Example for installation and initial operation of an evaporation equipment with EHV 108 A

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DANGER HIGH VOLTAGE

Touching parts under high voltage is absolutely FATAL.
Service work on the high voltage supply and the high voltage feedthroughs may only be carried out by qualified personnel. Service work on the high voltage system may only be carried out when the high voltage has been turned off.
The system is considered turned off when the master switch (MAIN SWITCH) on the EHV 108 A has been turned off or when the mains plug has been disconnected.
As a safety precaution a screw coupling connection is to be made from the grounding bar in the high voltage supply to the high voltage output (capacitator discharge).
The various terminals in the interlock circuit must not be considered as safety elements.
Caution:
When the cabinet doors are open and the high voltage supply is on there is **FATAL DANGER.**
The cabinet door of the EHV 108 A is only to be opened with a specially marked key (high voltage lightening streak). This key may only be carried by a qualified electrical expert.
The doors to the system frame must be provided with a lock. For service purposes the doors to the system frame may only be opened by a qualified electrical expert. Interlock switches on the frame doors do not qualify as safety elements. Before installing the EHS, therefore, be sure that the master switch is off or that the mains plug has been pulled.

1. EVAPORATION EQUIPMENT (one source)

consisting of EHV 108 A, EKS 110 A, ETS 110, EHS 110/111 and ESQ 110

1.1.1. Mounting the ESQ 110 source in the evaporation system

a. Fit the feedthrough with flange into the coating unit base plate above and fix in position with the washer (connect ground line) and nut (M30 x 1.5 mm). If the underside of the coating unit base plate is covered with a protective film, then the gun and also the angle of the high current transformer (anode current) must be connected to the ground line (16 mm^2 Cu or Al strip 3 x 60 mm which is provided with two 33 mm diameter holes and is firmly screwed to the gun and to the high current feedthrough.

b. Fit the 80 x 4 mm O-ring.

c. Fix the completely assembled source upper section (without the crucible or the crucible lower section) in position with four M5 inner hex screws.

d. Mount the lock nut and the clamping ring on the feedthrough from unterneath.

e. Mount the source lower section on the feedthrough and with the positioning screw (inner hexagon screw M4) slackly tighten in the key way.

f. Tighten the lock nut firmly.

g. Check the sealing surfaces for the L-ring gaskets (refer to spare parts list BB 800 041 E/1, 2, item 19 and 20) on the crucible lower section and repolish, if necessary. There should be no grooves resulting from the machining operation.

h. Push in the crucible lower section with the crucible assembled from above in downward direction (turn slightly to avoid damaging the various L-ring gaskets).

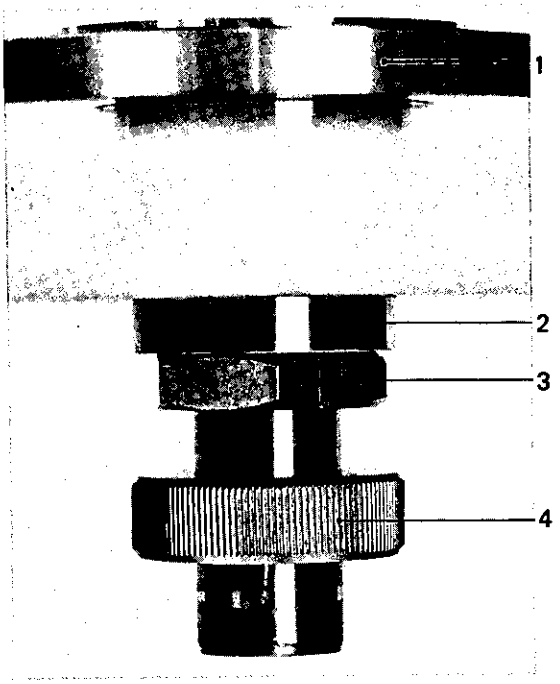

Fig. 1

1. Feedthrough
2. Washer
3. Nut
4. Knurled nut

i. Tighten the crucible lower section with the knurled nut M10 and the intermediate pipe towards the ball bearing manually. (Crucible cannot be turned). Following this, reset the knurled nut by turning back half a rotation and secure with two set screws M5. The axial clearance of the crucible lower section in the gun must be approx. 0,3 ÷ 0,5 mm.

