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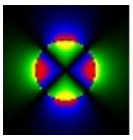
Magnet Division Procurement Specification

Specification Number: SMD-ILC-RD2002

Revision: A



Superconducting Magnet Division

Procurement Specification For ILC Service Cryostat 2K Cryogenic Valves

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Revision History
Rev. A: Initial Release 1/12/10

1. Scope

This specification defines the two (2) cryogenic control valves for installation on the ILC Service Cryostat under construction at Brookhaven National Laboratory. These two valves will be used for 2 K superfluid helium II service. Long stem, ultra low heat leak and bellow seal valves are required.

2. Process Design Requirements

2.1. The process design requirements are given in Attachment 1 & 2.

2.2. All valves shall be designed for minimum heat leak to process

2.3. All valves are required to be designed to operate between 2K and 400K

2.4. Pressure rating of the valve is 10 bar (~ 150 psig) as given in the tables.

2.5. Design pressure shall be vacuum to full pressure rating.

2.6. Depending on the control function, the vendor shall propose either equal percentage or linear plug for BNL to choose.

2.7. Supplier shall have previous, demonstrable, experience producing superfluid valves.

3. Materials Of Construction

3.1. All material shall be new and proven for 2K superfluid helium II application.

3.2. Selection of materials used shall prevent the occurrence of galling between mating parts

3.3. Selection of materials used shall prevent the occurrence of galvanic corrosion

3.4. Epoxy or other similar materials shall not be used

3.5. All piping shall be seamless or welded stainless steel

4. Mechanical Design Requirements

4.1. All fixed permanent joints shall be welded

4.2. No mechanical joints are allowed to the vacuum space and suitable for cold box installation.

4.3. All seals, joints and welds shall be suitable for design temperature, pressure and full vacuum

4.4. The valve will be subjected to temperature cycling and shall be capable of withstanding 10,000 cycles from 400K to 2K without loss of leak-tight integrity

4.5. The valve shall be helium mass spectrometer leak tested for external leakage and shall have a leak rate less than $1x10^{-9}$ atm. cc/s at 1 atm differential pressure

4.6. The valve shall be designed for helium bubble tight closure at a differential pressure equal to the design pressure across the valve seat in either direction

4.7. The valve shall incorporate soft seating with easily replaceable plugs and seats

4.8. Special tools for installation and maintenance along with price shall be given in the proposal

4.9. The valve and all internal surfaces shall be clean for helium refrigeration application

5. Type Of Valves To Be Furnished:

5.1. Valve operators shall be instrument air actuated. Instrument air provided by the buyer is regulated between 60 to 80 PSIG. All the mounting brackets and attachment to valve shall be provided.

5.2. Due to the tight space above the cold box, an actuator of the smallest possible projected area is required. *The maximum diameter for the operator shall not exceed 4 inches, or 6.5 inches with feature for externally mounted positioner.*

5.3. Control valves shall be equipped with air-operated actuators, positioners, filter/regulator sets, and I/P (current to pneumatic) transducers. These devices shall be tubed and assembled on the valve actuator by the valve supplier. The instrument air supply connection to the valve assembly shall be 1/4 FNPT. I/P transducers shall be 4-20 mA with load impedance less than 350 ohms. The electrical enclosure for the solenoid connections shall be NEMA 1 and provided with provision for flexible conduit connection.

6. Interface Type And Installation Of The Valves

6.1. These two valves will be installed inside a coldbox, and thus require a coldbox cuff/neck. These valves shall be designed for low heat leak to process and the heat leak value shall be provided for these valves with the proposal.

7. Documentation

7.1. The following shall be provided:

7.1.1. Data sheets with valve & interface dimensions

7.1.2. Outline drawings including the operator shall be furnished with the proposed submittal offer.

7.1.3. Max. allowable forces, moments and deflections induced by piping at the valve body.

7.1.4. The proposed valve data

7.1.5. The proposed actuator data

8. QA Deliverables

1) Certified Material Test Reports (CMTR's) For Pressure Boundary Materials
2) Pressure Test Report
3) Seat Test Report
4) Leak Check Test Report
5) Certificate Of Conformance
6) Information Listed in Attachment 3

Attachment 1 - Specification for Valve AOV2

Service	Helium and Superfluid Helium II
Function	JT
Valve type	Angle pattern with butt weld end
Control	Maintain liquid level
Operator	Normally closed
Control type	Continuous control throttling
Actuator	Diaphragm/Spring or Piston/Spring
Positioner	Vendor propose
Pressure rating [bar]	10
Design Pressure	Vacuum to full pressure rating
Design Temperature [K]	2 – 400
Seat leakage	Bubble tight at max. pressure differential
Valve leakage to vacuum	1 x 10^{-9} atm-cc/s at max. pressure differential
Seal type	Bellow
Vacuum boundary interface	Cold box cuff / neck
Max. heat leak to 4.5 K [W]	< 0.3
Max. valve size [in]	½" OD
Min. length of valve inside vacuum [in]	34

		Off-design		
	Baseline	**#1**	**#2**	**#3**
Mass flow [g/s]	1.99	9.94	4	4
Inlet				
Pressure [bar]	1.176	1.2	1.2	1.2
Temperature [K]	2.28	4.407	2.5	3.0
Density [g/cc]	0.148	0.121	0.147	0.144
Phase	Liquid/Supercritical			
Outlet				
Pressure [bar]	0.0164	0.1	0.0164	0.0164
Temperature [K]	1.8	2.489	1.8	1.8
Density [g/cc]	-			
Phase	two phase			
Vapor fraction [%]	13.87	31.12	16.10	20.98

Attachment 2 - Specification for Valve AOV3

Service	Helium
Function	Make up / Pressure regulating
Valve type	Angle pattern with butt weld end
Control	Maintain pressure in superfluid helium II to 1 bar
Operator	Normally closed
Control type	Continuous control
Actuator	Diaphragm/Spring or Piston/Spring
Positioner	Vendor propose
Pressure rating [bar]	10
Design Pressure	Vacuum to full pressure rating
Design Temperature [K]	4 – 400
Seat leakage	Bubble tight at max. pressure differential
Valve leakage to vacuum	1 x 10^{-9} atm-cc/s at max. pressure differential
Seal type	Bellow
Vacuum boundary interface	Cold box cuff / neck
Max. heat leak to 4.5 K [W]	< 0.3
Max. valve size [in]	½" OD
Min. length of valve inside vacuum [in]	34

Flow Range

Mass flow [g/s]	0	5
Inlet		
Pressure [bar]	1.2	1.2
Temperature [K]	4.407	4.407
Density [g/cc]	0.121	0.121
Phase	Liquid	
Outlet		
Pressure [bar]	1	1
Temperature [K]	≈1.8	≈1.8
Density [g/cc]	-	-
Phase	He II at 1 bar	He II at 1 bar

Attachment 3 - Data To Be Provided By Vendor

Valve Data

Tag Name: _____
Model N0.: _____
Valve Size: _____
CV: _____
Heat Leak: _____
Design Max. Press. _____
Design Max. Temp. _____

Type (Globe / Angle): _____
Body End Conn. _____
(IN/OUT) IPS
Body Matl. _____
Packing Matl. _____
Packing Type _____

Plug Matl. _____
Seat Matl. _____
Stem Matl. _____
Recommended
Spare Parts _____

Actuator Data

Tag Name: _____
Model N0.: _____
Type: _____
Size: _____
Actuator Dia _____
Stroke _____
Seating Force _____
_____

Recommended
Spare Parts _____