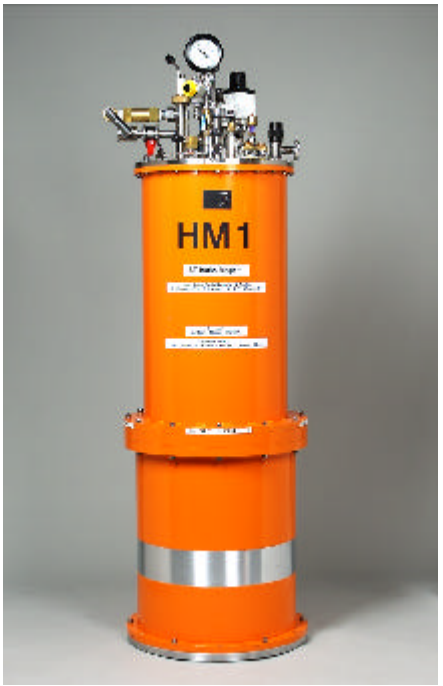
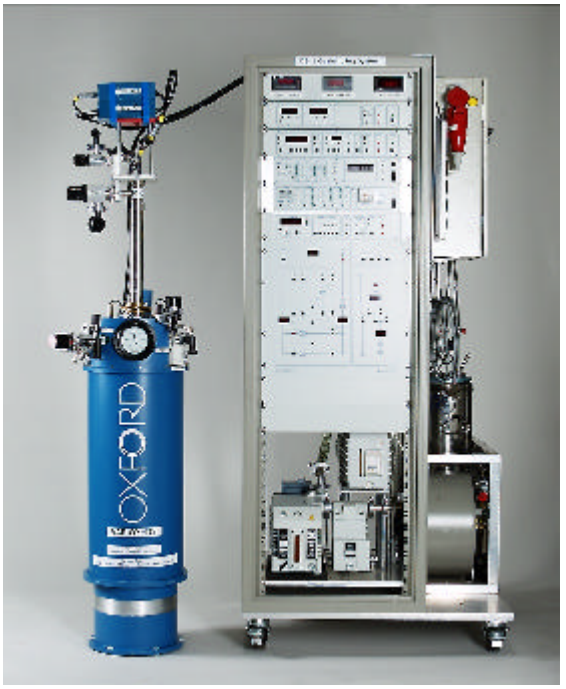
Hahn-Meitner-Institut
Berlin

U.S.E. Handbook

Version 2000.6

Usage of **S**ample **E**nvironment
at BENSC
Technical Handbook





Contents Page

Foreword

The purpose of this handbook is to present a survey of the sample environment (SE) equipment available to the users of the neutron scattering instruments at the Berlin Neutron Scattering Center, BENSC. So that the users (without having to contact BENSC staff) get a general overview.

This handbook cannot, of course, cover every individual case and in many situations further assistance of personnel shall be required. Furthermore some of the equipment (dilution inserts, magnets, heigh pressure cells) may only be handled by SE staff.

Due to new developments in the field this handbook may not be up-to-date with the latest equipment available. We should therefore like to refer the reader to the corresponding pages on our web homepage*). For special problems please do not hesitate to contact our staff by phone, fax or e-mail. A list of the staff members can be found in the appendix section B.

This is the second edition of the ”Handbook for Usage of Sample Environment Equipment at BENSC". The project has started in spring 1995 as a technical documentation of the various cryogenic apparatus and was intended as a helping tool for the staff at BENSC. During the period of extensive editorial work it became clear that two versions, a traditional paper version and electronic INTERNET pages would serve the needs of the in-house users and external guests as well. Due to the progress in computer hard- and software today the second edition is published in an electronic version only, presented in PDF-format.

The first version of April 1997 has benefitted from the start-up work of two persons: Hubert Waldmann (conceptual layout) and Günter Rahn (technical drawings) invested about one year of work into the development of the U.S.E.-Handbook at that time.

Many new contributions have been added to the second edition as new sample environment equipment has been installed. New photography and PDF-formatting have been arranged by the Berlin Software Company "Screenworks". New basic drawings and lots of editorial work has been provided by Sebastian Kausche and Christian Kamm. The appendix section has been updated and further extended: items like operation modes, recipes and valuable table information can be found in addition.

We hope that this handbook will be of some value and would like to encourage readers to inform us where mistakes and obscurities must be corrected and other improvements could be made.

HMI-BENSC, July 2002
Michael Meissner

*) adress: http://www.hmi.de/bensc/sample-env/home.html and links therein

1. Introduction

A broad range of equipment is available to provide different sample environments for neutron scattering experiments with a wide temperature range, T = 0.1 mK - 2100 K, and with variable magnetic fields up to B = 15 Tesla. The components are mutually compatible and can be used on most of the instruments both in the experimental and the neutron guide hall.

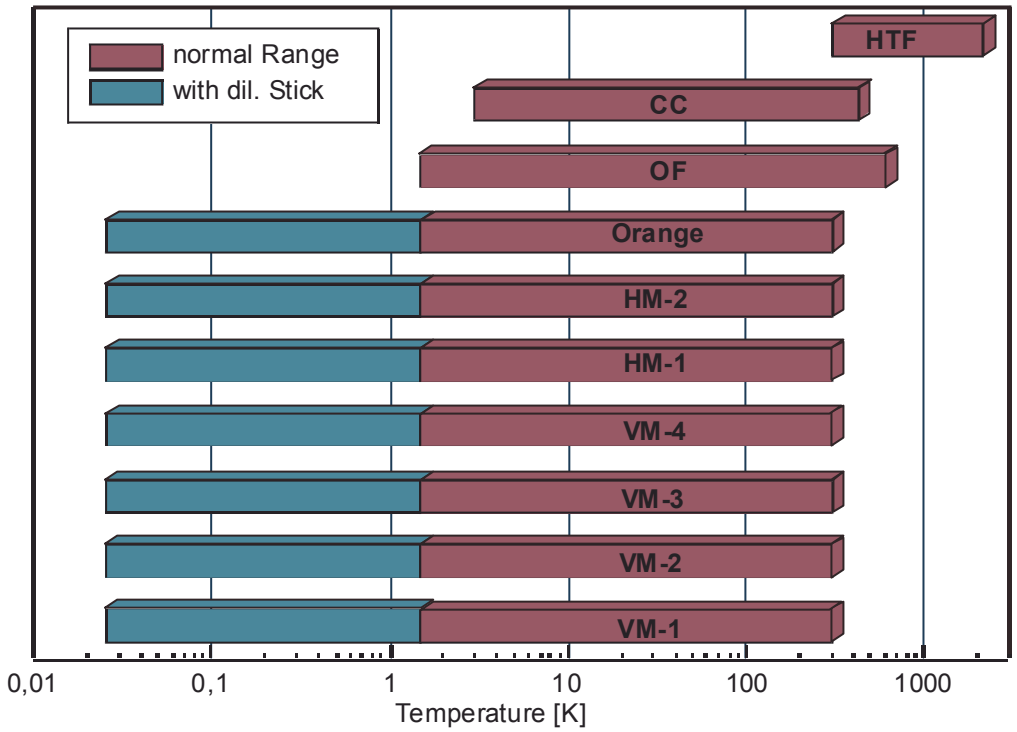
The ultralow-temperature equipment consists of two Dilution Refrigerators with Nuclear Demagnetization Stages (DM-1 with Ag, and DM-2 with $PrNi_5$) and where a second vertical magnetic field stage can be used for sub-mK-studies. For detailed information about DM - 1 and DM - 2 please contact the special instruments responsibles (see appendix).

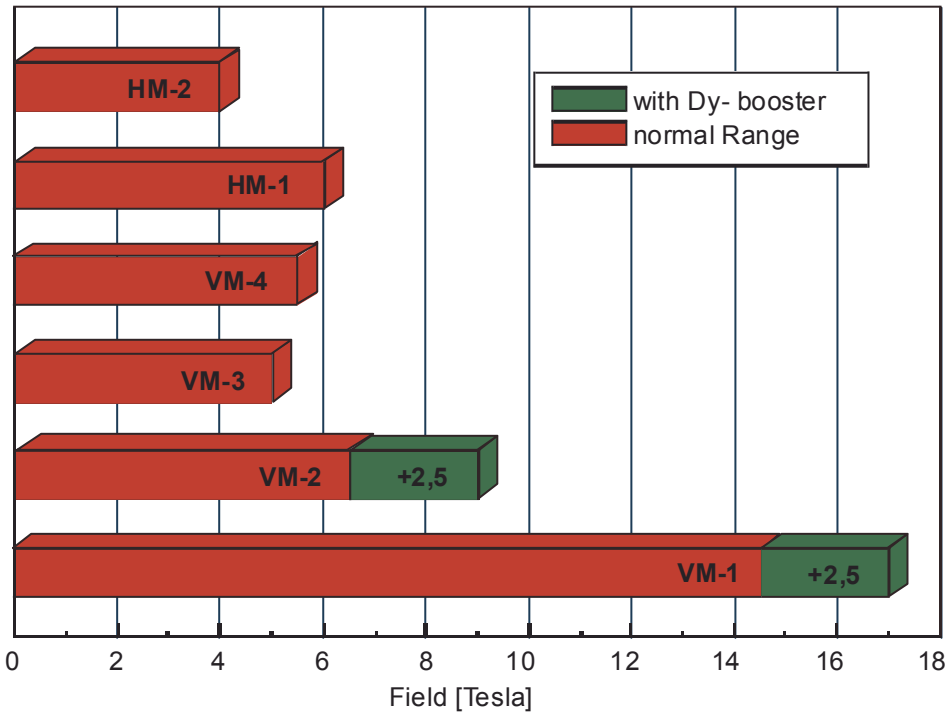
For experiments down to 30 mK two Dilution Refrigerator Sticks can be combined with a variety of Magnet Cryostats and Orange Cryostats. This technique provides a cryostat set-up for a temperature range, T = 30 mK - 300 K, combined with Vertical Magnetic Field up to 15 Tesla (7 Tesla for studies with polarized neutrons) or Horizontal Magnetic Field up to 6 Tesla.

The standard low-temperature equipment consists of Orange Cryostats (T = 1.5 K - 300 K / 600K) or Closed Cycle Cryocoolers (T = 10 K - 300 K) permanently at the instrument or for schedule on most of the instruments. High Temperature Furnaces for temperatures as high as 1800°C are available as well. For all top-loading sample sticks the sample mounting interface is the M8-pin.

For powder samples a High Pressure Cell has been developed in collaboration with the Institut für Mineralogie u. Kristallographie of the Universität Kiel and is now available for experiments in a pressure range p = 0 - 17 kbar (for temperatures T = 25°C - 400°C). For detailed information about the High Pressure Cell please contact the special instruments responsible (see appendix).

The following graphic diagram provides an overview on the samples environment equipment available at BENSC.





A more detailed information on the equipment specifications can be found in the tables listed on page 4 - 6.

Standard Equipment

Orange Cryostats

System Code	Temperature Range	Sample Space Dia./Height	Thermometry Sensors	Permanent on Instrument X
OS-X	1.5K - 300K	<50mm/ <30mm	RhFe, SiD	E1...E4, E6, E9, V1, V2, V4, V5
OM-1, OM-2	1.5K - 300K	<100mm/ <50mm	RhFe, SiD	see below
OF-1, -2, -3	1.5K - 600K	<50mm/ <30mm	RhFe	see below
OFM-V3	2K - 600K	<80mm/ <80mm	RhFe	V3

OM-1, OM-2, OF-1, OF-2, OF-3 can be posted for E1, E2, E3, E4, E6, E9, V1, V2, V4, V5.

Closed Cycle Refrigerators

System Code	System Construct.	Temperature Range	Sample Space Dia./Height	Thermometry Sensor	Permanent on Instrument X
CC-E1	Leybold	10K -300K	<50mm / <30mm	Si-Diode	E1
CC-E5	Air Products	10K - 300K	<50mm / <30mm	Si-Diode	E5
CC-V6	Air Products	10K - 300K	<50mm / <30mm	Si-Diode	V6
CC-A1	Air Products	5K - 300K	<50mm / <30mm	Si-Diode	see below
CC-A2	Air Products	5K - 430K	<50mm / <30mm	Si-Diode	see below
CC-S1	Sumitomo	3K - 300K	<50mm / <30mm	Si-Diode	see below

CC-A1, CC-A2, CC-S1 can be posted for E1, E2, E3, E4, E6, E9, V1, V2, V4, V5 (starting 1/2001).

High Temperature Furnaces

System Code	System Construct.	Temperature Range	Sample Space Dia./Height	Thermometry Sensor
HTF-1, HTF-2	ILL/AS	400K - 2000K	<50mm / <30mm	Type C (WRe5%/WRe26%)
HTF-J1	IFF Jülich	300K - 1500K	?	Type K (Chromel/Alumel)

HTF-1, HTF-2 can be posted for E1, E2, E3, E4, E6, E9, V1, V2, V4, V5;
HTF-J1 can be posted for E5 and for the above instruments using the 4-circle-cradle (starting 1/2001).

High Pressure Cells

System Code	System Construct.	Temperature Range	Pressure Range	Sample Space Dia./Height	Thermometry Sensor
HPC-1	U. Kiel/HMI	25°C - 400°C	0 - 17kbar	7 / 20 - 12mm	K-type (NiCr-Ni)
HPC-2	U. Kiel/HMI	25°C - 400°C	0 - 17kbar	7 / 20 - 12mm	K-type (NiCr-Ni)
CPC-1	IP Prague	1.5K - 300K (OS)	0 - 5kbar	?	Pb-wire
CPC-2	ILL	1.5K - 600K (OF)	0 - 10kbar	?	?

HPC-1 can be posted for E1, E2, E3, E4, E6, E9, V1, V2, V4;
HPC-2 can be posted for E1, E2, E3, E4, E6, E9, V1, V2;
Clamped cells CPC-1, CPC-2 can posted with any Orange Cryostat OS, OF, OM, OFM (starting 1/2001).

Special Equipment

Magnet Cryostats with Vertical Field

System Code	System Construct.	Temperature Range	Magnetic Field Max./Asy./Acc.	Sample Space Dia./Split/Angle	Thermometry Sensors
VM-1	OI	1.5K - 300K	14.5T (+2.5T) /no/rings	<20mm/20mm/2°	Cernox
VM-2	OI	1.5K - 300K	6.5T /yes/rings	<50mm/30mm/5°	Cernox
VM-3	AS / OI	1.5K - 300K	5T /no/3x5°wedges	<50mm/30mm/0°	Cernox
VM-4	AS / Thor	1.5K - 300K	4T /yes/3x55°wedges	<50mm/40mm/+35°	Cernox

VM-1 can be posted for E1, E4, E6, V2;
VM-2 can be posted for E1, E2, E4, E6, V1, V2;
VM-3, VM-4 can be posted for E1, E2, E4, E6, E9, V1, V2, V4.

Magnet Cryostats with Horizontal Field

System Code	System Construct.	Temperature Range	Magnetic Field Max./Asy./Acc.	Sample Space Dia./Split/Angle	Thermometry Sensors
HM-1	AS / RMC	1.5K - 300K	6T/2-coil/wedges	<50mm/ see U.S.E. book	Cernox
HM-2	OI	1.5K - 100K	4T/4-coil/wedges	<40mm/40mm/0°	Cernox

HM-1 can be posted for E1, E2, E4, E6, E9, V1, V2, V4;
HM-2 can be posted for E1, E4, E6, V2.

^{3}He/^{4}He Dilution Cryostat Inserts ("Dilution Stick")

System Code	Temperature Range	Sample Space Dia./Height	Thermometry Sensors	Insert suitable to cryostat
DS-2	25mK - 1.4K	<35mm/ <30mm	RuO_2	AS-type: OS, VM-3, VM-4, HM-1
DS-3	25mK - 1.4K	<35mm/ <30mm	RuO_2	OI-type: VARIOX, VM-1, VM-2, HM-2

DS-2, DS-3 can be posted in combination with the cryostats (and instruments) listed above.

Explanation of abbreviations used in the tables:

Acc.	Construction design which influences the 360°-access to the sample
Ang.	Angle of vertical apperture above and below horizontal magnet split
Asy.	Non-zero field profile in n-beam path (for polarized neutrons)
Demag.	Nuclear demagnetization stage for adiabatic cooling
Dia.	Diameter of sample given by sample tube diameter
Height	Maximum sample height for n-beam
Max.	Maximum magnetic field strenght
Ring(s)	Concentric aluminium ring(s) in the split area which attenuate n-beam
Split	Maximum height for n-beam through magnet split (= sample height)
Wedg.	Wedges of significant size which reduce the 360°-access to the sample

1.2 Information on equipment supplied by users

Electrical interfaces: 240V/380V power supply (plugs, cables, etc.) must be to German VDE-standard.

Mechanical interfaces: For details of the various instrument interfaces (device flanges,sample mounting, cooling water, gas supply) contact the instrument responsible.

Safety aspects: Sample containers and supply lines under vacuum or under pressure have to be approved by the Research Reactor BER-II safety engineer. For use of toxic, flammable and explosive gases a safety system (i.e. gas detector, magnet valves, actuator logic) has to be installed and the system must be approved by the BER-II safety engineer.

2. Orange-Cryostats

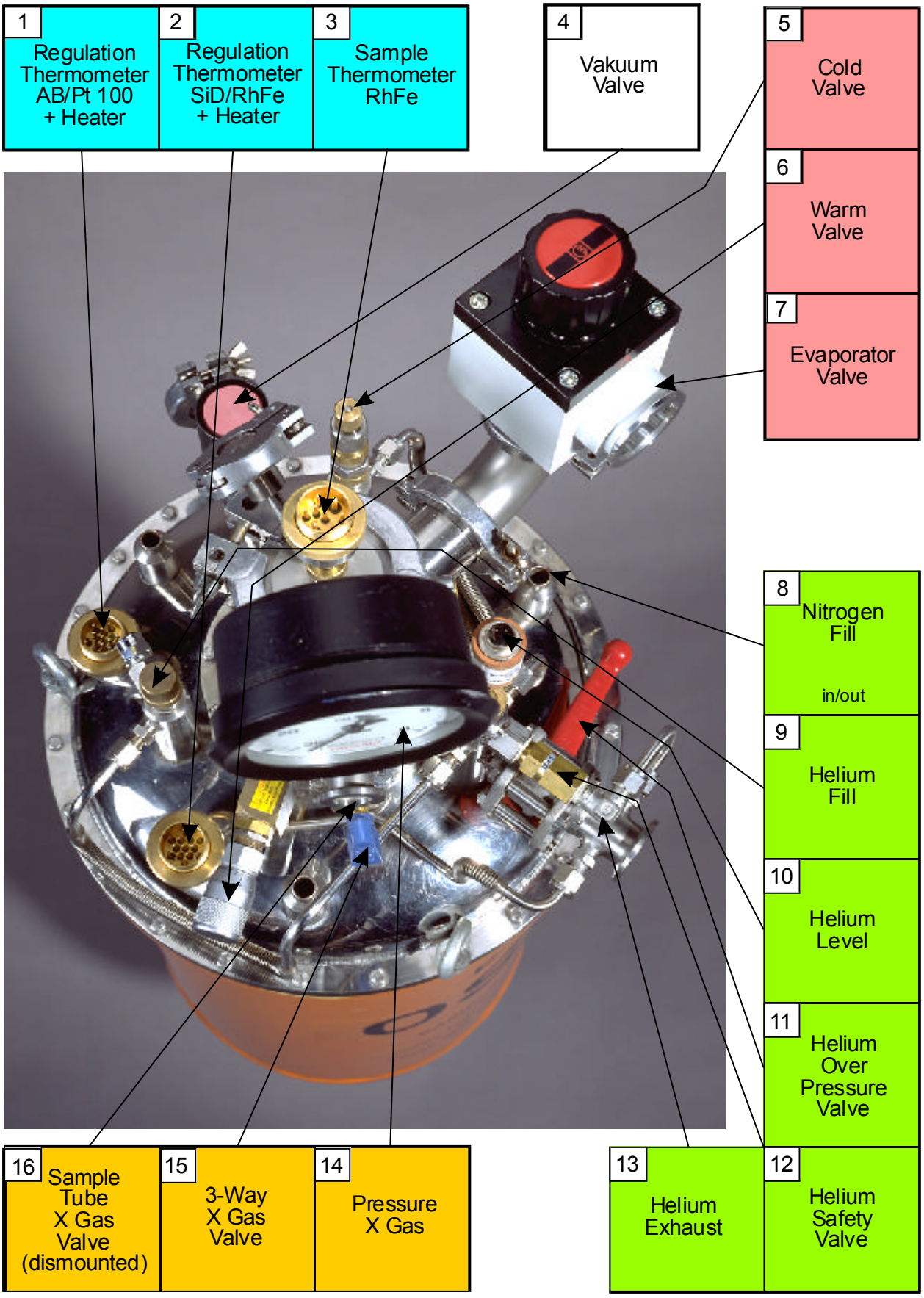
2.1 Orange Standard OS

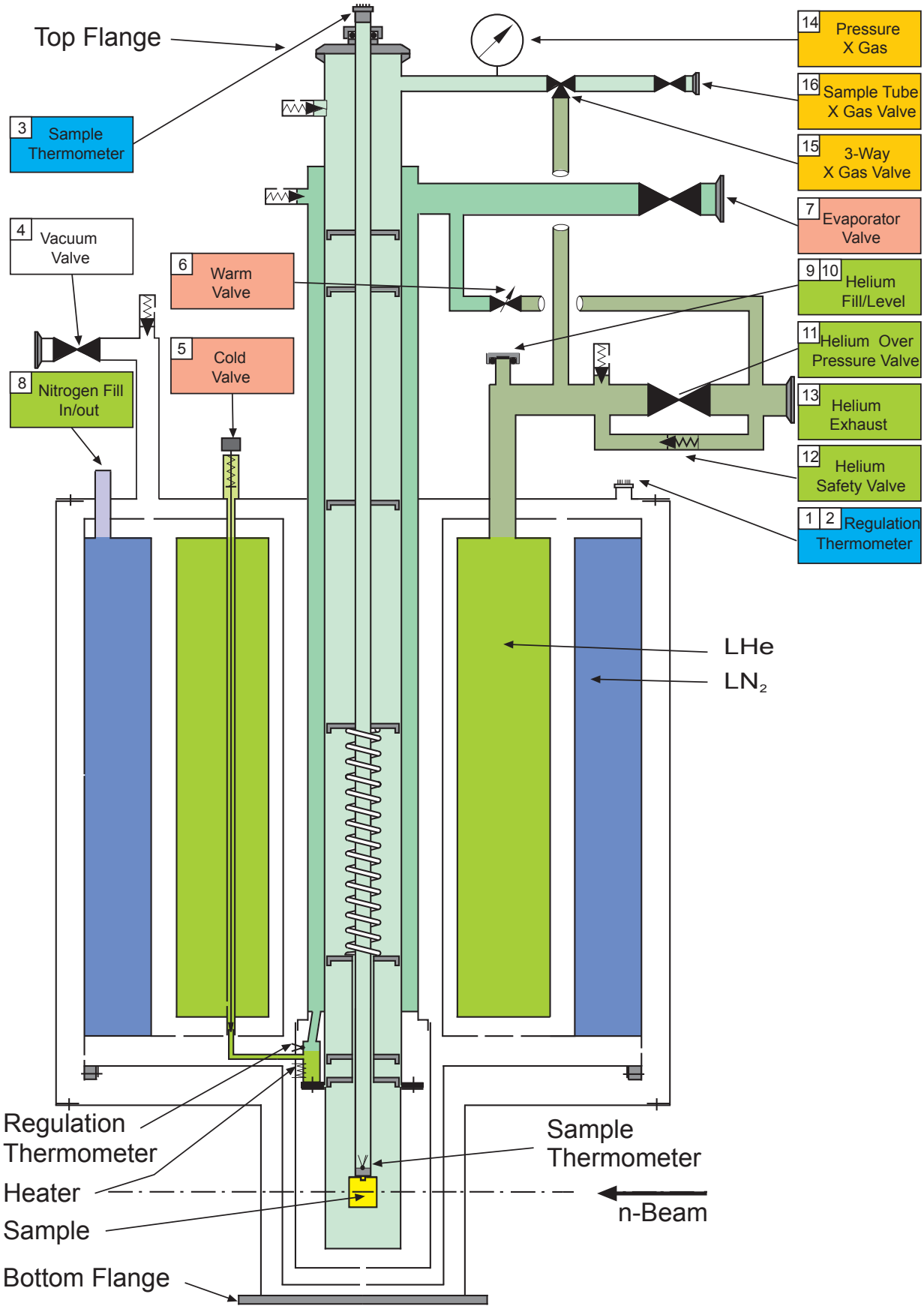
Specifications:

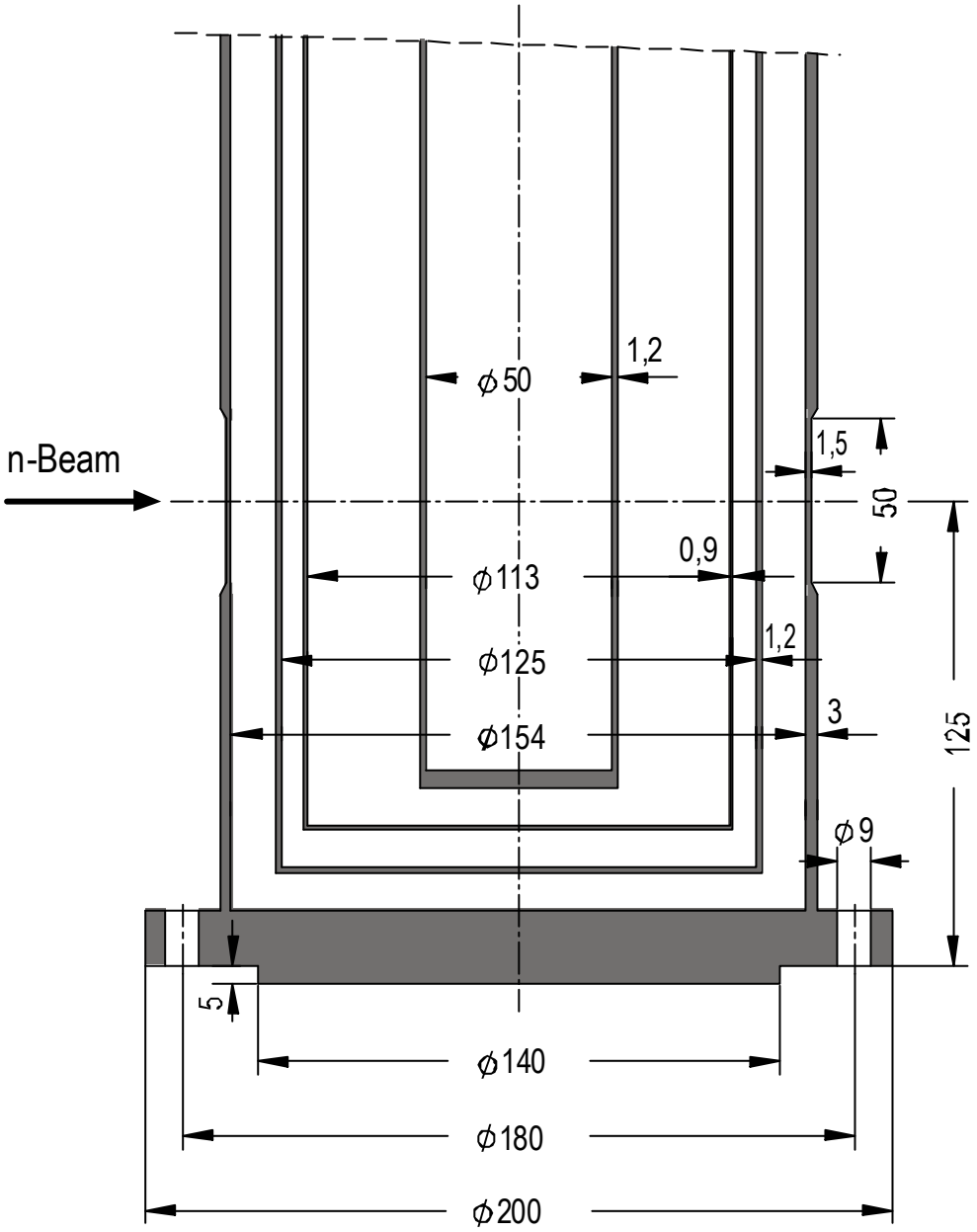
Manufacturer:	AS-Scientific Products Ltd., Abingdon, GB
Temperature Range: with Dilution Insert	300 K - 1.5 K - 50 mK
Sample Diameter:	< 50 mm
Sample Height:	< 30 mm
LN_2-Hold Time:	24 h
LHe-Hold Time[1]:	24 h
No. Al-Screens[1]:	2 x 3
Total Thickness of Al-Screens[2]:	2 x 4.8 mm
Thermometry Sensor:	RhFe, SiD
Permanent Position:	E1, E2, E3, E4, E6, E7, V1, V2, V4, V5

