

**Operation Readiness Clearance (ORC)
of
SpinQuest (E1039) Polarized Target (summary
for the final walkthrough)**

ORC – 2055 (Responses to the recommendations)

SpinQuest Collaboration

Below are our responses to your comments/recommendations.

1. We note that Vacuum pump piping mechanical installation and supports, and electrical installation, is being addressed by separate reviews.

> The ORC (1847.03) is signed and approved. Don Mitchell recommended installing some clamps (on the west wall mounts) further constraining the movement of the main roots piping. This will be done by a technician as soon as possible.

2. PID should be updated with UVa comments and corrections noted during installation.

> Dustin contacted Grace to make these corrections.

3. For LHe flow to the separator vessel, the small Cryofab u-tube does not have relieving of insulating vacuum space in the event of internal leak and warming of gas. Currently, it has isolation valve and blanked off KF flange. Replace that setup with one that provides adequate relieving (for example, pump-out that cannot hold pressure)

a. Project engineering team needs to inspect system for other utube installations to confirm they have adequate insulating vacuum relieving.

> If there is an internal leak inside the u-tube (vacuum space connected to liquid helium transfer space), then the insulation vacuum space connects directly to the magnet helium space and separator helium space. Both of these helium spaces have separate safety relief paths. There are no closing valves on either side of the u-tube, so trapping helium in the vacuum space is not possible. In addition, we have already taken the steps to acquire a u-tube with SV-9 pump-out port (pump-out port is also functioning as an emergency relief valve).

Furthermore follow-up:

In an incident of the transfer line inside the u-tube is broken, then the entire u-tube becomes a single space (transfer tube space + insulation vacuum space of the u-tube) which connects to the magnet, and separator helium space. Therefore, the excess pressure can be relieved either from the magnet relief valves or the separator relief valves.

“Oh, I see you are saying utube insulating vacuum space under internal rupture conditions is now common with magnet and separator helium space. One problem is the magnet and separator space are rated at MAWP that does not consider pressure rating of the utube insulating vacuum space construction and components. Another problem is there would be high pressure drop from rapidly boiling liquid in the utube insulating vacuum space through a cracked inner line then out the magnet and separator reliefs. Potentially, utube vacuum space could be much higher pressure than the magnet or separator relief set points. ” ~ Bill

In addition to the current u-tube that we have installed, we are purchasing another u-tube with the same dimensions with a relief on the pump-out port as an additional safety as you recommended. But the current u-tube will be also safe to operate in such a situation as mentioned/described above.

“For the reasons above, the utube insulating vacuum space needs relieving. I disagree that the current one, with capped off vacuum space, is safe to operate. If you want to use it, add relief or pumpout that does not allow positive pressure to be held. I understand this utube will not be used for magnet conditioning, is this correct?” ~ Bill

Yes, we would like to proceed with the magnet cooldown commissioning without using the u-tube at the moment with the approval on the magnet cooldown ORC 2056.

Please see the supplemental files for a technical drawing of the recently ordered u-tube which includes the relief mechanism on the pump-out port; Also, the drawing from cryofab for the existing u-tube.

4. PID to be updated to indicate that LHe supply to separator is u-tube connection. Currently, shown as simple line only.

> Dustin contacted Grace to make these corrections.

5. For magnet safety relief lines flex hose to rupture disk, one of the KF flange seals is reddish color while other seals are black. Check temperature compatibility of seals for these lines.

a. Project engineering team needs to inspect system for other KF flange seals to confirm compatible temperatures if they can get cold.

> The experiment is ensuring that cryogenic seals are used everywhere the cryogenic vapor is used. Aluminum knife edge EVAC seals are used.

