Stand 4 Cryogenic Operations for Testing MQXFA Magnets

R. Rabehl
February 24, 2021
Test Stand 4

- The test stand (test bench) occupies the fourth position on our cryogenic distribution box.
Test Stand 4 Equipment

- An Adapter Box was installed on the existing Feed Box.
- A new return end vacuum vessel was built.
Test Stand 4 Equipment – Feed Box

- Interfaces
  - LHe and GHe supplies
  - LN2 and GN2 supplies
  - (3) 15 kA vapor-cooled current leads
  - Pumping line
  - Fill valves
  - Instrumentation
Test Stand 4 Equipment – Adapter Box

- Interfaces
  - Non-IP end interconnect
  - Thermal shields
  - Lambda plug
  - Lambda valve
  - Cooldown return
  - Quench line
  - Cold mass relief valves
  - Instrumentation
Test Stand 4 Operations – Cooldown/Warmup

- Controlled cooldown/warmup are automated through the process controls PLC based on requested mass flow rate, measured cold mass temperature, and ΔT requirement.
- For a GHe supply temperature between 300 K and 80 K, mix 300 K GHe with 80 K GHe.
- For a GHe supply temperature below 80 K, mix 80 K GHe with 4.5 K LHe.
- Flow into the Feed Box and then through the Adapter Box and the Cold Mass.
- Flow returns through the LD line and the Adapter Box cooldown return, back to the compressors.
Test Stand 4 Operations – 1.9 K operations

• Supply LHe to the X line heat exchangers from the Feed Box, which includes a J-T heat exchanger.
• LHe collects in a reservoir at the return end (IP end) of the Cryo-Assembly.
• X lines are connected through the Adapter Box to the Feed Box pumping line.
• 1.9 K Cryo-Assembly is separated from the 4.5 K Feed Box by the lambda plug and lambda valve built into the Adapter Box.
Test Stand 4 Operations – 1.9 K operations

- Test stand is pumped on by two Roots blower/liquid ring pump vacuum skids.
- Upstream control valve throttles pumping speed to control Cryo-Assembly temperature.
Test Stand 4 Operations – Quenching

• Through the Adapter Box and an intermediate valve, the Cryo-Assembly can be connected to the Quench Tank.

• The Quench Tank is one of the test facility’s 30,000 gallon (114 m³) GHe storage tanks that can be reconfigured.