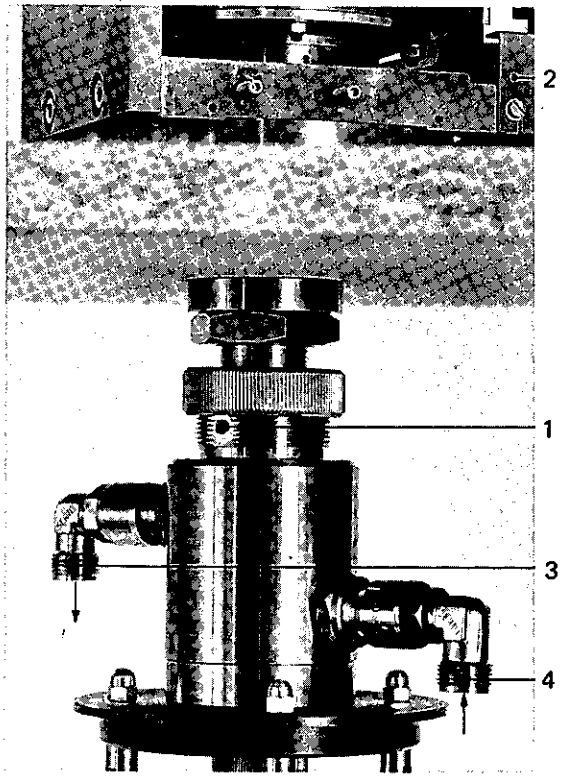

Fig. 2 Source lower section
1. Inner hex screw M4
2. Evaporation protection for the flat insulator
3. Water outlet
4. Water inlet

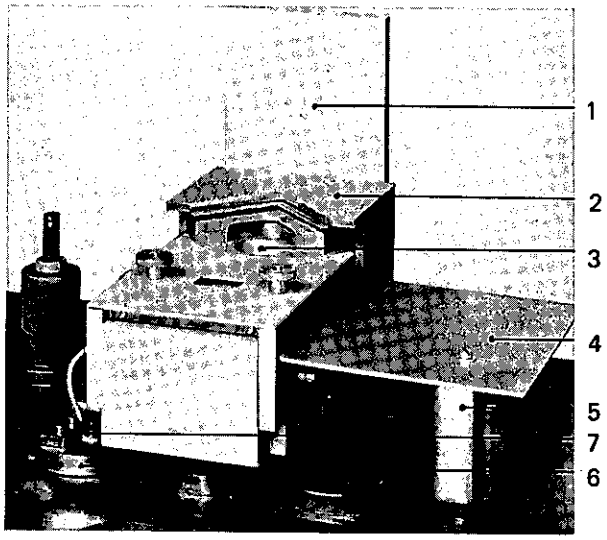

Fig. 3 Source complete with 4-way crucible
1. Deflection plate
2. Crucible cap
3. 4-way crucible
4. Screen for the cathode power supply
5. Screen for the high voltage feedthrough
6. High current feedthrough (anode)
7. Coil current feedthrough

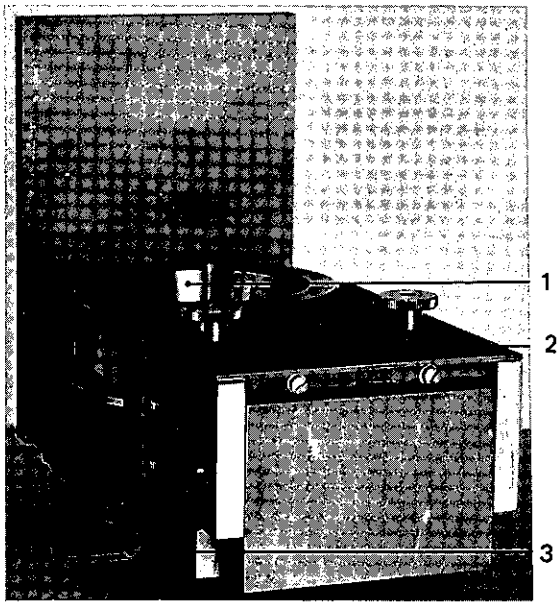

Fig. 4 Source with pot crucible
1. Pot crucible
2. Cu-mask
3. High current connection of the anode current.

j. Screw the crucible cap (on 4-way crucible or oscillating crucible only).

k. Tighten the Cu-mask with two knurled nuts M5.

l. Optically, the high voltage supply lines must be adequately screened from the high voltage feedthrough up to the source. The pertinent screening plate (fig. 3, item 4.), included in the source, must be cut accurately after installation to avoid frequent arcing during evaporation.

m. If enough space is available, the deflection plate (fig. 3, item 1) may be bent backwards by 90° to crucible level. In this way, the cleaning periods can be extended considerably if larger batches of material are evaporated (Pot crucible).

n. A shutter on top of the source must always be grounded. If the shutter has been insulated by means of ceramic parts, this ground line has to be provided between the shutter plate and the evaporation system (naked metal wire, Cu, Al, Ni).

1.1.2. Cooling water connection

Providing for the water lines:

a. From the water valve outlet (currentless, open) to the water inlet of the source (refer to fig. 2, item 4).

b. From the water outlet of the source (refer to fig. 2, item 3) to the inlet of the water flow control switch (note direction of flow).

c. From the outlet of the water flow control switch to the water outlet (no pressure).

1.2. Mounting the high voltage feedthrough

a. If the high voltage feedthrough in has not been completely dismantled, the following components must be removed: the protection tube, insulation tube, nut (M30 x 1.5) and connection plate to which the external cable is attached.

b. Thread in the high current cable (white) as well as the Wehnelt cable (red) through the pertinent cable union.

c. Fit the feedthrough from above (be sure not to damage the seal) and secure in place with the nut and washer (M30 x 1.5).
Push up insulation tube.

d. Screw the protection tube holding plate with thread M 30 x 1,5 on the feedthrough.

e. Push the insulation tube and the protection tube over the high current and Wehnelt cable.