[1] during experimental runs on the instruments incl. cold valve operation
[2] see fig. on page 2.2.2 and 2.2.3


E 4
OS-9
SAMPLE TUBE
distance :
flange (top-edge) - bottom
1032 mm
flange (top-edge) - beam
937 mm


1
Regulation Thermometer AB/Pt 100 + Heater
2
Regulation Thermometer SiD/RhFe + Heater
3
Sample Thermometer RhFe
4
Vakuum Valve
5
Cold Valve
6
Warm Valve
7
Evaporator Valve
8
Nitrogen Fill
in/out
9
Helium Fill
10
Helium Level
11
Helium Over Pressure Valve
12
Helium Safety Valve
13
Helium Exhaust
14
Pressure X Gas
15
3-Way X Gas Valve
16
Sample Tube X Gas Valve (dismounted)


Top Flange
3 Sample Thermometer
4 Vacuum Valve
6 Warm Valve
5 Cold Valve
8 Nitrogen Fill In/out
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 2 Regulation Thermometer
LHe
LN2
Regulation Thermometer
Heater
Sample
Bottom Flange
Sample Thermometer
n-Beam



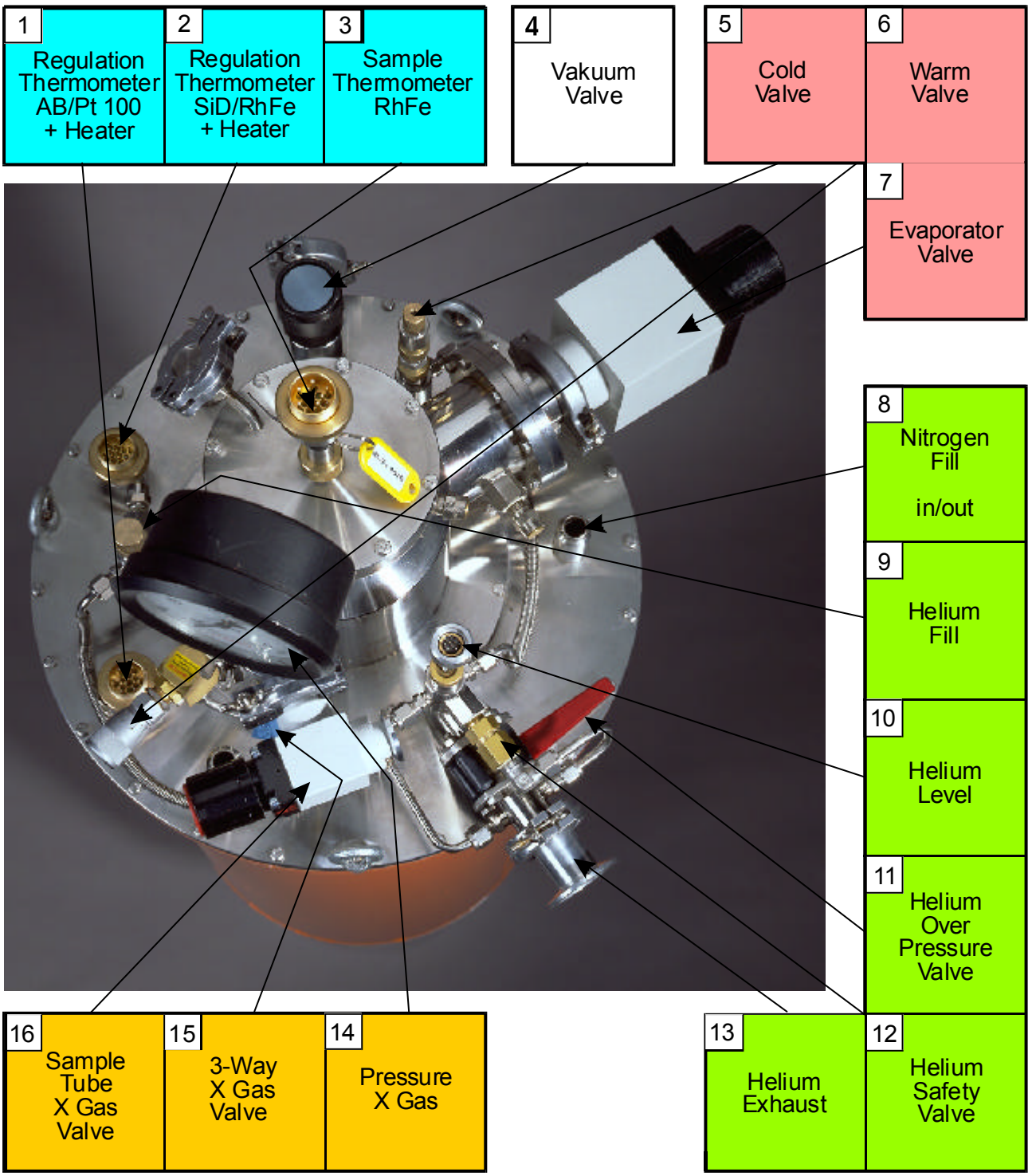
Standard Tail 125 mm

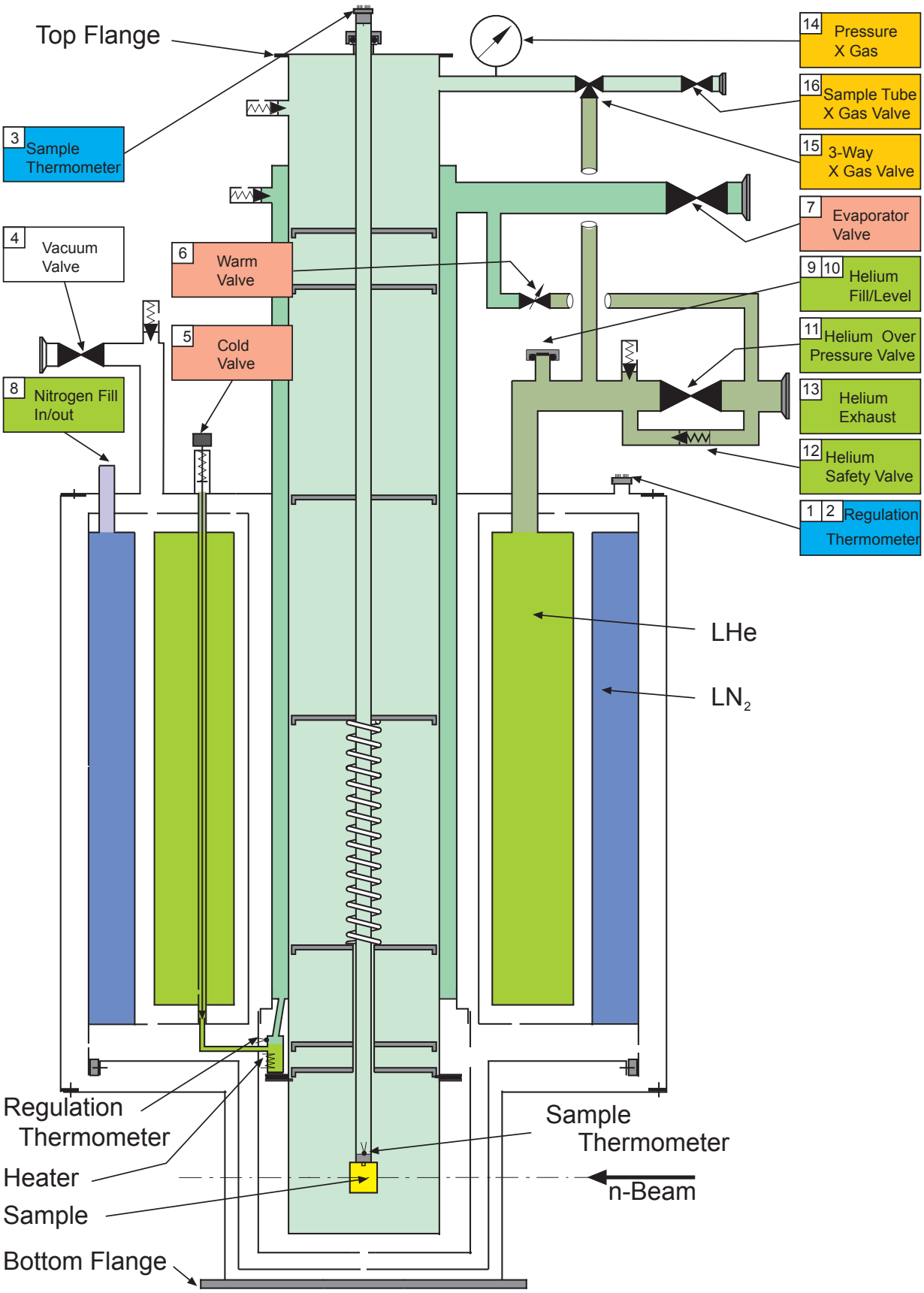
2.2 Orange Maxi OM

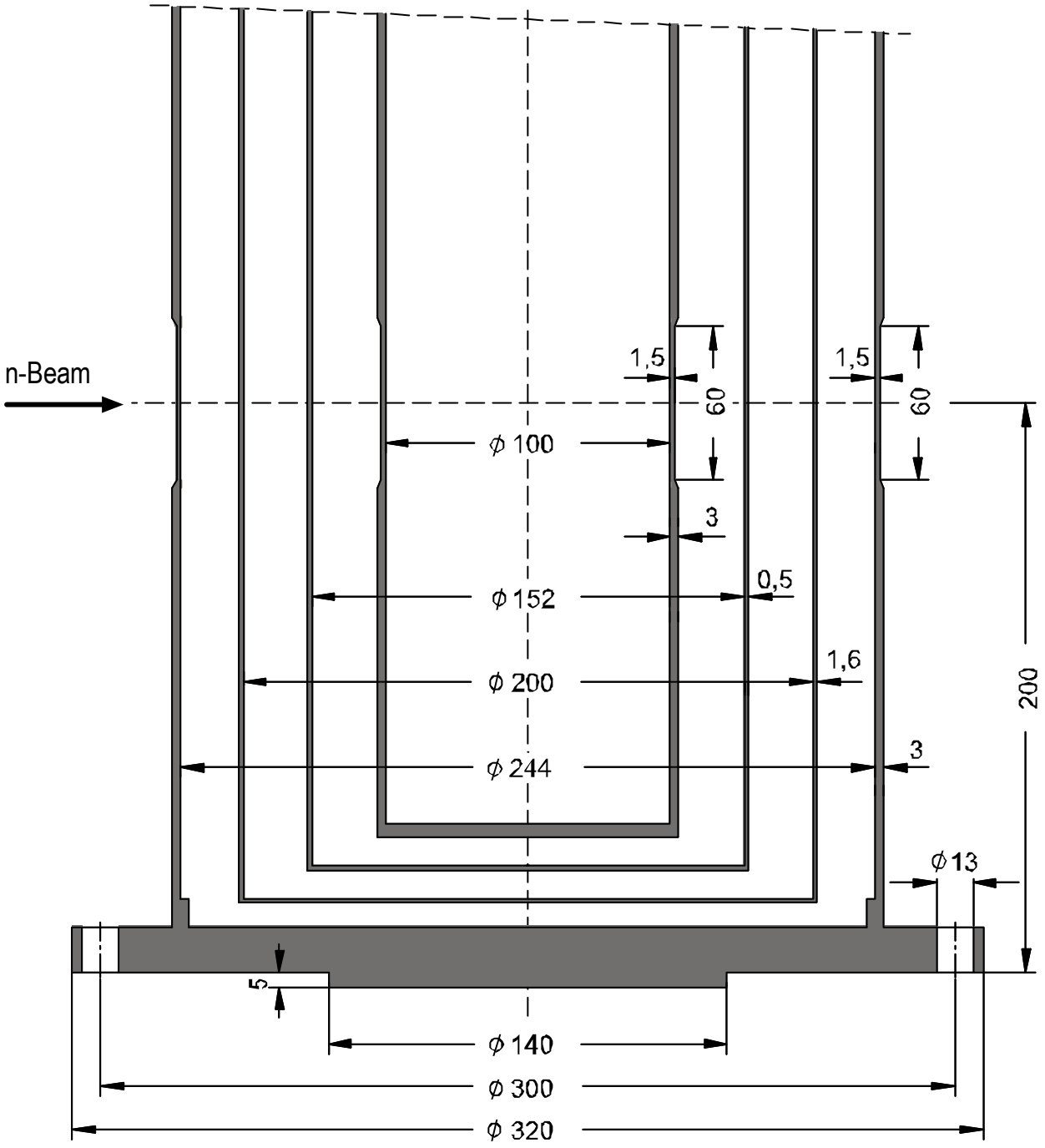
Specifications:

Manufacturer:	AS-Scientific Products Ltd., Abingdon, GB
Temperature Range: with Dilution Insert	300 K - 1.5 K - 50 mK
Sample Diameter:	< 100 mm
Sample Height:	< 50 mm
LN_2-Hold Time:	24 h
LHe-Hold Time[1]:	36 h
No Al-Screens[2]:	2 x 3
Total Thickness of Al-Screens[2]:	2 x 5.1 mm
Thermometry Sensor:	RhFe, SiD
Scheduled Position:	E1, E2, E3, E4, E6, E7, V1, V2, V4

[1] during experimental runs on the instruments incl. cold valve operation
[2] see fig. on page 2.3.2 and 2.3.3


1
Regulation Thermometer AB/Pt 100 + Heater
2
Regulation Thermometer SiD/RhFe + Heater
3
Sample Thermometer RhFe
4
Vakuum Valve
5
Cold Valve
6
Warm Valve
7
Evaporator Valve
8
Nitrogen Fill in/out
9
Helium Fill
10
Helium Level
11
Helium Over Pressure Valve
12
Helium Safety Valve
13
Helium Exhaust
14
Pressure X Gas
15
3-Way X Gas Valve
16
Sample Tube X Gas Valve


Top Flange
3 Sample Thermometer
4 Vacuum Valve
6 Warm Valve
5 Cold Valve
8 Nitrogen Fill In/out
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 2 Regulation Thermometer
LHe
LN2
Regulation Thermometer
Heater
Sample
Bottom Flange
Sample Thermometer
n-Beam



Maxi Tail 200 mm

2.3 Orange Cryofurnace OF

Specifications:

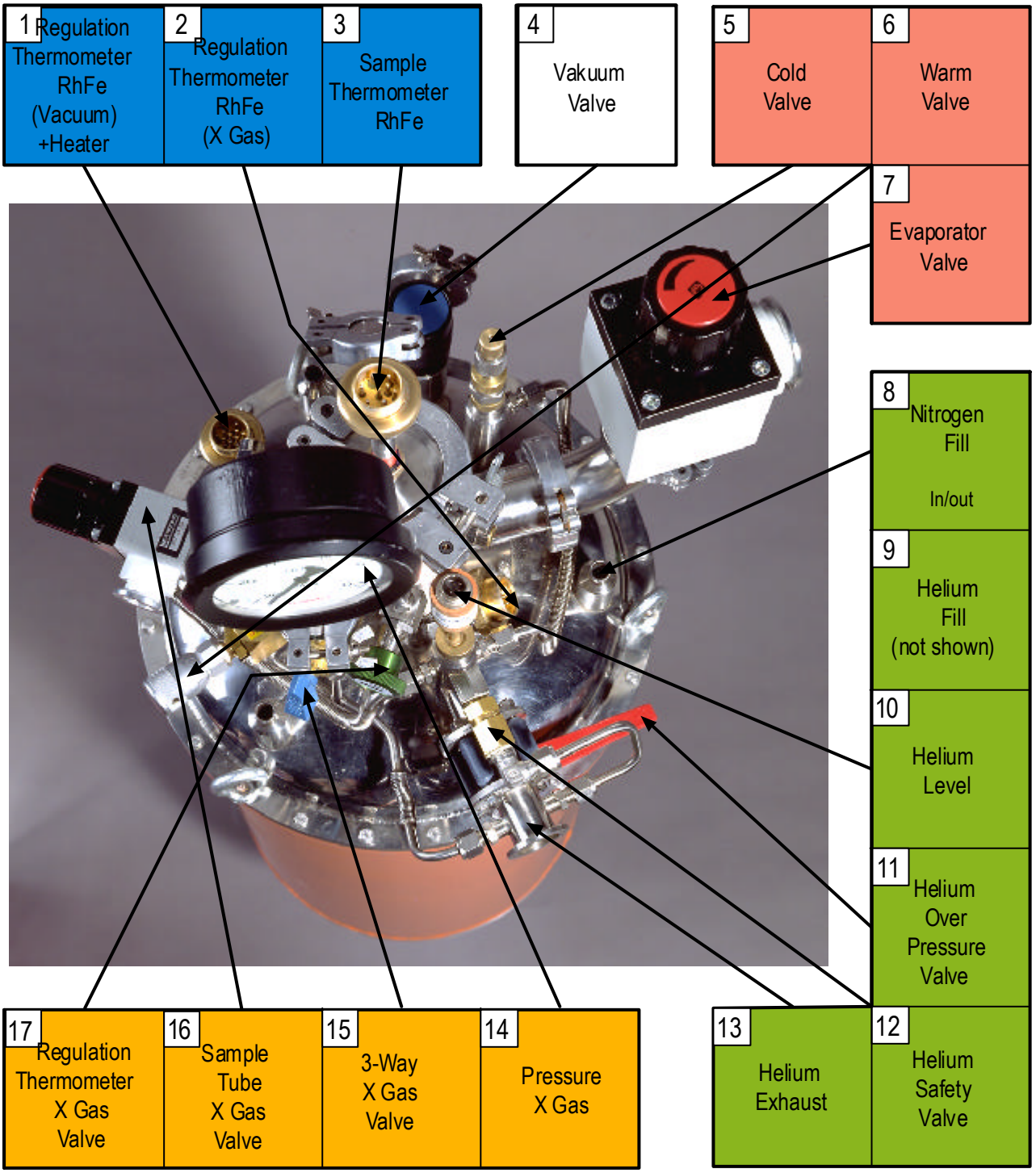
Manufacturer:	AS-Scientific Products Ltd., Abingdon, GB
Temperature Range:	600 K - 1.5 K
Sample Diameter:	< 50 mm
Sample Height:	< 30 mm
LN_2-Hold Time[1]:	24 h
LHe-Hold Time[1]:	24 h
No Al-Screens[2]:	2 x 4
Total Thickness of Al-Screens[2]:	2 x 4.9 mm
Thermometry Sensor:	RhFe
Scheduled Position:	E1, E2, E3, E4, E6, E7, V1, V2, V4

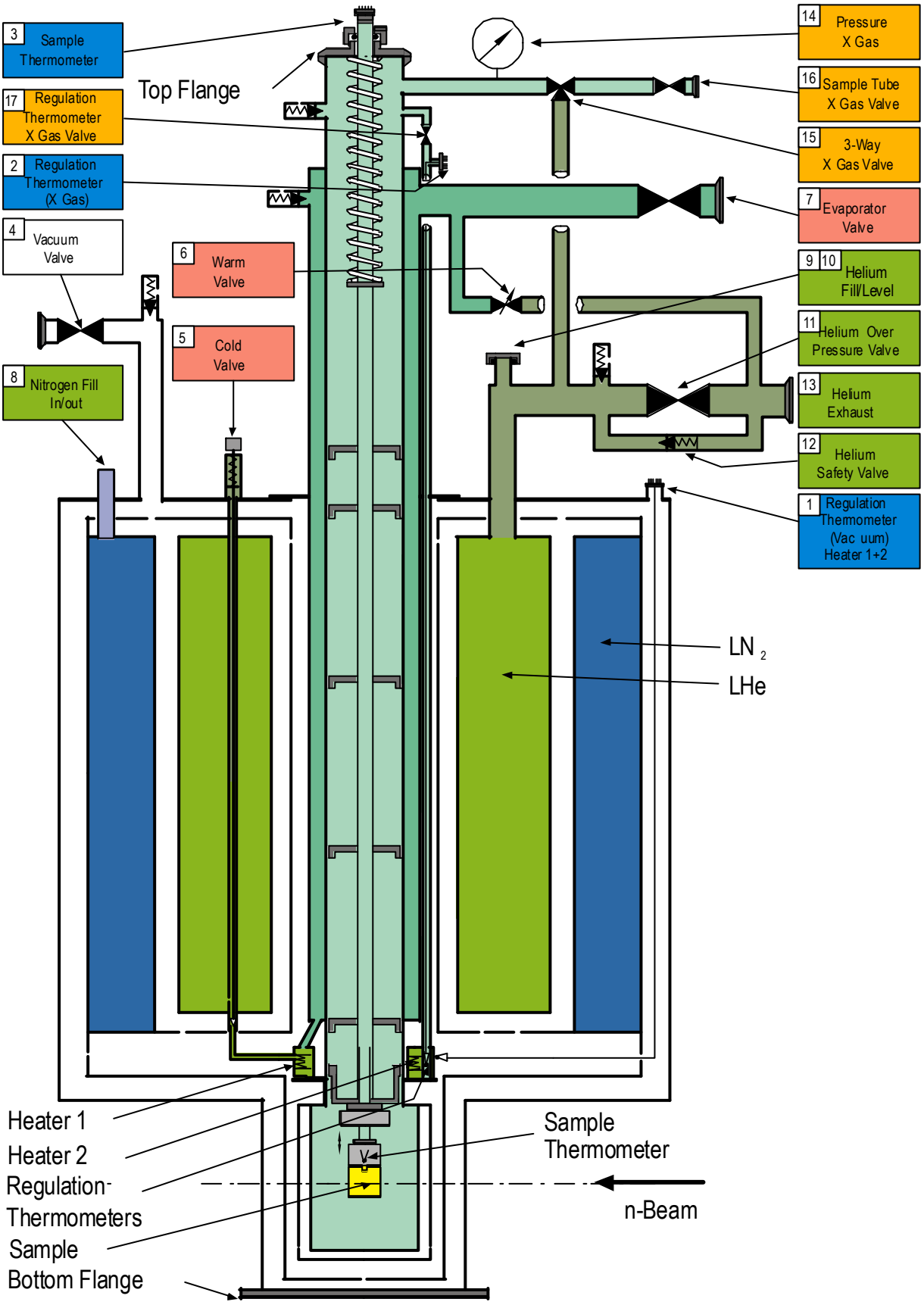
Note on Sample Containers:

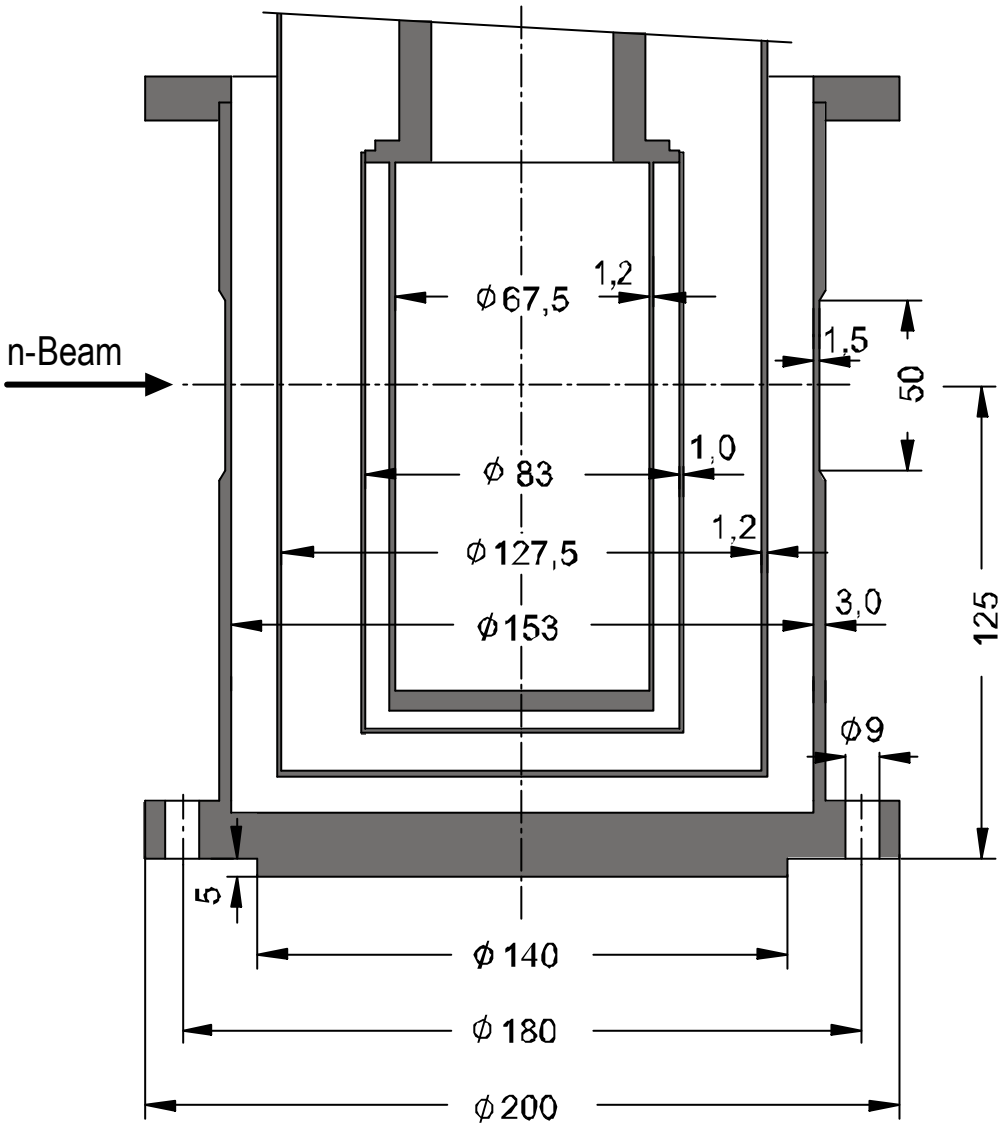
Depending on the temperature range and the sample material a closed sample container should be supplied by the user. The construction of the sample container must include precautions against leakage into the sample tube of the OF and against overpressure damages of the container.

