Change Control Risk Assessment Checklist

Change Proposal: To change the relief circuit for the absorber insulating vacuum from a dedicated line going via a relief valve situated inside the gas panel to making use of the existing vacuum pumping line, incorporating a bypass of the turbomolecular pump and parallel relief valves upstream of the backing pump.

Does the proposed change:
(If 'Yes', identify if 'change intent' or how to be addressed. Record and assign any actions arising.)

A. Safety/Environmental

1. Impact on the basis of safety? ***Yes***

Without this change, the safety windows would not have sufficient safety margin in the event of an absorber failure. The infrastructure as it exists would not be safe.

2. Introduce or alter any potential cause of over/under pressurisation/vacuum or raising or lowering the temperature in the system or part of it? ***Yes***

As described above, this change will limit the pressure rise inside the insulating vacuum to an acceptable level when subject to absorber window failure.

3. Go outside the safe operating pressure/temperature limits and/or the design pressure/temperature? ***No***

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4. Affect equipment installed to prevent or minimise over/under pressure or temperature? ***No***

Click here to enter text.

5. Require Emergency Shutdown Trips, interlocks or alarms or affect existing ones (e.g. test frequency)? ***Yes***

An interlock currently exists to close the vacuum line gate valve in the event of vacuum failure. This must be reversed – it is proposed to remove remote control from the valve by unplugging the air supply, effectively locking it in the open position.

6. Introduce new vents, or a valve or other device which may isolate or block an existing vent or relief line? ***Yes***

The new relief line introduces three components which could be considered potential blockages:

- The gate valve. This will be locked open by removing the air supply for actuation and implementing relevant operating procedures.

- The turbomolecular pump. This will likely fail in a catastrophic manner if it is subjected to a rapid pressure wave, creating a significant flow blockage. As such, a bypass will be implemented using a welded burst disk assembly and large bore pipe.

- The backing pump. This is not designed to take the flow rates likely experienced in the scenario being considered. As such, two high-flow cryogenic relief will be situated immediately upstream of this pump.

7. Introduce the potential for leaks of material, especially flammable, toxic, corrosive and/or those onto hot surfaces? ***No***

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8. Introduce new sample points (for flammable, toxic or corrosive materials)? ***No***

Click here to enter text.

9. Alter the hazardous area classification (zone, gas group, temperature class)? ***No***

Although the concentration of hydrogen in the pump enclosure would be higher than originally anticipated, it would not persist for long enough, nor be a common enough occurrence, to justify uprating the ATEX zone for the enclosure.

10. Affect safe access for personnel, vehicles and equipment or affect means of escape or affect access to safety showers or other key equipment? ***Yes***

The use of the pump enclosure as the vent space for this scenario will mean access if prohibited during liquid hydrogen operations. This will be controlled by integrating the enclosure key into the control system key panel – removal of the key during hydrogen operations would instigate a visual and audible warning.

11. Adversely affect plant layout ie make key equipment hard to reach or operate? ***No***

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12. Affect the fire protection system (hydrants & sprinkler systems, etc.)? ***No***

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13. Affect Personnel Protective Equipment requirements? ***No***

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14. Affect the inspection interval of an equipment item or group of items? ***Yes***

Relief valves and burst disks will require inspection and testing – see maintenance plan

15. Require further Hazard Studies, HAZOP, etc? ***No***

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B. Process Conditions and Quality

1. Affect the controllability of the process? e.g. reaction, heating, cooling, agitation, etc. ***Yes***

Due to the requirement to lock open the gate valve, isolation of the cryostat for diagnostic purposes, such as leak checking, will be more difficult. However, the gate valve can be manually activated if necessary.

2. Allow new mixing of process streams? ***No***

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3. Involve a change in a raw material or its specification? ***No***

Click here to enter text.

4. Alter the composition, physical properties or specification of any in-process materials, including recycle streams? ***No***

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5. Alter the composition, physical properties or specification of the finished product? ***No***

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6. Alter the composition, physical properties or specification of any solid, liquid or gaseous effluent stream? ***No***

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7. Introduce the potential for blockage of process materials? ***No***

Click here to enter text.

8. Involve reworking of material, not covered by the operating procedures? ***No***

Click here to enter text.

9. Affect shutdown, start-up or cleaning operations? ***No***

Click here to enter text.

C. Engineering Considerations

1. Require engineering design (civil, electrical, mechanical, process, instrument, systems)? ***Yes***

Requires mechanical design to implement bypass burst disk. Electrical modifications are only to remove the software interlock for closing the gate valve in a vacuum failure.

2. Affect the civil & mechanical integrity (foundations, supports, vibration, etc.)? ***No***

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3. Affect guarding? ***No***

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4. Introduce new or alter existing electrical equipment? ***No***

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5. Affect electrical earthing (grounding)? ***No***

Click here to enter text.

6. Introduce new or alter existing safety hardware? ***Yes***

Burst disk and two relief valves.

7. Affect process equipment upstream or downstream? ***No***

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8. Affect the interlinking of vessels? ***No***

Click here to enter text.

9. Affect any critical instrumentation, whether safety, environmental or quality related? ***Yes***

A different hydrogen alarm will be triggered in the event of an absorber breach to the previous setup (pump enclosure as opposed to vent line). However, the resulting operator actions remain the same.

10. Use different materials of construction? ***No***

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11. Affect any other jobs? ***No***

Click here to enter text.

12. Make any facilities, equipment, alarms etc redundant? ***No***

Click here to enter text.

D. Operating and maintenance methods

1. Require change to Operating Procedures or Maintenance Records? ***Yes***

Operating Instructions will require alteration. New safety equipment will be included in the maintenance plan.

2. Require additional training of personnel? ***No***

Click here to enter text.

3. Require changed to engineering drawings or other Process Safety Information? ***Yes***

Process and Instrumentation Diagram requires modification to represent new relief circuit.

E. Other Considerations

Introduce any other hazard potential or potential impact on operations or maintenance? ***No***

Click here to enter text.