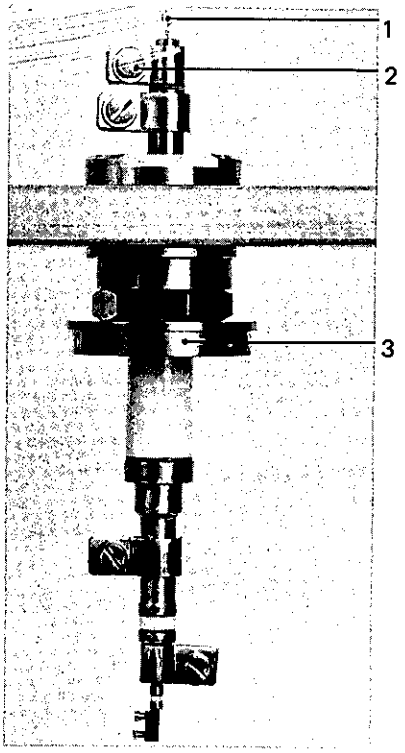

Fig. 5 High voltage feedthrough

1. Wehnelt connection
2. Heater current connection
3. Protection tube holding plate

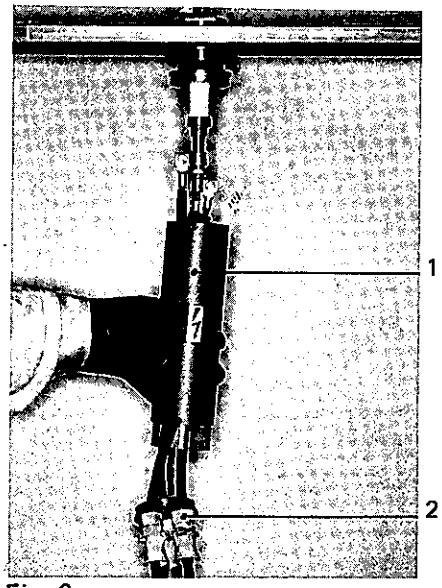

Fig. 6
1. Protection tube (with the insulation tube pushed into position)
2. Cable union plate

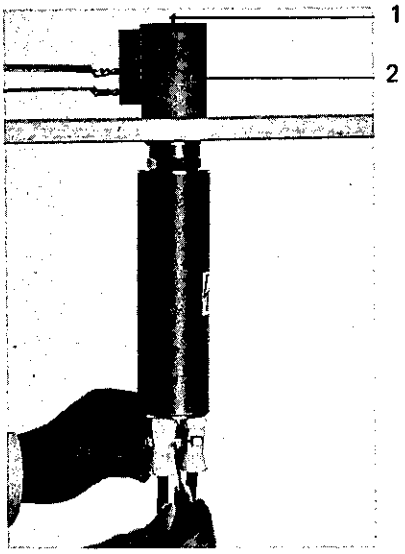

Fig. 7

1. Holder of the screen for the cathode power supply
2. Protection cover for the high voltage feedthrough

f. Screw the cable shoes of the high current cable to the appropriate clips on the feedthrough.

g. Connect the Wehnelt cable.

h. Push up the insulation tube and the protection tube to the protection tube holding plate and secure the protection tube with three M3 countersunk screws.

i Push up the cable union plate and screw it to the protection tube by means of three M3 countersunk screws.

j. Tighten the cable union so that the high current and Wehnelt cable are stress-free.

1.3. Mounting the anode current feedthrough and the anode current transformer (low voltage feedthrough)

The high current feedthrough (Fig. 3, Item 6) acts as a current supply for the upper section of the anode (X-sweep). The feedthrough must therefore be electrically insulated from the coating unit base plate by means of two insulating plates, Items 118 and 119 of the spare parts list BB 800 041 E/6 and an insulating tube. If the underside of the coating unit base plate is covered with an insulating protective film (anodized or brushed on), a ground line must be connected from the gun feedthrough to the fixed angle 3 of the high current transformer. The connection from the feedthrough to the anode is made with the installation material furnished in accordance with the lay-out of the gun and high current feedthrough The coil current lead-in is mounted in the high current feedthrough (Fig. 3, Item 6).

a. The anodized Al-high current feedthrough must be in serted through the base plate (32,5 mm diam.) from above and secured with the nut (M30 x 1,5) simultaneously with the attachment of the angle and insulation plate.

b. The nickel-plated copper angle is secured with the nut (M20 x 1,5).

c. Attach the high current transformer to the angle item 142 of the spare parts list BB 800 041 E/6 so that the high current contact can be made. In this step, the Cu-strip must be clamped between the Al-angle and the transformer.

d. Make the high current contact using the screw (M8), nut and washer.

f. Connect the primary line to the inlet with 240 V. If the sweep amplitude is too small, or it becomes too small after an extended operating period, the 220 V connection may be used. A change-over may also be made in the control unit EKS on the variable transformer from connection 240 V to the connection of 220 V!

1.4. Installation of the heater current power supply EHS

1.4.1. EHS 110

a. Mount the terminal box underneath the gun and connect the appropriate control cable to socket SOURCE 1 – J9 of the EHV 108.

b. The EHS 110 must be mounted in the frame of the coating unit, underneath the electron beam gun, and fastened with 4 screws at the feet of the filament current transformer.
The doors of the system frame must be provided with a lock. The doors of the system may only be opened for service purposes by a qualified electrician. Interlock switches on the frame doors do not qualify as safety elements. Before installing the EHS it must be assured, therefore, that the master switch is turned off or that the mains plug has been pulled.

c. Loosen the 4 fastening screws for the red cover hood and lift the hood about 10 cm.

d. Connect the high voltage cable:
Inner conductor to the centre tapping (secondary) of the filament current transformer T1 (screw M5); outer conductor (sheathing) to the earth screw (Fig. 3, item 3 of the operating instructions BB 800 062 BE).

e. Lower the hood again and fasten it with the 4 screws.

f. Fit the angle with traction relief for the high voltage cable to the bottom of the stand frame.

g. Carefully fasten the return conductor (16 mm^2, black) which is parallel to the high voltage cable to the base plate of the coating chamber (near the gun).

h. Remove the cable guard from the red cover hood.

i. Pass the two high voltage cables and the Wehnelt cable through the rubber cuffs and the screw connections and plug them in.

j. Re-tighten the cable guard (traction relief) (mind the rubber cuffs!)

k. Connect the primary terminals of the two transformers in the terminal box below the gun (the connections inside the EHS were made in the factory). Make sure to follow the correct connection diagram e.g. S 5219 a.

1.4.2. EHS 111

a. Mount the terminal box underneath the gun and connect the appropriate control cable to socket SOURCE 1 – J9 of the EHV 108.

b. The EHS 111 must be mounted in the frame of the coating unit, beneath the electron bem gun.
The doors of the system frame must be provided with a lock. The doors of the system may only be opened for service purposes by a qualified electrician. Interlock switches on the frame doors do not qualify as safety elements. Before installing the EHS must be assured, therefore, that the master switch is turned off or that the mains plug has been pulled.

c. Loosen 8 screws and remove the front panel.

d. Insert the high voltage cable without the return cable (16 mm^2, black) through the cable connector on the metal housing.

e. Connect the high voltage cable:
Inner conductor to the centre tapping (secondary) of the filament current transformer T1 (screw M5); outer conductor (sheathing) to the earth screw (Fig. 3, item 3 of the operating instructions BB 800 062 BE).

f. Attach the angle with traction relief for the high voltage cable to the bottom of the metal box.

g. Carefully fasten the high voltage cable, which is parallel to the return cable (16 mm^2), to the base plate of the coating chamber (near the gun).

h. Remove the cable guard for the two filament current cables.

i. Pass the two filament current cables through rubber cuffs and screw connectors and connect them to the filament current transformer (screw M5).

j. Re-tighten the cable guards (mind the rubber cuffs).

k. Connect the primary winding of the filament current transformer in the terminal box below the gun (the connection inside the EHS was made in the factory). Make sure to follow the correct connection diagram, e.g. S 5219 a.

l. Remount the front panel with 8 screws.

1.4.3. Installation of the HV-cables from the EHS to the EHV 108

a. The return conductor (16 mm^2, black) in parallel with the HV-cable is to be attached to the rear plate of the EHV 108 at the designated ground terminal.

b. The HV-cable with the external conductor is to be passed through the cable feedthrough (HIGH VOLTAGE CABLE-SOURCE 1).

c. The external conductor must be directed to the internal ground terminal, and thus grounded before it reaches the transducer.

d. The fully insulated center conductor has to be attached to the high voltage outlet after passing through the transducer (refer to Fig. 8, Item 10).

e. Screw the cover above HV-section.

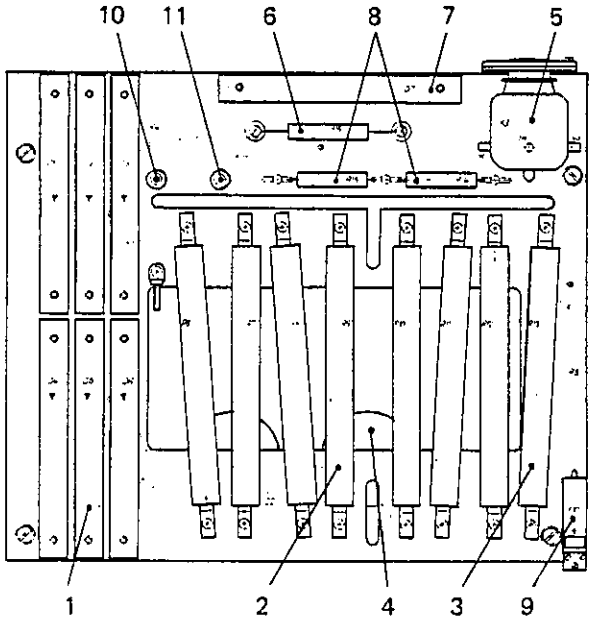

Fig. 8

1.5. Connections of the control and interlock circuits in the terminal box (refer to pertinent connection diagram, e.g. S 5219 a)

Before the connections are made, the limit switches, vacuum switches and valves must be mounted, if necessary.

a. Door switches of the cabinet doors
b. Disconnect plug of the coating unit or bell, respectively
c. Vacuum switch
d. Water flow control switch of the gun
e. Water valve of the gun
f. Anode current transformer
g. Coil

1.6. Connections between the EHV 108 A and EKS 110 A

Sockets on the EHV		Sockets on the EKS 110 A
a. EKS1 – J1	control cable	J3
b. EKS1 – J3	motor cable	J5
c. EKS1 – J5	control cable	J6
d. EKS1 – J7	transducer cable	J8

e. Connect the blind plug to the socket EKS2 – J6 on the EHV 108 A must be removed.
f. The shorting plug "MULTI. CHAMB. OPER." on the EHV 108 A must be removed.
g. When an external interlock circuit is used for the high voltage, the shorting plug "AUXIL." on the EHV 108 must be removed.

1.7. Other connectors

a. If a substrate heater is used in the evaporation system, it must be interlocked via socket J9 of the EKS 110 A.
b. If the gun control is triggered by an external rate measuring device for rate regulation (0 – 10 V, DC), the corresponding control voltage is supplied to the EKS 110 A via the socket J1.
c. Connect the rotary drive EDE 110 to the socket J2 on the EKS 110 A.
d. For manual operation: Connect the Coat-O-Matic blind plug to the socket J4 of the EKS 110 A and insert the blind plug-in printed circuit board in the interior of the EKS 110 A.
e. For automatic operation: Connect the control cable of the Coat-O-Matic or of the regulating unit ADU 100 to the socket J4 and insert the relay plate E5 (Coat-O-Matic pc board) in the EKS 110 A.

1.8. Control measurement

Using an ohmmeter, the resistance between the ground terminal on the EHV 108 A and the evaporation system must be measured. The resistance must be smaller than 0.1. Ω.

1.9. Power supply

a. The supply voltage must coincide with the data on the name plate of the EHV 108 A. If this is not the case, refer to the specifications for "Voltage change" BG 241 148 in the operating instructions of the EHV 108 A.
b. Preliminary fuse according to the data in the diagram of the EHV 108 A.
c. Connect the power cable to the connector "MAINS – J12" of the EHV 108 A as specified in the diagram.
d. Affix the high voltage labels furnished to the rack doors of the evaporation system.

2. EVAPORATION EQUIPMENT (two sources)

consisting of: one EHV 108 A, two EKS 110 A, two ETS 110, two EHS 110/111 and two ESQ 110.

2.1. Installation

Both sources, high voltage and anode current feedthroughs as well as the heater current power supply units EHS must be mounted according to sections 1.1. to 1.4.

The control cable of the EHS No. 2 must be connected to the socket SOURCE 2 – J10 of the EHV 108 A.

2.2. Installation of the HV cables from the EHS units to the EHV 108 A unit

a. The return conductor (16 mm^2, black) in parallel with each HV-cable is to be attached to the perinent, designated ground terminal of the EHV 108 A.
b. The HV-cable for source 1 is to be passed through the cable feedthrough HIGH VOLT. CABLE SOURCE 1 and that of the source 2 through the cable feedthrough HIGH VOLT. CABLE SOURCE 2.
c. The external conductors are to be directed to the internal ground terminal of the EHV 108 A, and thus grounded, before they reach the transducers.
d. Install the transducer T4 furnished with the EHV 108 A.
e. The fully insulated center conductor of source 1 is to be passed through the transducer T3 and that of the source 2 through the transducer T4 and attached to the high voltage outlets Fig. 8, Item 2 and Fig. 8, Item 3.
f. Screw the cover avove HV-section of the EHV 108 A.

2.3. Connections of the control and interlock circuits in the terminal box (refer to pertinent connection diagram, e.g. S 5219 a).

The interlock circuits for the second source (refer to section 1.5, items a – c) are bypassed in the terminal box for the second source.

The remaining connections are made in the terminal box as specified in section 1.5. (Single chamber operation).

2.4. Connections between the EHV 108 A and EKS 110 A

sockets on the EHV 108 A	Sockets on the EKS 110 A
a. EKS1 – J1 control cable	EKS 110 A, No. 1, J3
b. EKS1 – J3 motor cable	EKS 110 A, No. 1, J5
c. EKS1 – J5 control cable	EKS 110 A, No. 1, J6
d. EKS1 – J7 transducer cable	EKS 110 A, No. 1, J8
e. EKS2 – J2 control cable	EKS 110 A, No. 1, J3
g. EKS2 – J4 motor cable	EKS 110 A, No. 2, J5
f. EKS2 – J8 transducer cable	EKS 110 A, No. 2, J8
h. EKS2 – J6 control cable	EKS 110 A, No. 2, J6

i. The shorting plug "MULTI CHAMB. OPER." on the EHV 108 must be removed.

j. When an external interlock circuit is used for the high voltage, the shorting plug "AUXIL." on the EHV 108 must be removed.

