Vacuum & Pressure Test Procedure for SHMS Magnet's He, LN2 & OVC
Revision 2
Jan 12, 2015

Description:
Pressure and vacuum leak tests are required of the Helium vessel, LN2 circuit and the outer vacuum container (OVC) of the final assembled magnet. The following procedure combines the pressure testing of the He and LN2 circuits with the internal vacuum leak check of the OVC.

The test pressure of the He and LN2 circuits will be 95 psig with the OVC under a vacuum. This test pressure condition is restricted to the previous maximum pressure test conditions of the cryo-can reservoir (CCR), tested separately.

The Helium and LN2 circuits are, for the most part, shielded by the thick walled OVC. The exposed components of the pressurized systems are located at the top of the CCR. These components, along with the CCR have been tested previously by its manufacture.

Access to the top of the CCR will be restricted to trained personal wearing hearing protection and safety glasses. Signage will be put in place around magnet during test indicating Magnet is undergoing pressure testing and proper PPE requirements.

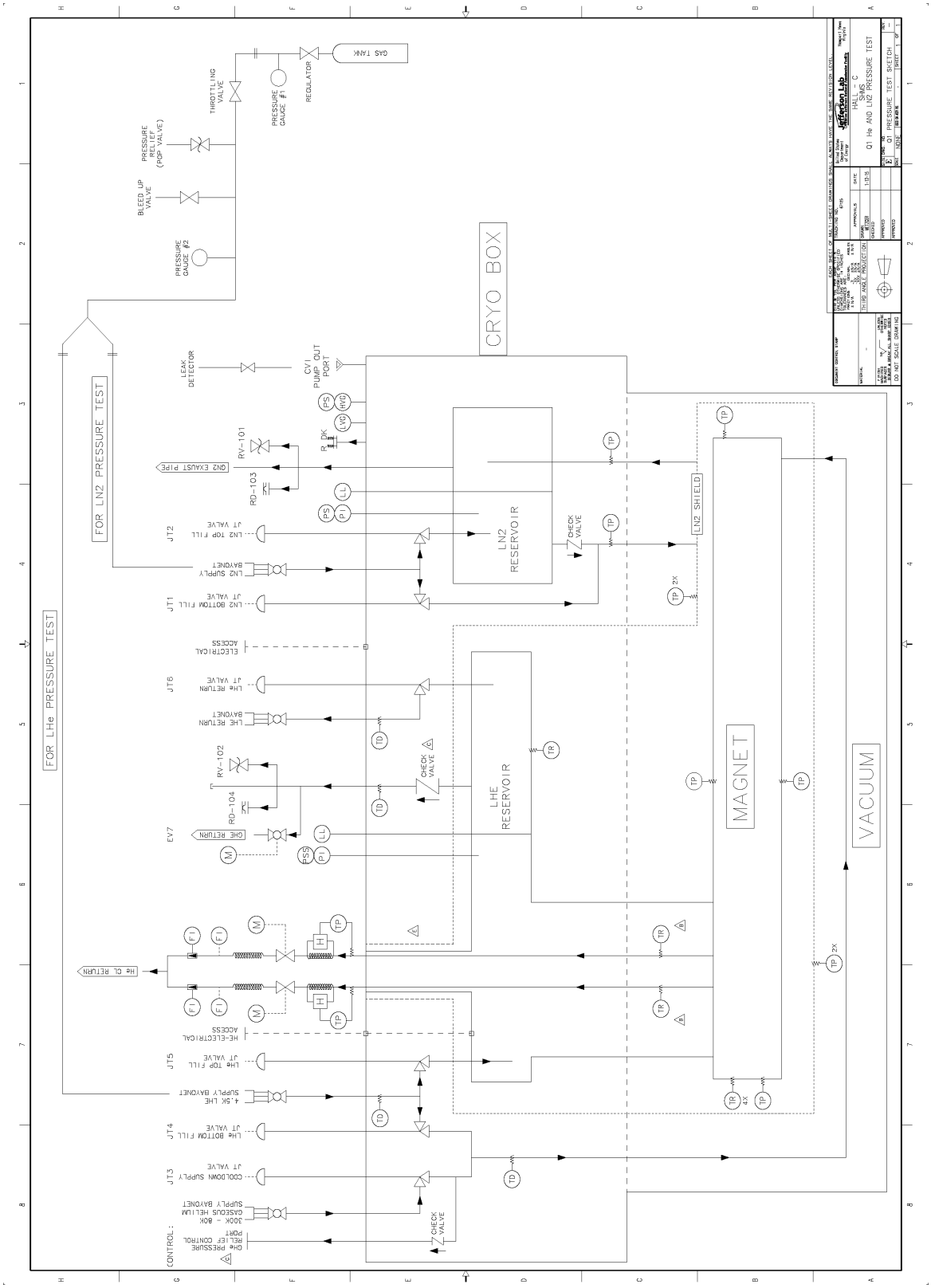
Continuous electronic recording of pressure and vacuum is recommended.

