Service Physics
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Revised 11/4/05
BSB/DG V

E-gun replacement:

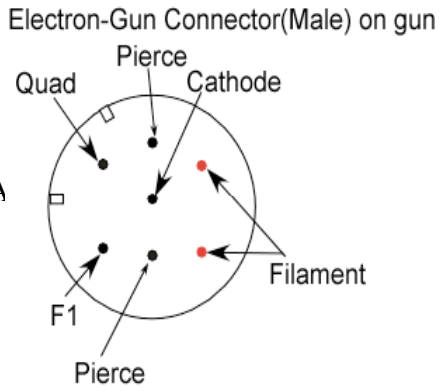
A. When replacing the e-gun make sure the cutouts in the e-gun flange match the cutouts in the chamber flange.

B. Also the cutout's in the electrical connector to the e-gun should be at about 9 and 11 o'clock.

E-gun Spot size and power set-up

Restore system vacuum. After analyzer pressure is in the 10^{-8} T range, the e-gun start-up and alignment can be performed.

A. With an external power supply bring the e-gun filament up to 1.2 Amp. Start at about 0.75 A and slowly increase the current. Monitor the system pressure; when the pressure rises above 10^{-7} Torr stop increasing the current and wait for pressure to drop 5×10^{-8} Torr. When the filament current is about 1.2 A at this current for 2 hours.
Note: There is a special power supply with a special cable that is used for this initial procedure. Use the Fluke 4 digit DVM to monitor the current.



B. Reconnect E-gun connector.

Warning

C. The Following procedures can allow you to come in contact with lethal voltages if you are not careful. Use extreme caution in the following and have a buddy there to help in case of trouble.

D. Remove the top cover of the 8702 x-ray controller. The left side cover screw is an interlock screw, replace this screw. Do not remove the plastic cover.

E. Locate the four pots on the High Voltage Regulator Board in the front of the 8702. See Figure2. These are the F1 (focus) adjustments. Turn all four pots two turns CCW.

F. Locate the four large pots on the Pierce Board in the center of the 8702. See Figure 1. These are the pierce adjustments. Turn all four pots fully CCW then turn them 1/8 turn CW.

G. Locate the pot on the Filament Regulator Board at the rear of the 8702. See Fig 1. This is the I2KV adjustment. Turn this pot 15 to 20 turns CCW.

H. I2KV can be measured in the following way. Using a floating DC Voltmeter across TP3 and TP4 on the Filament Regulator Board. The meter will be floating at about 2000 Volts!!! when the Glassman is off and at 12,000 V when the Glassman is at 10 KV. Be careful. Set the meter on the plastic cover or another insulated surface.

DO NOT TOUCH THE METER WHILE THE 8702 IS TURNED ON!!!

The current is calculated by measuring the voltage between TP3 and TP4 and using the formula:

I2KV = Voltage/40.

I. *When turning on the E-Gun watch the system pressure on the Ion gauge controller. If the system pressure rises quickly or into the 10^{-7} range go back to the previous step.*

J. Set the meter function switch on the 8702 to I Fil. Set the spot size switch to off. Turn on the 8702 and press the pre-heat switch. Watch the front panel meter. I Fil will increase slowly over 1 minute. After 30 to 45 seconds the I2KV will come up slowly. The I2KV should settle between 1 and 2 mA after a few minutes. Leave it at this current for at least an hour. Be sure the pressure has dropped below 5×10^{-8} Torr before proceeding.

K. Slowly adjust I2KV pot for 3.0 mA of current. Leave at this current for ½ hour. If the vacuum permits, proceed slowly to 5.0 mA. This will take about 1 day. If you are unable to get 5.0 mA, see attached Filament Regulator Modification.

L. Check Calibration of 8702 Front Panel I2KV Meter. Adjust if required. See Fig 1 for meter calibration instructions.

M. **Turn OFF the 8702 and remove the meter** used to measure I2KV.

Failure to perform the next 2 steps voids the warrenty

N. Turn on the 8702. Turn spot size to off. (Check that the Glassman HV power supply is off). After 2 minutes measure Pierce voltage (Fig 1). The Pierce voltage should be greater than 850 V. If below 850 V call SPI.

   a. Place the spot size switch on the front panel of the 8702 to the 1000 micron position. Set the Pierce Voltage to 110 +/- 5 V. See fig 1.

   b. If you are unable to set the pierce pot in this range **turn off the 8702** and you will need to move the Pierce jumpers.

      The Pierce jumpers are in pairs and should be moved as pairs. Move the jumper pairs one set of holes forward to decrease the pierce voltage or back to increase the voltage. See fig 1.