[1] during experimental runs on the instruments incl. cold valve operation
[2] see fig. on page 2.3.2 and 2.3.3


OF-2
SAMPLE TUBE


1 Regulation Thermometer RhFe (Vacuum) +Heater
2 Regulation Thermometer RhFe (X Gas)
3 Sample Thermometer RhFe
4 Vakuum Valve
5 Cold Valve
6 Warm Valve
7 Evaporator Valve
8 Nitrogen Fill In/out
9 Helium Fill (not shown)
10 Helium Level
11 Helium Over Pressure Valve
12 Helium Safety Valve
13 Helium Exhaust
14 Pressure X Gas
15 3-Way X Gas Valve
16 Sample Tube X Gas Valve
17 Regulation Thermometer X Gas Valve


3 Sample Thermometer
17 Regulation Thermometer X Gas Valve
2 Regulation Thermometer (X Gas)
4 Vacuum Valve
8 Nitrogen Fill In/out
Top Flange
6 Warm Valve
5 Cold Valve
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 Regulation Thermometer (Vac uum) Heater 1+2
LN 2
LHe
Heater 1
Heater 2
Regulation-Thermometers
Sample
Bottom Flange
Sample Thermometer
n-Beam

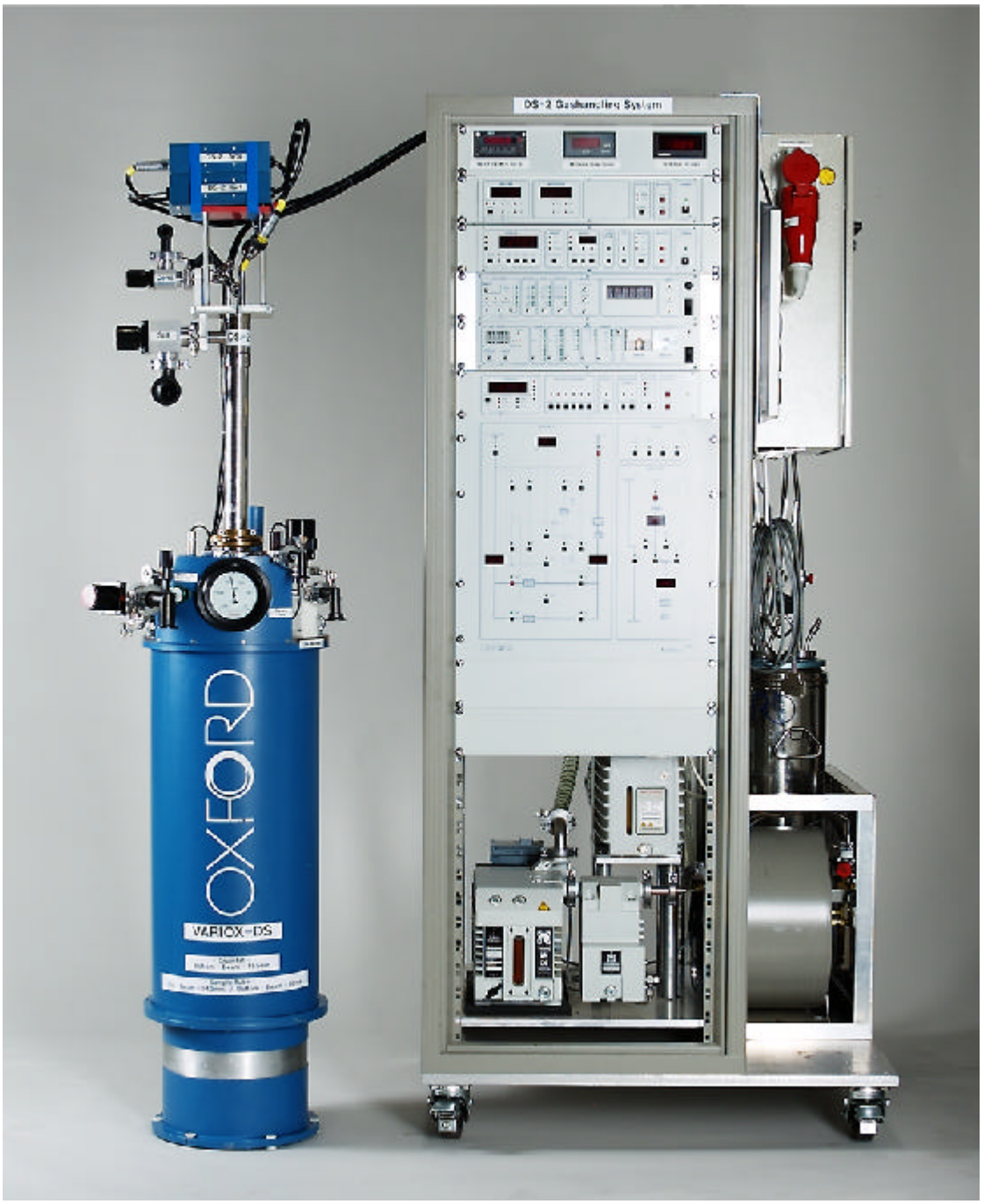


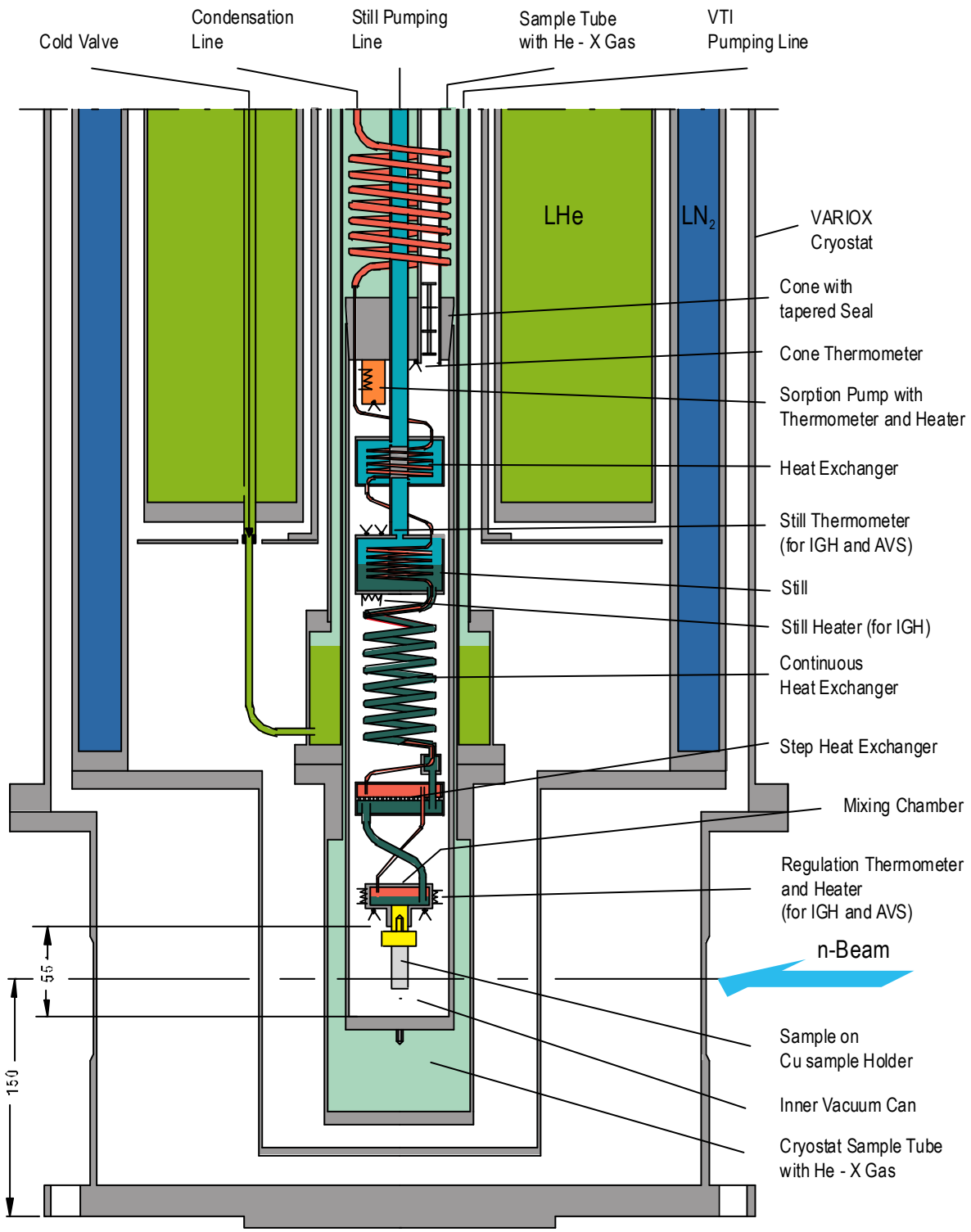
Cryofurnace Tail 125 mm

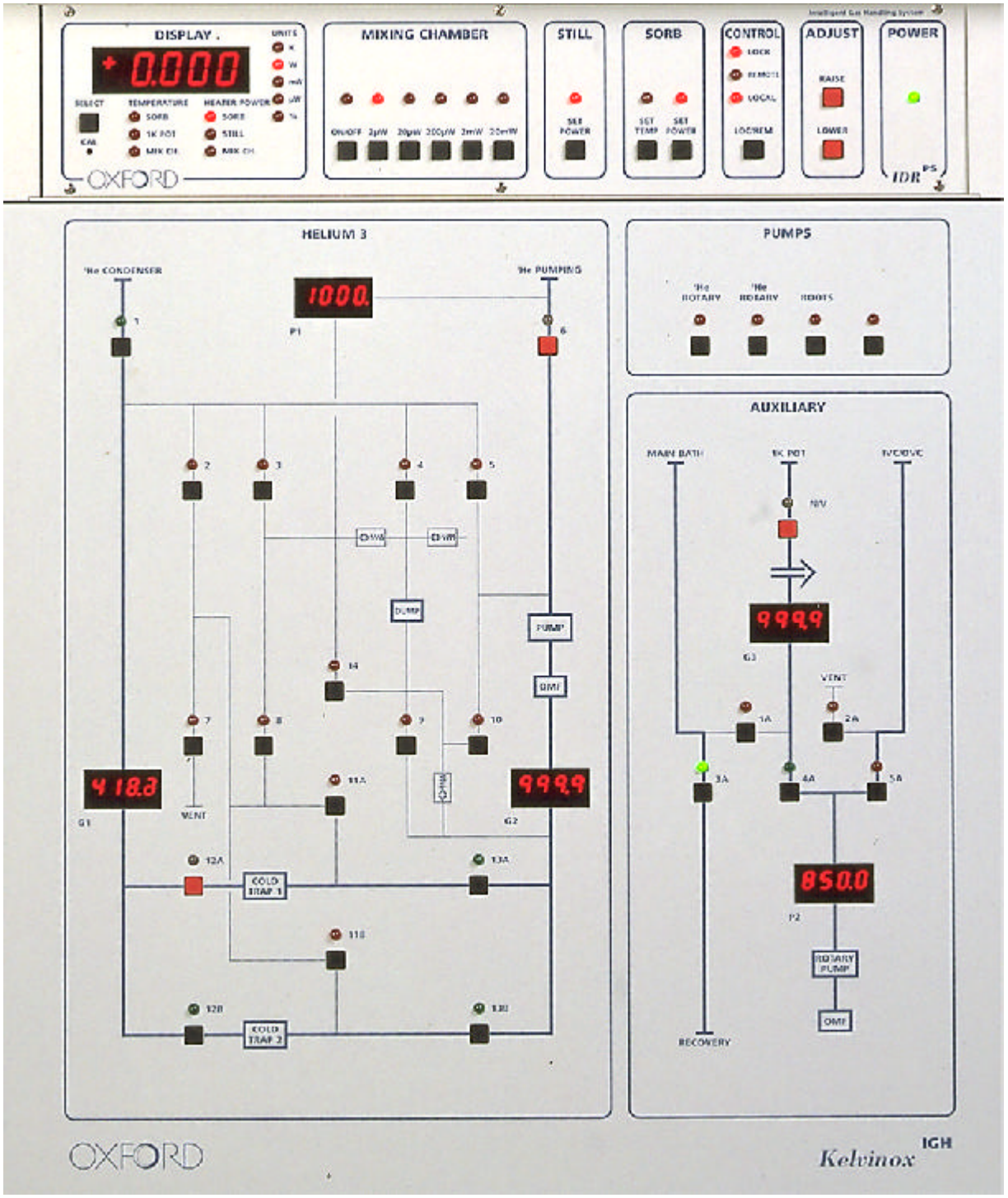
3. Dilution Refrigerator DS - 2/3

Specifications

Manufacturer:		Oxford Instruments, GB
Temperature Range: with 4He - X Gas:		30 mK - 1.2 K 1.5 K - 300 K
Sample Diameter:	 (in VM-1: (in HM-2:	< 38 mm < 12 mm) < 30 mm)
Sample Height		< 50 mm
No of Al-Screens/Thickness		2 x 1 mm plus cryostat
Thermometry Sensor		RuO^2
Insert suitable to		VARIOX, OS, OM, VM-1, -2, -3, -4, HM-1, -2
Sample Mount:		Mixing chamber mounting port is a M6 hole, 6mm deep; the Sample holder should have a M6 pin, 5mm long.


OXFORD
VARIOX-DS


Cold Valve
Condensation Line
Still Pumping Line
Sample Tube with He - X Gas
VTI Pumping Line
LHe
LN2
VARIOX Cryostat
Cone with tapered Seal
Cone Thermometer
Sorption Pump with Thermometer and Heater
Heat Exchanger
Still Thermometer (for IGH and AVS)
Still
Still Heater (for IGH)
Continuous Heat Exchanger
Step Heat Exchanger
Mixing Chamber
Regulation Thermometer and Heater (for IGH and AVS)
n-Beam
55
150
Sample on Cu sample Holder
Inner Vacuum Can
Cryostat Sample Tube with He - X Gas

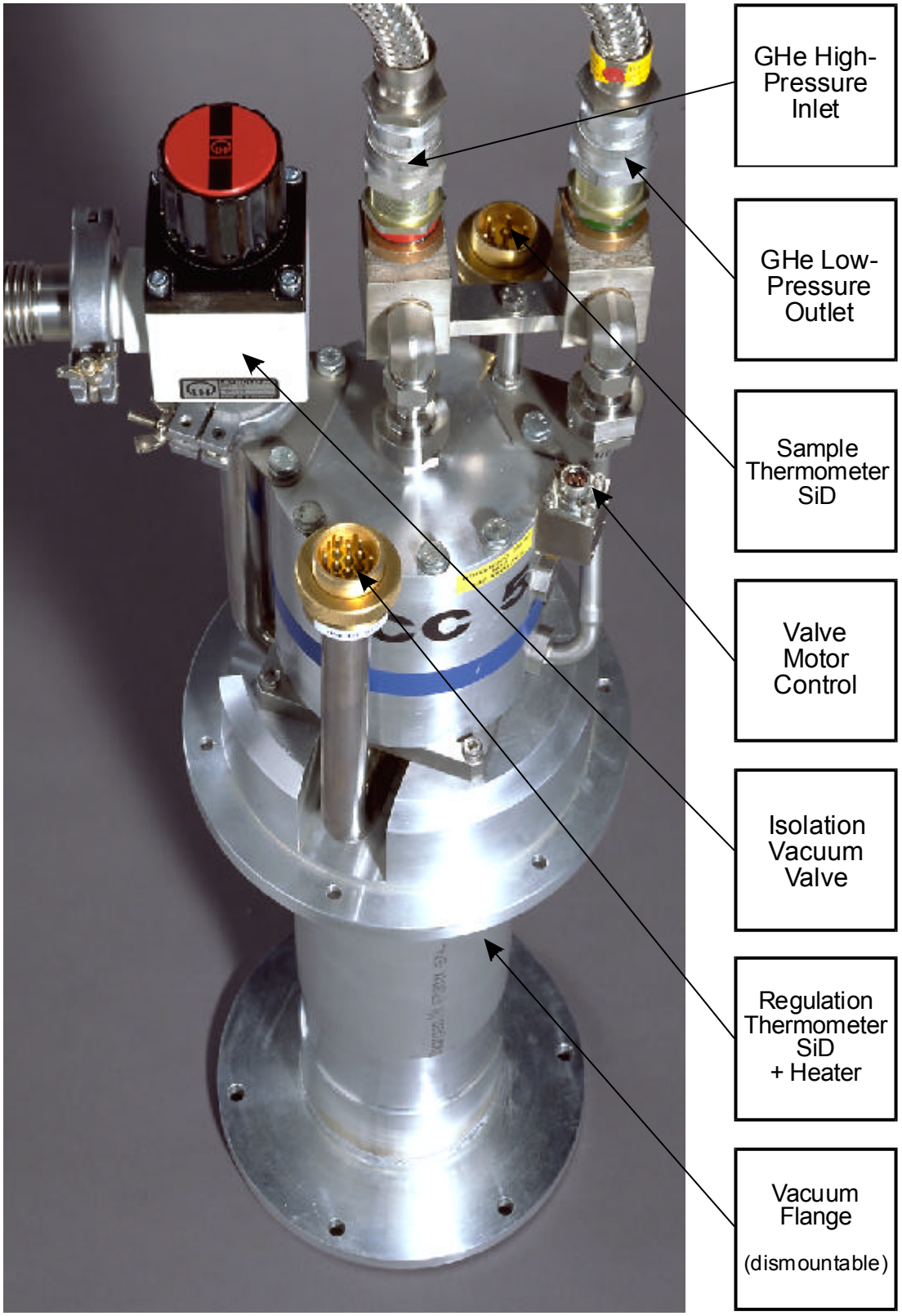

DISPLAY
+ 0.000
MIXING CHAMBER
STILL
SORB
CONTROL
ADJUST
RAISE
LOWER
POWER
OXFORD
HELIUM 3
PUMPS
AUXILIARY
1000.
418.3
9999
850.0
OXFORD
Kelvinox
IGH

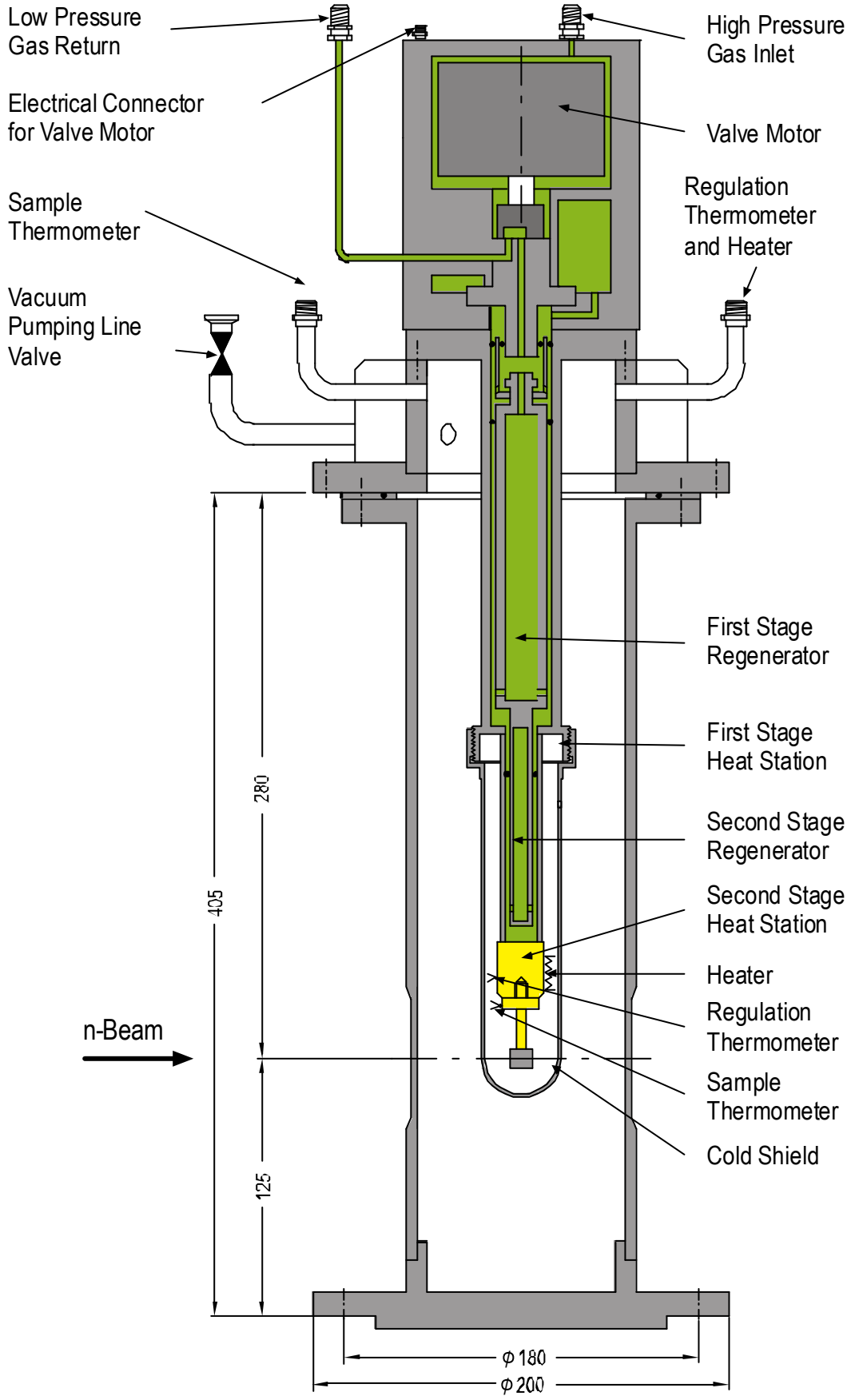
4. Closed Cycle Refrigerator CC - AP

Specifications:

Code:	CC - E5 and CC - AP	CC - V6 and CC - LB (Split Version)
Manufacturer:	Air Products Abingdon, GB	Leybold AG Cologne, FRG
Temperature Range:	300 K - 10 K	300 K - 10 K
Sample Diameter:	< 50 mm	< 80 mm/< 50 mm
Sample Height:	< 30 mm	< 20 mm/<.30 mm
Thermometry Sensor:	all SiD	
Total Thickness of Screens:	all 2 x 1 mm plus 2 x 1.5 mm	
Scheduled Position:	E1, E2, E3, E4, E6, E7, V1, V2, V4	


CC-AP


GHe High-Pressure Inlet
GHe Low-Pressure Outlet
Sample Thermometer SiD
Valve Motor Control
Isolation Vacuum Valve
Regulation Thermometer SiD + Heater
Vacuum Flange (dismountable)


Low Pressure
Gas Return
Electrical Connector
for Valve Motor
Sample
Thermometer
Vacuum
Pumping Line
Valve
High Pressure
Gas Inlet
Valve Motor
Regulation
Thermometer
and Heater
First Stage
Regenerator
First Stage
Heat Station
Second Stage
Regenerator
Second Stage
Heat Station
Heater
Regulation
Thermometer
Sample
Thermometer
Cold Shield
n-Beam
280
405
125
φ 180
φ 200

5. Vertical Magnets

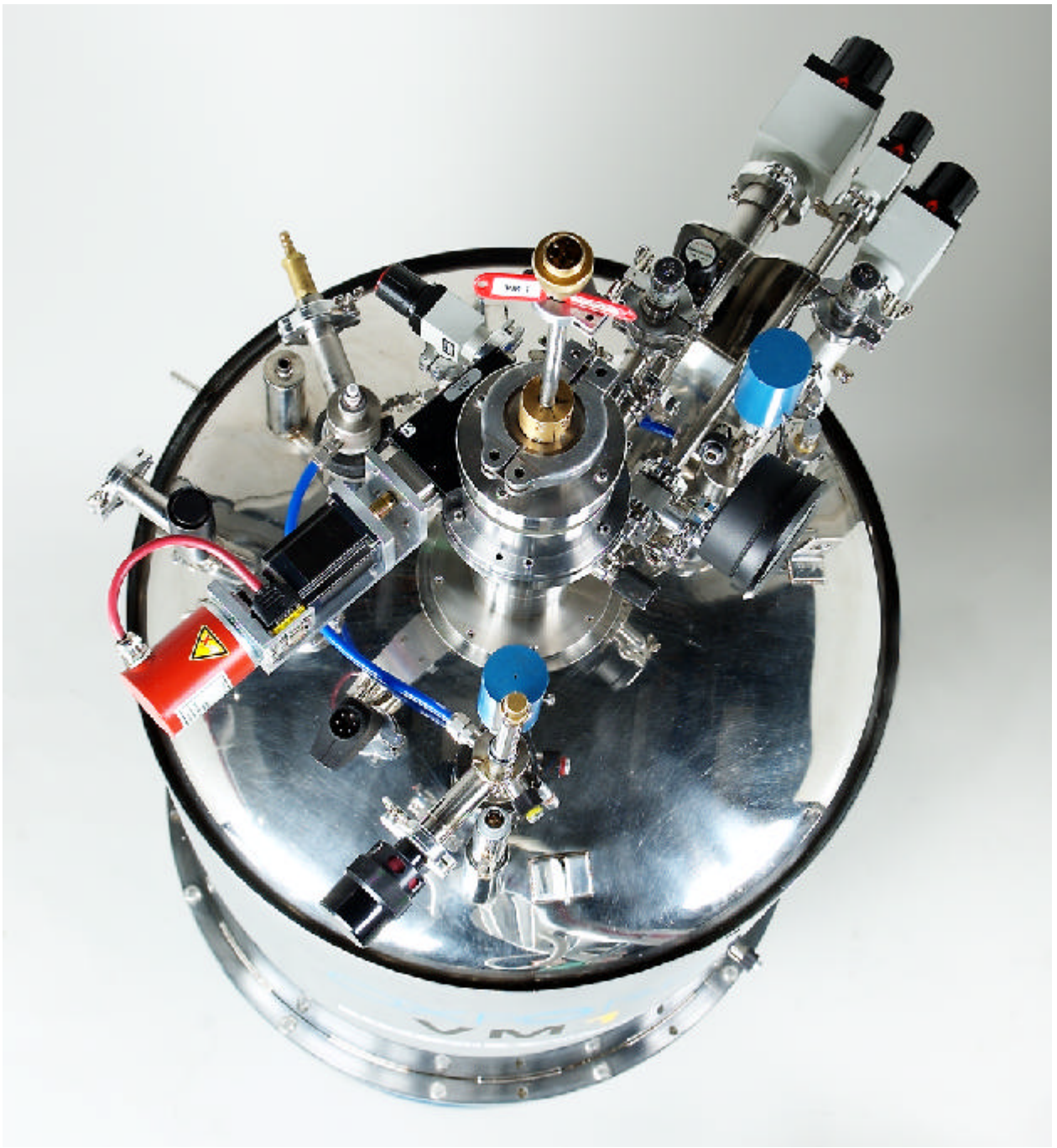
5.1 Vertical Magnet VM - 1, VM-1B

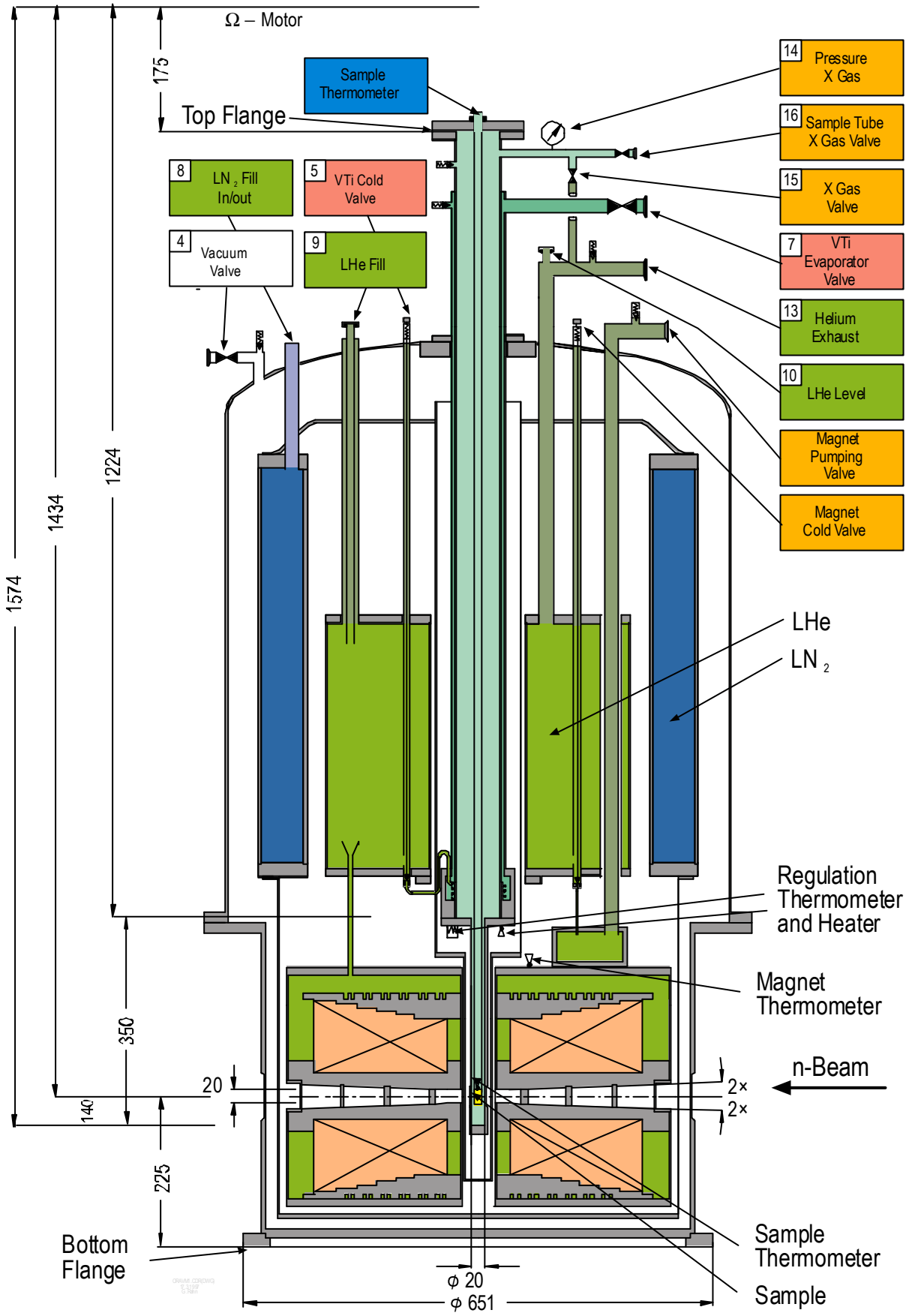
Specifications:

