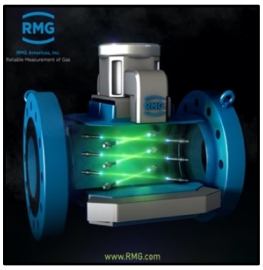
TECH NOTE 2

GT400 6-Path Gas Ultrasonic Meter Wet Gas Test Results Summary

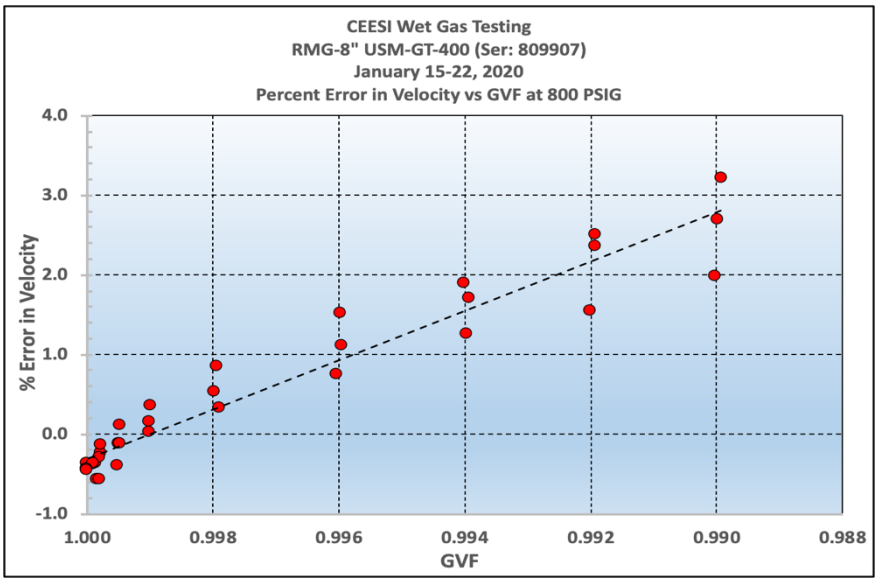


Introduction

The use of custody quality gas ultrasonic meters (USMs) in pipeline applications, where liquids may be present, has often been considered a bad application for this technology. Since there are many different USM path configurations being used today, *one should not assume poor performance by one brand translates into the same performance for all others*. In order to better understand how the RMG GT400 6-path USM responds to liquids, several tests were conducted in January 2020 at the CEESI Nunn Wet Gas Test Facility in Colorado. Data included in this document was collected and processed by the CEESI staff.

Test Details

The purpose of these tests was three-fold. **First**, identify how much liquid the GT400 could tolerate before a path failed. **Second**, and more importantly, quantify the meter error at various liquid loadings the client expects to see in the "real world." **Third**, identify / verify which diagnostics changed, and the extent of these changes. This helps not only identify when liquids are present but may help in error correction. Two pressures were chosen (200 and 800 PSIG) based on previous testing. The client requested these test pressures, and also specified liquid loadings they see in their system. For the 800 PSIG test, liquid loading varied from 1.000 GVF (Gas Volume Fraction), which is 0.000 LVF (Liquid Volume Fraction), to 0.990 GVF (0.01 LVF), or about 4,740 GPH of liquid (approximately 8,770 lbs. per MMSCF). The fluid was Exxsol D80, which is commonly used to replicate field hydrocarbon condensates. The following graph shows the effect on meter accuracy, from no liquid loading (1.000 GVF) to the maximum of 0.990 GVF. The pictures show the test setup at CEESI Nunn.



Data Analysis

This GT400 8" meter was not previously flow calibrated. This explains why it registered approximately -0.43% relative to the facility at 1.000 GVF. It was installed with the typical 10D + CPA 50E + 10D piping. Velocities tested were primarily 20, 40 and 55 FPS (55 FPS is the facility maximum) with some data 10 FPS with very light liquid loading. Thus, for each liquid loading, there are typically three red dots representing a gas velocity at that GVF. These results show the GT400's response to liquid, over the client's anticipated liquid loading and gas velocity operation, to be relatively linear. The third objective was to obtain GT400 diagnostics data on how the meter responded to the various tests. Several of the GT400s diagnostics clearly indicated the presence of liquids throughout most of the GVF testing.

Summary

The CEESI Wet Gas Testing graph above shows that, even with a liquid loading of 8,770 Lbs./MMSCF (4,740 GPH), the meter was relatively linear in over-registration up to the test requirements of 0.990 GVF. The GT400 shifted no more than +3.5% at the highest liquid loading with **all 6 paths still operating at 100% performance**. The meter's diagnostics were also reporting several changes that relate to the presence of liquids. Thus, when liquids become present in the metering system, **the GT400 is an excellent choice** to not only measure at least as accurately as an orifice meter, but clearly indicate that liquids are present. The GT400 also experienced **no path failures or transducer damage from the wet gas testing.** Because the meter's integrity was not compromised, it will be installed in a field custody application.