Equipment:

1. Calibrated Pressure Gauge:
   Minimum range of 0 to 150 psig with 0.5 psi resolution.
   Preferable with digital/analog output.
2. Test gauges: visual, digital or analog. Resolution of visual gauge 0.5 psi or less, 0.01 psi or less for digital or analog gauges.
3. Inline Pressure relief valve (preferable ASME):
   Preset on bench to Pressure set pressure +1.0 psi
4. Gas Sources:
   He gas
   N2 gas
5. Regulator
6. Throttling valve
7. Isolation and Bleed up valve and lines.
8. Pressure rated hoses, tubing
9. Clamps, fittings, connectors.
10. Vacuum pump.
11. Leak detector with digital/analog output
12. JT valve stem retainer caps

Process:

1. Install JT valve stem retainer caps on each of the JT ports. Caps should be set such that the valves are partial opened (~50%).
2. Ensure that all U-tube valves are closed and capped off. Blank offs shall be securely tightened on all unused ports, relief tree port , liquid level ports, pressure gauge ports, etc.
3. Bench set up and verify inline pressure relief to test pressure plus +1.0 psig
4. Bench test and verify all test gauges to the calibrated gauge at the following spacing: 0, 50%, 75%, 100% and 150% of test pressure. Record values during charging up and discharge.
5. Calibrate just the leak detector with calibrate leak source. Record and use correction for test.
6. Setup the calibrated leak source at point furthest from leak detector connection. Valve off calibrate leak source.
7. Hook up leak detector to OVC and leak check connecting piping prior to pressure test.
8. Pull vacuum on OVC insulating space. Pump/purge OVC space with LN2 gas until leak detector can handle load on its own.
9. Leak detector should be in the low 10-9 range (corrected).
10. Leak check the external surfaces of the OVC/Cryo-Can.
11. Pull vacuum on He vessel and LN2 circuit. Allow circuits to clean up.
12. Valve off pump and measure rate of rise, duration of 15 minutes.
13. Hook up He gas source to magnet He circuit and slowly charge to 1 atm gauge. Set regulator to pressure and use metering valve to slowly charge circuit.
14. Shut off metering valve and hold at 1 atm pressure for 15 mins. Monitor and record leak detector on the OVC.
15. Unhook He gas source and connect N2 gas source to charging line.
16. Finish charging circuit to be tested with N2 gas using the following process:
    a. Set regulator to pressure and using metering valve slowly charge circuit to test pressure. Shut off metering valve once test pressure has been obtained.
    b. Charge to 50 psig (~1/2 of test pressure) and hold for 2 minutes.
    c. Continue to slowly charge system at 10 psig increments, waiting 2 minutes after each 10 psig step.
    d. Final increment will be a step of 5 psig to full test pressure of 95 psig.
17. Valve off gas source and monitor test pressure and OVC vacuum for 1 hour.
18. Vent He circuit, preferable to outside of room.
19. Repeat pressure test for LN2 Circuit, steps 11 through 18.
20. Open calibrated leak source to leak detector and record response time and levels.
21. All parties involved in testing shall sign datasheet.


CRYO BOX
LN2 RESERVOIR
LHE RESERVOIR
MAGNET
VACUUM
LN2 SHIELD
FOR LN2 PRESSURE TEST
FOR LHe PRESSURE TEST
GAS TANK
REGULATOR
PRESSURE GAUGE #1
THROTTLING VALVE
PRESSURE RELIEF (POP VALVE)
BLEED UP VALVE
PRESSURE GAUGE #2
LEAK DETECTOR
CV1 PUMP OUT PORT
RV-101
RD-103
RV-102
RD-104
CHECK VALVE
JT1
JT2
JT3
JT4
JT5
JT6
EV7
HALL C
Q1 He AND LN2 PRESSURE TEST
Q1 PRESSURE TEST SKETCH