Binary 20 kA Current Leads for the HFML 45T Hybrid Magnet

M. Hoffmann, A. den Ouden, C.A. Wulffers, J.A.A.J. Perenboom, G.A. Laureijs

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The current leads have been tested successfully up to 16 kA. The current was limited to this value due to insufficient joint connection.

**Cu-HEX characteristics**

<table>
<thead>
<tr>
<th>Technical data</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>HEX length</td>
<td>0.9 m</td>
</tr>
<tr>
<td>Number of fins per CL</td>
<td>20</td>
</tr>
<tr>
<td>Fin thickness</td>
<td>2 mm</td>
</tr>
<tr>
<td>Fin width</td>
<td>87.5 mm</td>
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<td>Gap between fins</td>
<td>2.5 mm</td>
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**Cu-Heat Exchanger**

Bundle of copper fins with the bottom end submerged in a liquid nitrogen bath. Adaptive cooling achieved by adjustable liquid nitrogen level.

**Manufacturer & Testing**

60 soldered stacks of Bi-2223 in Ag-Au matrix. Stacked 4 high length 0.4 m Soldered onto a stainless steel (304L) shunt Total heat leak at 77K and 20 kA ~ 1000W

**HTS Section**

Connection to aluminium-stabilized Rutherford cable Cooled with supercritical Helium Total heat leak at 4.5 K ~ 15W

**CL cryostat**

- Nitrogen exhaust
- Nitrogen vapour space
- Liquid nitrogen
- Mechanical connection to nitrogen vessel
- Ceramic isolator

**CL test cryostat at HFML**

- Current supply up to 20 kA
- Controlled supply of liquid nitrogen and liquid helium
- Forced flow of scHe (3-8 bar)

**Design Attributes**

- Current leads during installation
- Bottom block of Cu-HEX
- Current leads – ready for integration

**Cu-HEX Temperature Distribution**

- $T_{cu}$ @ 20kA
- $DT$ @ 20 kA
- $T_{cu}$ @ 0A
- $DT$ @ 0A

**Technical data**

- HEX length: 0.9 m
- Number of fins per CL: 20
- Fin thickness: 2 mm
- Fin width: 87.5 mm
- Gap between fins: 2.5 mm

**CL cryostat**

- Nitrogen exhaust
- Nitrogen vapour space
- Liquid nitrogen
- Mechanical connection to nitrogen vessel
- Ceramic isolator

**HTS Section**

- Liquid Nitrogen
- Gaseous helium space
- The current leads have been tested successfully up to 16 kA

**Current leads – ready for integration**

**Current leads – during installation**

- Current leads: final position in CL cryostat

Reference: