# HVCEB E-Beam Power Supply Trouble Shooting

**Most Operational problems can be associated directly with filament issues.**

## How the system works:

**The filament controls how many free electrons are produced. This process is called thermionic emission in which electrons that are produced are then moved by a potential voltage causing a current to be established.**

**Power supply turn on sequence is fixed; the filament standby is turned on first then High Voltage On is allowed changing the standby filament control to emission current regulation when HV On is applied and back to standby filament control when HV is Off.**

**When the power supply high voltage is turned on the free electrons being emitted by the filament are attracted to ground and move toward the e-gun crucible. The beam is bent by an extremely strong magnetic field and directed into the crucible.**
**If more current is demanded the filament current increases causing more electrons to be emitted precisely regulating the output to the exact current you asked for. The Current Meter will be stable and the Filament Current Meter may move around slightly because it is heating and cooling the filament in order to maintain an exact emission current into the crucible.**

**The voltage level matches the magnetic field exactly when the beam hits the center of the crucible. Once this is set visually it very rarely needs adjustment. If the e-gun is cleaned and the magnets are re-installed wrong, the beam will not be focused (spreading) or the voltage required to hit the crucible may be much less than the setting before the e-gun was disassembled reducing power delivered to the crucible.**

**Filament Controls: There are two versions of filament controls.**

- **Version 1 with the front panel filament standby adjustment:**

**This filament standby adjustment could be set anywhere from 6 to 14 amps with the recommended nominal setting of 8-10 amps. The filament standby adjustment only works and is adjustable only when HV is OFF. Standby is an idle or (pre-heat) so the filament is not thermally shocked when HV is turned on. It also allows the user to see if the filament is in good condition on the e-gun and increases the life of the filament.**

- **Version 2 with the rear panel adjustment:**

**This filament is set at the factory to 8-10 Amps by a small screwdriver adjustment above the analog interface sub-D connector on the rear panel.**

***DO NOT USE HIGH VOLTAGE FOR THIS TEST.***

## Filament Trouble shooting:

**Does the filament driver work?**

- **If you turn on the filament and the meter reads less than 1 amp the filament driver is not working and must be repaired.**
- **If you turn on the filament and you get a reading 6 amps or greater the filament driver is working and you can proceed.**

**Condition of the filament:**

**OPEN Filament: Both of the following conditions must exist**

- **If you *can not* adjust the filament standby current level in either version 1 or 2 the filament is open and must be replaced or something is disconnected where the HV wires are attached to the e-gun input inside or outside the vacuum chamber.**
- **Second verification is NO filament glow from vacuum chamber.**

**SHORTED Filament: Both of the following conditions must exist**

- **If you *can* adjust the filament standby current in either version 1 or 2.**
- **Second verification is NO filament glow in chamber.**

**HV wires maybe shorted outside the vacuum chamber by wires touching or inside the vacuum chamber due to metallic contamination on the e-gun HV filament feed wires or the filament itself.**
**Be aware you may have a partially shorted filament and still see some glow.**

**Note: Additional abnormalities to be aware of are:**

- **Welded turns on the filament**
- **Filament touching or too close to e-gun body or emitter shield.**
- **Filament too high or too low in mount, use alignment tool to correct.**
- **White Ceramic HV feed thru insulators contaminated under e-gun.**

**Filament is OK: Both of the following conditions must exist.**

- **If you *can* adjust the filament standby current in either version 1 or version 2.**
- **Second verification glow in chamber is present and varies up and down with filament standby current adjustment.**

**CLEANING: E-gun must be cleaned very often to maintain proper function of System & HV Power Supply any contamination however insignificant can cause arcing & interruption of your process.**

***The verification of the above procedure is required in order to move to the next phase of troubleshooting if necessary.***

## *HIGH VOLTAGE will be applied FOR THIS TEST.*

**The probability of the system working is very high after passing the before mentioned filament trouble shooting.**

- **Vacuum chamber should be ready to operate.**
- **You must have system in local or front panel control mode.**

**Turn On Filament Standby:**
**Be sure KV reference Voltage and the Current is set to zero. Press and hold the preset button and dial about 200 V or 0.2 on the KV and 5 mA on the Current.**

**Filament Standby should be set at 6 to 10 amps.**

**TURN ON High Voltage: Read the next paragraph before application of HV.**

**Unit should do very little if the filament current jumps to 50 amps and the current goes to a very high level SHUT DOWN YOU HAVE A SHORT CIRCUIT in the e-gun.**
**If you have a clicking or ticking sound SHUT DOWN as well.**

**Units with "Mercury e-beam Control"**
**Newer Units with "Mercury e-beam Control Board" will either fault off in the case of a dead short or during Arcing will continually roll-back to zero output and reapply HV every half second. If the e-gun continues arcing shut off the power supply and check the e-gun for contamination.**
**If everything looks normal dial up the KV while keeping the current low at 5mA and look for the beam to hit the pocket.**

***No Output Must be returned to the factory for evaluation.***