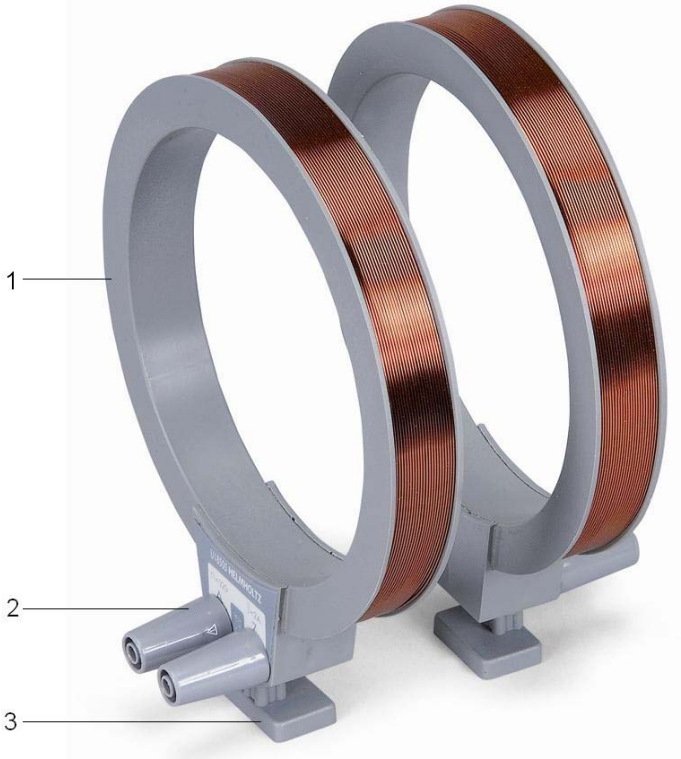
# 3B SCIENTIFIC® PHYSICS

## Helmholtz Pair of Coils S 1000611

### Instruction sheet

12/12 ALF




1 Coils
2 4-mm safety socket
3 Coil base

### 1. Description

The Helmholtz coils are used to create magnetic fields for deflecting electron beams and are attached to the tube holder S (1014525). The tube holder allows the coils to be set up in Helmholtz configuration or at varying distances. The resulting magnetic fields are highly uniform and can be aligned perpendicular to the axis of the tube or in co-axial alignment.

The two air-filled coils are made of lacquered copper wire on a plastic bobbin with connectors at both ends of the winding labelled (A) and (Z).

### 2. Technical data

| | |
|---|---|
| Number of winding turns: | 320 each |
| Coil diameter: | 136 mm approx. |
| Max. current: | |
| continuous: | 1.0 A |
| short term: | 1.5 A (max. 10 min)<br>2.0 A (max. 3 min) |
| Effective impedance: | 6 Ω approx. |
| Connectors: | 4-mm safety socket |
| Magnetic flux *B* in Helmholtz-configuration: | $B = k * I$, where<br>$k$ = appr. 4,2 mT/A |

## 3. Operation

### 3.1 Setting up the coils for a transverse field

- Insert the coils into the middle of the coil slot and push them out as far as they go. Make sure the connectors point outwards.
- Insert the hot cathode tube into the holder.
- For Helmholtz configuration $d = r$ the outer edges of the coil base should be flush with the dashed lines (refer to Fig. 1).

### 3.2 Setting up a coil for an axial field

- Insert the hot cathode tube into the holder.
- Slot the base of the coil into the groove from the front making sure that the connectors point forwards (refer to Fig. 2).
- When using both coils, put the base of the second coil onto the plugs of the first coil.

### 3.3 Determining the current in the coils

3.3.1 Series connection

- When the coils are to be connected in series, connect terminal Z of coil 1 to terminal Z of coil 2 (refer to Fig. 3.1).

Take into account the total current when calculating *B*.

3.3.2 Parallel connection

- When the coils are to be connected in parallel, connect terminal A of coil 1 to terminal Z of coil 2 and terminal Z of coil 1 to terminal A of coil 2 (refer to Fig.3.2).

To calculate *B* the total current 2 *I* should be halved since both coils have the same resistance and half the current *I* passes through each one.

