automation.

Fig. 2: Portable Flare Gas Monitoring Skid

Hoover's portable flare gas monitoring systems run either on full solar power or on local shore power, and in the event of a power loss on location then the skid switches seamlessly over to solar without ever shutting down. They feature sophisticated

communications capabilities including SCADA monitoring. With additional IO modules, the system provides flare temperature data and indicates flare valve open/closed status. A camera also can be added to the system for full flare visualization. In fact, they can function as a full flare reporting system (Fig. 3).

These rugged systems are operated by Hoover Energy at multiple sites across eastern New Mexico and west Texas, as well as Wyoming. Hoover's portable gas monitoring systems utilize thermal mass flow meters because of their accuracy, repeatability, ease of installation and low maintenance. Thermal technology provides direct mass gas flow measurement and is among a small number of flow sensing technologies approved for this demanding application by the International Organization for Standardization (ISO), the American Petroleum Institute (API) and the American Gas Association (AGA).

Technicians from Hoover Energy are responsible for flare system flow monitoring and testing at multiple locations for a large compressor station facility operated by Luger Energy of Artesia, New Mexico, which serves several midstream gas processing companies including Matador and Targa. The network of pipelines feeding into the main facility is large and covers many square miles, which frequently requires Hoover Energy's technicians to drive several hours to install its portable flare gas flow monitoring skid systems at critical process measurement points.

These measurement points, which are in various line sizes of 4-, 6-, 8- or 10-inches, are also often near valves and elbows, which can affect gas throughput as well as accurate gas flow measurement. Flow meters are sized according to pipe line size so that the flow sensor is located optimally within the pipe and then calibrated to the specific gas flowing in the pipeline for accurate measurement. That meant the technicians needed to know in advance the size pipe in which they would be measuring gas or risk having wasted precious travel time to the site only to find out they had brought their portable flare monitoring system with the wrong flow meter installed.

This requirement also means that while in the field that the technicians were limited in what they could do—limited by the pipe line size and calibration of the meter they brought to the site with no flexibility to install the system in other locations with different line sizes. To solve this frustrating problem, Hoover Energy contacted ESquaredi, a manufacturer's representative, who suggested that the ST100A Thermal Flow Meter from Fluid Components International (FCI) could help solve these issues.

Fig 3: Portable Flare Gas Monitoring Skid - FCI ST100A

Flare Gas Measurement Issues

The accurate measurement and disposal of flare gases is essential to manage potentially hazardous combustible, flammable and toxic gases. Accurate measurement allows them to be processed efficiently to protect people and equipment. The combustible and flammable properties of hydrocarbons make their handling a highly regulated process, requiring flow meter design certifications from multiple international approval agencies including FM, FMc, ATEX and IECEx to name a few.

Measuring flare gas is challenging for several reasons. These issues include mixed gas compositions, highly variable flow rates, multiple line sizes, lack of available pipe straight-run, limited access for installation or maintenance, and the effects of corrosion. Only a few flow meter sensing technologies are robust enough to meet these many demanding requirements while providing accurate, repeatable gas flow measurement.

Fig 4: FCI's ST100A Series Thermal Flow Meter

The Solution

The FCI application engineers recommended to Hoover Energy the ST100A Series Thermal Flow Meter. FCI's proven thermal dispersion, EPA Quad O compliant ST100A Flow Meters (Fig. 4) offer highly accurate and repeatable gas flow measurement in hazardous areas to assist in compliance with environmental mandates. They are direct mass flow measuring devices, producing flow rate and totalized flow output signals and readouts in pounds or tons (kg, tonne) of emitted gases for monitoring and reporting.

FCI's versatile thermal mass gas flow meters are internationally deployed in air pollution monitoring and other industrial air/gas measurement and control applications across many different industries including oil/gas refineries and chemical plants. They offer ease of installation, require little to no maintenance and offer a long life, which provides for an exceptionally low cost of ownership.

The ST100A Series Flow Meters combine ultra-dependable and feature-rich electronics for fast response and range-ability. They operate over a wide range: the insertion style measures flow from 0.25 to 1000 SFPS (0,07 to 305 NMPS); the inline meter measures flow from 0.0062 to 838 SCFM (0,01 to 1425 Nm3/h) with turndown ratios up to 1000:1.

The ST100A transmitter's outputs are a match to existing plant DCS, PLC, SCADA, recorder, or alarm systems. For local display, the ST100A Meter features a graphical, backlit LCD that is unmatched in showing what is happening in the pipe. Flow rate, totalized flow, and temperature are continuously displayed in both a digital and bar graph presentation, while alarms and/or diagnostic messages will display as needed to alert operators. Their large screens and intuitive displays make it easy for field technicians to perform instrument set-up and continuously monitor the process data.

The ST100A Meters insertion style meters require only a simple, single tap point into a pipe to install. Instruments are available for line sizes from 0.25 to more than 100 inches. Furthermore, FCI's accuracies of ±1% reading, ±0.5% of full scale exceed the stated acceptable accuracy within the newest U.S. EPA regulations and reporting requirements.

The Results

The new ST100A Flow Meters were the accurate, flexible, reliable solution needed by technicians at Hoover Energy. This thermal flow meter provided them with a flexible, accurate, safe gas flow measurement instrument. Highly dependable and repeatable measurements with the ST100A Flow meters helped Hoover Energy's customer process and plant engineers meet their flare gas environmental monitoring and reporting requirements while at the same time safely and efficiently moving gas through their pipelines.

Fig 5: FCI's ST100A Series Thermal Flow Meter with Verical

After a period of time, the engineers at FCI suggested the technicians at Hoover Engineering consider switching to the newer ST110A Series with multiple gas calibration groups (Fig. 5). This feature allows the user to store up to five separate gas calibrations in a meter, which in this case Hoover chose to program for each of the typical line sizes encountered in the field: 4-, 6-, 8- and 10-inch lines along with the in-situ VeriCal flow meter calibration verification feature.

All FCI products are tested and calibrated to rigorous standards prior to customer shipment to ensure users get the instrument that does the job they specified. They are calibrated to real world gas compositions rather than to air equivalencies, which are frequently inaccurate under installed field conditions. To design and produce the highest quality flow instrumentation, FCI operates its own world-class, fully NIST traceable flow calibration laboratory that is certified to meet such stringent standards as MIL-STD 45662A and ANSI/NCSL Z-540.3

Many flare meter installations, either per plant requirement or for compliance with environmental regulations, require regular periodic validation of flow meter gas calibrations. Traditionally, this has required a tedious and costly project to remove the meter from service and return it to a calibration laboratory, which is particularly frustrating if the meter is found to still be within its original calibrated specifications.

FCI's exclusive VeriCal option eliminates the need for unnecessary de-installations, shipping and time delays. The VeriCal system provides a simple-to-use bult-in tool to verify the FCI flow meter is still within calibration without extracting the meter from pipe. There is no need to retract or remove the meter from the process piping or to suspend operations.

The VeriCal self-test feature initiates an electronic, three point calibration drift self-test. In the test mode, the meter automatically and sequentially substitutes three precision resistors into the measuring circuit and compares the resulting measurements against the same measurements at factory calibration.

Technicians have been using the highly flexible ST110A flow meters with multiple line size calibration groups and the VeriCal feature now for several years. There have been no incidents or problems with the meters, and best of all the technicians say there have been no more wasted trips to the field only to discover they did not have the correct meter they needed on their skid system to complete their mobile testing and data reporting projects. ■