Degassing the E-Gun

O. Set the Spot size switch to OFF.

P. Make sure the pressure is $< 5\times10^{-7}$ Torr. Turn the voltage control on the Glassman power supply to zero. Turn on the Glassman power. Slowly increase the Glassman power supply voltage while watching the analyzer vacuum pressure on the Ion gauge. If the system pressure starts to rise quickly, by a factor of 2 or rises above 10^{-7} Torr STOP increasing the Glassman voltage and wait until the pressure decreases again. You should increase the Glassman by 1KV steps and wait ½ hour between increases when you are below 5 KV and an hour between steps when you are above 5KV. Watch for signs of arcing, which will show a quick change in the Glassman current and/or vacuum pressure. Stop increasing voltage until arcing stops. Increase the Glassman voltage to 10 KV.

Q. Note the current reading on the Glassman power supply and write it down. This is the base current and will be between 2 and 3 mA. If it is above 3 mA call SPI.

R. Switch the spot size to 150 μm. Check Glassman current. Be sure it is below 4 mA, if necessary turn down I2KV. Check vacuum. Make sure vacuum is below 10^{-7} Torr.

S. Continue to increase to larger spot sizes. Follow the above procedure. Glassman current should be below 7 mA for 300 and 12 mA for 600 μm spots. After spot size is at 1000 μm wait for system pressure to drop below 5×10^{-8} Torr.

   If the pressure rises you can turn down the Glassman to 5 KV and then increase it again in 1 KV steps waiting between each rise for the pressure to stabilize or decrease if it is above 5×10^{-8} Torr.

T. Read the Glassman power supply current. If the Glassman current is less the 22 mA use the I2KV pot to increase the I2KV. If the Glassman current is greater than 23 mA, decrease I2KV until the Glassman current is 23 mA. Make adjustments slowly keeping the vacuum pressure below 10^{-7} Torr.

Setting the Glassman current to 22 mA for the largest spot by adjusting the I2KV with the Pierce Voltage in the range of 105 to 115 V is very important to filament and cathode life. The measurement of the Pierce Voltage is made with the Glassman off.

S-PROBE POWER OF 250 WATTS MAY BE OBTAINED BY SLIGHTLY HIGHER I2KV SETTINGS.

It is normal for the Glassman current to drift for the 1st hour of operation. Let the gun and supply stablize before proceeding. Readadjust I@KV to keep the Glassman current between 22 and 23 mA.

U. Measure the E2KV and E10KV with 1000:1 HV probe. Compute:

(E2KV – E10KV) * I2KV

This is the cathode power. If value for cathode power has been supplied, compare to the installed value. Contact SPI if installed power is greater than 1 W above factory test value.

V. Select 150 μm spot. Set the 150 μm Pierce pot for 4.0 mA on the Glassman. If you can not reach the current required you will need to move the Pierce jumpers for the 150 μm spot. Move the jumpers forward to increase the current and back to decrease current.

W. Load a phosphor sample into X-ray analyzer. (it is also good to load a Cu and Au sample at the same time).

If E-Gun test data sheet is with E-Gun, the voltages on data sheet may be used to initially set F1. Usa a 4 ½ digit DVM with 1000:1 High Voltage divider probe.

Final values must be obtained by measuring actual spot size

X. Set the spot size to 150 μm. Adjust the 150 μm spot F1 pot (turn cw slowly) to get a 150 μm spot on the phosphor. This is measured in the microscope on 50 X. See Fig 1. Check the power on the Glassman when setting the spot size, and if it changes re-adjust pierce to correct power.

Y. Select the 300 μm spot size and set the Pierce pot for 7.5 mA. Set the size to 300 μm using the F1 pot(fig1).

Z. Select the 600 μm spot size and set its Pierce pot for 12.5 mA and set its size using the correct F1 adjustment.

AA. Select the 1000 μm spot and set it to **800 μm** (fig 3). Check the voltage on F1 and make sure it is below 8400 V.

BB. With a high voltage probe and meter measure F1 and pierce voltages for all four spot sizes and recode these voltages for future use.

AFTER COMPLETING THIS PROCEDURE FILL OUT WARRANTY CERTIFICATE AND FAX TO SPI.

CC. Replace top cover of the 8702.

Setting Monochromator and Microscopy.

A. Place the Au sample into the x-ray beam.

B. Adjust the z motor control of the stage to maximize the counts for Au. You will need to use the software to set up a scan for Au and stop it near the Au peak.

C. Remove the cover of the controls for the monochromator crystal (black plastic cap to the left of the microscope). There are two controls for the monochromator the Bragg and nonBragg control. The Bragg control is at 3 o'clock and the nonBragg is at 11 o'clock.