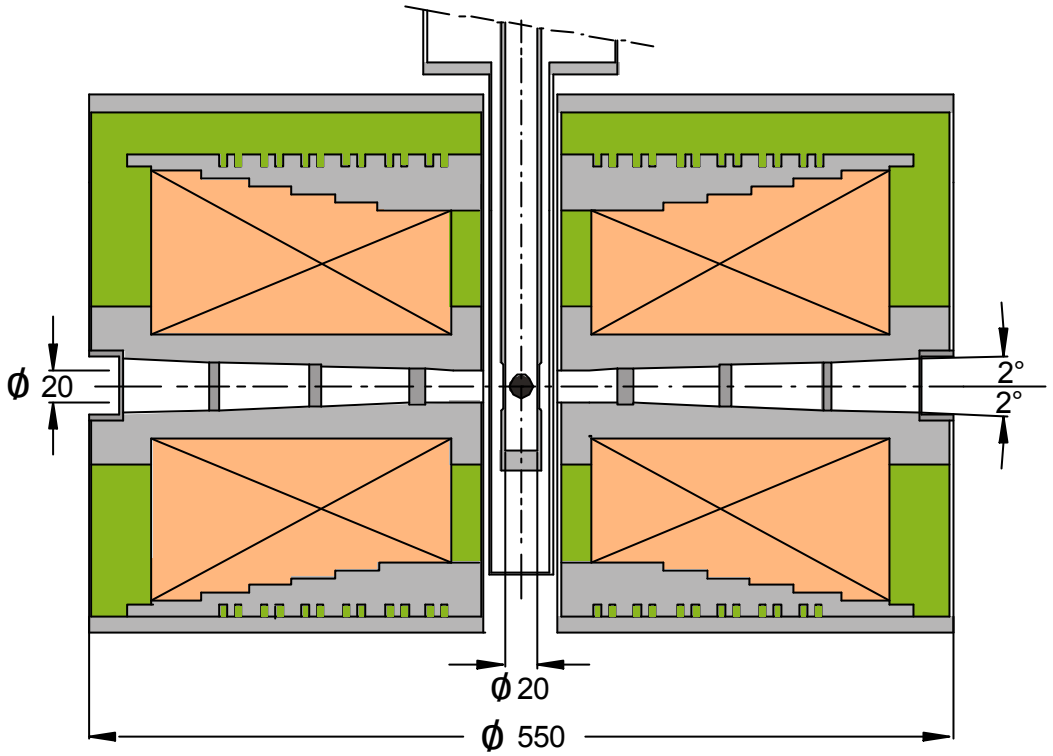
Manufacturer:	Oxford Instruments, Oxford, GB
Temperature Range:	1.5 K - 300 K
with Dilution Insert:	< 50 mK - 1.2 K
Sample Diameter:	< 18 mm
with Dilution Insert:	< 12 mm
Split:	20 mm
Angle:	2^{o}
LN_2-Refill Intervall:	3 days
LHe-Refill Intervall:	1 - 2 days
Magnetic Field (max)	
at 4.2 K:	12 T (symmetric)
at 2.5 K:	14.5 T (symmetric) plus ca. 2 T with Dy-booster
Horizontal Access:	total view 335^{o} (25^{o} dead angle)
Total Thickness of Al-Screens and Al-Rings in Split:	ca. 30 mm
Thermometry Sensors:	Cernox®
Scheduled Position:	E1, E3, E4, E6, V1, V2

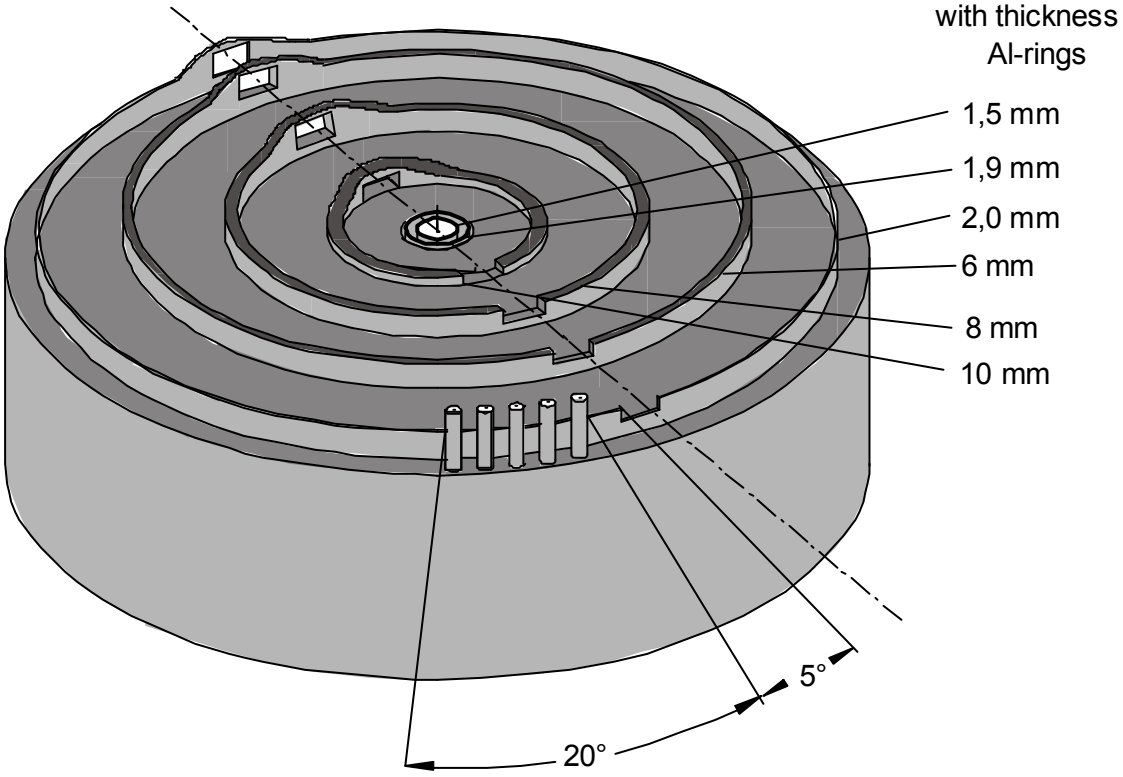
VM-1B offers magnetic field strength up to 15 T, while all the construction details remain the same as to VM-1. Within the range from H = 14.5 T to 15.0 T manual ramping is allowed, only.


OXFORD
VM 1
14.5T vert. & sym. Magnet




Ω – Motor
175
Top Flange
Sample Thermometer
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 X Gas Valve
7 VTi Evaporator Valve
13 Helium Exhaust
10 LHe Level
Magnet Pumping Valve
Magnet Cold Valve
8 LN 2 Fill In/out
5 VTi Cold Valve
4 Vacuum Valve
9 LHe Fill
1574
1434
1224
LHe
LN 2
Regulation Thermometer and Heater
Magnet Thermometer
n-Beam
350
20
140
2×
2×
225
Bottom Flange
Sample Thermometer
Sample
φ 20
φ 651


ϕ 20
2°
2°
ϕ 20
ϕ 550

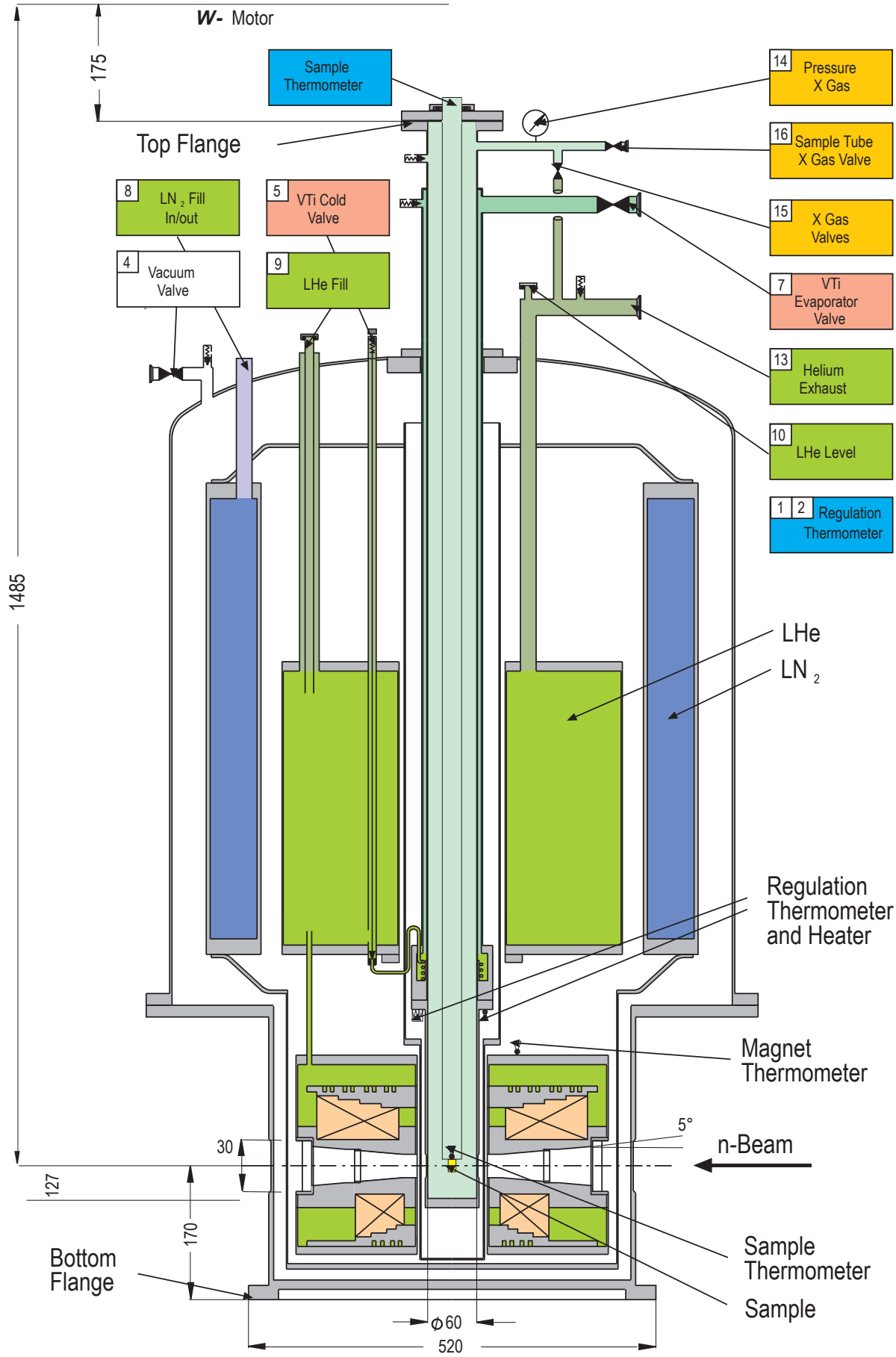

with thickness
Al-rings
1,5 mm
1,9 mm
2,0 mm
6 mm
8 mm
10 mm
5°
20°

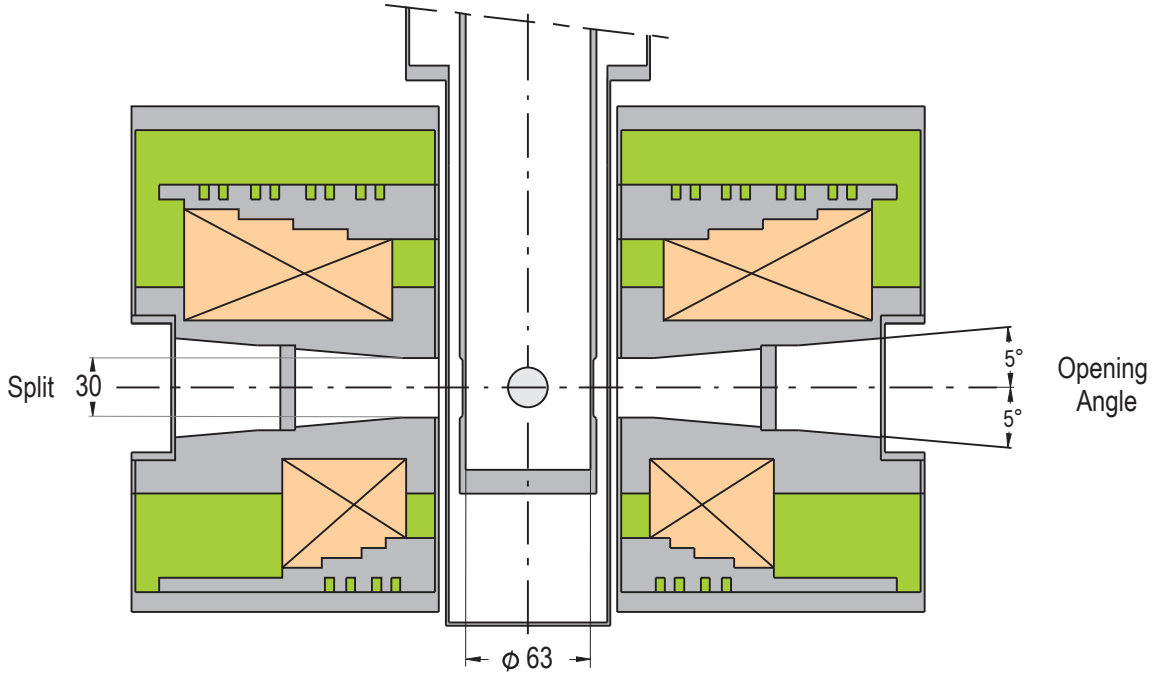
5.2 Vertical Magnet VM - 2

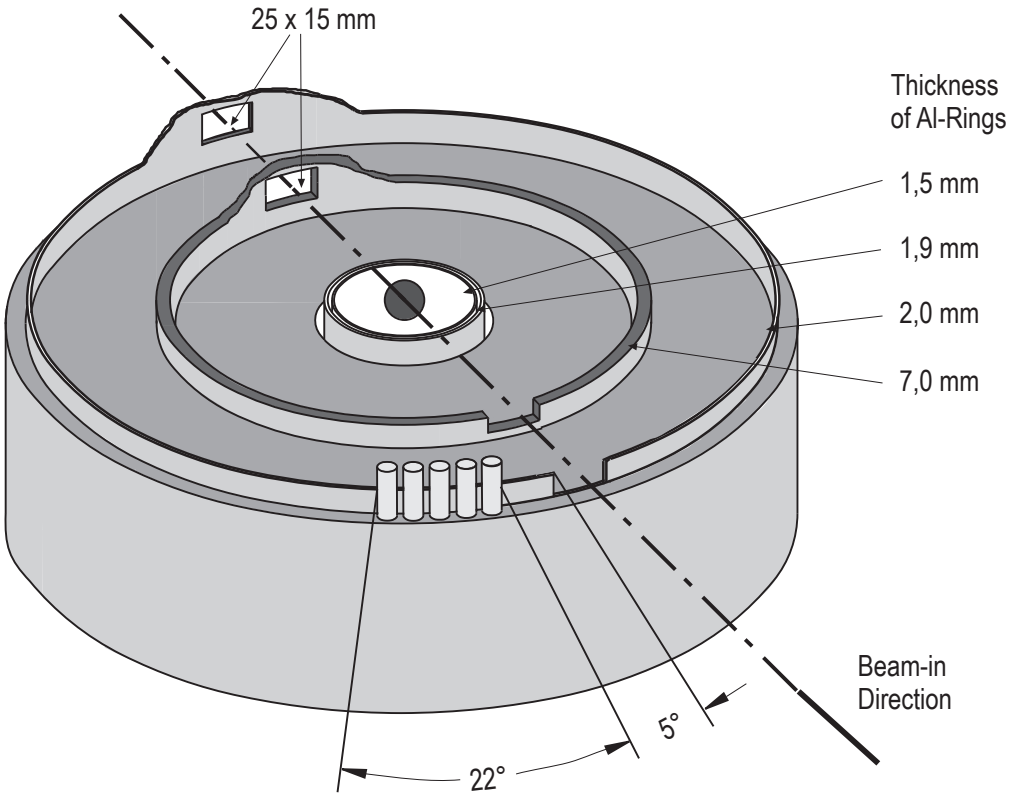
Specifications:

Manufacturer:	Oxford Instruments, Oxford, GB
Temperature Range: with Dilution Insert:	1.5 K - 300 K < 50 mK - 1.2 K
Sample Diameter: with Dilution Insert:	< 50 mm < 40 mm
Split:	30 mm
Angle:	5°
LN_2-Refill Intervall:	3 days
LHe-Refill Intervall:	1 - 2 days
Magnetic Field at 4.2 K:	6.5 T (asymmetric)
Horizontal Access:	total view 335° (25° dead angle)
Total Thickness of Al-Screens and Al-Rings in Split:	ca. 17 mm
Thermometry Sensors:	Cernox®
Scheduled Position:	E1, E3, E4, E6,


OXFORD
VM2
7T vert. & asym Magnet


W- Motor
175
Sample Thermometer
Top Flange
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 X Gas Valves
7 VTi Evaporator Valve
13 Helium Exhaust
10 LHe Level
1 2 Regulation Thermometer
8 LN 2 Fill In/out
5 VTi Cold Valve
4 Vacuum Valve
9 LHe Fill
1485
LHe
LN 2
Regulation Thermometer and Heater
Magnet Thermometer
5°
n-Beam
30
127
170
Bottom Flange
Sample Thermometer
Sample
ϕ60
520


Split 30
5°
5°
Opening
Angle
ϕ 63


25 x 15 mm
Thickness
of Al-Rings
1,5 mm
1,9 mm
2,0 mm
7,0 mm
Beam-in
Direction
5°
22°

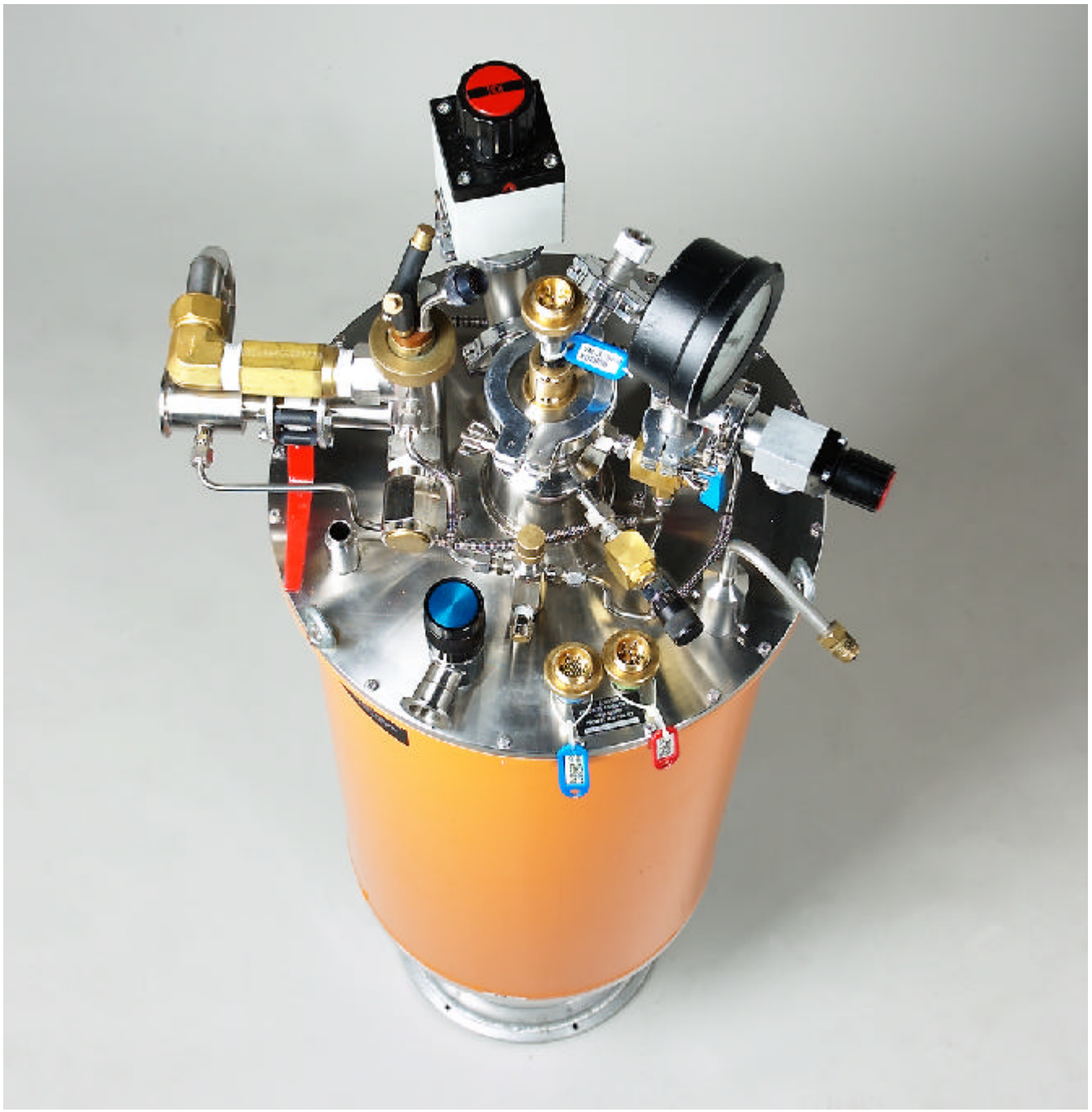
5.3 Vertical Magnet VM - 3

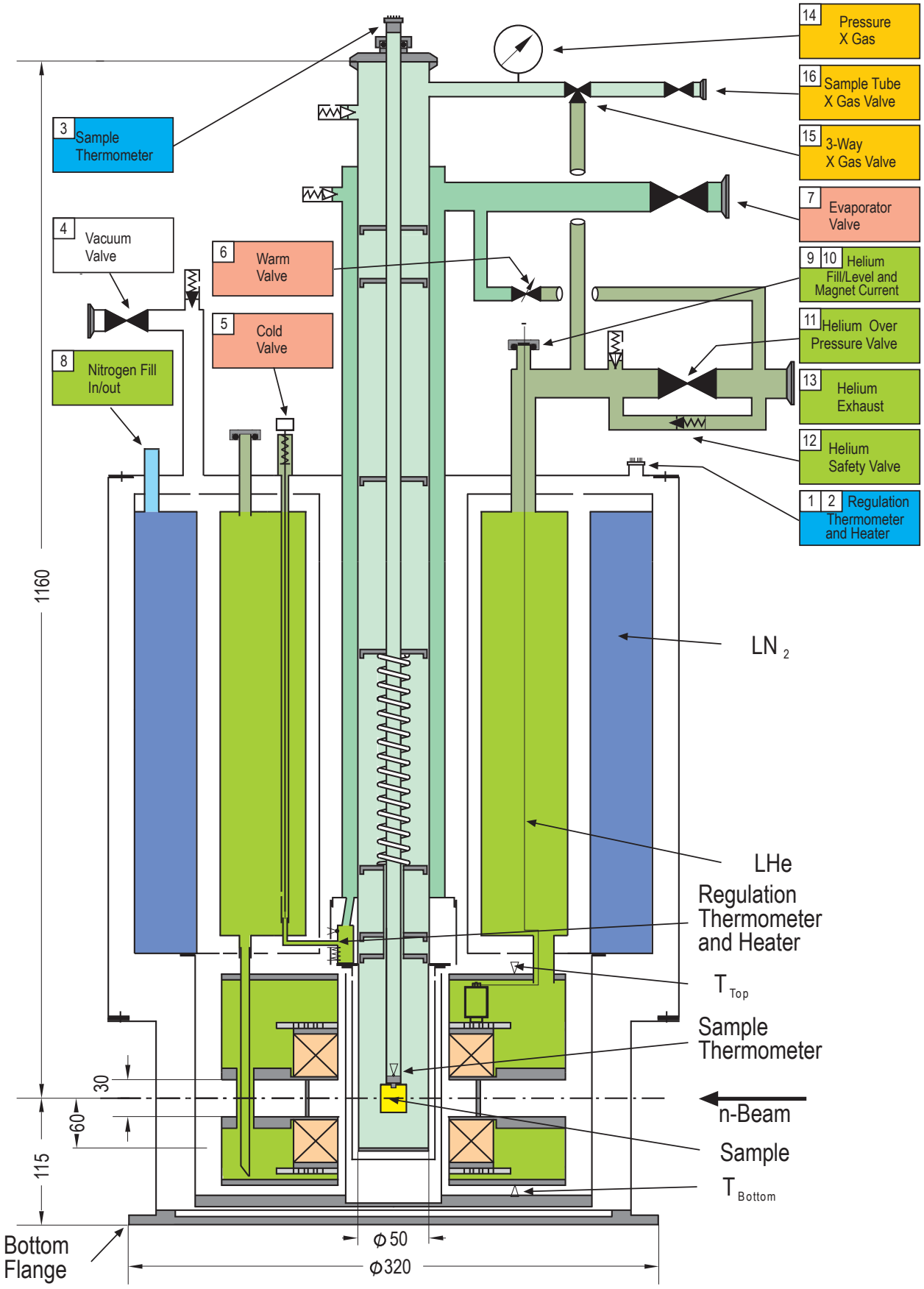
Specifications:

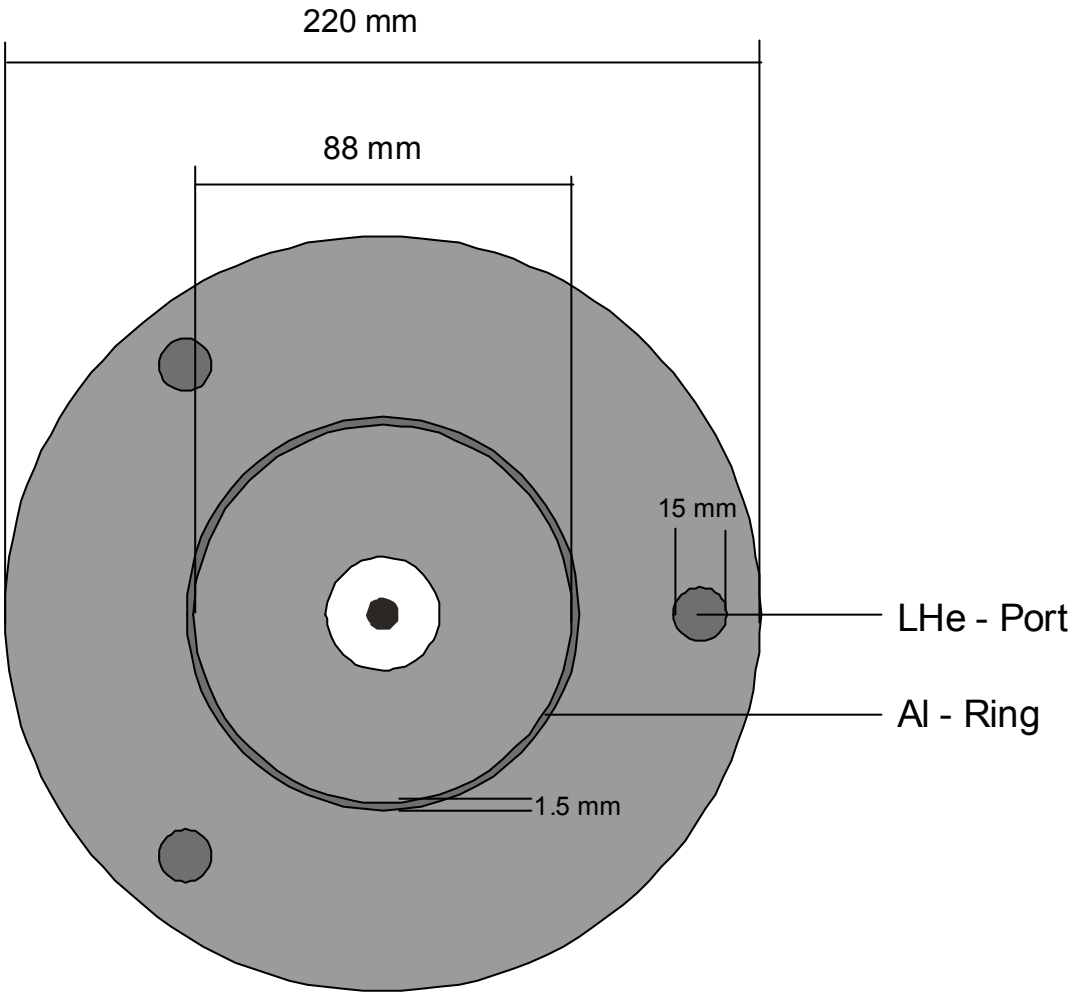
Manufacturer:	AS Scientific Products Ltd., Abingdon, GB
Temperature Range:	1.5 K - 300 K
with Dilution Insert:	50 mK - 1.2 K
Sample Diameter:	< 50 mm
with Dilution Insert:	< 40 mm
Split:	30 mm
Angle:	0°
LN_2-Hold Time:	24 h
LHe-Hold Time:	24 h
Magnetic Field (max):	5 T (symmetric)
horizontal Access:	Total view 345° (15° dead angle)
Total Thickness of Al-Screens:	2 x ca. 8 mm (no beam-in windows)
Thermometry Sensors:	Cernox®
Scheduled Position:	E1, E2, E3, E4, E6, V1, V2, V3, V4

