

Storage Cavern Operator Successfully Helium Tests Casing Connections

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Abstract

Having previously experienced suspect casing connection leak resistance, a storage cavern operator (SCO) recently chose a new vendor with the capability to internally pressure test each casing connection with a helium/nitrogen mixture and detect potential leaks with a highly sensitive mass spectrometer.

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Hydrocarbon storage wells (figure 2) utilize multiple strings with premium connections. These casing strings are subjected to pressure and pressure changes both internally and externally throughout their service life. To ensure the gas integrity and leak resistance of each casing connection, SCO elected to have the connections internally gas tested.

The following strings were tested this summer at the SCO's location –

13 3/8" 68# K-55 SLX
7 5/8" 26.40# K-55 SLX
10 3/4" 51# L-80 SLX

Test Procedure

The information listed below provides details of gas test equipment (figure 3) utilized on SCO's casing string testing. In addition a pre-job quality assurance protocol is provided and our standard operating procedure

EQUIPMENT

- Loomis proprietary self-contained hydrostatic test unit with gas control panel
- Casing tool draw works
- Gas accumulator
- Containment sleeve
- Mass Spectrometer with vacuum probe
- Pressure and helium recording CT3000 computer
- Rack of helium/nitrogen bottles
- Helium test tool dressed for specific casing
- Sheave and shackle
- Control air hoses
- Hydraulic hoses for draw works

- High pressure test tool hoses

OPERATOR QUALITY ASSURANCE PRE-JOB

Test tool

- Assemble tool under supervision of senior operator and district manager
- Verify assembly with 504 manager in Pasadena
- Test functionality of tool – mandrel movement, port sub release, packer set and connection make-up
- Provide duplicate of port sub release and pressure port parts, back-up soft packers, hard rings to redress tool
- Duplicate all o-rings in tool assembly

Test unit, draw works and accumulator

- Run test unit maintenance check list
- Verify and change fluids as needed
- Function test gas panel, draw works and accumulator with test unit
- Verify completeness of standard spare parts for test unit, air pots, pump, accumulator, draw works and hoses

Mass spectrometer

- Assemble and calibrate mass spectrometer
- Run sniff test to verify calibration

CT3000

- Hook-up pressure module and helium detection
- Run mock test in conjunction with mass spectrometer and test unit
- Print out mock test as verification of completed procedure

Rig-up

- Spot test unit and draw works (figure 4)
- Secure draw works
- Hang sheave and run cable through same
- Spot mass spectrometer and CT3000, hook-up same
- Place tool on floor
- Hook-up tool to cable and pressure line
- Spot helium rack and hook-up to gas panel
- Run all other hoses

Pre-job test

- Function test unit
- Function test gas panel with accumulator
- Function test tool
- Probe test of mass spectrometer
- Function test CT3000 pressure and helium module

JSA

- Prepare and present Job Safety Analysis
- Hold tail gate safety meeting and go over JSA

Running procedure

- After make-up of each connection, lower tool across connection internally (verified by marker on cable line)
- Install containment sleeve
- Pressurize tool to required test pressure with gas
- Hold pressure 90 seconds, minimum
- Release pressure, pull tool

- Probe containment sleeve for helium, 15 seconds each side
- No leak - remove containment sleeve and proceed to make-up next joint
- Leak - remove containment sleeve, break-out connection, clean and visually inspect connection for obvious damage, if none found, remake and re-test
- Damaged connections and second test failures (leakers) are to be laid out
- Manual probe test and verification is done every fifth joint and noted on hand charts, as well as leakers and rejects

CONCLUSION

The SCO successfully ran and gas tested their critical casing strings with the assurance that the premium connections were properly made-up and gas tight. Internally gas testing of connections is the only direct measurement of the leak resistance of a threaded tubular connection.

Historically, our data base shows that one out of five strings of tubulars gas tested will have at least one leak detected. This statistic is based on the first run of new tubulars with premium connections that were torque-turned.

