Micro Motion® Specific Gravity Meters Improve Furnace Performance with Reliable Monitoring of Fuel Quality

BENEFITS

- One-time, onsite calibration for better accuracy and lower operation cost with minimal consumables
- No pressure, temperature, or compressibility factor effects as seen with previously installed density meter
- Accurate, stable output signals that can be transmitted over long distances

APPLICATION

During the refining process of crude oil, crude oil is heated and recondensed in a fractioning tower. In this fractioning tower, hydrocarbons are separated into groups, or fractions, while the impurities are removed. The industrial process furnaces (or burners) provide heat for this process. To produce and distribute heat throughout the refining plant, fuel gas flows into the furnace and is burnt with air. The flames produced heat the internal tubes in the furnace, which in turn heat the fluid inside the tubes to the desired temperature. The heated fluid then is circulated to heat exchangers throughout the plant.

The quality of the fuel gas flowing into the furnace can have a significant effect on the auto-combustion control of the furnace. A small change in fuel quality can lead to the furnace over-firing, which can result in thermal shock. Over-firing can also result in increments of COT (1, 3, 5, 7-Cyclooctatetrane or C_8H_8) being introduced into the furnace. COT is unstable and easily forms explosive organic peroxides. The introduction of COT results in flooding of the furnace and will have an adverse effect on the product yield and quality.

CHALLENGE

A major crude oil refinery was having problems with its installed density meter producing fluctuating measurements that resulted in inaccurate readings to the furnaces and reduced the furnaces' performance and efficiency. The current density meter was sensitive to the changing effects of pressure, temperature and gas compressibility, thus causing the fluctuating results. Operators at the

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Micro Motion 3098 Gas Specific Gravity meter in enclosure

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refinery had to frequently reset the density meter and manually adjust the furnace coefficient of performance (COP).

SOLUTION

Because of the meter's capabilities, the oil refinery chose to install a Micro Motion® 3098 Gas Specific Gravity meter to replace its current density meter. Some advantages of the 3098 meter were the ability to perform onsite calibration and receive direct measurements of the gas molecular weight and specific gravity. Calibrating to the refinery's fuel gas composition would eliminate the need for recalibration and maintenance. Because both molecular weight and specific gravity are insensitive to changes in pressure and temperature, any change in these measurements outside a designated range would alert the operator to a change in the fuel gas quality. Better management of the fuel gas quality would increase the furnace efficiency and safety in the heating process.

The refinery was using a fuel gas with the following composition:

Temperature	10 to 50 °C
Pressure	3 kg/cm^2
Molecular weight	5.1 to 6.26
Actual density	1.1 kg/m^3
Viscosity	0.008 cP
Component weight %	
CO_2	1.470
H_2	24.574
N_2	0.468
CH_4	63.136
C_2H_8	5.944
C_3H_8	4.350
n–C_4H_{10}	1.478
i–C_4H_{10}	1.596
n–C_6H_{12}	0.013
i–C_6H_{12}	0.04
n–C_6H_{14}	0.115

The operators chose to calibrate the 3098 meter using methane and hydrogen gases, because these gases best represented the fuel gas composition.

After installing the 3098 meter, the refinery saw the following benefits:

- Density readings that were stable and accurate because of the meter's insensitivity to pressure, temperature, and gas compressibility.
- Lower operating costs due to the elimination of having to recalibrate or maintain the meter, which reduced the system down time.
- The ability to receive stable, accurate signals from the 3098 over long distances (with the Micro Motion 7950 signal converter) that allowed for installation flexibility.