This vertical magnet is a modified version of an Orange Standard cryostat


Scientific
VM3
5T vert. & sym. Magnet




14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level and Magnet Current
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 2 Regulation Thermometer and Heater
3 Sample Thermometer
4 Vacuum Valve
6 Warm Valve
5 Cold Valve
8 Nitrogen Fill In/out
LN 2
LHe
Regulation Thermometer and Heater
T Top
Sample Thermometer
n-Beam
Sample
T Bottom
Bottom Flange
1160
30
60
115
ϕ50
ϕ320


220 mm
88 mm
15 mm
LHe - Port
Al - Ring
1.5 mm

5.4 Vertical Magnet VM - 4

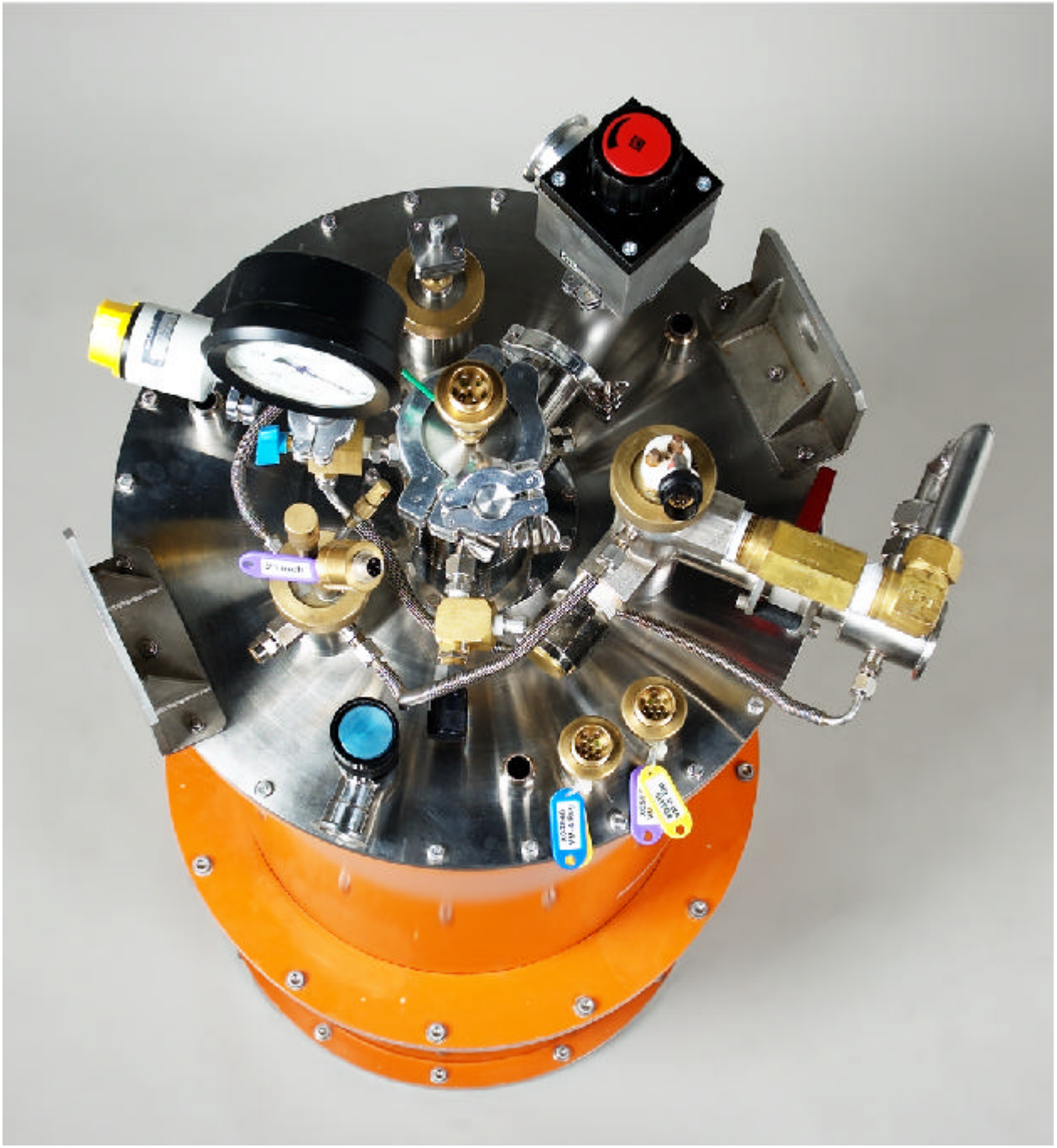
Specifications:

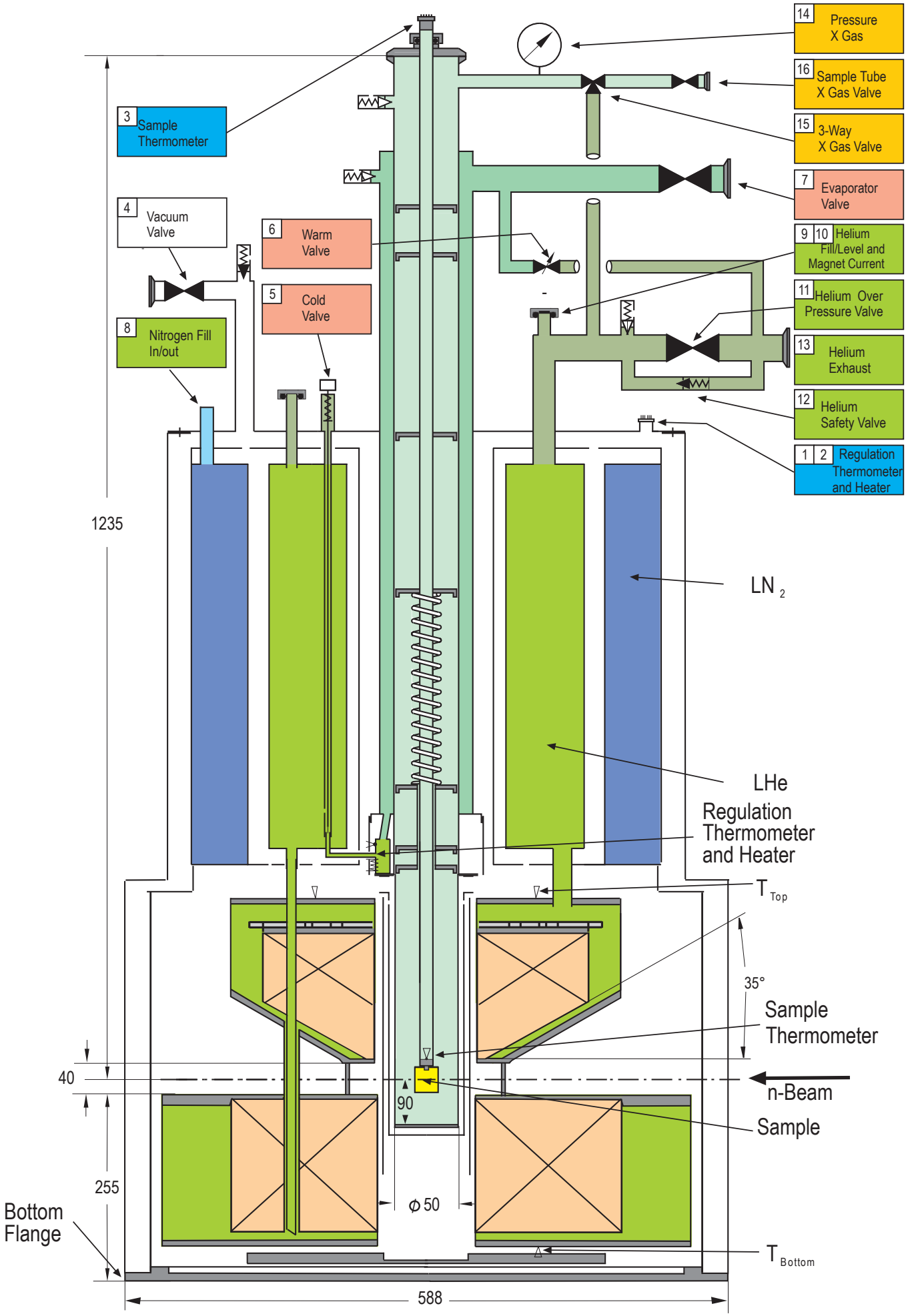
Manufacturer:	AS Scientific Products Ltd., Abingdon, GB
Temperature Range:	1.5 K - 300 K
with Dilution Insert:	< 50 mk - 1.2 K
Sample Diameter:	< 50 mm
with Dilution Insert:	< 40 mm
Split:	40 mm
Angle:	Wedges
LN_2-Hold Time:	1 day
LHe-Hold Time:	2 days
Magnetic Field (max):	4 T (asymmetric)
horizontal Access:	Total view |??|° (|??|° dead angle)
Total Thickness of Al-Screens:	2 x ca. 8 mm (no beam-in windows)
Thermometry Sensors:	Cernox®
Scheduled Position:	E1, E3, E4, E6, V1, V2, V4

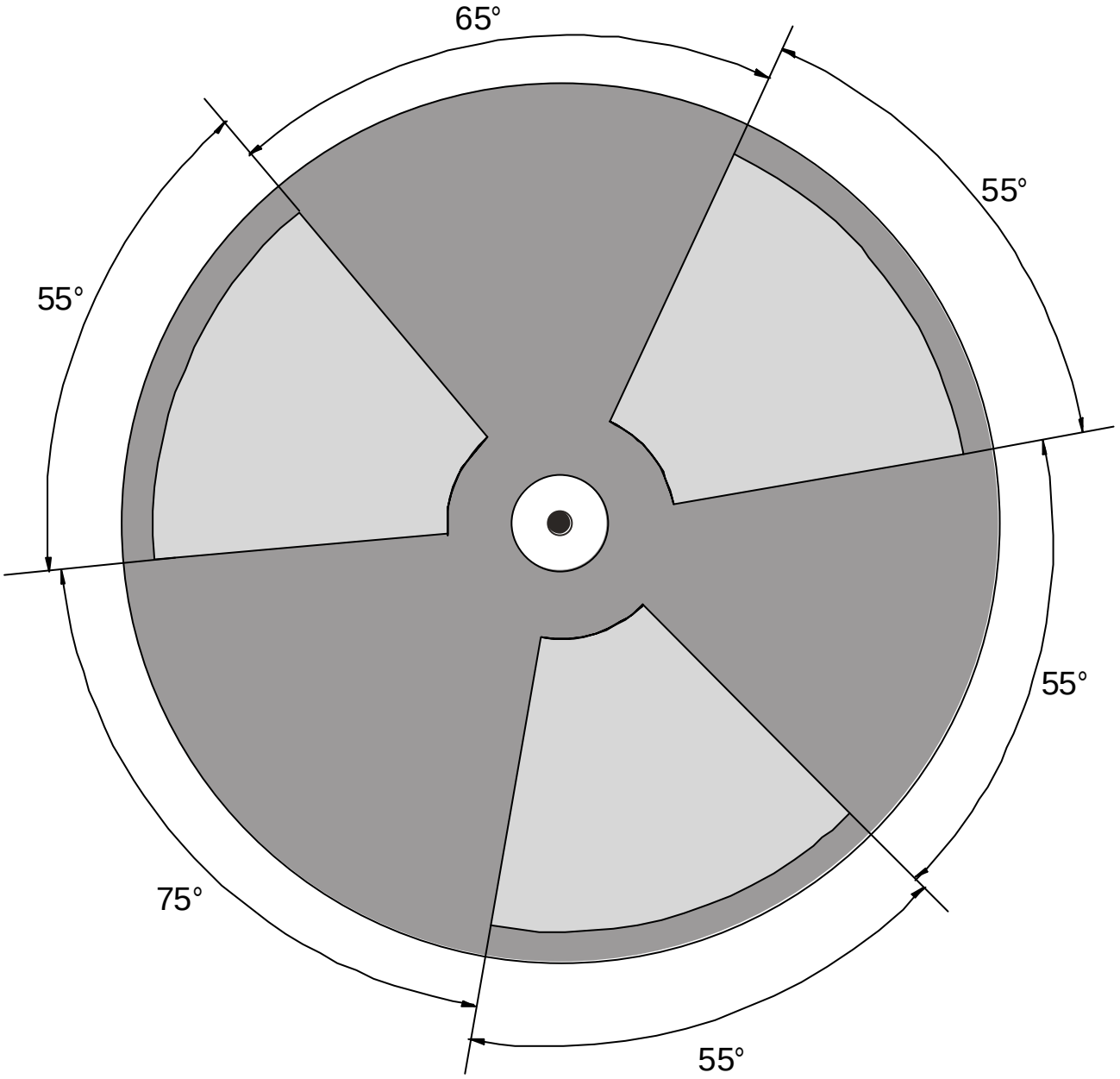
This vertical magnet is a modified version of an Orange Standard cryostat

Sampletube:	Top - Beam	1153
	Bottom - Beam	162
Kryo:	Bottom - Beam	327


VM4




14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level and Magnet Current
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 2 Regulation Thermometer and Heater
3 Sample Thermometer
4 Vacuum Valve
6 Warm Valve
5 Cold Valve
8 Nitrogen Fill In/out
1235
LN 2
LHe
Regulation Thermometer and Heater
T Top
35°
Sample Thermometer
40
90
n-Beam
Sample
255
Bottom Flange
ϕ 50
T Bottom
588



stainless steel wedges

6. Horizontal Magnets

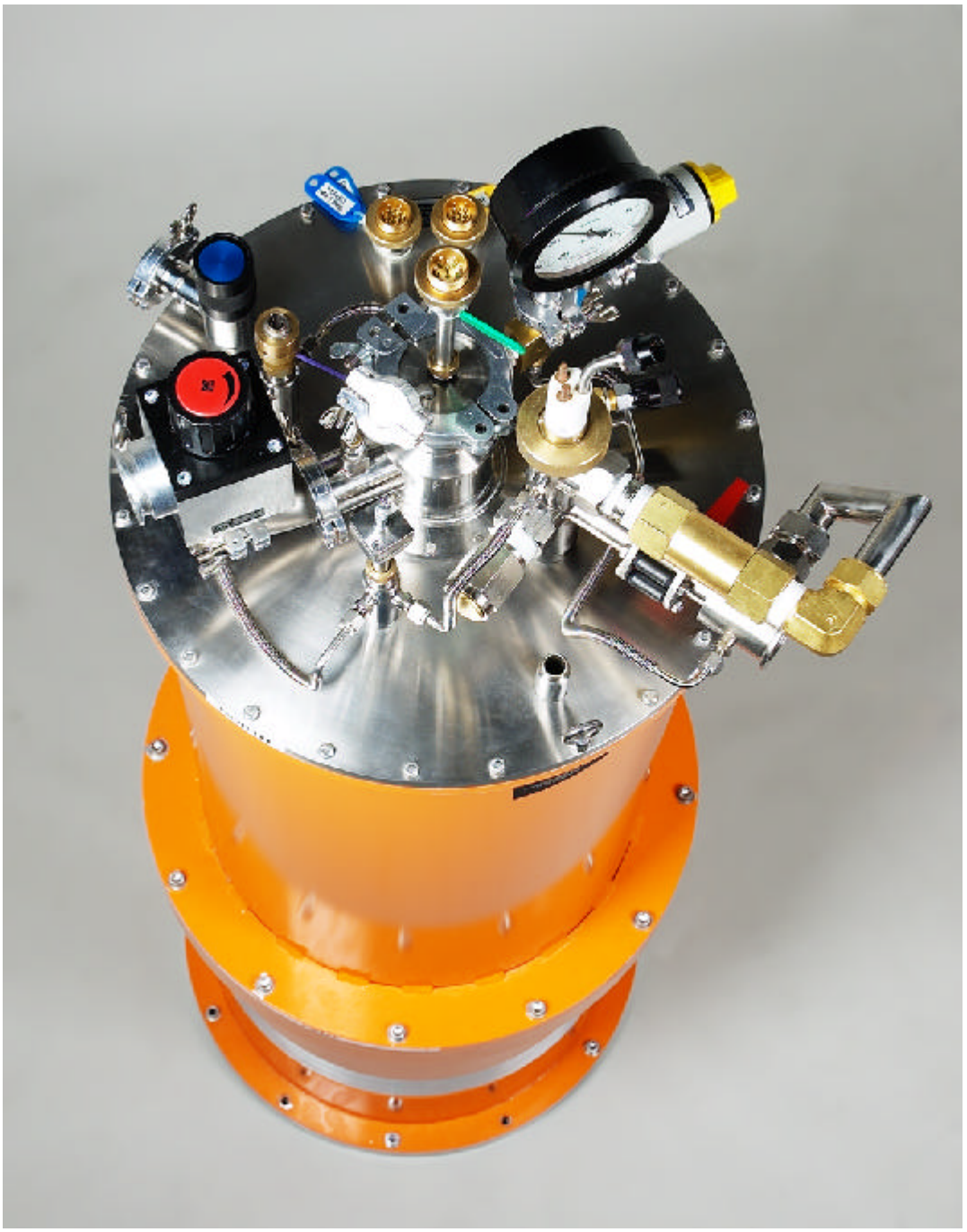
6.1 Horizontal Magnet HM - 1

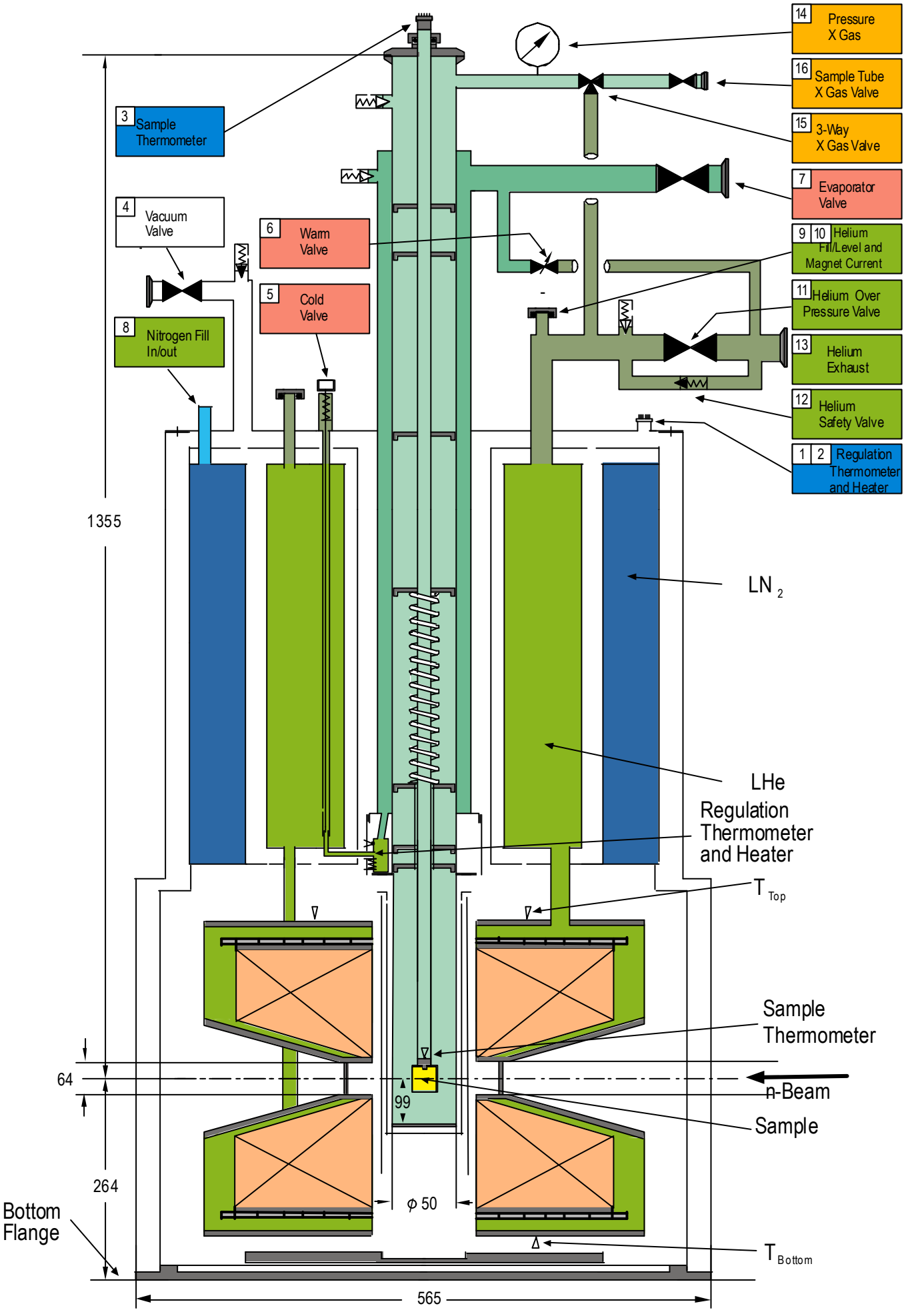
Specifications:

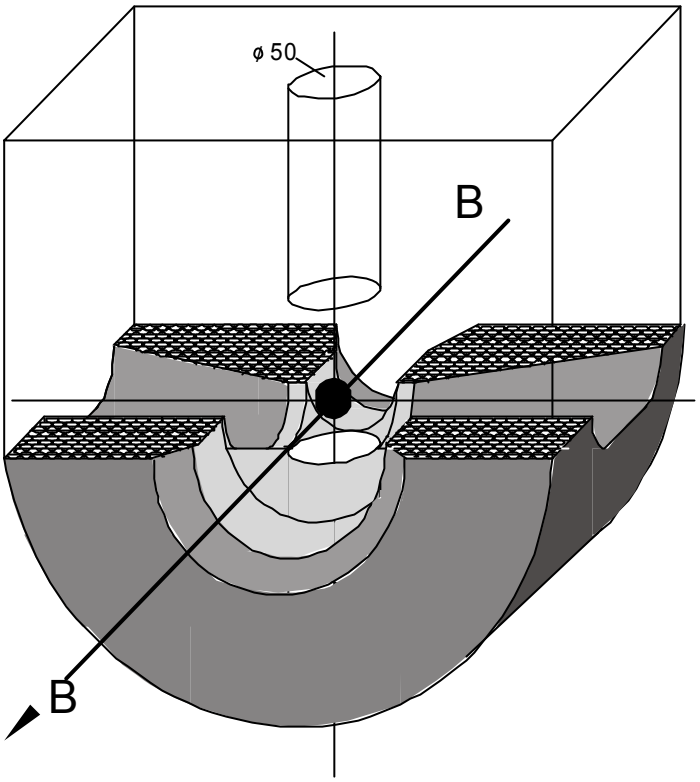
Manufacturer:	RMC Cryosystems/AS Scientific
Temperature Range:	1.5 K - 300 K
with Dilution Insert:	- 50 mK
Sample Diameter:	< 50 mm
with Dilution Insert:	< 40 mm
Split:	65 mm
Angle:	> 10°
LN_2-Hold Time:	24 h
LHe-Hold Time:	24 h
Magnetic Field (max):	6 T
horizontal Access:	2 bores with axes 90°
Total Thickness of Al-Screens:	2 x ca. 4 mm
Thermometry Sensors:	Carbon Glass/Cernox®
Scheduled Position:	E1, E3, E4, E6, V1, V2, V4

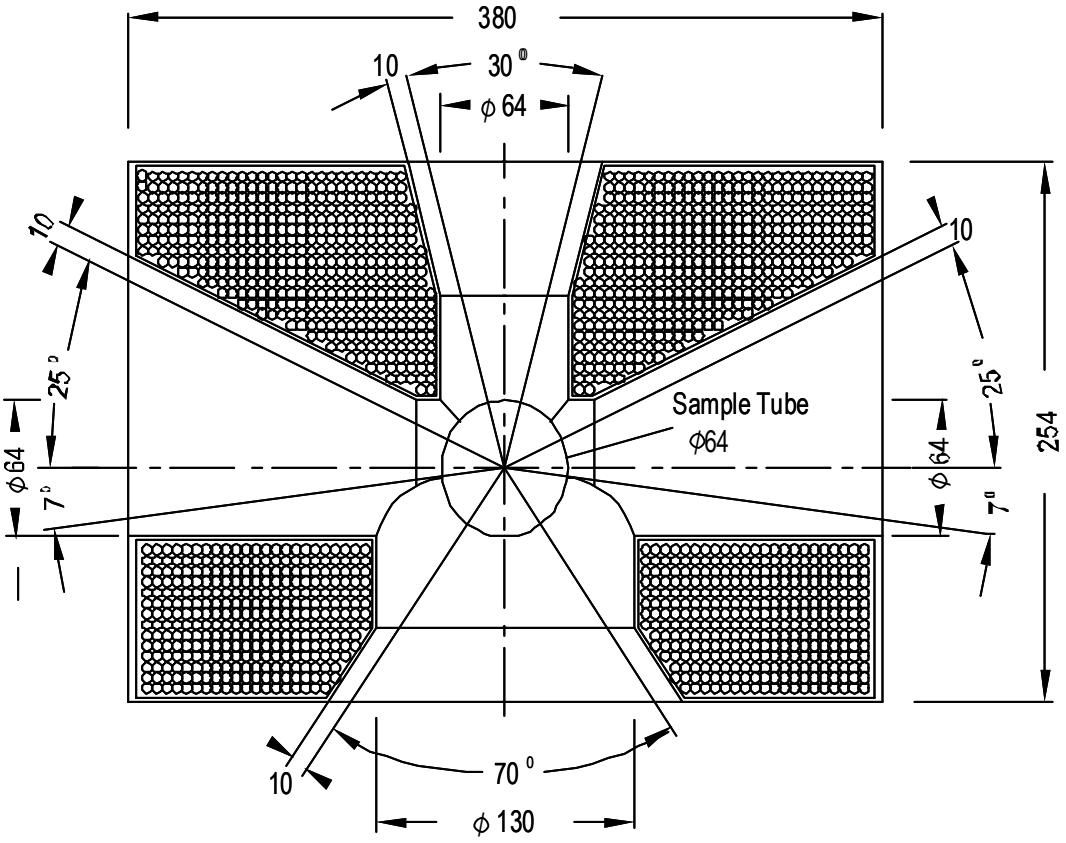
Sampletube:	Top - Beam	1355
	Bottom - Beam	99
Kryo:	Bottom - Beam	264


HM 1




14 Pressure X Gas
16 Sample Tube X Gas Valve
15 3-Way X Gas Valve
7 Evaporator Valve
9 10 Helium Fill/Level and Magnet Current
11 Helium Over Pressure Valve
13 Helium Exhaust
12 Helium Safety Valve
1 2 Regulation Thermometer and Heater
3 Sample Thermometer
4 Vacuum Valve
6 Warm Valve
5 Cold Valve
8 Nitrogen Fill In/out
1355
LN 2
LHe
Regulation Thermometer and Heater
T Top
Sample Thermometer
64
n-Beam
99
Sample
264
Bottom Flange
φ 50
T Bottom
565


