GSI FAIR	Technical Guideline	Number	01
B-MT	Valves for Cryogenic Media	Status	2011-05-17

Contents

1. Scope

I. The information presented in this document is intended as a basic reference to valves for cryogenic media. This document contains minimum requirements for the use of valves in cryogenic process lines in

- feed and end boxes,
- distribution boxes,
- accelerator and experimental installations

within the FAIR facility.

II. Installations for cryogenic media in experimental areas which are not connected towards the common cryogenic system neither by cryogenic liquids (helium or nitrogen) nor by the cryogenic control system (except interlocks) are not included.

III. This document is not related to any purpose other than the aforementioned.

IV. This document is not covering safety valves. These devices are covered in a separate technical guideline [1].

2. Definitions of valves

I. Valves are included into devices as feed boxes, distribution boxes, branch boxes, end boxes or further, to regulate the flow of cryogenic gases or liquids by opening, closing or partially regulating passageways.

II. The placement and the characteristic of a valve is given by requirements of the cryogenic process to fulfil the demands on a reliable operation of the cryogenic system and to provide sufficient cooling within the machine.

III. In addition of the process valves for safety aspects of the system are required. These are covered by a separate technical guideline [1].

3. Technical Requirements

I. To achieve a high helium tightness for the overall system and to avoid a humidity break-in to the cryogenic system only bellow sealed valves shall be used.

II. The valves have to be designed in such a way, that they can guarantee tightness in the process line for the full temperature range of operation.

III. For maintenance the valve head have to be replaceable by removing the valve rod without opening the device, neither without breaking the insulating vacuum of the device.

IV. The heat load to the system should be kept as small as possible. As the value is strongly depending on size and length the heat load of each valve is summed up in the heat load budget for the individual device given in the detailed specification. The following reference values should not be exceeded:

Table 1: Reference values for the heat load onto the 4 K level for a valve without additional shield cooling in W for two typical lengths

Length = 600mm							Length = 875 mm	
<=DN6	<=DN10	<=DN20	<=DN25	<=DN32	<=DN40	<=DN50	<=DN100	<=DN125
0.3	0.5	1	1.5	2	3	4	8	11

V. Special attendance has to be given to the thermoacoustic oscillations; the probability of thermoacoustic oscillations has to be minimized.

VI. To reduce the heat loads onto the process gases at 4K valves for operating temperatures below 50K should foresee a fixation port for a shield cooling, which will be used where ever a shield cooling is available.

VII. For each valve a data sheet has to be provided that gives information about the expected k_v-/ c_v- value. The value has to meet the requirements for the overall pressure drop of the deliverable for every operational case.

VIII. The cryogenic valves may be equipped with manual or pneumatic actuators. The Operating parameters of the pneumatic supply are given in document [2]. The pneumatic actuators are preferred, but electrical actuators may be used for dedicated reasons, which have to be documented. Every valve, also manual operated one, which is part of the closed loop cooling scheme of FAIR have to be equipped with a positioner, which can be connected to the control system. The interface of the actuator and the positioner to the cryogenic control system is described in document [3].

IX. For valves, which are required in the radiation exposed area the positioner electronic has to be split, in such a way that a reliable operation is possible.

X. A CAD model of the outer contour of the valve must be transferred following the regulation for data exchange given in document [4]; to include the valves into the CAD model of the device.

4. Quality Test

I. At least for one valve of the type series the prediction of the k_v-/ c_v- value and expected heat load data have to be proven.

II. Each individual valve has to pass a helium leak test in the pressurized [5] and in vacuum [6] modus.

III. Before shipping each individual valve has to be checked, that

- all valve functions are fulfilled,
- the dimensions are correct
- and the cleanliness of all fluid contacted surfaces are sufficient.

IV. These tests must be documented.

5. References

[1] Safety Devices for Cryogenics, F-TG-K-52.0e Safety Devices for Cryogenics 20100907.pdf
[2] Common Specification TGA
[3] Common Specifications for the Accelerator Control System, F-CS-LS-01e ACS v10.doc
[4] Terms and Conditions for the Exchange of Mechanical Engineering Data, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, 2009
[5] Pressurised leak Testing of Cryogenic Tubing, F-TG-K-7.24e Pressurised Leak Testing of Cryogenic Tubing 20101029.pdf
[6] He-Leak Testing of Cryogenic Tubing, F-TG-K-7.23e He Leak Testing of Cryogenic Tubing 20101101.pdf