Hydrogen Storage Wells

VAM® 21 Successfully Qualified

SETTING THE PATH FOR CONNECTION QUALIFICATION

- Existing ISO 13679/API 5C5 not fully adapted for hydrogen storage wells.
- Validate the connection's tightness to hydrogen and its integrity in operational conditions.
- Dedicated protocol to simulate well lifecycle.
- Establishing leakage acceptance criterion as 10 times more stringent than standard OCTG application.

- Internal pressure cycling at temperature with mechanical load.
- Thermal + pressure cycling with mechanical load.
- Internal pressure with bending.
- Internal pressure capped-end.

OBJECTIVES

- Evaluate the hydrogen leak potential vs. other gases (Nitrogen, Helium, Methane).
- Physically assess the connection's tightness with 100% hydrogen.
- Develop a new testing protocol suitable for hydrogen storage operations.
- Perform full-scale validation testing.

STATE-OF-THE-ART TESTING CAPABILITIES

- Several testing frames able to apply up to 3,000 T of tension and 2,500 T of compression.
- Bending up to 2,000,000 N.m.
- Pressure with gas up to 2,400 bars.
- Hydrogen and helium leak detection system by spectrometry.

ENSURING TIGHTNESS EVEN WITH THE SMALLEST MOLECULES

Full-scale testing has been carried out on VAM® 21 with gas mixtures including 5% to 100% of hydrogen. Consistent results showed significantly low leak rates, always within acceptance criteria.

Therefore, pure hydrogen application validation can be achieved with only 5% H_2 gas mixtures and is recommended for safety reasons.

EVALUATING OPERATIONAL CONDITIONS

- Daily & seasonal storage modes.
- Temperature & thermal cyclic loads associated to H_2 storage.
- Extreme hydrogen pressure loads.

Internal pressure operation	275 bar
Internal pressure maximum	560 bar
Pressure cycling	>5,500 cycles
Maximum tension	440 T
Maximum compression	440 T
Temperature range	10°C - 70°C
Gas mixture (hydrogen leak detector)	5% H_2/95% N_2

A SUCCESSFUL TESTING METHODOLOGY

- Specific testing methodology & equipment has been put in place.
- 100% hydrogen application validation can be achieved with only 5% H_2 gas mixtures.
- VAM® 21 successfully evaluated with H_2 for storage applications (up to 560 bar).

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