# Cryostat design and heat loads 

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## Branch Box

## Cryogenic diagram

For the transfer line the most tubes were chosen to be DN15 STD, so $\mathrm{OD}=21.34 \mathrm{~mm}, \mathrm{ID}=15.8 \mathrm{~mm}$.

The valves are of PN25 type.
Valves stems have interceptions at $\sim 65 \mathrm{~K}$ temperatures.

Pressure drop about 0.006 bar at nominal operation

Heat transfer to the radiation shields is on return 50 K line.
The return line will have about 60 K


## Total heat loads

Table 3 Heat loads on 4.5 K helium from both coils and the cryostat

| Heat load from | Values |
| :--- | :--- |
| Thermal radiation on the LHe case, W | 0.12 |
| Support struts, W | 13 |
| Tie rods, W | 0.05 |
| Soldering connection of the cable (at least 6 short splices), W | 0.12 |
| Thermal radiation on the cryostat, W | 0.015 |
| Cryostat suspension, W | $<0.1$ |
| Current leads, W | 0.5 |
| Measurements wires, W | $<0.1$ |
| Heat bridges of the cryostat neck and others connections, W | $<0.1$ |
| Total, $W$ | $\sim \mathbf{1 4 . 1}$ |

Table 4 Heat loads on 50 K helium from both coils and the cryostat

| Heat load from | Values |
| :--- | :--- |
| Thermal radiation on the shields from the vacuum vessel, W | 10 |
| Support struts, W | 38 |
| Tie rods, W | 0.5 |
| Thermal radiation on the cryostat shield, W | 1.5 |
| Cryostat suspension, W | 2 |
| Current leads, W | 50 |
| Measurements wires, W | 0.5 |
| Heat bridges of the cryostat neck and others connections, W | 1 |
| Total, $W$ | $\sim 104$ |
| \multirow{3}Itwillbecorrectedafterdetaileddesionofthecurrentleads{} |  |

Table 5 Heat loads on 4.6 K helium from the Branch Box, the Feed Box and the transfer line

| Heat load from | Values |
| :--- | :--- |
| Thermal radiation on 4.5 K surfaces from the shields on the FB and BB, W | 0.15 |
| Supports and suspensions, W | $<2$ |
| Control Valves, W | 15.2 |
| Check Valves, W | 0.9 |
| Measurement wires, W | $<0.01$ |
| Heat bridges of the cryostat neck and others connections, W | $<1$ |
| Total, $\boldsymbol{W}$ | 19.26 |

Table 6 Heat loads on the 60 K helium (return line) from the Branch Box, the Feed Box and the transfer line

| Heat load from | Values |
| :--- | :--- |
| Thermal radiation on the shields from the vacuum vessel, W | 7 |
| Support and suspensions, W | 20 |
| Control valves, W | 38 |
| Check valves, W | 11 |
| Measurement wires, W | $<1$ |
| Heat bridges of the cryostat neck and others connections, W | 5 |
| Total, $W$ | 82 |

Total heat loads:
for 4.6 K He is 33.4 W

Mass rates: for 4.6 K He is $1.7 \mathrm{~g} / \mathrm{s}$ for 50 K He is $1.8 \mathrm{~g} / \mathrm{s}$

## Design of the Branch Box, view 1



## Design of the Branch Box, view 2



## Design of the Feed Box, view 1



Design of the Feed Box, view 2


Design of the transfer line, view 1


Design of the transfer line, view 2


Design of the transfer line, view 3


Design of the transfer line, view 4


## Interface (as example)



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The working folder contains:
T_test.exe - executable code;
- Server.uir - user interface resources;
- Port.cfg - configuration file for RS232 connection;
- T_data.cfg - configuration file for temperature sensors (JB channels, data files etc.);
- Mntr.cfg - configuration file for JB channels (Pressure, GHe Flow, Vacuum);
- Field.dat - field ramping table;
- T_PROBES - temperature response curves folder.
```


## SCW server application main functions:

- Monitoring of all cryostat \& magnet parameters;
- PSU's control \& monitoring;
- Cryo-compressors monitoring;
- Field ramping task;
- Software interlock logic;

Client/Server communication.


