Effects of Hydrogen Injection on Emerson Rosemount Ultrasonic 8" Flow Meter Through DNV GL Joint Industry Project

DNV GL project

The following are some of the results of tests done as part of a JIP done by DNVGL for a group of end users and manufacturers.

Ggas which is simply Groningen gas present in the area of the test facility was used as the base and H_2 was injected in 5% volumetric intervals. The pressures were 16 and 32 bar, once the meters were setup for the tests using normal CH_4 gas there could be no other changes made to the configurations and the manufacturers could only collect logs.

Figure 1- Shifts from Baseline @ 32 bar (464 psi)

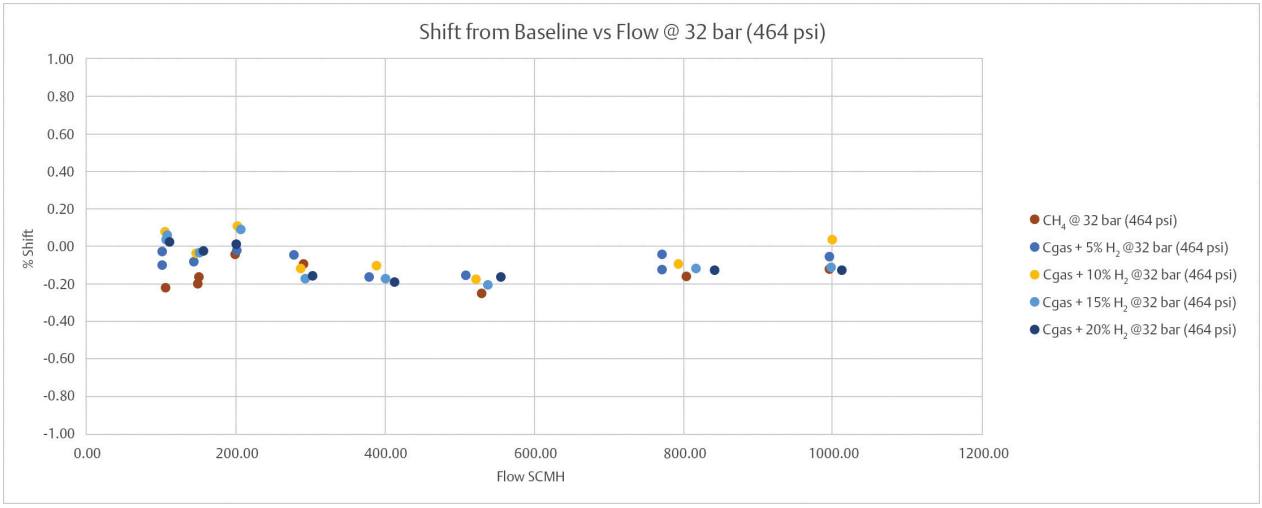
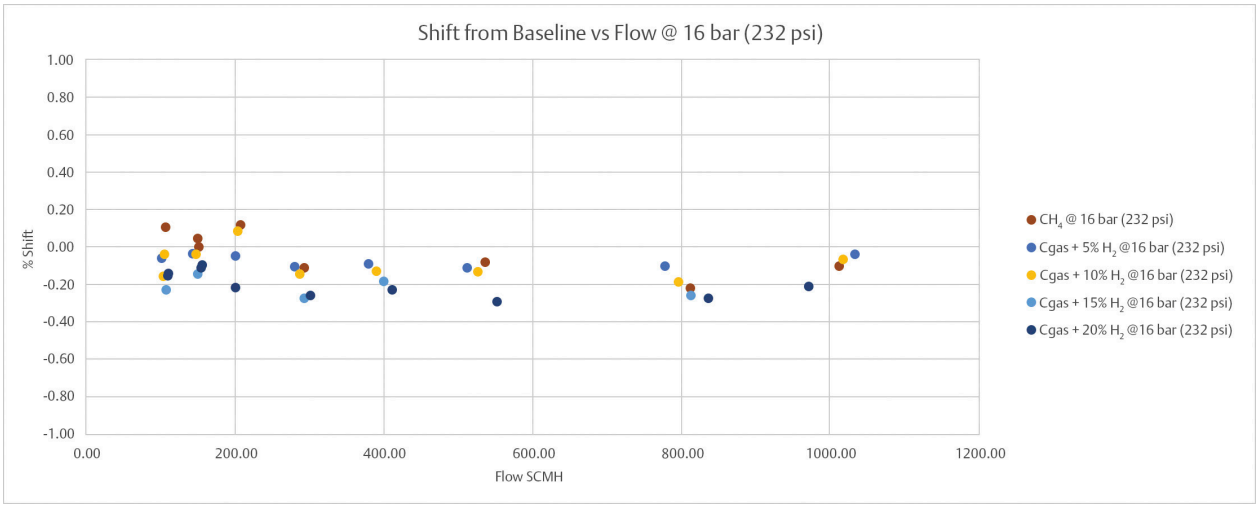


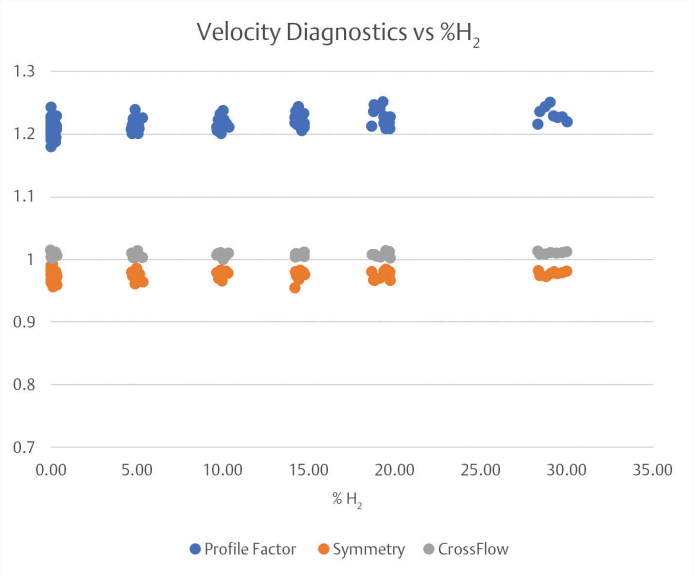
Figure 2 - Shifts from Baseline @ 16 bar (232 psi)