ϕ 50
B
B

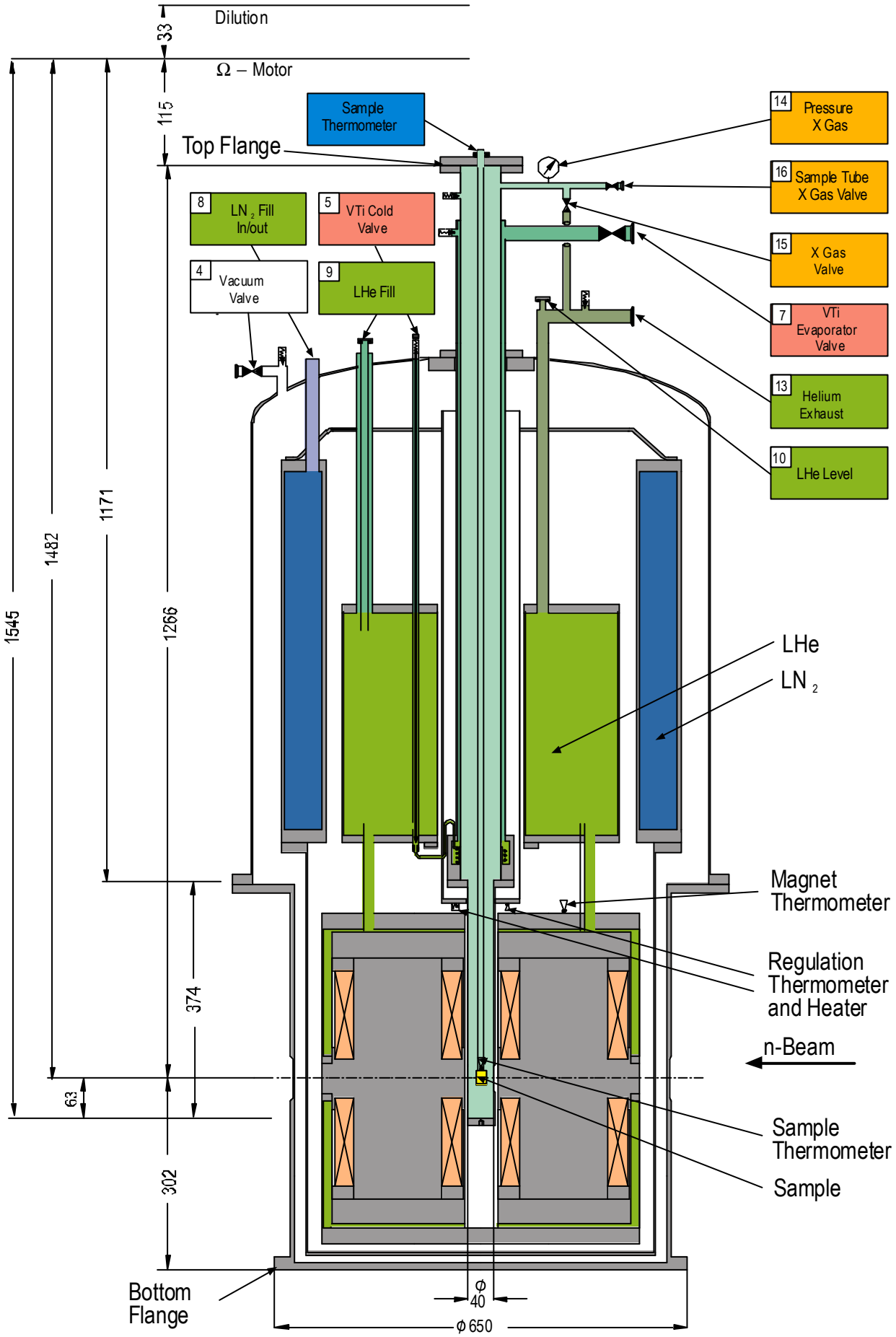

380
10
30°
ϕ 64
10
10
25°
25°
Sample Tube
ϕ64
ϕ64
ϕ64
7°
7°
254
10
70°
ϕ 130

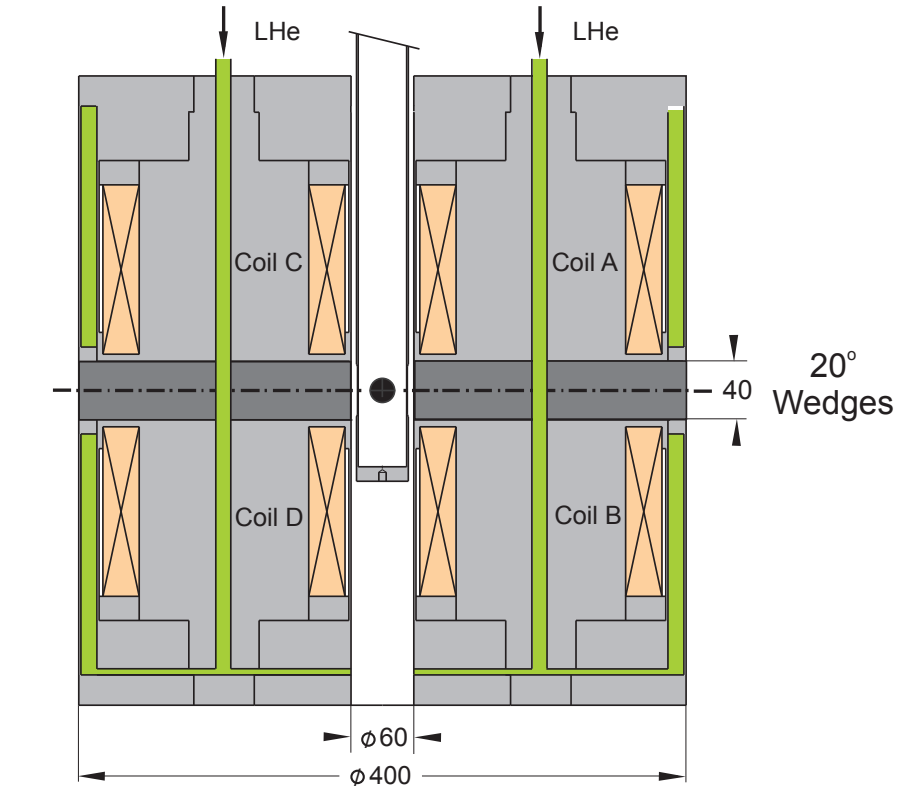
6.2 Horizontal Magnet HM - 2

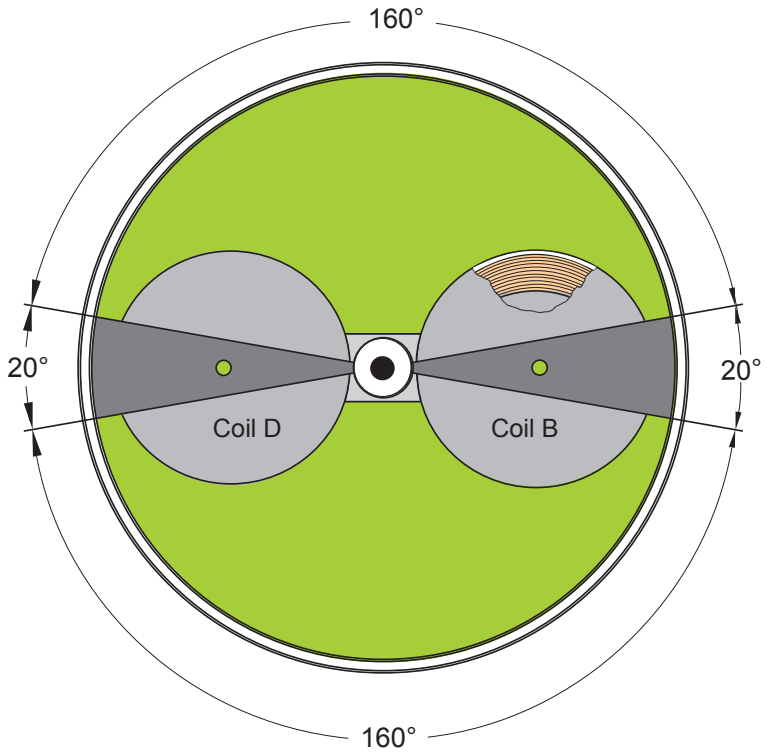
Specifications:

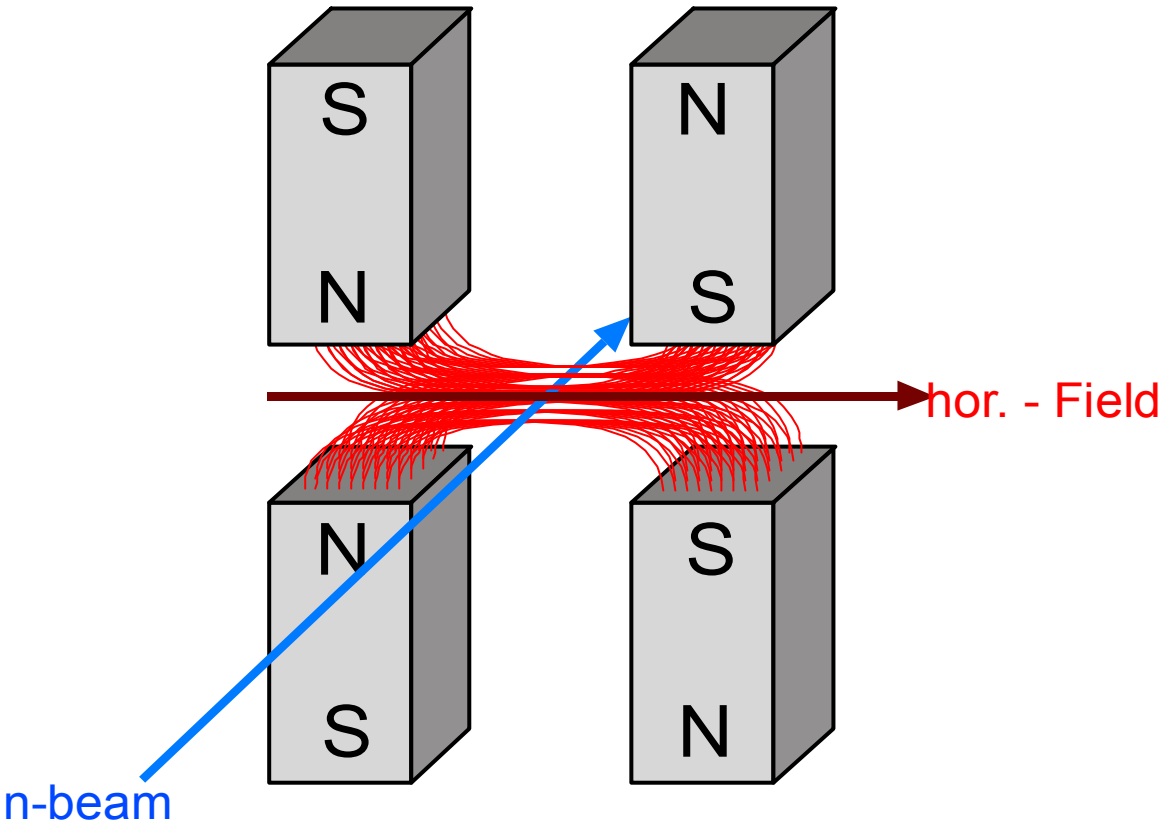
Manufacturer:	Oxford Instruments, Oxford, GB
Temperature Range:	1.5 K - 300 K
with Dilution Insert:	- 50 mK
Sample Diameter:	< 40 mm
with Dilution Insert:	< 30 mm
Split:	40 mm
Angle:	0^{o}
LN_2-Refill Intervall:	3 days
LHe-Refill Intervall:	1 - 2 days
Magnetic Field (max):	4 T
horizontal Access:	2 x 160^{o} (2 wedges 20^{o})
Thermometry Sensors:	Cernox®
Scheduled Position:	E1, E3, E4, E6,


OXFORD
HM 2
4T horiz. 4-Coil Magnet


Dilution
33
Ω – Motor
115
Top Flange
Sample Thermometer
14 Pressure X Gas
16 Sample Tube X Gas Valve
15 X Gas Valve
7 VTi Evaporator Valve
13 Helium Exhaust
10 LHe Level
8 LN2 Fill In/out
5 VTi Cold Valve
4 Vacuum Valve
9 LHe Fill
1545
1482
1171
1266
374
63
302
LHe
LN2
Magnet Thermometer
Regulation Thermometer and Heater
n-Beam
Sample Thermometer
Sample
Bottom Flange
ϕ 40
ϕ 650


LHe
LHe
Coil C
Coil A
Coil D
Coil B
40
20°
Wedges
ϕ60
ϕ400


160°
20°
20°
Coil D
Coil B
160°


S
N
N
S
hor. - Field
N
S
S
N
n-beam

7. High Temperature Furnances

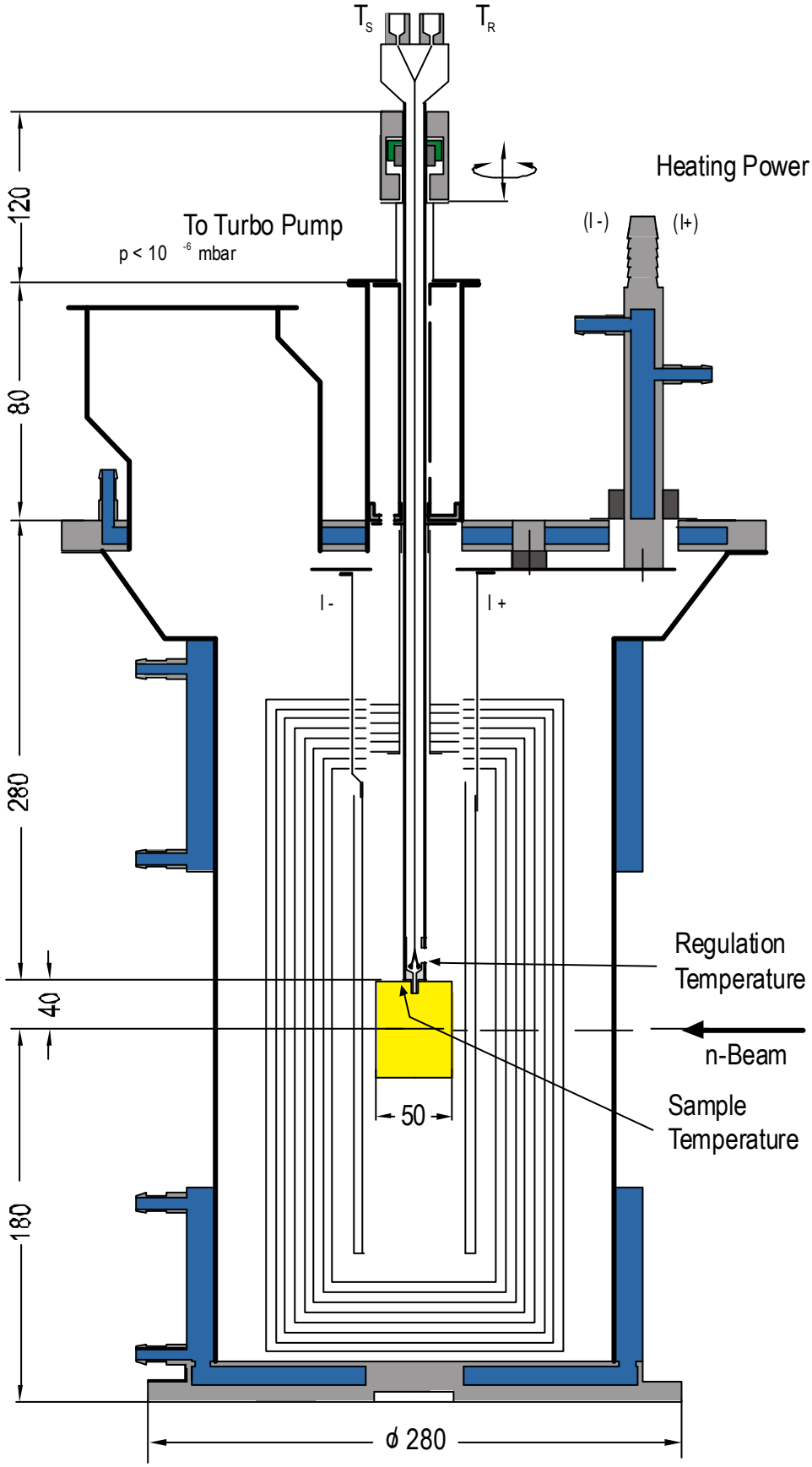
7.1 HTF - I

Specifications:

Manufacturer:	AS Scientific Products Ltd., Abingdon, GB
Temperature Range:	25°C - 1800°C
Sample Diameter:	< 50 mm
Sample Height:	< 30 mm
Heating Power (max):	3 kVA
No Nb-Screens:	2 x 10
Total Thickness of Nb-Screens:	2 x 1 mm
No Al-Screens:	2 x 1
Total Thickness of Al-Screens:	2 x 2 mm
Thermometry Sensor:	W-Re (W5-type)
Scheduled Position:	E1, E2, E3, E4, E6, E7, V1,V2, V3, V4

Note on Sample Containers:

Samples must be enclosed in a sample container supplied by the user. Depending on the temperature range and the sample material the construction of the sample container must include precautions against leakage into the vacuum of the HTF and against overpressure damages of the container.


T_S
T_R
Heating Power
To Turbo Pump
p < 10 -6 mbar
(I -)
(I+)
I -
I +
120
80
280
40
180
50
Regulation Temperature
n-Beam
Sample Temperature
ø 280

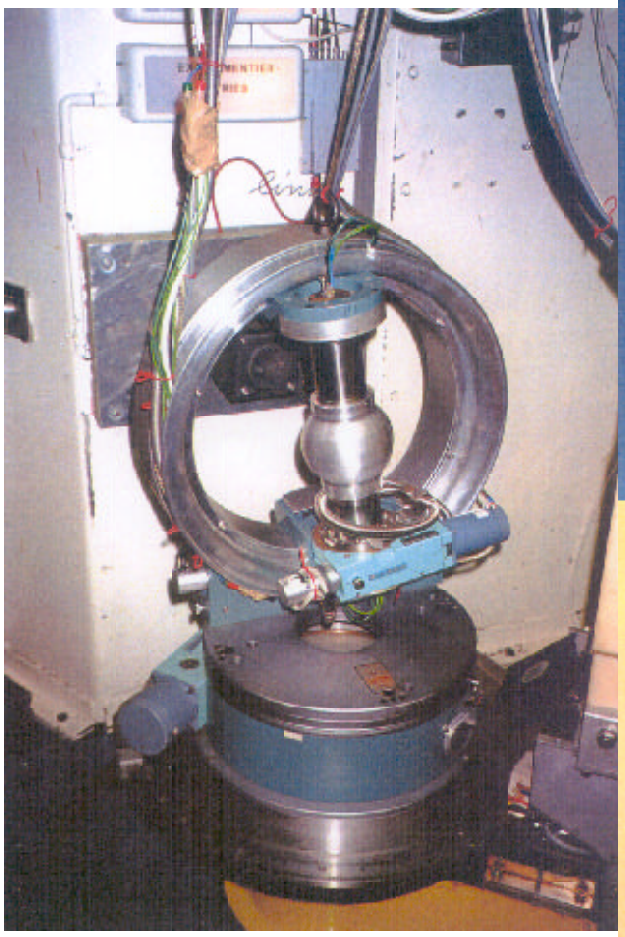
7.2 HTF - J

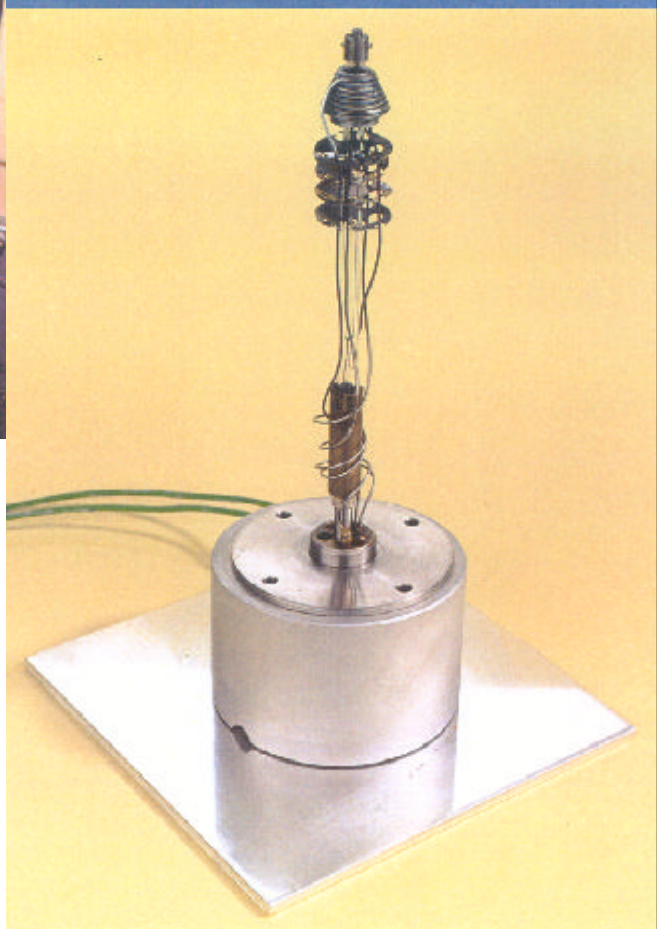
Specifications:

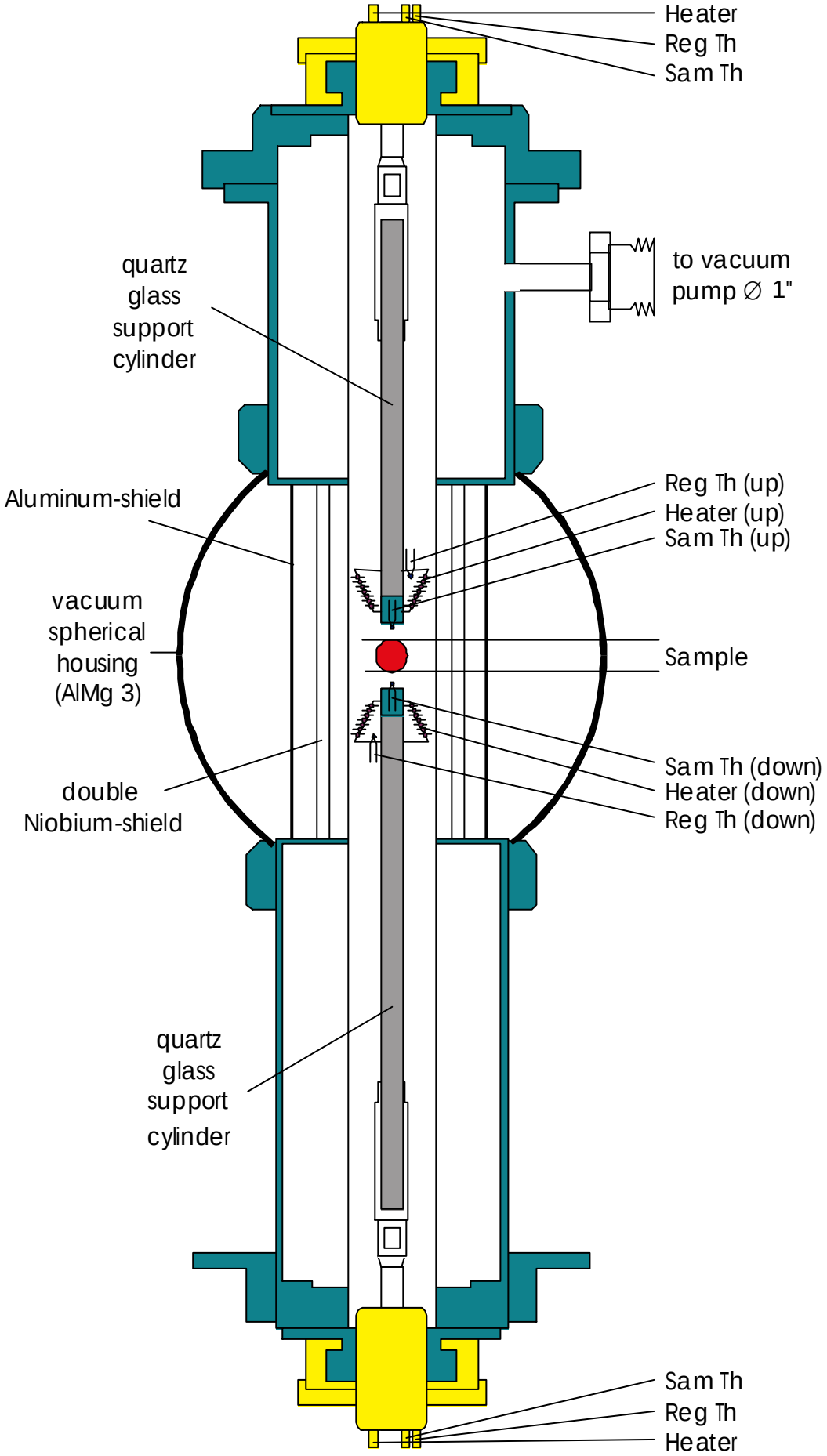
Manufacturer:	IFF-KFA Jülich, Germany
Temperature Range:	300 K - 1500 K
Sample Diameter:	< 20 mm
Sample Height:	3 - 21 mm
Heating Power (max):	300 W
No Nb-Shields:	2
Total Thickness of Nb-Shields:	0.4 mm
No Al-Shields:	1
Total Thickness of Al-Shields:	1 mm
Thickness of quartzglass tube:	2 mm
Thermometry Sensor:	Type K (Chromel/Alumel)
Scheduled Position:	E1, E2, E3, E4, E4, E6, E7, V1,V2, V3, V4 and the 4-circle-cradle

Note on Sample Containers:

Samples must be enclosed in a sample container supplied by the user. Depending on the temperature range and the sample material the construction of the sample container must include precautions against leakage into the vacuum of the HTF and against overpressure damages of the container.





