

Management Summary - Gas pressure regulating station operating on hydrogen

The Dutch gas distribution network operators want to determine the suitability of existing – or possibly limited adapted – gas pressure regulating stations for natural gas for use with pure hydrogen (H₂).

At present it is not known whether the current natural gas pressure regulating stations are suitable for reducing hydrogen in pressure in a correct, reliable and safe manner.

The aim of this project is to gain insight into the operation and suitability of a new gas pressure regulating station, by means of practical tests, when hydrogen is used instead of natural gas.

Main research question: is the natural gas pressure regulating station technically suitable for use with hydrogen?

On behalf of the network operators a gas pressure regulating station was provided by Rendo for carrying out the tests. The capacity of the gas pressure regulating station is 750 m³/h (natural gas) at the minimum inlet pressure of 3 bar. The nominal inlet pressure is 8 bar and the nominal outlet pressure is 100 mbar. The gas pressure regulating station complies with NEN 1059 (the Dutch version of the European standard for gas pressure regulation installations EN 12186).

For the execution of the tests a measurement protocol was developed specifying the steps, conditions and measurements to be taken for all tests. In addition to the measurement protocol, vibration and pulsation measurements were performed.

The gas pressure regulating station was first tested with natural gas up to a maximum of 750 m³/h. The gas pressure regulating station was subsequently tested with hydrogen up to a maximum flow rate of 2,250 m³/h.

Conclusion

Based on the measurements, as presented in this report, the main conclusion is:

The tested gas pressure regulating station designed for natural gas can be used for hydrogen without modification.

Note:

The conclusion only concerns the technical functioning. No statement can be made about long-term behavior.

Recommendations

In addition to the investigation in the context of the HyDelta work packages, it is recommended to investigate (existing) stations with different configurations as well as stations with another type of frequently used controller.

Explanation:

- An installation in a housing with a volume of approximately 0.5 m³ was investigated. Installations with other configurations are, for example, installations in a cabinet (2 by 1 m) and a free-standing building, as well as pressure regulator stations for households.
- By researching the most common combinations of configurations and pressure regulators, the occurrence or non-occurrence of resonances can be determined for those combinations.

Other recommendations are:

- Investigation of the cause and effect of the unstable outlet pressure (high frequency pressure fluctuations) is advised, if it recurs again.
- Further research into the functioning of directional control valves under hydrogen conditions.
- Further research into the functioning of safety shut-off valves under hydrogen conditions.