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FIGURE 1

13 3/8" Production Casing

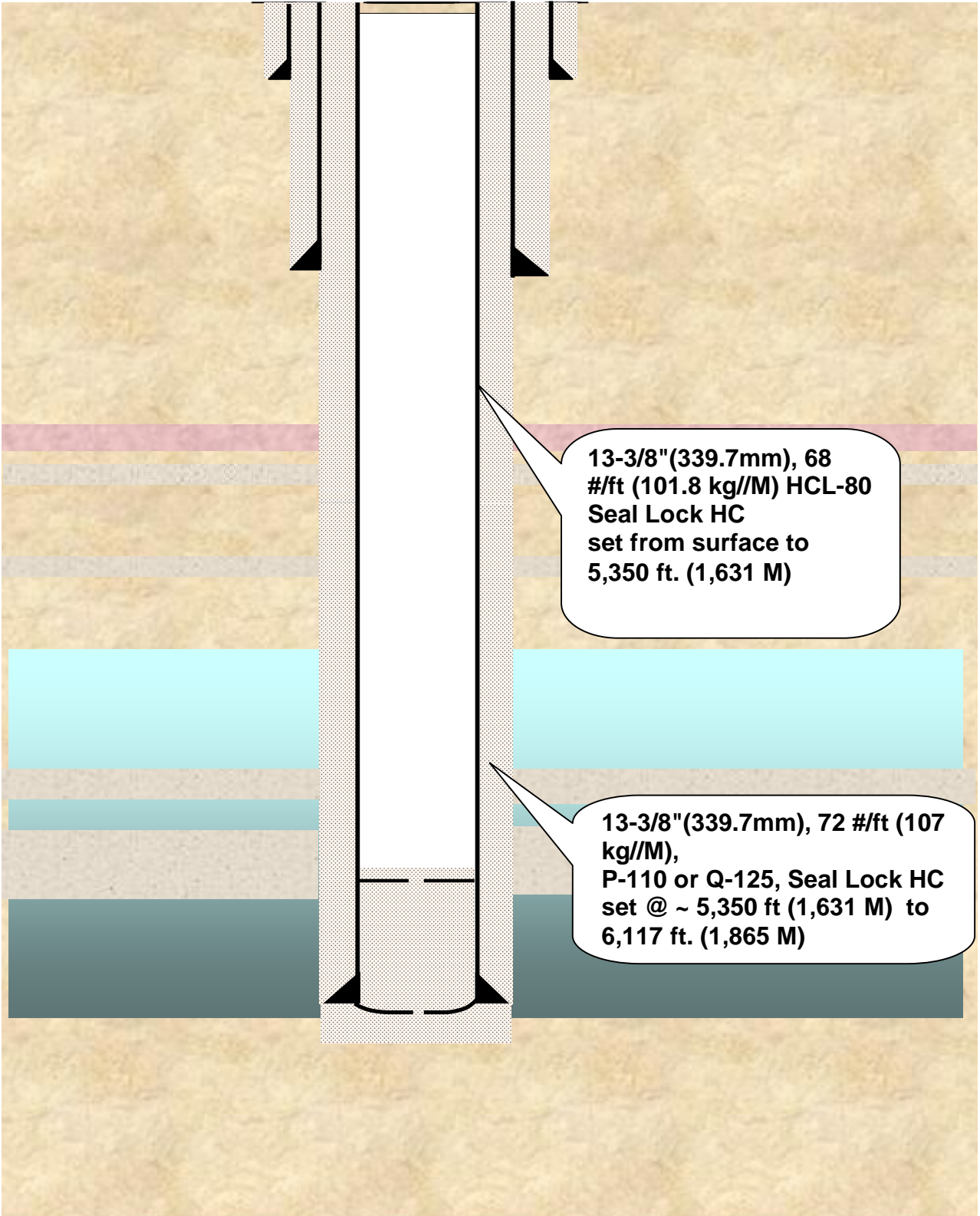


