

## Technical Data Sheet

# Calibration and Installation Procedures for Lanthanum Hexaboride (LaB<sub>6</sub>) and Cerium Hexaboride (CeB<sub>6</sub>) Cathodes

**#80920 - 80933**

### Calibration Procedure for LaB<sub>6</sub> or CeBix Cathode

Use the following proposed calibration procedure for correct initial filament current when using an APTech LaB<sub>6</sub> or CeBix cathode.

1. Bypass vacuum interlocks, disable high voltage.
2. Place load resistor across filament leads in gun chamber with an ammeter in line. Load resistor should be equal to the resistance of the cathode at 1800K (0.67 Ω, 15 watts, 1%\*).
3. Probe transformer primary inputs outside HV tank on circuit boards.
4. Ramp up primary voltage with filament control knob until cathode's 1800 K current is obtained on ammeter (2.81 amps). Read primary voltage ( $V_{1800}$ ). This is the only calibration point that will be useful, as the resistance of the cathode will change with temperature due to changes in the resistivity of the pyrolytic graphite heater blocks.
5. Install cathode, restore interlocks, pump down.
6. Ramp cathode slowly to primary  $V = V_{1800}$ , ideally with HV set as low as system will allow. Initial resistance of the cathode will be somewhat high due to oxidation of block-to-crystal interfaces. Do not try to saturate or locate beam at this point. Let the cathode sit at  $V_{1800}$  for ~ 3 hrs to remove oxide and stabilize resistance.
7. Assume that at this point the resistance of the cathode is actually 0.67 Ω and stable, and the filament current is as expected (2.81 amps).
8. Proceed with saturation procedures. Find correct bias setting to saturate beam without having to increase the primary voltage beyond  $V_{1800}$ . The recommended point for maximum brightness is just short of saturation. Align beam, etc
9. Expect that brightness should be different than seen initially with the CeBix cathode, primarily due to a lower temperature. (Assuming here that the CeBix cathode was initially running hotter than 1800 K).

\*Allied Electronics 2005 catalog p. 1160. Stock #'s 524-6002, 524-6005, 524-6010, and 524-6015.

### Installation Procedure for CeBix Cathode

Use the following procedure when installing a CeBix cathode in a self biased or an independently biased system.

If you have **Self Biased System** and are installing a CeBix™ cathode, you must:

- Increase the distance between the tip of the crystal and the Wehnelt cap. For example, when installing a cathode in a JEOL JBX-5DII Lithography system, the crystal truncation should be recessed from the front surface of the Wehnelt 3/5 a turn for LaB<sub>6</sub>, or 3/4 turn for CeBix™. Use a similar tip distance relationship when installing CeBix™ in other LaB<sub>6</sub> instruments.

-OR-

- Increase the bias resistance by a factor of 2.

**NOTE:** In some cases you will need to perform a combination of both of the above.

If you have an **Independently Biased System** and are installing a CeBix™ cathode, you must:

- Simply operate it the same way as you would operate a LaB<sub>6</sub> cathode. Do expect, however, the total emission current to be approximately half of that obtained when operating a LaB<sub>6</sub> cathode.

