Northeast GAS ASSOCIATION
NYSEARCH

Technology Brief

Impact of H_2 Blending on Threaded Connections

Description: **A testing program to evaluate impact of emissions from threaded connections with hydrogen blends up to 20% by volume**

Status: **Failure rate testing is ongoing with different thread sealant compounds and results are to be analyzed by statistician to provide meaningful conclusions**

BENEFITS

As decarbonization efforts to prepare and modify natural gas infrastructure are formally beginning, this project addresses the need for data regarding the impacts of alternate fuels on threaded connections. Specifically, the impact of blended hydrogen (up to 20%) is being evaluated to test if any changes are expected in the number of leaks from fittings constructed from joints that meet the NPT thread standard. This test effort builds on earlier phases of another NYSEARCH program, Reducing Emissions at Threaded Connections, by subjecting fittings in the test protocol to 20% blended hydrogen and quantify the change in the number of leaks as well as the leak rate, if any develop. Such results are intended to aid in making decisions to better implement and prepare the distribution system for hydrogen blending.

BACKGROUND

Several organizations and agencies are studying and testing the use of blends of hydrogen up to 20% (and some higher up to 100%) for use as a carbon neutral heating fuel and for use in industry and transportation. As the natural gas industry addresses decarbonization, it has a keen eye on the potential for leveraging the existing natural gas network. Thus, there is a lot of new and ongoing work studying the impact of hydrogen blends on various gas operations and assets. NYSEARCH is building on ongoing projects that focus on risk assessment to help accelerate the education needed for transition to fuels that aid decarbonization.

Related to a regulatory driver on methane emissions, NYSEARCH completed three phases of an ongoing project looking at how to measure whether threaded connections; both those that conform to standards and those that do not, contribute to methane emissions or fail in the form of leaks. With the work in that project, we have established a process for measuring whether threaded connections leak over time for a range of pressures and temperatures.

With the existing process and equipment setup, this NYSEARCH project will use similar test methodology but consider what is needed to examine whether and to what extent blended hydrogen could create more leaks in threaded connections and other connections near the meter set.

Hydrogen is a much smaller molecule than methane and will influence leakage within the distribution system. How hydrogen (up to vol 20%) affects leakage at threaded connections throughout the distribution system will inform utilities on how to adapt current natural gas infrastructure and procedures for hydrogen blends up to 20 vol%.

Figure 1 Experimental Set-up for evaluating threaded connections

TECHNICAL APPROACH

The overall objectives of the NYSEARCH program are to evaluate the impact of blended hydrogen on threaded connections and determine if failure rate or flow rates of those failures increase with blended hydrogen.

The first part of the project established safe and effective benchtop testing procedures to ensure repeatable and reliable methods during experimentation with pure methane (CH4) and methane-hydrogen blend (80% CH_4 / 20% H_2). In the next tasks, a rigorous test protocol was developed and implemented to perform comparative leak testing between CH_4 and H_2 blends. Specifically, the tests were designed to compare the performance of NPT thread joints against a combination of different thread sealants and out-of-spec thread joints. A statistical analysis is to be performed to determine the difference, if any, of failure rate between threaded connections exposed to pure CH_4 and H_2 blend.

To understand if a failure at a threaded connection leaks more when a hydrogen blend is operating through the distribution system, a specific gas "bounce" test methodology was established for this project. This bounce methodology allows testing failed threaded connections at a constant pressure and exposing the joints to pure CH_4 and H_2 blend to make a direct comparison of the leak flow rates.

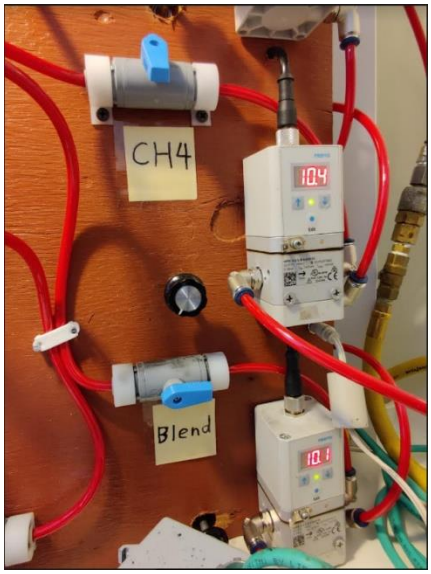

Figure 2. Test set-up for bounce testing between CH4 and H2 blend

PROGRAM STATUS

Failure rate testing with different thread sealant compounds is near complete. The statistician will be provided those results for analysis. The leak flow rate testing is anticipated to be complete by first quarter of 2023.

Highlights

- A program to measure and evaluate the impact of blended hydrogen on the failure and leak rates of threaded connections in Meter Set Assemblies.
- Initial results are showing negligible difference in failure rate and flow rate of threaded connections when exposed to hydrogen blend, up to 20 vol%.

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