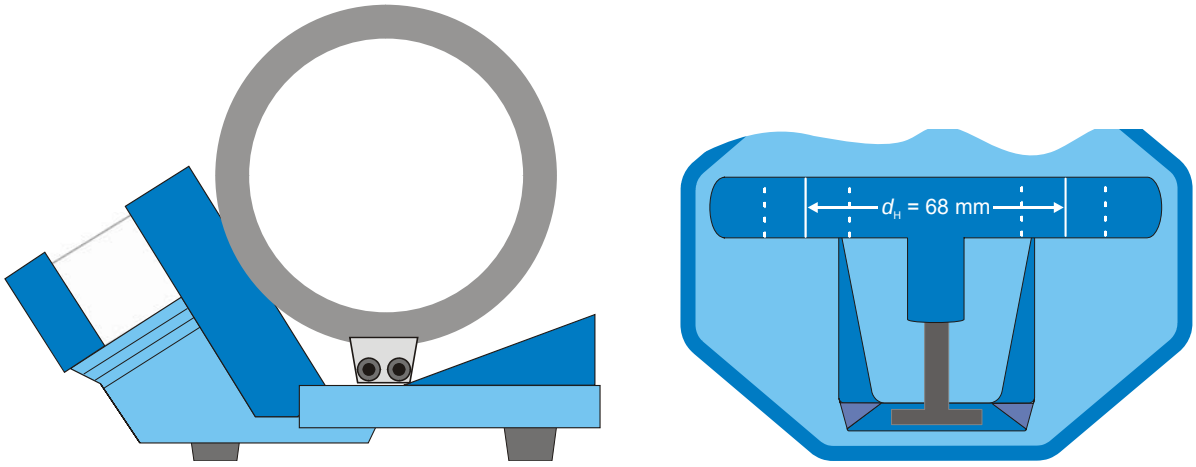



Fig. 1 Setting up the coils for a transverse field

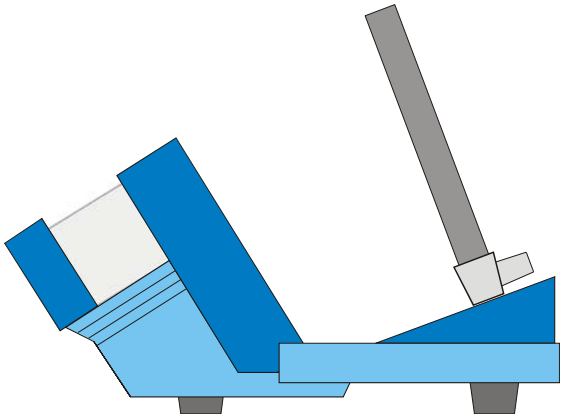


Fig. 2 Setting up a coil for an axial field

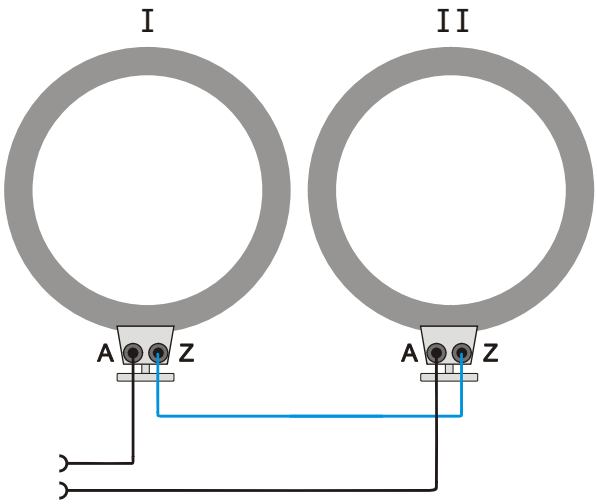



Fig. 3.1 Series connection

Make sure the connectors of each coil are facing outwards

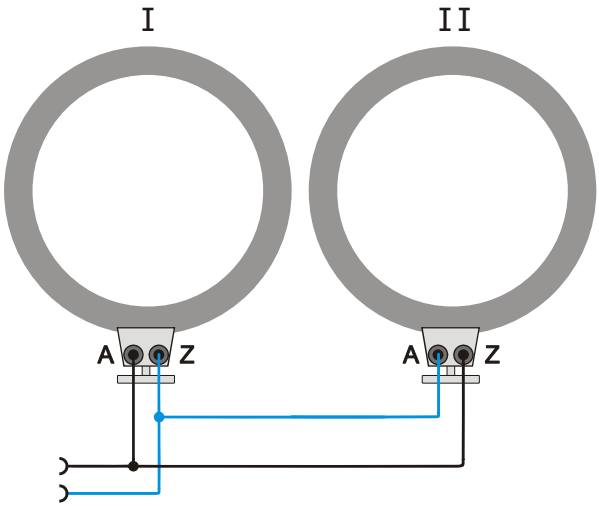



Fig. 3.2 Parallel connection