GSI Helmholtzzentrum für Schwerionenforschung GmbH

Document Title

Common Specification
Distribution system (Common Systems)

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F-CS F-CS-K08e_ Distribution System

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Abstract

This document describes the distribution system for liquid and gaseous helium and for gaseous nitrogen, which are part of the cryogenic system.

FAIR Division/Group/Supplier
GSI-MT-Department

Prepared by:
Kauschke

Table of Contents

List of Tables:

List of Figures:

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1. Purpose and classification of the document

The purpose of this document is, to describe the cryogenic distribution system at the FAIR facility, which is covered by the common systems. The placement of the distribution system in the cryogenic infrastructure for FAIR is given in the Common Specification of Cryogenics [1]. This document should clarify more precisely the boundaries towards the refrigerators and their infrastructure and towards the infrastructure for machines or experiments.

2. Scope of the technical System

2.1. System Overview

The distribution system is required to supply the cold helium to all users and to return the used helium to the refrigerator. The different helium conditions for the user at the inlet of each individual feed box are given in [1]. The distribution system starts at the outlet of the refrigerator valve box. Therefore the gate valve/ block valve for the refrigerator is part of the refrigerator. The distribution system covers the piping, the required distribution boxes and the instrumentation up to the interconnection point of the user. The valves for operation and cool down of the transfer lines belong to the individual user. The exact interconnection point is given in the following table:

Table 1: Interconnection points between distribution system and users

User	Interconnection point	Coordinates
SIS100	Inlet of feed-box for the synchrotron, and for the reference magnets	M08, K12, G08 G08
SIS 300	Inlet of feed-box for the synchrotron, and for the reference magnets	G08 G08
HEBT300	Inlet of feed-box in the up-stair cryogenic area	K07
CBM	End of channel at the cave wall	L06
SuperFRS	Vertical end to the transfer line along the magnets Inlet of branch box in the tunnel	K06 K05 K03
R3B	Inlet of branch box in the tunnel Or Inlet of individual feed box (RADIATION PROTECTION??)	
Low energy branch		