D. Adjust the Bragg control to maximize the counts. (this can also be done with the Phosphor screen in the x-ray beam and you will be able to see the beam getting brighter.

E. Maximize the counts using the z control of the stage (if you go to the motor control panel and turn off the computer control of the stepper motors, this is easier) . Note the number of counts that you have.

F. Move the nonBragg control in one direction to reduce the counts by ½.

G. Adjust the z control to bring back the counts.

H. If the maximum in the counts is more that it was in step E above continue in the same direction and redo step F-G. If the maximum in the counts is less then it was in step E above adjust the nonBragg in the opposite direction. If it was more adjust the nonBragg again in the same direction.

I. Continue doing steps F-J until no more improvement can be found.

J. Redo steps D-H until both the Bragg and nonBragg are optimized.

K. Put the phosphor in the x-ray beam.

L. Maximize the counts by using the z stepper motor control.

M. Loosen the two screws that keep the microscope from moving on the side of the microscope

N. Remove the cover on the back of the microscope stand (black round knob on the top of microscope stand).

O. Move the microscopy left right and forward back to place the x-ray spot in center of microscope. The left right adjustment is on lower right of microscopy support and the forward back is on the back of the support.

P. Focus the microscopy on the spot using he brass knob on the top of the support (it was under the cover that was removed in step M).

Q. Adjust the microscope position so that the cross hair in the right eye piece of the microscope is in the center of the spot.

R. Replace the cover on the microscopy focus adjustment and tighten the screws on the sides of the support.

Calibration of Detector

A. Load a Cu and Au sample into the XPS and focus on the Au sample

B. Set the spot size to remote.

C. Start the data collection program.

D. Go to: "settings: set up ESCA: Detector width"

E. Go to the detector width calibration. Running the detector width calibration takes about 10 minutes.

F. Go to V1 curves and run the procedure. If it completes, click calculation and then update register.

G. Put the Cu sample into the XPS and go to DAC

H. Run the procedure

I. Put the Au sample into the beam

J. Go back to the collection main program

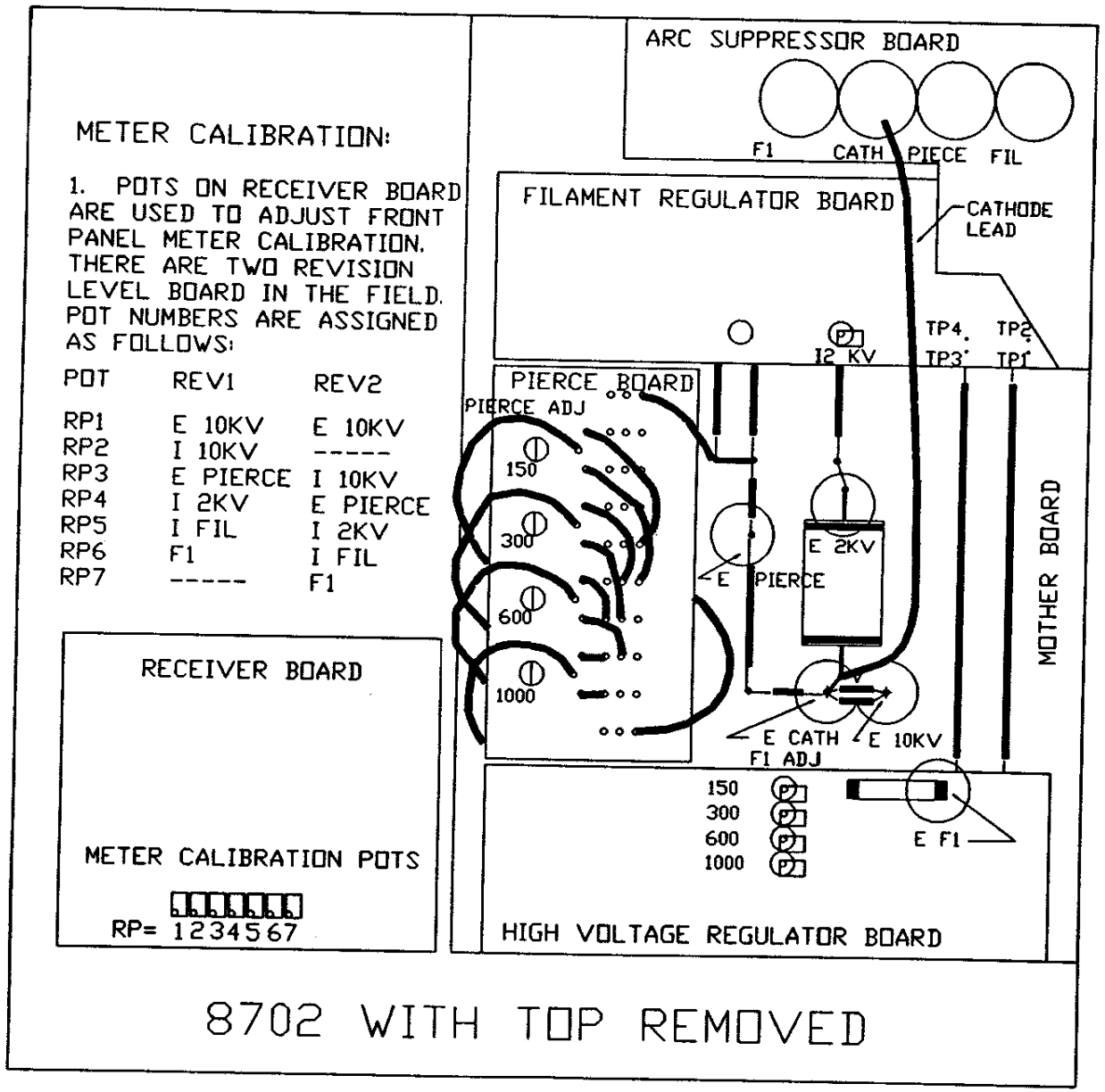
K. Open performance test (top left)