FIGURE 2

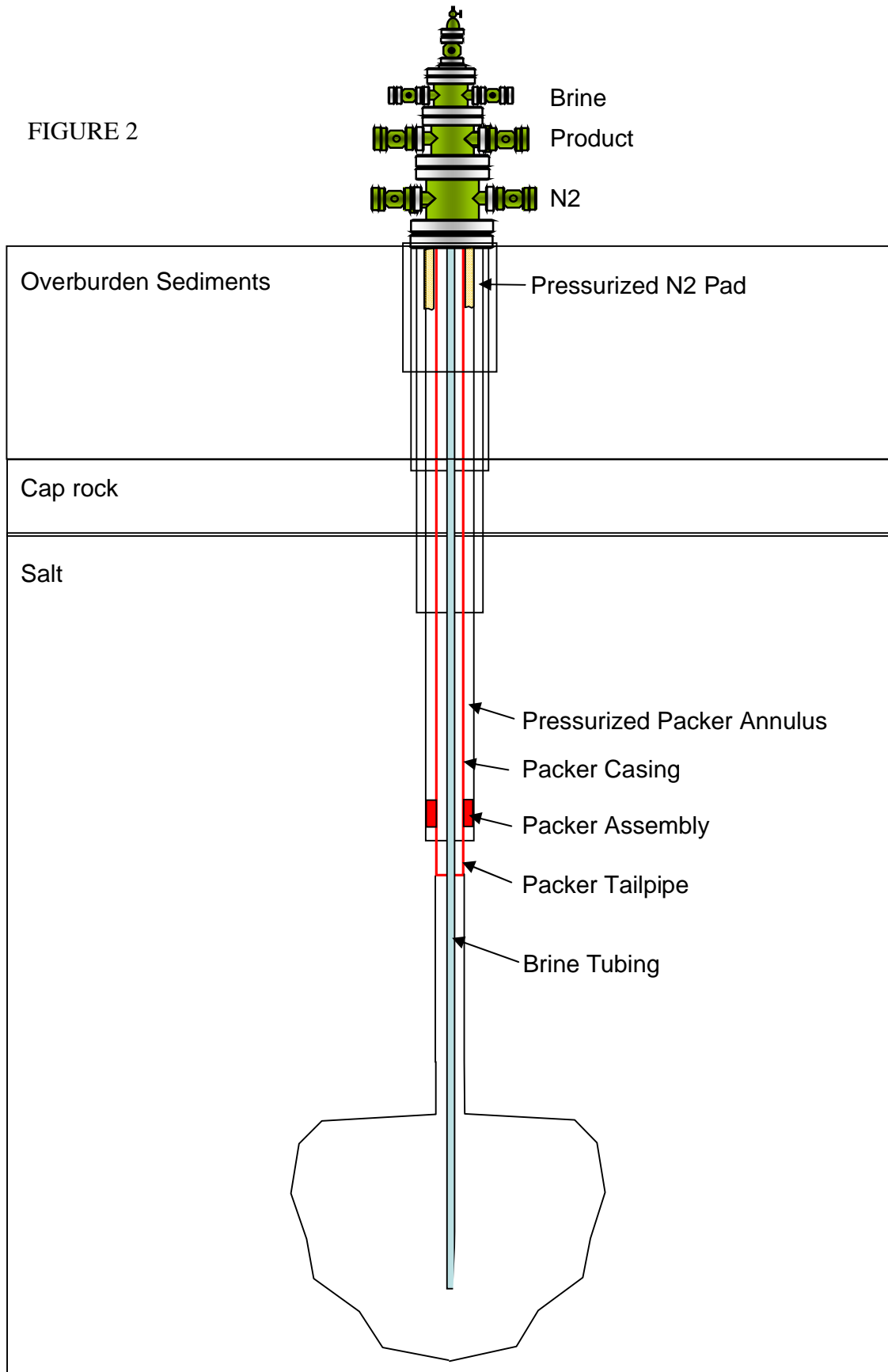


FIGURE 3



Major Components

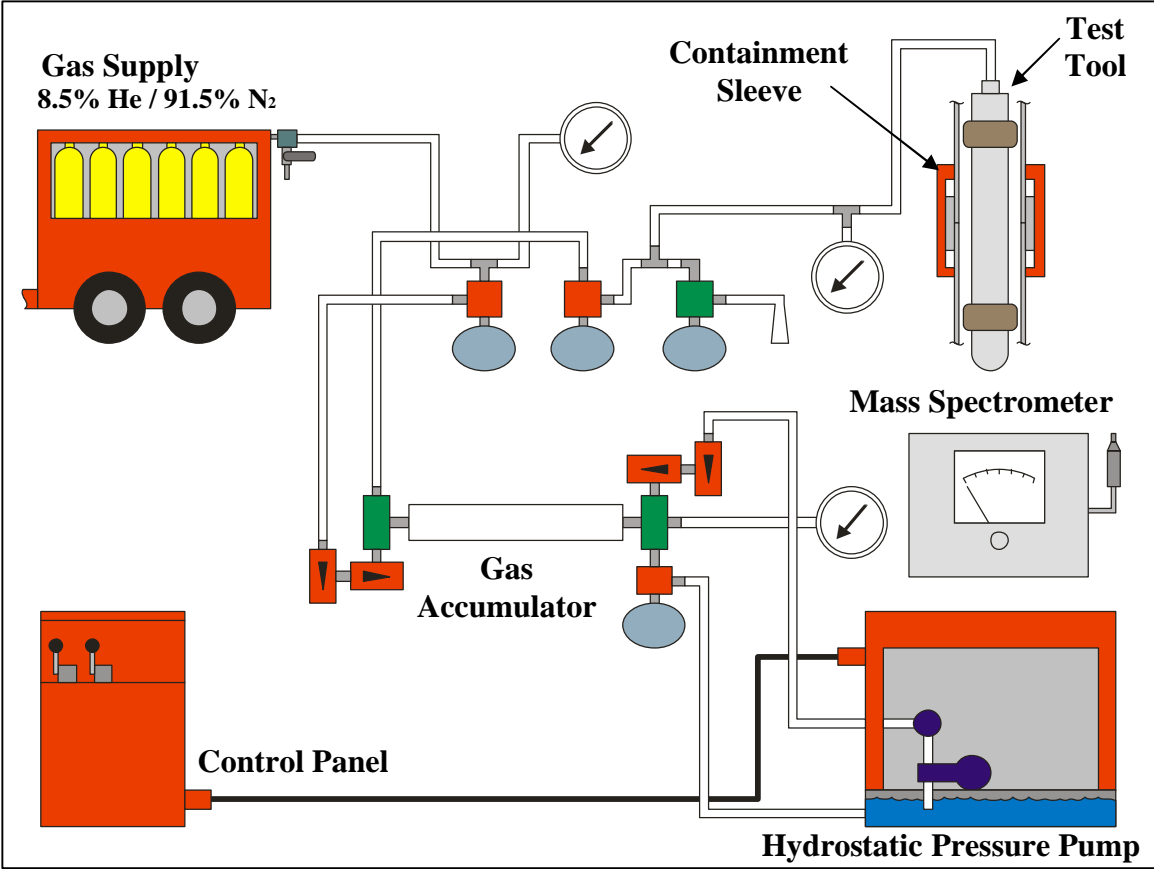