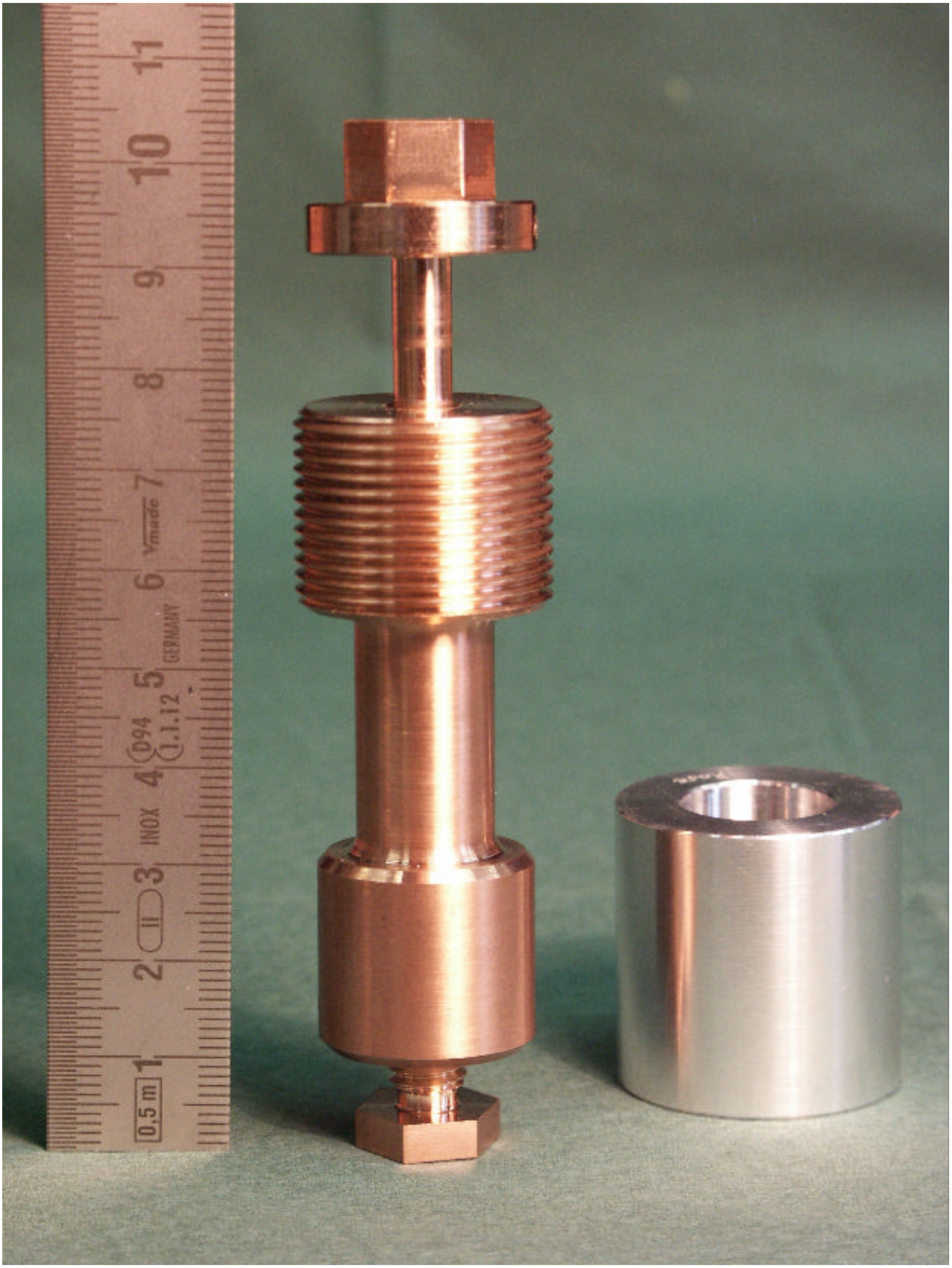

Heater
Reg Th
Sam Th
quartz glass support cylinder
to vacuum pump ∅ 1"
Aluminum-shield
Reg Th (up)
Heater (up)
Sam Th (up)
vacuum spherical housing (AlMg 3)
Sample
Sam Th (down)
Heater (down)
Reg Th (down)
double Niobium-shield
quartz glass support cylinder
Sam Th
Reg Th
Heater

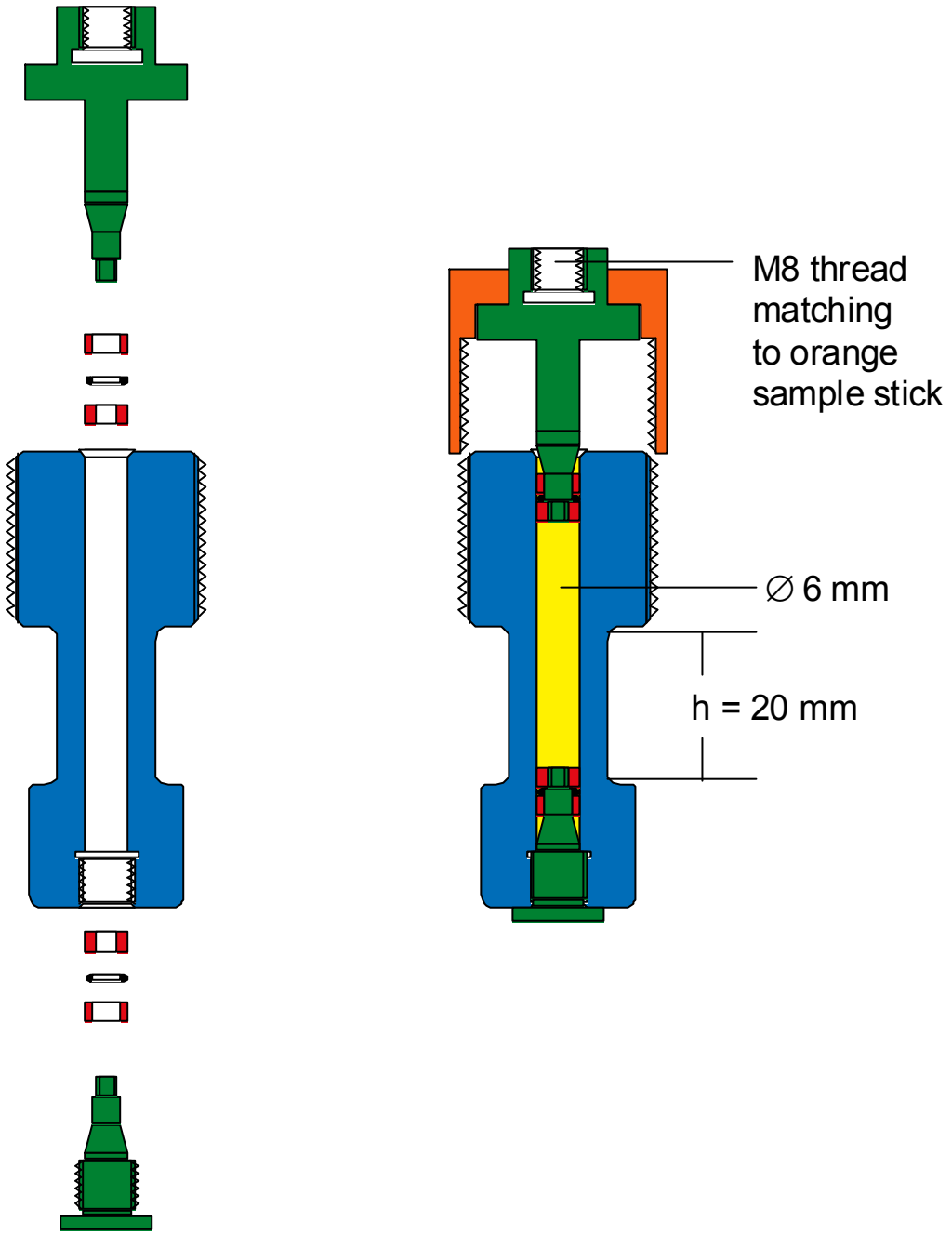
8. Pressure Cells

8.1 Pressure Cell CPC - I

Specifications:

Manufacturer:	ILL
Temperature Range:	1.5K - 300K
Pressure Range:	0 - 5 kbar
Sample Diameter:	5.5 mm
Sample Height:	10 mm
Thermometry Sensor:	OS-Sample

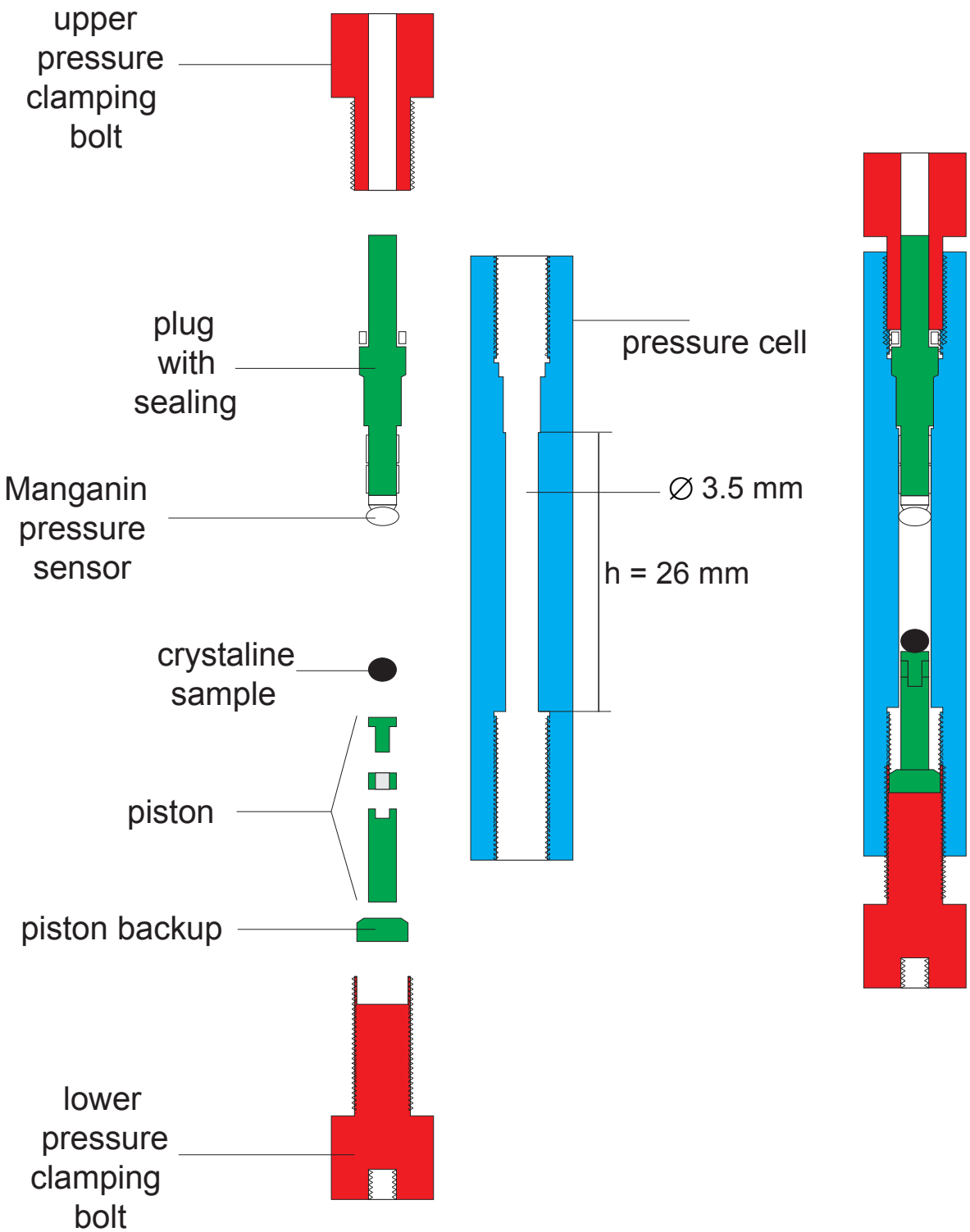

INOX
GERMANY
0,5 m


M8 thread
matching
to orange
sample stick
∅ 6 mm
h = 20 mm

8.2 Pressure Cell CPC - P

Specifications:

Manufacturer:	IP Prague
Temperature Range:	1.5K - 300K
Pressure Range:	0 - 10 kbar
Sample Diameter:	2.4 mm
Sample Height:	10 mm
Thermometry Sensor:	OS-Sample


upper
pressure
clamping
bolt
plug
with
sealing
Manganin
pressure
sensor
crystaline
sample
piston
piston backup
lower
pressure
clamping
bolt
pressure cell
∅ 3.5 mm
h = 26 mm

Appendix

A1 Cool-Down Procedure for the Orange-Cryostats

Legend:

GHe	Gaseous helium
LHe	Liquid helium
V1,V2,V3,V4,V5	Valves as shown on page 2.5 and 2.5.1
(1)....(16)	Valves as shown on page 2.2.1 and 2.2.2

1. Rinse Cryostat with GHe

1.1 Put GHe-run-off-tube in LHe-port (9) of the cryostat.
1.2 Close V3 and V5; open V1,V2,V4.
1.3 Open He-cold valve (5) and He-warm valve (6).
1.4 Open evaporator valve (7) and helium-overpressure valve (red lever, 11).
1.5 Switch on helium pump and pump out until you reach p< 1 mbar (DIAVAC).
1.6 Close V1 and V2.
1.7 Fill GHe into LHe-port with the help of the run-off-tube until safety valve of the LHe-port opens up.
1.8 Interrupt gas-supply; open V1 and V2 and pump out until p < 1 mbar (DIAVAC).
1.9 Repeat procedure twice; afterwards close He-cold valve (5) and He-warm valve (6).

2. Test GHe-Flow through Cold Valve and Evaporator

2.1 Close V1 and V2; fill GHe into cryostat until safety valve opens up (as in 1.7).
2.2 Open V2; open evaporator valve (7) and cold valve (5).
2.3 Optimum GHe-rate of flow results in approximately p = 10-15 mbar (DIAVAC).
2.4 Close cold valve (5); continue pumping via V2 for p < 1 mbar (DIAVAC).

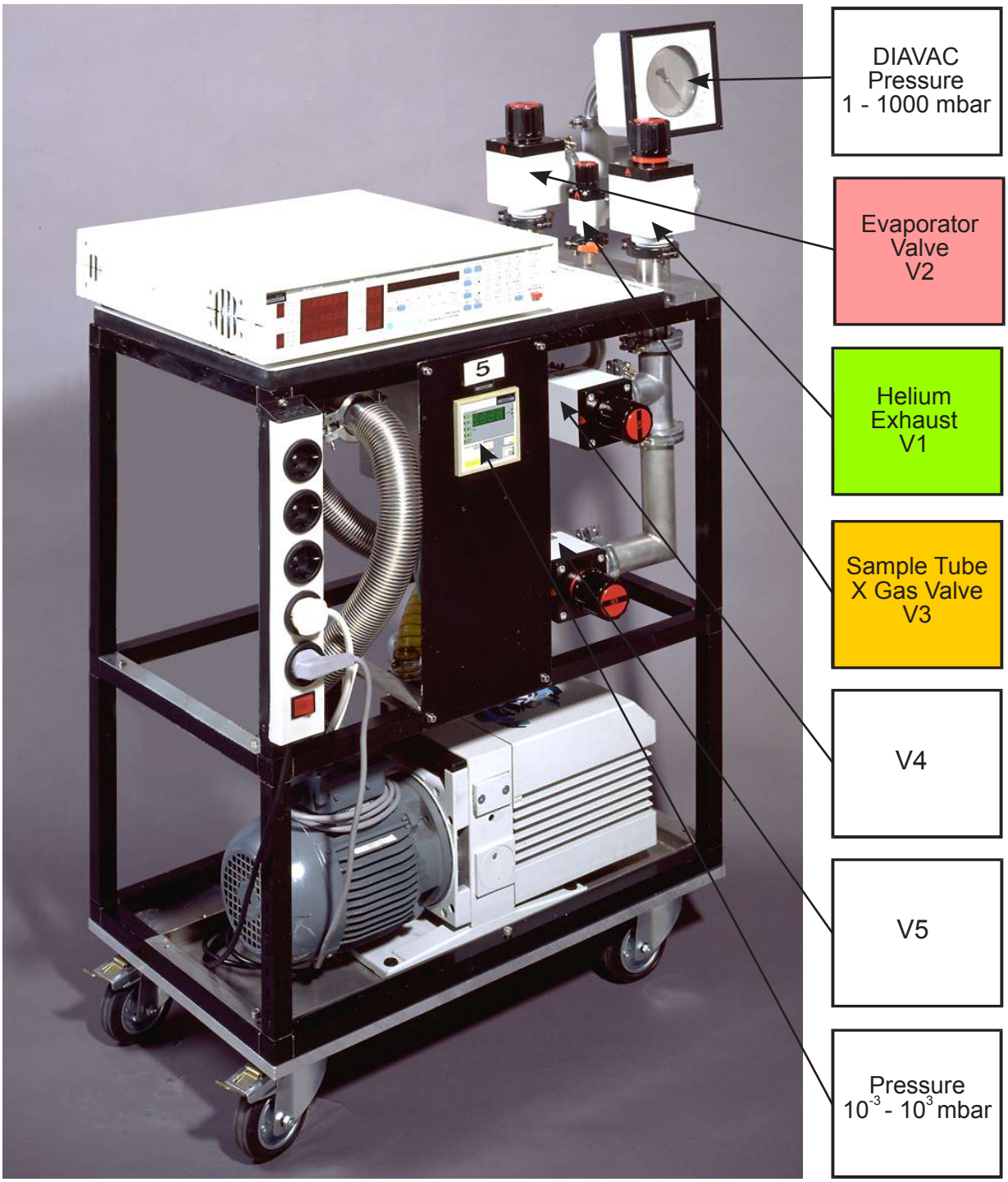
3. Rinse Sample Tube with GHe

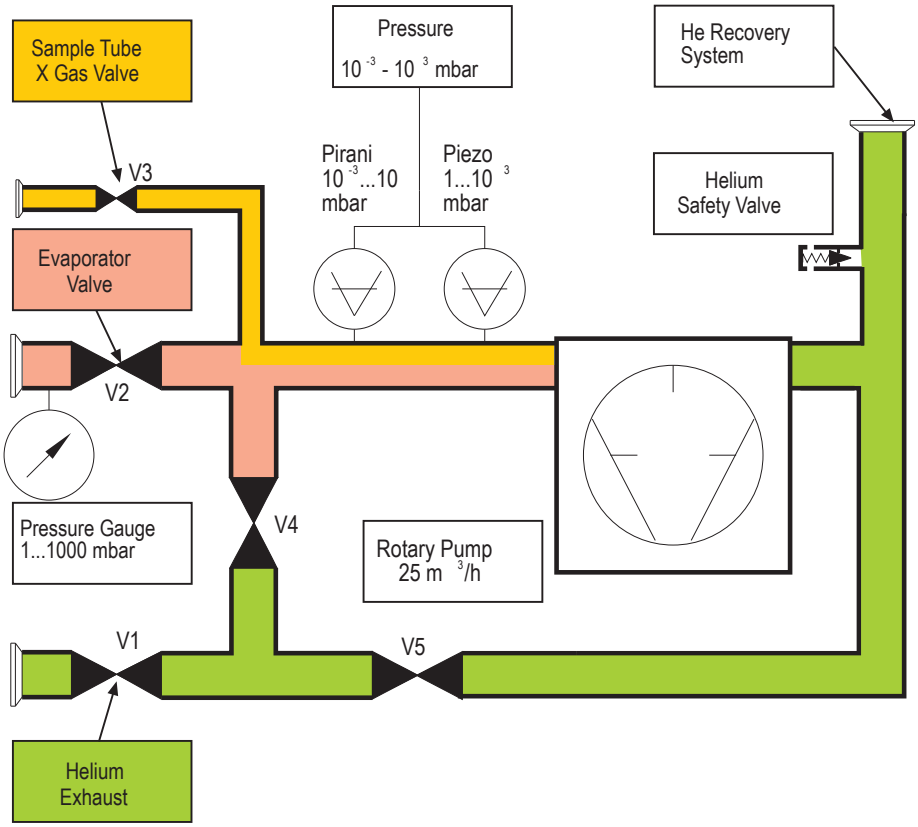
3.1 Open V3; open sample tube X-gas valve (16); 3-way X-gas valve (blue lever, 15) must be straight up.
3.2 Pump out sample tube until p = 0 mbar (EDWARDS 25 mbar capsule gauge).
3.3 Turn straight down 3-way X-gas valve (blue lever, 15) for GHe-recovery line; fill sample tube with p = 1 atm GHe.
3.4 Repeat procedure twice; adjust to approximately p = 15 mbar for Cool Down with sample stick.

4. Fill Cryostat with LHe and LN_2 and Cool Down to T < 4 K

4.1 Close V4; open V1 and V5; evaporator is constantly pumped through V2 with p < 1 mbar (see also 2.4).
4.2 Open helium-overpressure valve (11).
4.3 Prepare LHe-vessel: secure balloon; secure overpressure valve.
4.4 Insert LHe transfer syphon slowly into LHe-vessel.
4.5 Wait approximately 30 sec for the air-GHe-exchange in transfer line; then insert transfer line into the cryostat (LHe-Port, 9) up to the bottom of the helium tank .
4.6 Transfer LHe with approximately p = 0.2 - 0.3 bar.
4.7 Transfer LN_2 into cryostat during LHe-transfer
4.8 Close two ports (8) with rubber stoppers after LN_2-transfer; secure third port (8) with paper against H_2O-Icing.
4.9 LHe is collecting in the cryostat after appoximately 10 min and LHe-level meter shows increasing height (see appendix B).
4.10 Stop LHe-transfer at h = 35 cm.
4.11 Pull out LHe transfer syphon; close LHe-port (9); close GHe-over pressure valve (red lever, 11).
4.12 Open cold valve (5) until approximately p = 100 mbar (DIAVAC) is reached.
4.13 $T_{Regulation}$ and T_{Sample} decrease from 300K with about 0.5 K/sec.
4.14 For T < 50 K, close the cold valve (5) slightly until approximately p = 30 mbar.
4.15 After approximately two hours T < 4 K should be reached and the cold valve (5) should be adjusted to approximately p = 2 - 5 mbar.

A2 ^{4}He Pumping System




Sample Tube
X Gas Valve
Pressure
10 -3 - 10 3 mbar
He Recovery
System
V3
Pirani
10 -3 ...10
mbar
Piezo
1...10 3
mbar
Helium
Safety Valve
Evaporator
Valve
V2
Pressure Gauge
1...1000 mbar
V4
Rotary Pump
25 m 3/h
V1
V5
Helium
Exhaust

A3 Cool-Down Procedure of Close Cycle Refrigerator

1.) Check He-gas pressure p > 17 bar at compressor unit.

2.) Install water cooling circuit.

3.) After sample mounting check correct regulation and sample temperature read out with ILL-PTC or DRC-93; check heater function, also.

4.) Mount vacuum can and start pumping isolation vacuum with separate turbo pump for $p < 10^{-4}$ mbar.

5.) Start cooling by switching on the main power switch at the compressor unit.

A4 Warm-Up and Cool-Down Procedures for the HTF

1.) After inserting the sample start pumping the isolation vacuum with rotary pump and turbo pump.

2.) Install water cooling circuit.

3.) Wait until pressure $p < 10^{-3}$ mbar at the left instrument then the right instrument for $p = 10^{-8}...10^{-3}$ mbar will start reading automatically

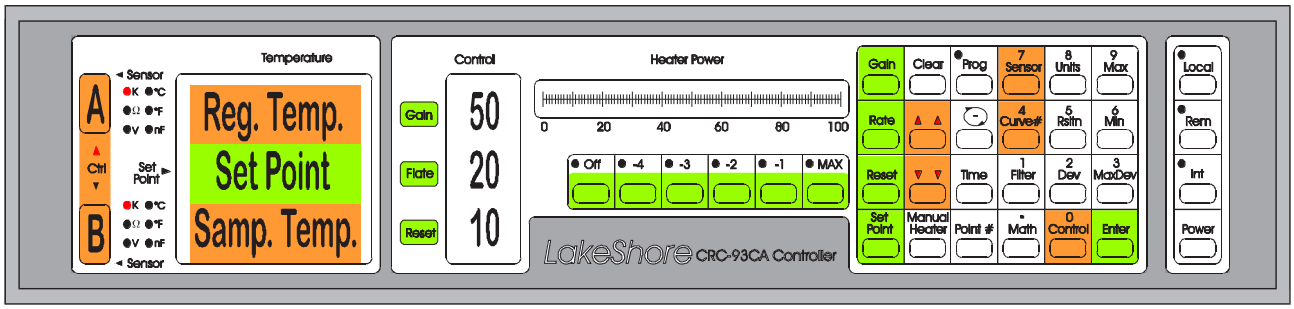
4.) Check if all connectors are in the correct positions (2 x 2 XRL-Plug for regulation and sample at ILL-Controller , BNC with adapter-box at the rear side of the ILL-Controller).

5.) Configure the ILL-Controller PID-settings to P=5000, I=1000 and all other parameters to zero.

6.) First, think about what temperature you want to work, because at temperatures l ower than 800 K the regulation is slow and you have to increase the temperature very slowly. Up to 600 K is useful to work in the 500 kVA-range, at higher temperatures use the 3500 kVA-range.

7.) Example: to reach 700 K, work with the “Create Temperature-profile-option” of the ILL-Controller. 1st step: ramp to 600 K in 30 min, 2nd step: stay at 600 K for 30 min, 3rd step: ramp to 700 K in 30 min.
Step 1 is to prevent overshoots, step 2 gives the controller time to minimize the regulation-difference and step 3 ramps slowly to the target temperature.

8.) For changing the sample, the furnace has to be cooled-down slowly. This may take many hours to temperatures $T < 100^{o}$ C. For a forced cool-down a bottle of Argon gas is supplied. This exchange gas procedure can be used as follows:
- Shut down the pumping system and close valves.
- Open the hold-position on the NW 50-top-flange, then supply p = 1 atm Argon-gas via the gas inlet at the side of the turbo pump.
- Adjust smooth Ar-gas flow through the NW 50-top-flange.
- Take great care that no air contaminates the vacuum space, i. e. the 100 µm thin Niobiumsheets.



Adjusting Sensor Type and Calibration (brown color)

Step 1: Set The Sensor-Positions by pressing Key ´***Sensor***´and simultanously Key ´***Arrow up***´ to Sensor ´A´ on the upper display and Key ´***Arrow down***´ to Sensor ´B´ on the lower display.

Step 2: Check the Input-Cards by pressing Key ´***Sensor***´. The Display shows the codes of the Input-Cards. Index : 9318/9317 for Carbon (CG) and Cernox-Sensors (CX)
9220-R1 for Rhodium-Iron-Sensors (RhFe)
9220-3 for Silicon-Diode-Sensors (SiD)
The Input Card must correspond with the Sensor Type.

Step 3: Check and adjust the Curve No. for the specific Sensor Number which you are ing. Press Key ´***Curve***´ and on the display and you will see the Curve Numbers for both channels. For changing the Curve Number press Key ´***Curve***´and simultanously Key ´***Arrow up***´ to increase the Curve Number of channel A; or Key ´***Arrow down***´ to increase the Curve Number of channel B. The relevant Curve No. can be found in the updated tables of the temperature sensors provided by the sample environment group.

Step 4: Set the Control Sensor to the corresponding channel, press Key ´***Control***` and simultanously key ´***Arrow up***´ for control on Channel A, or Key ´***Arrow down***´ for control on channel B. At the left side of the front panel one of two LED´s will light for the Control Channel. Normally the Control Sensor is set to Channel A and Channel B is the Sample Sensor.

Adjusting PiD Parameters and Heater Power (green color)

Step 1: Set the Control-Parameters for the PID-Controller, press Key ´***Gain***´and the gain-display blinks; now enter with the numeric Key´s (***0,...,9***) the value for the Gain and resume with Key ´***Enter***´. Use the same procedure for adjusting the Rate and Reset - values with the corresponding Key´s ´***Rate***´,´***Reset***´. Practical default values are : Gain = 50, Rate = 20, Reset = 10.

Step 2: For the Setpoint use the same procedure as for the Control Parameters; only use Key ´***Setpoint***´ and ´***Enter***´.

Step 3: The Heater Range is set for temperatures below 10K to ´***-1***´(Key) = 5W and for temperatures above 10K to ´***Max***´(Key) = 50W.