2.5. Other connectors

a. If a substrate heater is used in the evaporation system, it is to be interlocked via the female sockets J9 of both EKS 110 A units (series connection).

b. If a gun control is triggered by an external rate measuring device for rate regulation (0 – 10 V, DC), the corresponding control voltage is supplied to the EKS 110 A, being part of the system, via the socket J1.

c. Connect both rotary drives EDE 110 to the sockets J2 of the pertinent EKS 110 A units.

d. For manual operation of the source: connect the Coat-O-Matic blind plug to the socket J4 of the EKS 110 A, being part of the source, and insert the blind plug-in printed circuit board in the interior of the EKS 110 A.

e. For automatic operation of a source: connect the control cable of the Coat-O-Matic or of the Automatic Deposition unit ADU 100 to the socket J4 of the EKS 110 A, being part of the source, and insert the relay plate E5 – Coat-O-Maticprint.

2.6. Control measurement

Refer to section 1.8.

2.7. Power supply

Refer to section 1.9.

3. INITIAL OPERATION (single source)

(Refer to Section 1)

3.1. Switch on the power supply (switch on the automatic circuit breaker), the lamp "POWER" lights.

2. Turn on the cooling water for the electron beam gun ESQ 110, lamp "GUN WATER" on the EKS 110 A.

3. With the shorting plug "AUXIL." inserted, the pilot lamp "AUXIL." on the EHV 108 A lights. If an interlocking contact has been connected (shorting plug pulled out), this interlock circuit must be checked.

4. Check the coil current on the EKS 110 A (approx. 0,8 A with the high voltage switched off, approx. 1,6 A with the high voltage switched on).

5. In order to test the function of the electron beam gun, it is advisable to place some copper in the crucible. Due to its low melting temperature, this material is not too bright during evaporation, allowing a simple spot control.

   After filling the pockets of the crucible, run the rotary drive through the various positions to test if the rotary movement is functioning correctly (if too much material is charged, the crucible can be blocked).

6. The correct functioning of the monitoring switches of the first interlock circuit is indicated on the EKS 110 A by the three lamps "DOOR" (cabinet doors), "VAC" (vacuum switch) and "GUN WATER" (cooling water of the source).

7. Check the monitoring switches of the first interlock circuit,
   a. open and close each cabinet door of the evaporation system. Each time the lamp "DOOR" on the EKS 110 A must go out and light again. (if a switch is present)
   b. close the cabinet doors, pump down the system, the pilot lamp "VAC." must light at approx. 50 mbar, Following this, the system must be vented. The lamp must go out.

8. Evacuate the system, pressure $< 5 \cdot 10^{-4}$ mbar.

9. Release the high voltage on the EKS 110 A and on the EHV 108 A by means of the key switch. The lamps HIGH VOLTAG-OFF on the EHV 108 A and on the EKS 110 A will light.

10. The second interlock circuit acts on the release relay of the automatic circuit breaker F9. In the event that the connector K2 is still switched on (e.g. relay is still attracted), the primary voltage of the HV-transformer will be switched off by the automatic circuit breaker F9 when the second interlock switch on the door of the coating unit or bell, respectively, is actuated. In this event, the automatic circuit breaker F9 will be dropped out over the release relay.

11. Switch on the high voltage on the EKS 110 A or on the EHV 108 A.

    Vent the system without emission current, but with the high voltage switched on. After the maximum current of approx. 900 mA has been indicated on the emission current meter of the EHV for approx. 1,5 sec., the high voltage must switch off automatically (time relay).

3.12. Pump down the system, pressure $< 5 \cdot 10^{-4}$ mbar, switch on the high voltage. Switch on the cathode heater (FILAMENT ON) and wait for the turn-on time (approx. 3 sec.) of the heater current at position "0" of the emission current potentiometer.

When a new or cleaned vacuum chamber is taken into operation, the automatic circuit breaker F9 may release during the first 3 – 4 switching operations. These disconnections are unimportant, however.

Check the cathode heating current. When using the heater current power supply units EHS 110, a current of 25 A must be available and a current of 18 A on the EHS 111.

13. When the second heating stage has been switched on, increase the emission current slowly to approx. 100 mA. (If a crucible control unit ETS is used, a possible blocking of the emission current after the crucible position has been obtained must be unlocked by resetting the emission current potentiometer "EMISSION CONTROL" at 0 position). Observe the spot.

14. If at a coil current of 1,4 A no spot in the crucible area is visible, the polarity of the coil must be reversed on the terminal strip 1J2 (in the terminal box underneath the gun).

Underneath the potentiometer "BEAM POSITION", two adjustment potentiometers 6 kVa dn 10 kV are located. The position of the spot can be changed however, with 10 kV potentiometer R7 only. Extreme care should be taken in this step, since with this potentiometer the spot can be moved very rapidly beyond the rim of the crucible.

15. When the cathode is correctly mounted, an emission current of 700 mA can be obtained at a heater current of 40 – 45 A. For the adjustment it is advisable to enlarge the spot to approx. position "6" with the potentiometer AMPL. LAT in order to avoid a possibly contaminated evaporant splashing. If the heater current necessary to obtain 700 mA is greater than 50 A, the cathode must be shifted towards the anode (in steps of approx. 0,2 mm). If the heater current at 700 mA emission current is less than 40 A, the cathode must be moved in the opposite direction.

