FLARE MEASUREMENT

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Abstract

With the recent release of the Green House Gas Regulations, the increased visibility of flaring natural gas and increased awareness of royalty owners, the ability to accurately measure and account for the amount of product flared from a facility has become increasingly important to regulators, royalty owners and operators. In the past, flare gas was not considered a necessary measurement, so the measurement of flared product has often been overlooked or not given the same attention as custody transfer measurement. As such API published API MPMS Chapter 14.10, Measurement of Flow to Flares, in June of 2007. This paper will provide a quick overview of the contents of API MPMS 14.10 but is encouraged to obtain 14.10 if more detailed information is desired. In addition, a brief discussion on the importance of calibrating flare flow meters is also discussed.

History

On December 1, 2004 the Texas Committee on Environmental Quality issued Subchapter H (Highly-Reactive Volatile Organic Compounds) to Chapter 115 of Title 30 of the Texas Administrative Code. This regulation placed new monitoring requirements for those facilities emitting Highly-Reactive Volatile Organic Compounds (HRVOCs) into the air in the Houston, Galveston, and Brazoria areas. The requirement included initially calibrating the flare flow meters to an accuracy of 5% at flow rates of equivalent to 30%, 60% and 90% of the flare meters full scale. At the same time API began an effort to develop a standard for flow measurement in part to address the TCEQ regulation, but also to be able to have a standard in the event any other state or government agency developed similar regulations. API 14.10 was then published on June 2007 and subsequently reaffirmed in 2012. At the writing of this paper, API has released a working group to review and revise the standard with a target date of late 2016 for a new revision.

Review of API 14.10

API Chapter 14.10 is broken down into the following section:

- Introduction
- Reference Publications
- Terminology and Definitions
- Application Considerations for Meter in Flare Systems
- Factory Calibration/Verification
- Commissioning and Startup
- Periodic Verification
- Re-evaluations of existing FFMS (Flare Flow Metering Systems)
- Performance Test Protocol Scope
- Uncertainty and Propagation of Error
- Documentation

As noted in the Introduction, the standard focuses on the following items:

- Application considerations
- Selection criteria and other considerations for flare meters and related instrumentation
- Installation considerations
- Limitations of flare measurement technologies
- Calibration
- Operation
- Uncertainty and propagation of error
- Calculations

One item that the standard does not discuss is the analytical instrumentation which is used to determine the composition of the flared gases. Another item which is not addressed is the detailed requirements for secondary and tertiary devices. One final item of note is that the standard focuses on flared product in the gas or vapor phase.

Since the standard was written in response to the TCEQ requirements, the standard sets the targeted uncertainty for flare meters at 5% and at the same rates as the TCEQ requirements. The upcoming revision of the standard may change or modify the target based on other recent regulations which have sought to provide more stringent requirements.

The flare metering technologies discussed in the standard include:

- Differential pressure flow meters (Orifice, Venturi and Pitot tubes)
- Optical meters (Optical scintillation and Lased-2 focus)
- Thermal flow meters
- Ultrasonic flow meters
- Vortex shedding meters

Since the purpose of this paper if to merely highlight the contents of the standard, these technologies will not be further discussed.

One final item to note regarding the standard is that API has just completed developing API MPMS Chapter 22.3, Testing Protocol for Flare Gas Metering, which should be published during the summer of 2015. This standard will address the testing requirement for flare flow meters with emphasis on the procedures for manufacturers to present the data from the protocol in a similar fashion. This will allow the end user to easily evaluate different technologies and manufacturers when choosing a meter for their application. In addition, one of the revisions to 14.10 will be delete current calibration discussions and reference API MPMS 22.3 directly.

Importance of Calibrations

In working on the two standards mentioned in this paper, I have had the opportunity to be involved with testing of several flare meters both internal and external to my company. One particular calibration involved two 20" flare meters which were supposed to be identical to each other. The meters under test were "insertion type" two-path ultrasonic flow meters with field extractible transducers.

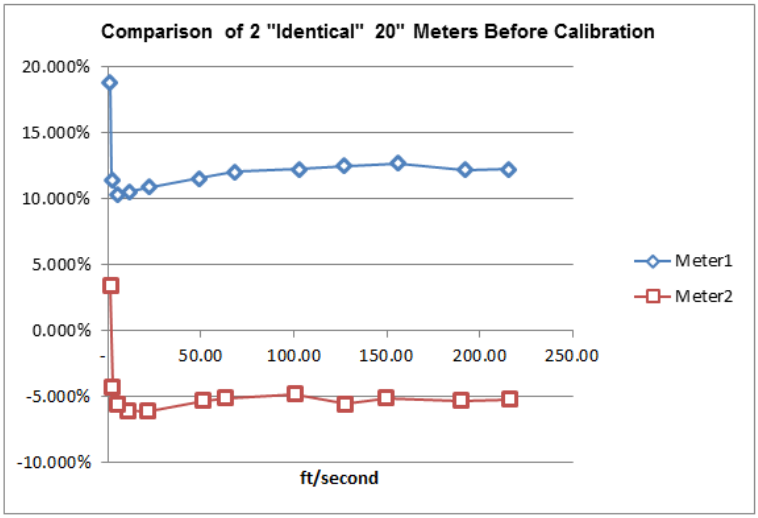

Figure 1. Pre-Calibration Comparison

The meter spools were built by the meter manufacturer which should have resulted in nearly identical spools. The results of the calibration are shown in the Figure 1. It is immediately obvious that while the two meter behaved similarly, they are significantly biased from each other. The absolute error of each meter also exceeds the regulatory requirements of +/- 5%. Figure 2 shows the as left values for the meters and once again it is clear that once calibrated both meters perform similarly, including both of them dipping at low velocities. The key point is that had these meters not been flow calibrated, the measurement would have been in error even though the manufacturing process should have produced two meters that performed at the as-left conditions.

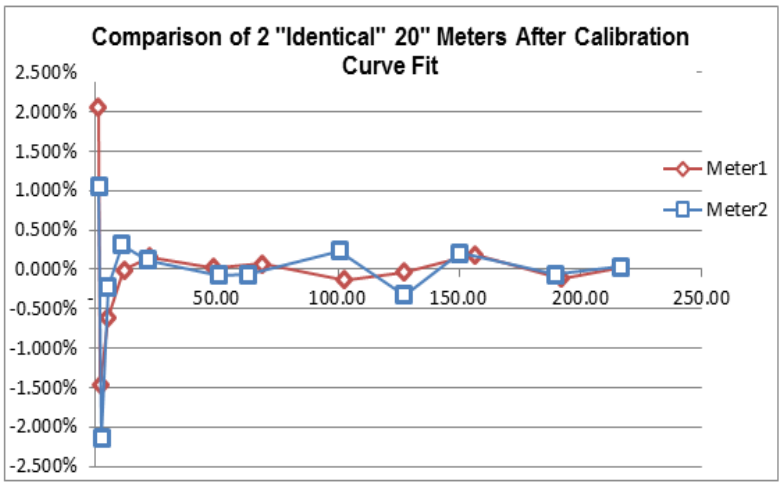

Figure 2. Post-Calibration Comparison

Conclusions

As noted the primary purpose of this paper was to introduce the reader to the topics covered in API MPMS 14.10 and discussion the importance of calibrating flare flow meters. One thing to note from the discussion of the 20" meter test data is that not all meter, no matter how identical they are, will perform the same. The end user should always thoroughly review vendor information and test data, where available, and strongly consider having their flare meters flow calibrated.

References

API MPMS Chapter 14, Section 10 - Measurement of Flow to Flares, June 2007