A6 Curve Numbers and Thermometer Codes for RhFe-Controller in the V-Hall

Curve No.	Therm. Code	Therm. Name	Calibration Range	Max. Setpoint
#01	* * *	* * *	* * *	* * *
#02	CRV 10	Si-Diode	1.4K - 325K	325K
#03	DIN-PT	Pt -100	14K - 800K	800K
#04	CRV 10	Si-Diode	1.4 K - 475K	475K
#05	RESVRD	* * *	* * *	* * *
#06	RF4853	Reg. OS-V1	1.2K - 322K	325K
#07	RF5860	Sam. OS-V1	1.5K - 300K	325K
#08	RF4582	Reg. OS-V2	1.5K - 300K	325K
#09	RF1099	Sam. OS-V2	1.5K - 300K	325K
#10	RF3992	Reg. OMF-V3	1.4K - 600K	800K
#11	RF5165	Sam. OMF-V3	1.4K - 600K	800K
#12	RF6268	Reg. OS-V5	1.5K - 300K	325K
#13	RF6274	Sam. OS-V5	1.5K - 300K	325K
#14	RF4611	Reg. OS-Res-E	1.6K - 300K	325K
#15	RF5875	Sam. OS-Res-E	1.5K - 300K	325K
#16	RF4612	Reg. OS-Res-V	1.6K - 300K	325K
#17	RF4579	Sam. OS-Res-V	1.5K - 300K	325K
#18	RF8122	Reg. OF-1	1.5K - 600K	800K
#19	RF3365	Sam. OF-1	1.5K - 600K	800K
#20	RF8123	Reg. OF-2	1.5K - 600K	800K
#21	RF8120	Sam. OF-2	1.5K - 650K	800K
#22	RF3363	Reg. OM-1	1.5K - 300K	325K
#23	RF4567	Sam. OM-1	1.5K - 300K	325K
#24	RF3363	Reg. OM-2	1.5K - 300K	325K
#25	RF4579	Sam. OM-2	1.5K - 300K	325K
#26	RF0342	Sam. OS-E4 Special	1.5K - 322K	325K
#27	RF5328	Sam. Wichert	1.4K - 300K	325K

Last updated: July 2002

A7 Curve Numbers and Thermometer Codes for RhFe-Controller in the E-Hall

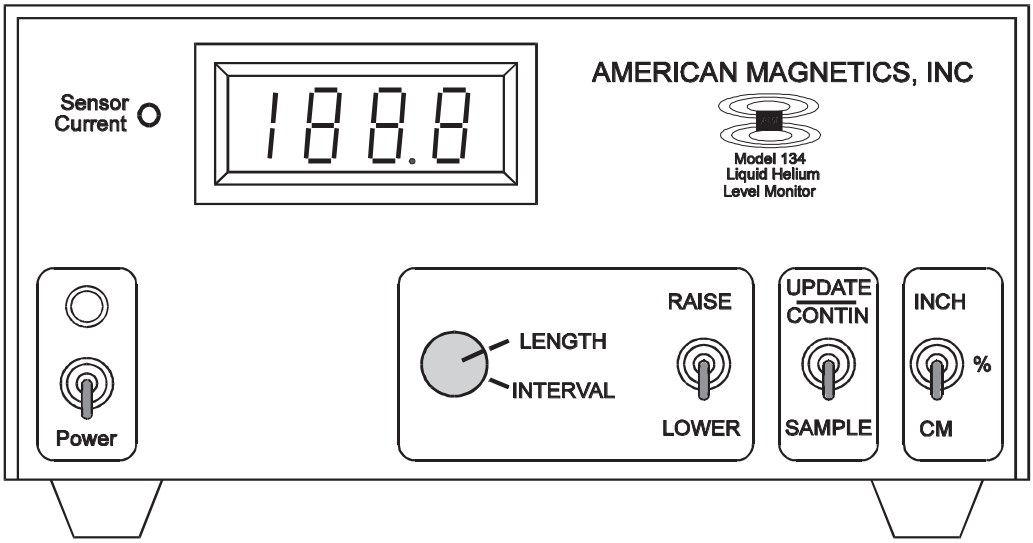
Curve No.	Therm. Code	Therm. Name	Calibration Range	Max. Setpoint
#01	* * *	* * *	* * *	* * *
#02	CRV 10	Si-Diode	1.4K - 325K	325K
#03	DIN-PT	Pt -100	14K - 800K	800K
#04	CRV 10	Si-Diode	1.4K - 475K	475K
#05	RESVRD	* * *	* * *	* * *
#06	RF4608	Reg. OS-E1	1.6K - 300K	325K
#07	RF1885	Sam. OS-E1	1.4K - 324K	325K
#08	RF4613	Reg. OS-E2	1.6K - 300K	325K
#09	RF1067	Sam. OS-E2	1.5K - 300K	325K
#10	RF4614	Reg. OS-E3	1.6K - 300K	325K
#11	RF5870	Sam. OS-E3	1.5K - 300K	325K
#12	RF4610	Reg. OS-E4	1.6K - 300K	325K
#13	RF1098	Sam. OS-E4	1.5K - 300K	325K
#14	RF0342	Sam. OS-E4 Special	1.5K - 322K	325K
#15	RF4851	Reg. OS-E6	1.6K - 300K	325K
#16	RF1118	Sam. OS-E6	1.5K - 300K	325K
#17	RF4852	Reg. OS-E9	1.6K - 300K	325K
#18	RF1883	Sam. OS-E9	1.4K - 324K	325K
#19	RF4611	Reg. OS-Res-E	1.6K - 300K	325K
#20	RF5875	Sam. OS-Res-E	1.5K - 300K	325K
#21	RF4612	Reg. OS-Res-V	1.6K - 350K	325K
#22	RF5879	Sam. OS-Res-V	1.4K - 300K	325K
#23	RF8122	Reg. OF-1	1.5K - 600K	800K
#24	RF3365	Sam. OF-1	1.5K - 600K	800K
#25	RF8123	Reg. OF-2	1.5K - 600K	800K
#26	RF8120	Sam. OF-2	1.5K - 650K	800K
#27	RF5328	Sam. Wichert	1.4K - 300K	325K

Last updated: July 2002

A8 Curve Numbers and Thermometer Codes for Magnet-Controller at BENSC

Curve No.	Therm. Code	Therm. Name	Calibration Range	Max. Setpoint
#01	* * *	* * *	* * *	* * *
#02	* * *	* * *	* * *	* * *
#03	* * *	* * *	* * *	* * *
#04	* * *	* * *	* * *	* * *
#05	* * *	* * *	* * *	* * *
#06	X06048	Reg. VM-1 (ITC #1)	1.5K - 304K	325K
#07	C11847	Sam. VM-1 (ITC #2)	1.4K - 325K	325K
#08	C13714	Sam. Dy-1 (ITC #3)	1.2K - 330K	325K
#09	X06045	Top VM-1	1.4K - 325K	325K
#10	X06231	Bot. VM-1	1.4K - 304K	325K
#11	X03894	Reg. VM-2 (ITC #1)	1.4K - 325K	325K
#12	X06782	Sam. VM-2 (ITC #2)	1.5K - 300K	325K
#13	X02399	SX. VM-2 (ITC #3)	1.4K - 325K	325K
#14	X09194	Reg. VM-3	1.4K - 325K	325K
#15	X09195	Sam. VM-3	1.4K - 325K	325K
#16	X02877	Top VM-3	1.4K - 325K	325K
#17	X02878	Bot. VM-3	1.4K - 325K	325K
#18	X04846	Reg. VM-4	1.4K - 325K	325K
#19	X04849	Sam. VM-4	1.4K - 325K	325K
#20	X05119	Top VM-4	4.0K - 325K	325K
#21	X05115	Bot. VM-4	4.0K - 325K	325K
#22	X13463	Reg. HM-1	1.4K - 325K	325K
#23	X13337	Sam. HM-1 old	1.4K - 325K	325K
#24	X02396	Sam. HM-1 new	1.4K - 325K	325K
#25	X13465	Top HM-1	4.0K - 325K	325K
#26	X04623	Reg. HM-2 (ITC #1)	1.5K - 300K	325K
#27	X04625	Sam. HM-2 (ITC #2)	1.5K - 300K	325K
#28	C12149	Sam. Res-1	1.4K - 325K	325K

Last updated: July 2002



1. Check (and adjust) sensor length:

a. Set right toggle switch to ´***INCH***´.
b. Set left knob to ´***LENGTH***´.
c. Push for 1 sec left toggle switch to either ´***RAISE***´ or ´***LOWER***´.
==> DISPLAY shows present LENGTH in INCH.
d. For change of sensor length repeat step 1c and adjust new length by holding the toggle switch up or down.

OS - X	==>	16 inch sensor length
OF - X	==>	16 inch ” ”
OM - X	==>	30 inch ” ”
LHe-Vessel	==>	18 inch ” ”

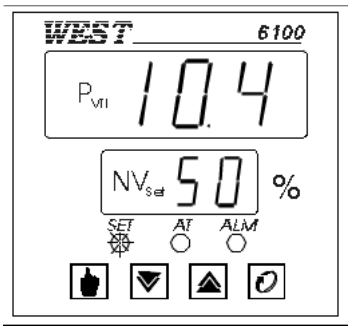
2. Check (and adjust) measuring intervall times:

a. Set middle toggle switch to ´***CONTIN***´ for a continous reading (during LHe-transfer or for immediate reading, only; for longer times the continous heat input results in an increased LHe boil-off).
b. Set middle toggle switch to ´***SAMPLE***´.
c. Set left knob to ´***INTERVAL***´.
d. Push for 1 sec left toggle switch to either ´***RAISE***´ or ´***LOWER***´.
==> DISPLAY shows present SAMPLE INTERVAL TIME in MINUTES.
e. For change of sample intervall time repeat step 2d by holding the toggle switch up or down and adjust new sample intervall time.

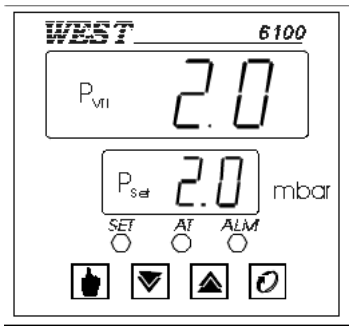
3. Operation settings for LHe-level monitor

a. Right toggle switch to ´***CM***´
b. Middle toggle switch to ´***SAMPLE***´
c. Sample intervall 5 minutes
d. Sensor length 16 inch 40.6 cm

Needle Valve Controller



Manual Mode



Control Mode

1. Installation

a. FESTO air pressure System must provide p = 6 bar.
b. Power off: Needle is closed (p = 6 bar via bypass).
c. Power on: Controller is either in Manual Mode (LED ´SET´ blinks) or in Control Mode (LED ´SET´ off).
For change of Mode press button.

2. Manual Mode

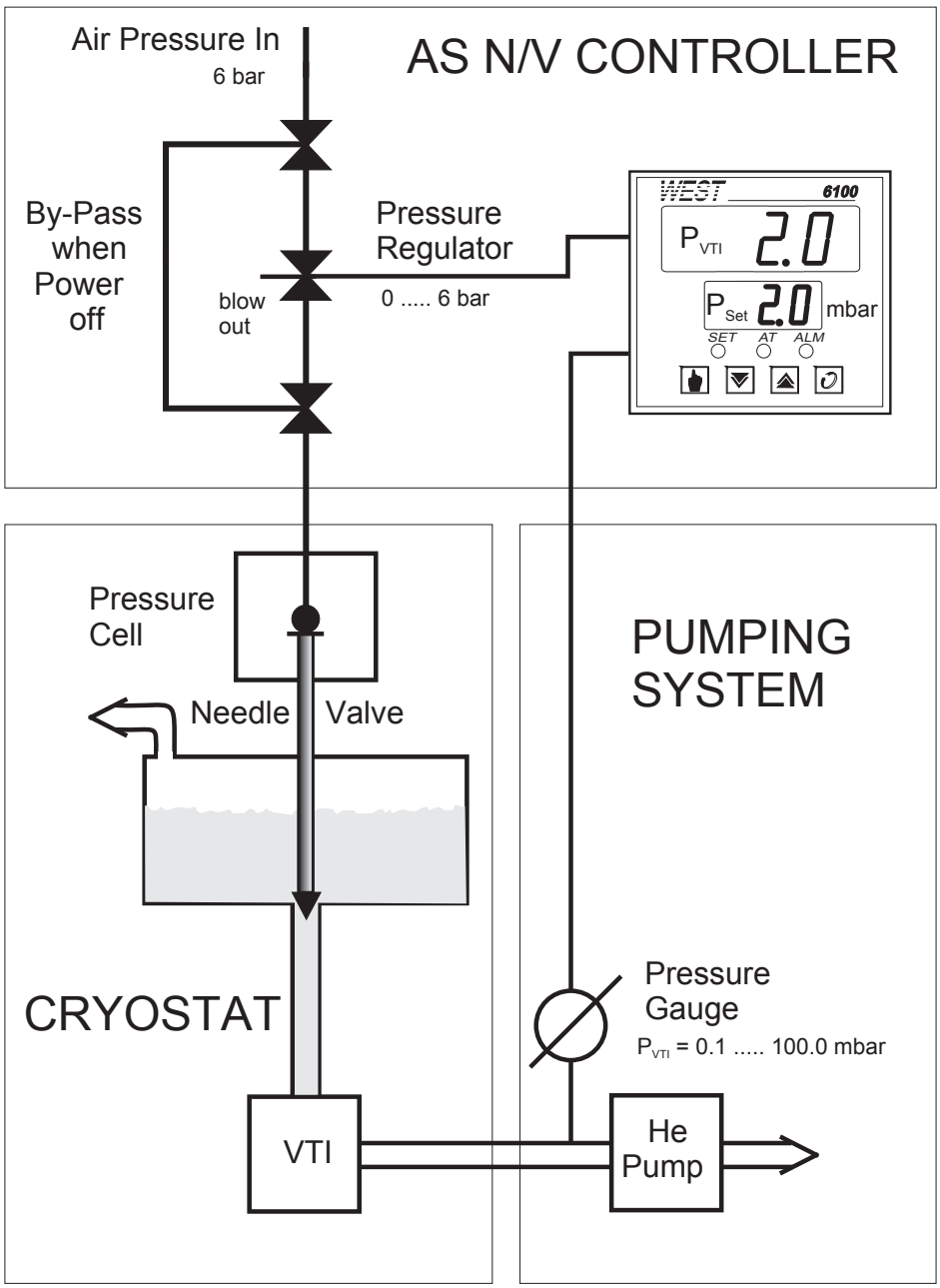
a. Upper display shows actual P**VTI** (in mbar).
b. Lower display shows actual FESTO regulated pressure:
0 % . . . 100 %
i.e. 0 bar . . . 6 bar
i.e. open . . . closed
c. For change of needle valve setting press or button according to desired setting.
d. This mode is helpful for testing, cool-down and stand-by.

3. Control Mode

a. Upper display shows actual P**VTI** (in mbar).
Lower display shows set point pressure (in mbar) to be controlled.
b. For change of controlled needle valve setting with constant pressure press or button according to desired set point pressure.

4. Services

a. For low pressure PVTI -> 0 the pressure gauge must be ZERO-calibrated for a reading PVTI >= 0.1 mbar;
for PVTI < 0.0 the reading is clo.
b. For high pressure P > 100.0 mbar the reading is chhc;
controlling is no more possible and the pressure must be lowered manually, for instance by closing the evaporator valve on top of the ORANGE cryostat.


Air Pressure In
6 bar
AS N/V CONTROLLER
By-Pass
when
Power
off
blow
out
Pressure
Regulator
0 ..... 6 bar
WEST
6100
P VTI
2.0
P Set
2.0
mbar
SET
AT
ALM
Pressure
Cell
Needle
Valve
PUMPING
SYSTEM
CRYOSTAT
Pressure
Gauge
P VTI = 0.1 ..... 100.0 mbar
VTI
He
Pump

West 6100 Controller Installation

Press UP + F for t > 5 sec:
Display shows as follow (upper / lower)
Forward by pressing F (function symbol button on right)
Changes by pressing UP or DOWN, confirm by MAN

1) 3414 / inPt (linear 4 - 20 mA)
2) dir / Ctrl (direct acting)
3) nonE / ALA1 (no alarm 1 type)
4) nonE / ALA2 (no alarm 2 type)
5) nonE / Inhi (no alarms inhibited)
6) 4800 / baud (communications link baud rate)
7) 1 / Addr (communication address)
8) 0 / Loc (set up mode lock code)

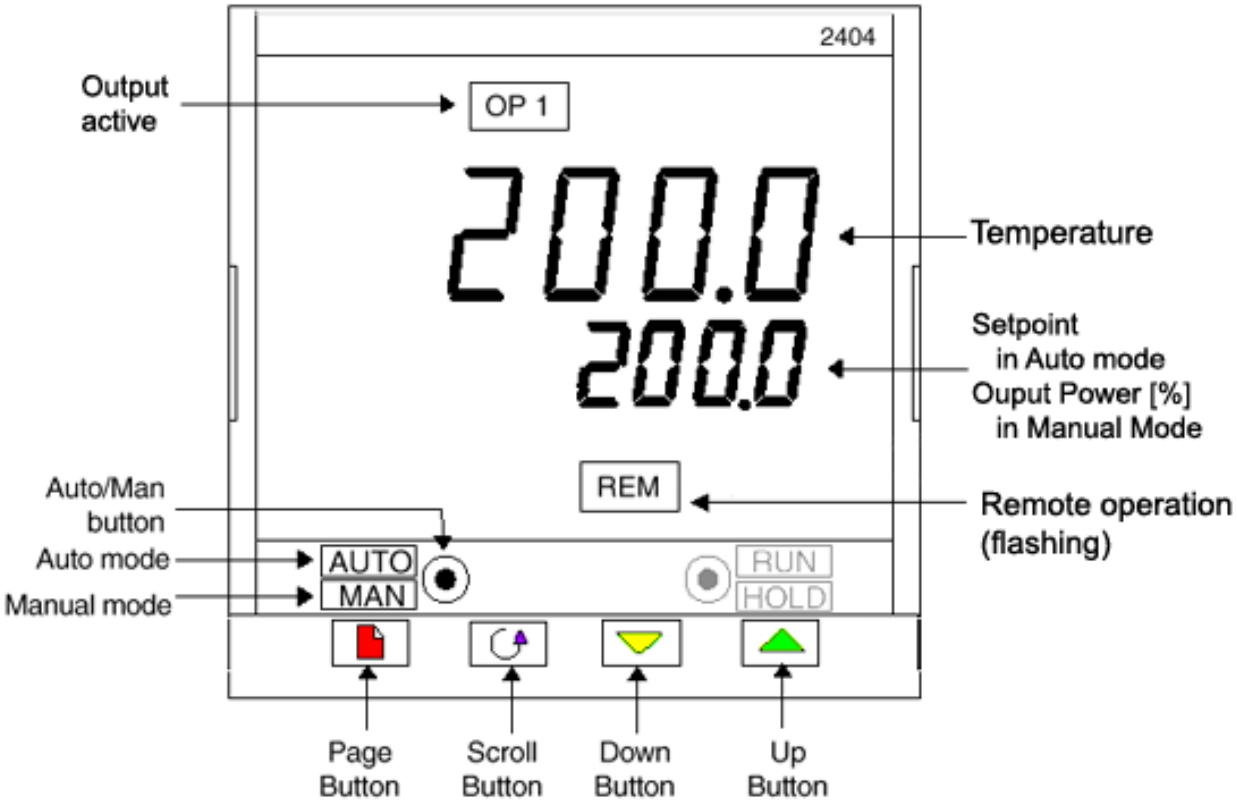
Exit: on any Pos. Nr. Press UP + F or auto exit after 2 min

Set Up Installation

Press UP + F:
Display shows as follow (upper / lower)
Forward by pressing F (function symbol button on right)
Changes by pressing UP or DOWN

1) Filt / 2.0 (electronic time constant in sec)
2) OFFs / 0.0 (input offset)
3) Out1 / read only (actual output)
4) Pb1 / 30.0->OS (Proportional in %)
5) rSET / 0.05->OS (Integral time constant in min.sec)
6) rAtE / 0.01->OS (Derivative time const. in min.sec)
7) biAS / 25 (manual reset in %)
8) Sphi / 100.0 (setpoint high limit)
9) Splo / 0.0 (setpoint low limit)
10) Ophi / 100.0 (output power high limit)
11) LAEn / 0 (loop alarm disabled)
12) rPnt / 1 (decimal point)
13) rhi / 100.0 (range maximum)
14) rlo / 0.0 (range minimum)
15) Apt / 0 (auto pre-tune disabled)
16) PoEn / 1 (manual control enabled)
17) rPEn / 0 (setpoint ramp disabled)
18) SPSt / 2 (setpoint display strategy)
19) CoEn / 1 (communication enabled)
20) Loc / 0 (lock value)
21) display mode

Exit: on Pos. 21 press UP + F or (at any Pos.Nr.) press
MAN and auto exit after 2 min.



Eurotherm Temperature Controller Operation

*Changing the **Setpoint***

Use the Up  and Down  buttons when the controller is in Auto Mode.

*Changing the **Output Power***

Set the controller to Manual Mode by pressing the Auto/Man button and increase or decrease the Output Power with the Up  and Down  buttons.

*Changing the **PID-Parameters***

See page 96 for a detailed description.

*Changing the **Serial Protocol***

See page 97 for a detailed description.

The **Access Diagram** of the first access level can be found on page 98.

How to change the PID-Parameters in the Eurotherm 2404 Controller

Proportional Factor Pb

press button	times	screen display
	6	► **Pid List**
	1	► **Pb 60**

Now the Proportional Factor can be changed with the Up and Down buttons.

Integral Time ti

press button	times	screen display	after a moment
	6	► **Pid List**	
	2	► **ti sec**	► **ti 10**

Now the Integral Time can be changed with the Up and Down buttons.

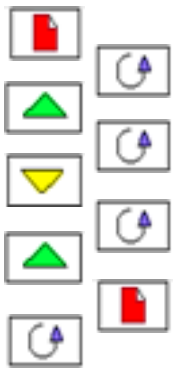
Differential Time td

press button	times	screen display	after a moment
	6	► **Pid List**	
	3	► **td sec**	► **td off**

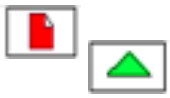
Now the Differential Time can be changed with the Up and Down buttons.

How to switch the Serial Protocol for the Eurotherm 2404 and the Eurotherm Temperature Read-Out 2408i between MOD-Bus (i-Tools) and Bi-Sync (Caress)

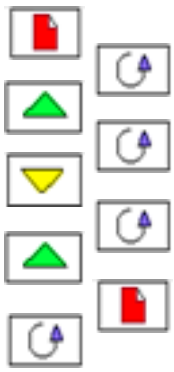
Eurotherm 2404 Temperature Controller

press button	times	screen display	after a moment
	6	► **ACCS List**	
	1	► **code 0**	
	1	► **code 1**	► **code PASS**
	1	► **goto oper**	
	1	► **goto conf**	
	1	► **conf 0**	
	2	► **conf 2**	► **conf PASS**
	10	► **HA conf**	
	2	► **Func El.bi (Bi-Sync)** **OR Func mod (MOD-Bus)**	

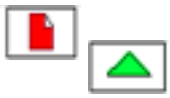
switch between the protocols with the  **and**  **buttons**

	9	► **Exit no**	
	1	► **Exit yes**	► **Reset &** **normal operation**

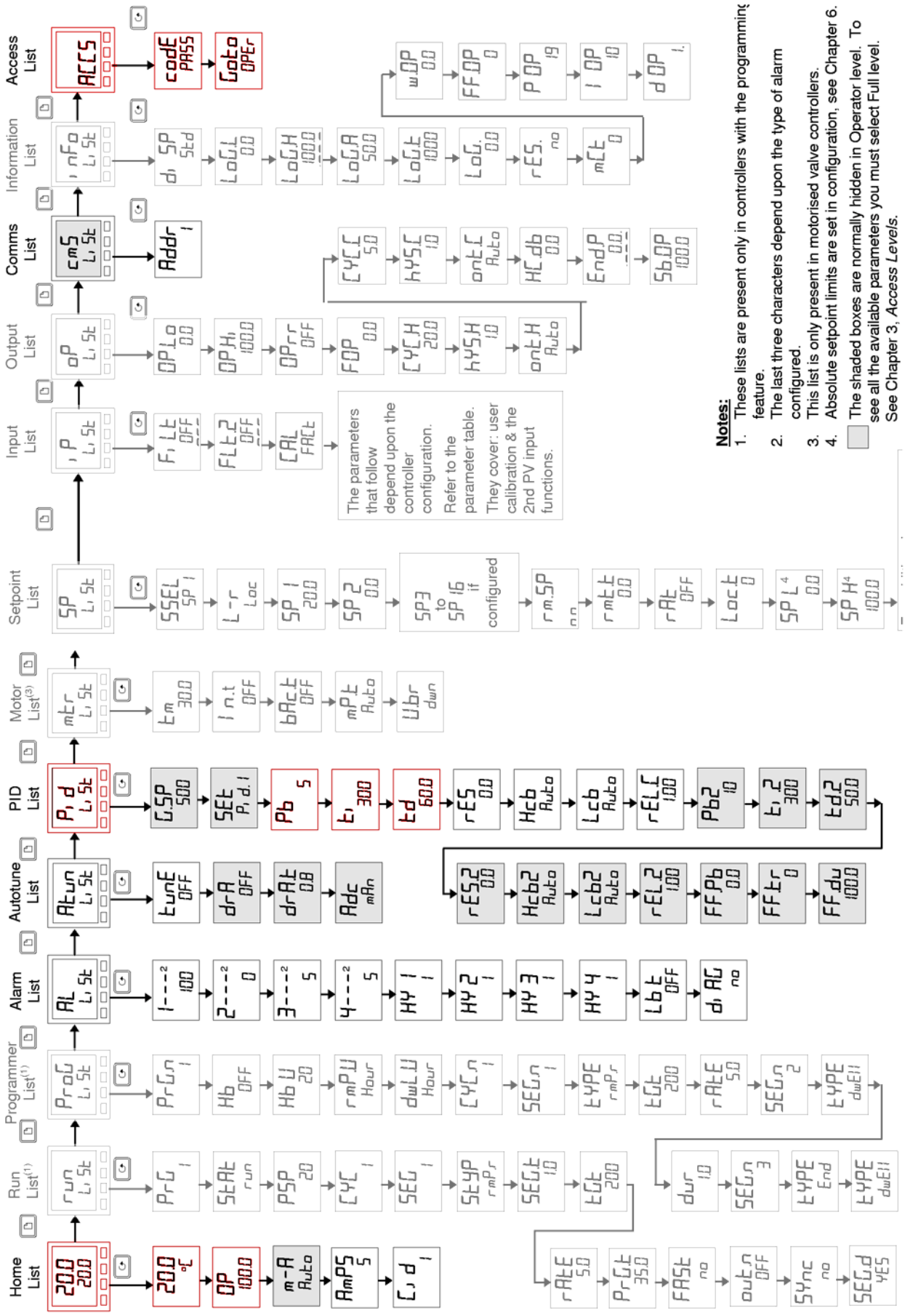
Eurotherm 2408 Thermometer

press button	times	screen display	after a moment	
	7	► **ACCS**		
	1	► **code**		
	2	► **1**	► **PASS**	► **code**
	1	► **goto**		
	2	► **conf**	► **goto**	
	1	► **conf**		
	3	► **2**	► **PASS**	► **conf**
	7	► **HA**		
	2	► **Func**		

use  **to switch between El.bi (Bi-Sync) and mod (MOD-Bus)**

	8	► **Exit**	
	2	► **yes**	► **Reset &** **normal operation**

Eurotherm Temperature Controller 2404 Access Diagram



High Temperature Furnance PID-Table

HTF #	Therm. Typ	300°C Pb	300°C Ti	300°C Td	800°C Pb	800°C Ti	800°C Td
1	K	***	***	***	***	***	***
1	°C	21	2m 45s	off	25	24s	off
2	K	51	2m 15s	off	86	18s	off
2	°C	16	2m 31s	off	20	21s	off
					600°C Pb	**600°C Ti**	**600°C Td**
V4	K	31	44s	off	41	11s	off
V4	°C	***	***	***	***	***	***

HTF #	Therm. Typ	1000°C Pb	1000°C Ti	1000°C Td	1300°C Pb	1300°C Ti	1300°C Td
1	K	***	***	***	***	***	***
1	°C	26	18s	off	27	13s	off
2	K	102	15s	off	**	**	**
2	°C	***	***	***	26	13s	off
V4	K	68	7s	off	---	---	---
V4	°C	***	***	***	---	---	---

* On Eurotherm is %9 selected

** K-Type Thermocouple only up to 1100°C !!

*** not tested yet

Thermometer Wiring Table

Therm. Type	4-Wire Pole	4-Pin LEMO No. 	Quad Colour	12-Pin JAEGER Regulat.	8-Pin JAEGER Sample	BELDEN Colour
		Cryo-intern / Sample-stick		***Cryo-extern / Sample-stick***		
Carbon	I+	4	red	1	1	green
C-Glass	U+	3	yellow	6	2	red
Cernox	U-	2	blue	3	3	black
Si-Diode	I-	1	green	4	4	white
Shield	---	---	---	---	---	---
	I+	4	red	8	5	green
Pt100	U+	3	yellow	9	6	red
RhFe	U-	2	blue	10	7	black
	I-	1	green	11	8	white
Shield	---	---	---	---	---	---
Heater	I+	---	---	7 (2)	1 (5)	---
Reg. / Sam.	I-	---	---	12 (5)	4 (8)	---

Therm. Type	5-Pin XRL-No. <-	2-Pin XM-No. LS-DRC-93	5-Pin Amphenol ->	6-Pin DIN LS-340	9-Pin Sub-D ITC-503
			Temperature-Controller		
Carbon	5	---	A	5	4
C-Glass	1	---	E	4	2
Cernox	2	---	D	2	1
Si-Diode	4	---	B	1	5
Shield	3	---	H	3	3
	5	---	A	5	4
Pt100	1	---	E	4	1
RhFe	2	---	D	2	2
	4	---	B	1	5
Shield	3	---	H	3	3
Heater	---	L	grey	---	6
Reg. / Sam.	---	N	black	---	7

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Wolfgang Schiemank	LS113/106	Office / SE Lab	3133
Christof Fritsche	V139	Office	2798
Klaus Sperlich	V139	Office	2798
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