16. The correct Wehnelt voltage is set on the rotary switch of the EHS in such a way (need only be checked after changing the cathode) that at 10 kV acceleration voltage, an emission current of 700 mA can also be obtained at a heater current of 40 – 45 A.

17. Any smaller emission current can now be adjusted as a maximum value with the potentiometer "POWER" LIMIT" on the EKS 110 A. With simultaneous operation of two guns, it is essential to observe this setting (distribution of the total emission current of 700 mA to both guns).

18. For all crucibles excepting the pot crucible, the maximum power is $L_{max} = 5.5$ kW for the evaporation of aluminum.

The corresponding Wehnelt voltage is 250 V or 300 V.

19. The distance between the edge of the spot and the inner wall of the crucible has to be at least 15 mm. Further, during evaporation the crucible should always rotate continuously.

20. High voltage test of the system under operating conditions. At a beam current of approx. 0,5 A all doors of the cabinet will be opened one after the other. Every time a door opens, the high voltage must switch off immediately.

21. Test of the crucible control unit ETS

During the evaporation, a new position is selected on the ETS 110. As a result, the emission current is blocked (lamp EMISS. BLOCKED lights) and can be switched on in the new position only after the potentiometer EMISSION CONTROL is reset at 0.

4. INITIAL OPERATION WITH TWO SOURCES

(refer to section 2).

4.1. The operation of the two sources is started as described in section 4. The power limitation (POWER LIMIT) must be set on each EKS 110 A in such a way that the total beam current does not exceed a value of 700 mA.

2. If the distance between the two sources is less than 50 mm, it will be noted that both magnetic fields are interfering with each other to a slight extent. For this reason it will be advisable to space the sources more than 50 mm apart.

5. TROUBLESHOOTING

The EHV 108 A has a weight of 108 kg. Should the power supply be removed from the rack cabinet, an adequate support (e.g. dolly) must be provided. If the rack module has to be pulled out only partly (servicing the low voltage system), the front plate located underneath the EHV 108 A is to be tightly screwed to the rack cabinet.

The EHV 108 A has been designed in such a way that the separation of the control voltage from the high voltage is assured. If, due to service work the perforated metal cover of the EHV 108 A is removed only, there are no hazards from high voltage conducting parts.
All electronic components, and relays are easily accessible on the three printed circuit boards above the core of the high voltage transormer. (An exception is the switching unit E4 with the switching relay K2, located on the rear panel of the EHV 108 A). Pull out the mains plug. The rear panel may only be removed by a qualified electrician.
ducting parts are exposed if the rear panel is removed!

When tracing faults, it may be necessary as an exception to take measurements with the power supply exposed (with a separate covering). Measurements of this kind may only by carried out by personnel with the necessary qualifications. Under no circumstances may measurement connections be made or disconnected whilst the high voltage is switched on. Neither may the various measuring instruments be touched during measurement.

The measuring lines must always be laid in such a way that they are a few centimeters apart from high voltage conducting components!

Fault	Cause	Correction
High voltage ON does not operate The OFF lamp does not light (on the EHV 108 A)	The automatic circuit breaker (HIGH VOLTAGE CIRCUIT) is not switched on	Switch on the automatic circuit breaker
Automatic circuit breaker F9 releases after the high voltage has been switched on (on the EHV 108 A)	The high voltage relay K3 has not been triggered (refer to operating instructions BB 800 180 BE)	Switch off the high voltage. Check the function of the excess current circuit board, (BG 241 104–U). a. input 80 V/0 check 15 V/0 b. feed current on printed circuit board E2 between contact 5 and 40 (0 ÷ 1 A, HV-relay K3 must switch at approx. 900 mA. If this is not the case, the excess current signal on the plug-in printed circuit E3 must be checked from input 15 to output 13.
The automatic circuit breaker F9 releases after the high voltage has been switched on following an installation of the system	Contamination of the high voltage conducting parts by contact during an installation or cleaning operation	Switch on the high voltage and repeat several times.
The automatic circuit breaker F9 switches off(therefore high voltage off)	Short circuit in HV-transformer	Exchange the HV-transformer
	Second interlock circuit interrupted	Fault has to be determined and corrected according to diagram according to diagram
	Time relay K4 switches (step 1 remains in ON position, contactor (K2 does not attracht)	
Cathode heater current lamp FILAMENT ON does not light	The COAT-O-MATIC blind plug has not been connected to the EKS (J4)	Connect the blind plug
	The blind printed circuit connector (fig. 8, item 1) is missing (refer to operating instructions BB 800 064 BE)	Connect the blind printed circuit connector
	No coil current or the coil current is set too low (< 0,4 A)	Set the correct coil current on the adjustment potentiometer (alt. trimpot) (below BEAM POS.)