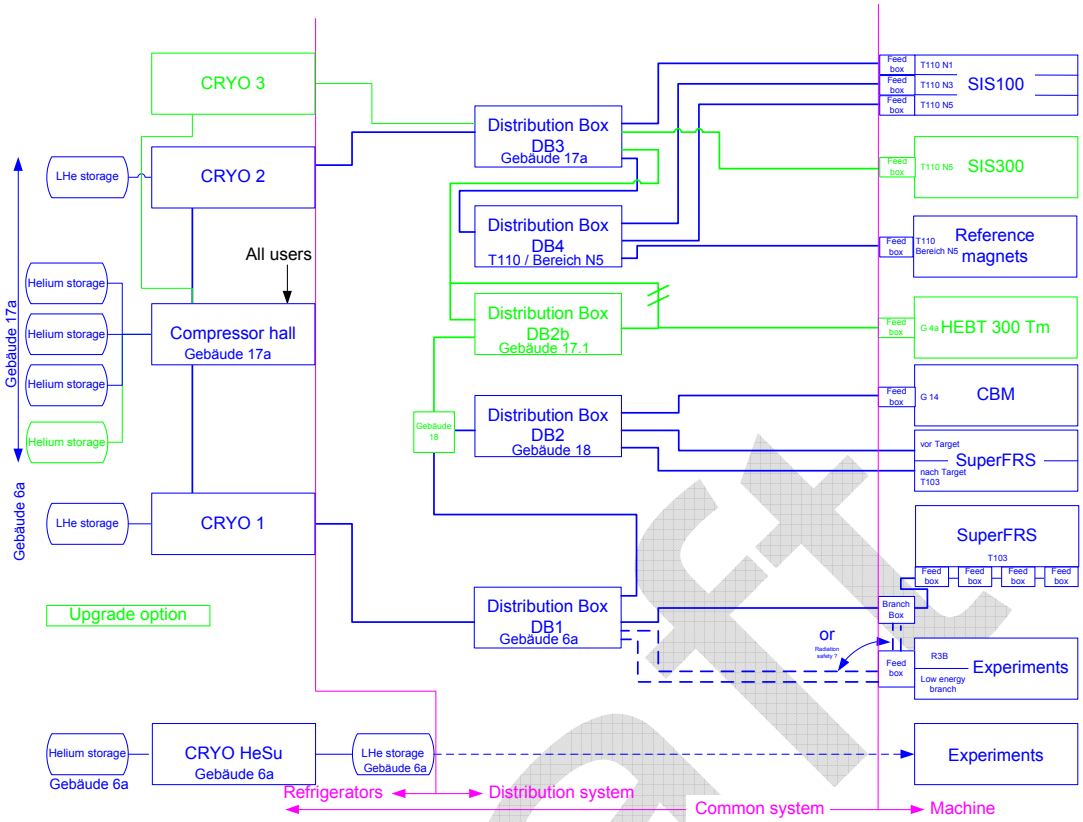

Figure 1: Schematic distribution system with main components

Limits of the System and environment
The interfaces to controls, vacuum and other media is described in the Common Specification [1].

2.2. Basis of concept

The basic principle of the cryogenic supply is given in the Common Specification Cryogenic [1].
For the distribution system it self a modular system is in favour, which allows the production of uniform parts, which are joined together at the facility following the geometries of the buildings. Therefore the supplier may optimize in such a way that the chosen diameter for the piping of the distribution system is equal all over FAIR. If the financial optimization leads to different layout, all auxiliary equipment that may be changed during operation as fittings, safety equipment has to identical all over the distribution system.

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3. Technical Specifications

The distribution system should connect the refrigerator to the consumers with losses in respect of refrigeration power and operating pressure as small as possible.

3.1. Loss budget for transfer lines

The total loss budget for the transfer lines is summarized in the following table: This budget has to be achieved for the design mass flow rates given in [1]. For the pressure drop budget the full length between refrigerator and the user feed box has to taken in account, excluding the distribution boxes.
The given budget has to be achieved for the total length of the distribution system including bends and vacuum barriers. For the feed trough of radiation protection walls the heat load budget may be exceeded locally by 25%.

Table 2: Loss budget for transfer lines following the labelling given in [1].

Label	Heat load [W/m]	Pressure drop [Pa]
A	0.03	10000
B	0.37	2500
C	0.2	5000
D	1.4	5000
E	Nonrelevant	

3.2. Loss budget for distribution boxes

The total loss budget for the distribution boxes is summarized in the following table: This budget has to be achieved for the design mass flow rates given in [1]. The full instrumentation of the box is included into the heat load budget.

Table 3: Loss budget for distribution boxes following the labelling given in [1].

Label	Heat load [W/exit]	Pressure drop [Pa]
A	5	5000
B	10	600
C	35	1300
D	35	1300
E	Nonrelevant	

3.3. Geometry

For the installation of the components of the distribution system the following geometric limits are given. Large distribution boxes will be either assembled at the place of operation or it will be mention in the detailed specification that the installation will take place before the building is closed.

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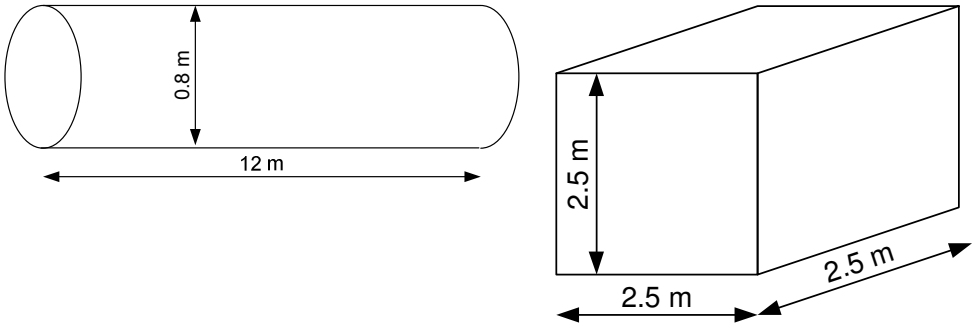

Figure 2: Outer geometry of the single deliverables for the distribution system.

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4. Quality Assurance, Tests and Acceptance, Documentation

During the manufacturing and commissioning process the supplier has to follow the regulations given in the various technical guidelines as referenced in [1].

I. Related Documentation

[1] **Common Specification Cryogenic,** F-CS-K-03e Cryogenic v1.0
[2] **Common Specification Refrigerator**
[3] Cryogenic Operation Parameters, F-TG-K-50.0e Cryogenic Operation Parameters 20100629.doc
[4]

II. Document Information

III.1. Document History

Version	Date	Description	Author	Review / Approval
0.1	yyy-mm-dd	Draft version	Author Name	review comment, approver
0.2				
1.0				

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