North American Refinery Uses Emerson Flow Meters and Valves to Comply with EPA Refinery Sector Rule for Flares

RESULTS

- Site has experienced no flare opacity NOVs since implementation in Q3 2017.
- Site has maintained 100% compliance with RSR since active date.
- Flow meters can easily be verified onsite and allow for extended calibrations

Vortex meters provide reliable measurements at wide turndowns especially for challenging applications like steam measurement

APPLICATION

Flares are important safety devices used in refineries to prevent over pressuring in pipes and reactors by safely burning excess flammable hydrocarbon gases which cannot be recovered or reused. There are several reasons flaring can occur including plant upsets, over pressuring, power failures, and equipment failures. During flaring, excess gases are combined with steam and/or air and burnt in the flare system to produce water vapor and carbon dioxide.

In 2015, the United States Environmental Protection Agency (EPA) introduced the Refinery Sector to Rule (RSR) to control air emissions by monitoring and controlling emissions at key sources within their facilities. The regulations entailed setting flare operating limits, requiring a flare management plan (FMP), and requiring a continuous parameter monitoring system (CPMS) plan in addition to reporting. January 2019 was the deadline for US refineries to comply to the RSR.

There are several requirements detailed in the FPM and CPMS, in particular one of those requirements in the FPM states that the Neat Heating Value (NHV) of the flare must be maintained at or above 270 BTU/SCF determined on a 15 minute block period basis when regulated material is routed to the flare for at least 15 minutes.

The EPA has determined that if the hydrocarbon mixture in the flare falls below 270 BTU/SCF, the hydrocarbon destruction efficiency is much lower reduced. Having the proper minimum BTU value is critical to ensure all hydrocarbons are combusted. To ensure combustion efficiency of all hydrocarbons and to reduce smoke emissions, steam is added to atomize the fuel and mix the air. Adding just the right amount of steam at all times is critical for maintain compliance.

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CHALLENGE

There are many challenges with the control and measurements across a flare system. The difficultly in measurement is due to the unpredictable and large variations in the composition and flow rates of the flare gas.

In particular one of those challenging measurements is the steam injected to atomize the fuel and mix the air. Inaccurate steam flow can lead to multiple problems. Too low steam flow results in an inefficient flare and increase in smoke. Too high steam flow results in an NHV below the 270 BTU /SCF. Extreme over-steaming could lead to unburned hydrocarbons, environmental fines, and impact the operator's license to operate.

The steam injection measurement requires a very high turndown that is difficult to measure with one meter. During normal operation, the steam requirement will be quite low, but the system must be sized to also handle the maximum flow of steam that the flare could see under full release conditions. The steam flow measurement required a 100:1 turndown with ±5% of mass flow accuracy with pressure and temperature compensation.

SOLUTION

Several Emerson flow measurement technologies and control valves were employed to meet the new requirements. The solutions discussed will be focused on a subset of the flow measurement solutions employed.

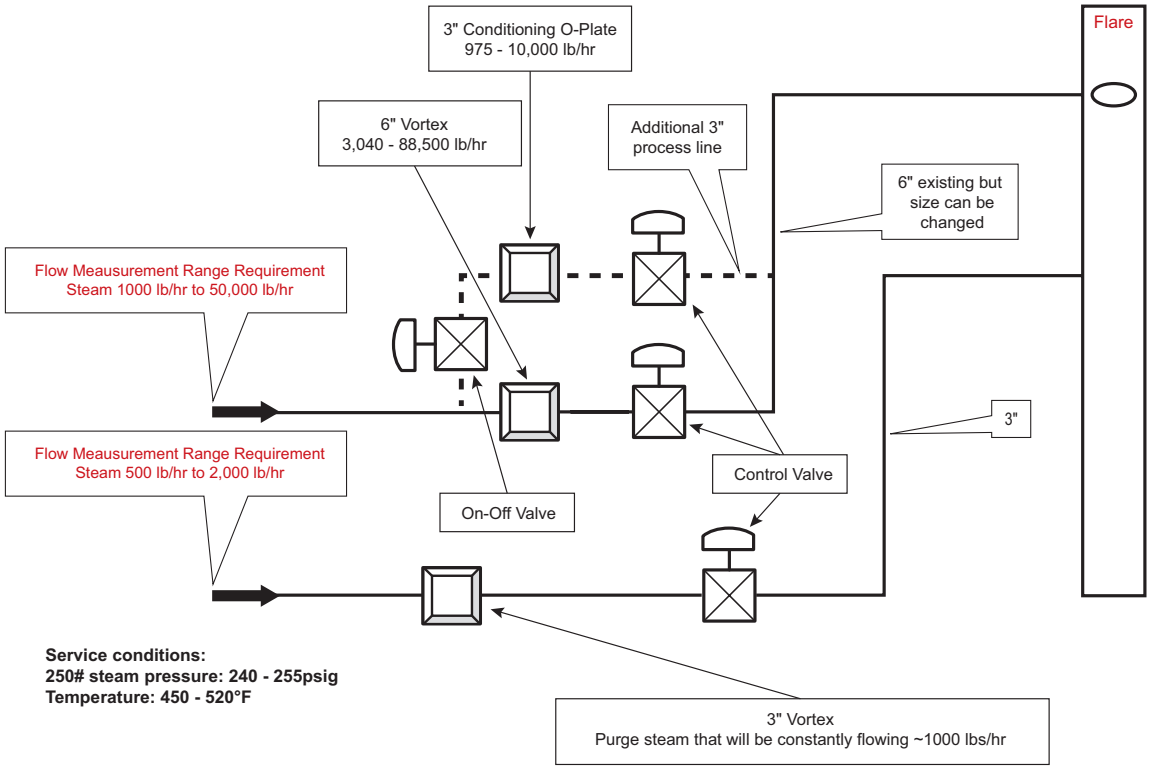
For measuring atomizing steam in the high flow range, Emerson's Rosemount conditioning orifice plates and 3051s transmitters were used to meet the mass flow accuracy and turndown requirements.

For measuring atomizing the steam in the low flow range, Emerson's Rosemount 8800 Vortex meter with temperature compensation was used to calculate mass flow and meet turndown requirements.

Rosemount's 8800 Vortex meters were also used for mass measurements of the center steam measurement affecting flame shape and stability.

Rosemount Vortex meters were selected for several of these steam injection measurements because of their reliability and fairly high turndown. Emerson's Vortex meters have no gaskets or leak points making them easier to install and maintain compared to other flow technologies. The accuracy of the measurement is not as sensitive to shedder bar wear unlike other technologies that utilize different primary elements. Emerson's unique Vortex design allows the ability to change out the sensor while the meter is still in the line preventing the shutdown of the flare and any units that relieve into the flare.

Emerson also has provided refineries with a sample monitoring plan, including manufacturer's calibration recommendations. This also includes testing reports showing the impact of shedder bar wear on flow meter accuracy, and calibration data showing a 96% chance of no significant shift in the calibration factor to support extending the required calibration frequency to meet turnaround cycles.



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