Fault	Cause	Correction
The coil current is not influenced by the adjustment potentiometer	The input transistor on the coil circuit board E4 is defective	Exchange the printed circuit board or replace transistor
No coil current	The fuse F2 is burned out (refer to BB 800 064 BE)	Replace
	The coil connection is defective either outside or in the evaporation system	Make the contact
The coil current is instable	The transistor T7, BC 261 B at the input 4/6 on the coil circuit board E4 is defective (refer to BB 800 064 BE)	Replace the printed circuit board or the transistor
The coil current 2 A cannot be influenced	The transistor T4, BSX 46 – 16 on the coil circuit board E4 is defective	Replace the transistor or the printed circuit board
With a slight turn of the emission current potentiometer the heater current is over 70 A, no emission	The thyristor (fig. 3, item 1) is defective (refer to BB 800 064 BE)	Replace the thyristor or thyristor set
	The relay K4 on the printed circuit board E1 in the EHV 108 A is defective	Replace the relay
After a slight turn of the emission current potentiometer the emission increases immediately to the set limit	The transducer outlet (J7, J8) has been confused (refer to BB 800 064 BE)	Connect the correct cable to the EKS socket J8 according to the source assigned
	The measuring outlets of the transducer have been confused	Change the polarity of the measuring outlets
	The potentiometer R1 is defective (fig. 1, item 5)	Replace the potentiometer (refer to BB 800 064 BE)
No emission with the high voltage switched on, the heater current remains at minimum setting	The toggle switch is at CONST. RATE (fig. 1, item 6)	Change
	POWER LIMIT (fig. 1, item 4) is set too low (refer to BB 800 064 BE)	Turn potentiometer clockwise
No heater current after depressing the push button FILAMENT ON	The coil current will be triggered by the EHV 108 A according to the high voltage. With the high voltage switched off it will therefore be absolutely possible that a coil current $J_c \approx 0{,}4$ A is available and the FILAMENT OFF push-button does not light. If the high voltage is switched on, this problem is solved. Hence, the filament can be switched on only after the high voltage (has been actuated).	
	The MIN setting on the potentiometer R12 on the thyristor driver circuit board is incorrectly adjusted	Set the potentiometer in fig. 4, item 2 at the heating current acc. to operating instructions BB 800 064 BE
	The pulse-transformer on the thyristor driver circuit board is defective	Exchange the printed circuit board
No emission with the high voltage switched on. The heater current remains at the minimum setting	The HV-measuring relay K4 on the printed circuit board E1 (EHV 108 A) is defective	Exchange the measuring relay
No instruction push-button on the ETS 110 lights with the EKS switched on	The fuse F1 is defective	Replace fuse F1 (refer to BB 800 061 BE)

Fault	Cause	Correction
The instruction push-buttons on the ETS 110 are operative. The drive cannot be switched on by the ETS	The fuse F2 is defective (built in the interior of the unit)	Exchange fuse F2 (refer to BB 800 061 BE)
The crucible is destroyed by the contents of the crucible (alloy the crucible)	The spot is not in the center of the crucible	
	For the spot crucible the distance between the spot and the wall of the crucible is too small	Correct the position of the spot
	The beam power is too high Cooling is inadequate	Reduce the beam power, If aluminium is evaporated in the 4-way crucible or in the oscillating or grooved type of crucible, then set "POWER LIMIT" on the EKS at 5,5 kW
Arcing at high evaporation rates	Poor screen of the high voltage installation	Screen carefully
Arcing at increased pressure, pressure peaks	The evaporant degasses too strongly	Degas at reduced pressure
The evaporant splashes too much	The electron beam power density is too high	Sweep or reduce the power
	The crucible is contaminated (e.g. from material previously evaporated)	Clean the crucible (e.g. sand-blast)
The crucible movement is jammed	Material splashes on the crucible/ mask	Clean
	Knurled nut on the crucible lower section (fig. 9, item 7) is too tight (refer to BB 800 059 BE)	Set the clearance with the knurled nut at approx. 0,3 to 0,5 mm and secure with the two M5 screws
The pressure rises if the rotation is switched on or off	The L-ring gasket H 25 – 14 25/38 x 6,5 (fig. 6, item 2) under the bronze flange leaks	Replace the L-ring gasket
The pressure rises if the cooling water is turned on	The O-ring 80 x 4 (item 18 of the spare parts list BB 800 041 E/1) leaks	
	Tapper of L-ring gasket too small (refer to section 4.1. BB 800 059 BE)	Machine the Cr/Ni flange by turning down 0,2 mm
The pressure rises if the cooling water is turned off	The L-ring gasket H25 –1425 / 38 x 6,5 (fig. 6, item 2) under the bronze flange leaks (refer to BB 800 059 BD)	Replace the L-ring gasket
No spot in the crucible though the high voltage has been turned on and the coil current read-out is correct J = approx. 1,6 A	Incorrect polarity of the coil	Interchange the coil connection on terminal strip underneath the coating unit with ground connection.
The spot is too large	The cathode is pushed too far in the direction of the anode	Move the cathode back (use a gauge)
	No Wehnelt voltage	Check the contact EHS to Wehnelt shutter
Irregular movement of the spot in the crucible	Electrostatic charge of the shutter above the source	Ground the shutter plate with a naked metal wire.