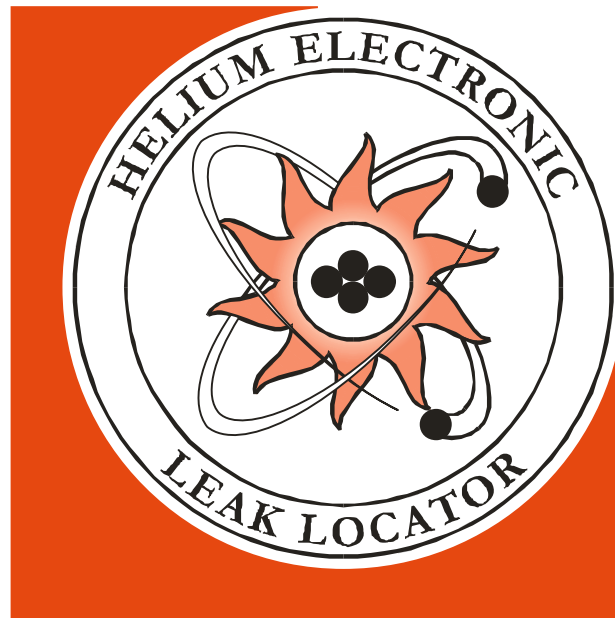
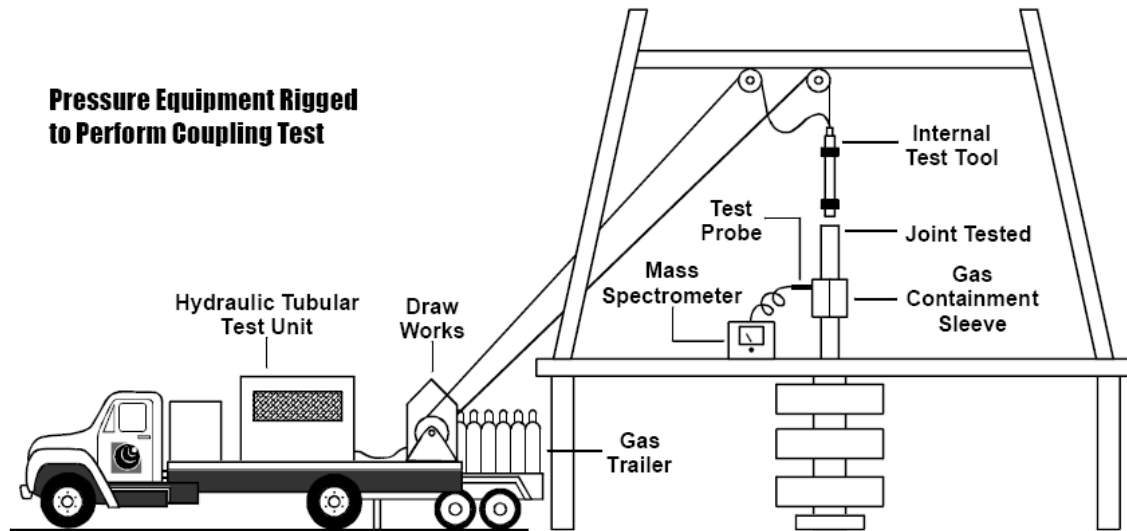


FIGURE 4



Helium Electronic Leak Locator