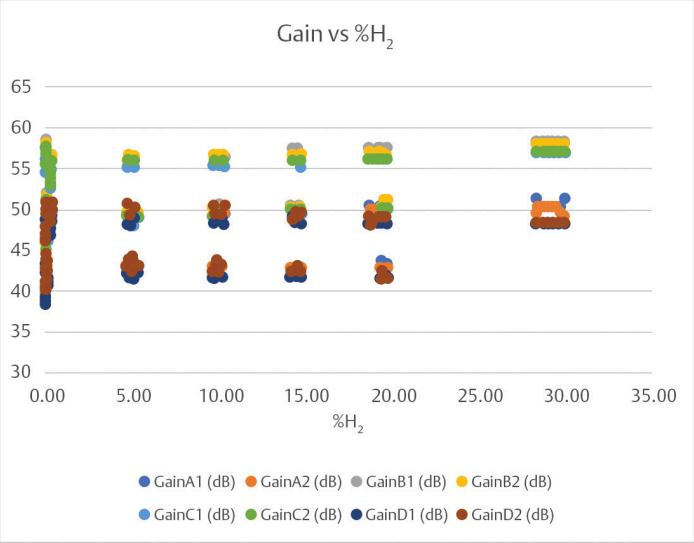
Diagnostic results

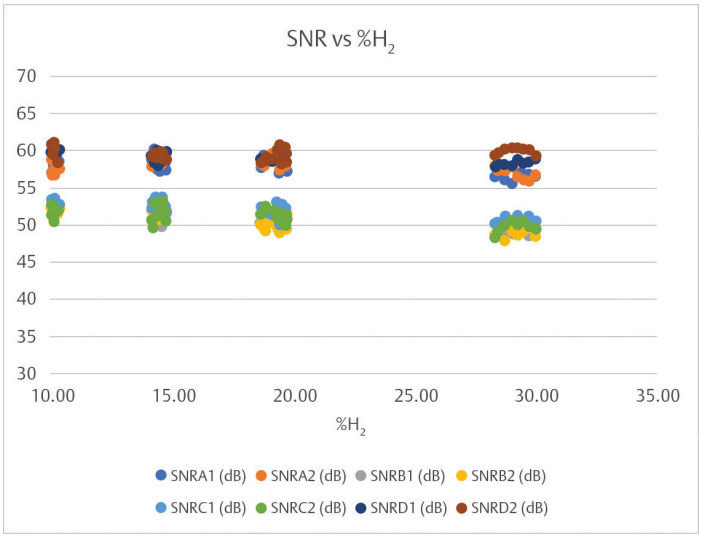
The diagnostic information for each test are plotted below with reference to the % of H_2, there is very little shift or difference in the velocity daignostics which confirm that the gas behaves similar regardless of the changes in density due to the H_2 percentages.

Figure 3 - Diagnostic Data



The strength of the signals showed very little change up until the 30% H_2 test which showed a slight increase in the gains of the outer paths A and D which was somewhat surprising considering that they are the short paths.





In conclusion there were very limited effects on the meter's performance and uncertainty with H_2 % up to 20%, this would indicate that the transit time measurements compensate for the changes in density which validates the basic theories of transit time measurements.

The 20% H_2 range seems to have become the target as it allows for reduction in the carbon footprint but still allows for the use of current devices and appliance without any modifications. As well the safety concerns of hanging explosive gases shows that mixtures 20% and less have similar characteristics to traditional natural gas and as such standard flame and gas detection equipment can be used with no modifications.

The following is an exert from a GTI document prepared for the DOE outlining Hydrogen Enriched Natural Gas (HENG) in existing pipeline and distribution systems.

1. Safety transcends all applications and is crucial to successful commercialization of hydrogen-based technologies. For lower concentrations of HENG, there is no substantial difference in risks, compared to natural gas.

2. Current results give confidence in the technical feasibility of using HENG at up to 20 percent hydrogen, by volume, in natural gas pipes, with respect to burst resistance, fast crack propagation, adhesion resistance of internal coatings and fatigue crack behavior.

3. Gas-quality management ensures that end users remain supplied with gas, in accordance with contractual specifications in order to guarantee safety, performance of appliances and billing accuracy. Although it is difficult to provide a general figure for acceptable hydrogen concentrations in natural gas, HENG up to 20 percent hydrogen by volume requires no significant modifications to most existing natural gas networks, meters and standard appliances.

Electric approvals

Currently the hazardous area approval for the USMs is Group C for North America and IIB for IEC, the statement below is from IEC 60079-10 and outlines the fact that for mixtures with less than 30% our current approval meets the requirements.

IEC 60079-10-1L2015 @ IEC 2015

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Annex H
(informative)

Hydrogen

H.1 The flammable range of hydrogen in air is between 4% and 77% by volume. Hydrogen is also commonly found in mixtures of flammable gases such as refinery process streams. With gas mixtures, the gas group should be considered as IIC or IIB+H2 where a gas mixture includes 30% or more of hydrogen by volume unless other specific data is available. The temperature class should be taken as the lowest ignition temperature for any gas exceeding 3% in the mixture.

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