L. Choose Gold diagonal

M. Run the test

N. For each curve go to peak and analyze it for area and peak width.

FIGURE 1



8702 WITH TOP REMOVED

8702 ADJUSTMENTS

NOTES:

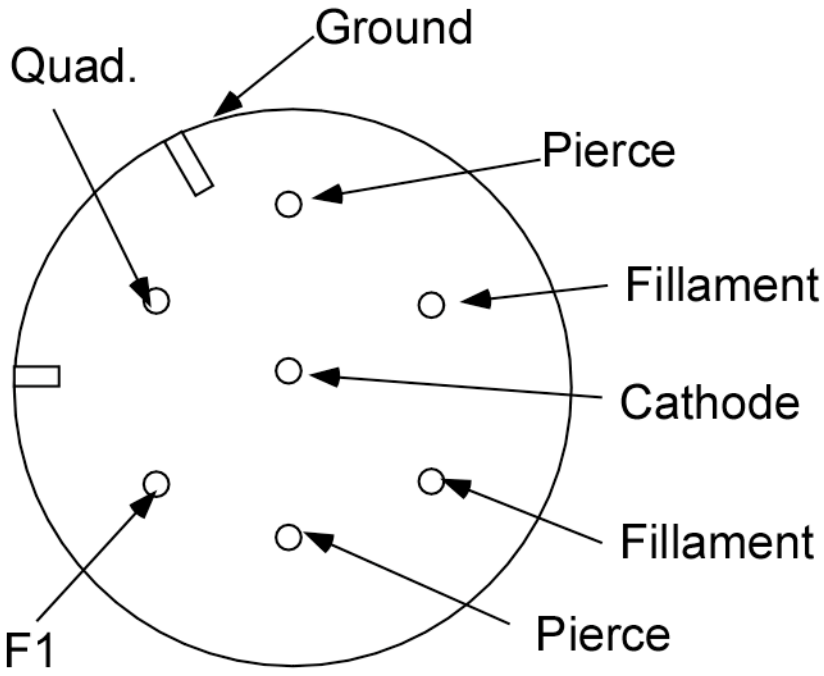
1. PIERCE JUMPERS SHOWN AT TYPICAL POSITIONS. ADJUST PAIRS OF WIRES FORWARD OR BACK TO KEEP CONSTANT DROP ACROSS POTS.

2. THE VOLTAGE BETWEEN TP3 - TP4 DIVIDED BY 40 PROVIDES GOOD MEASURMENT OF I 2KV. TEST POINTS ARE AT 2000 VOLTS WITH GLASMAN OFF. TEST POINTS ARE AT 12,000 VOLTS WITH GLASMAN ON.

DO NOT TOUCH METER WHEN CONNECTED TO TEST POINTS WITH EITHER SUPPLY ON!!

3. THE VOLTAGE BETWEEN TP1 - TP2 DIVIDED BY .33 PROVIDES GOOD MEASUREMENT OF I FILAMENT. ALL CAUTIONS ABOVE APPLY.

4. THIS IS A SIMPLIFIED DRAWING OF THE 8702. PARTS AND CONNECTION ARE ONLY SHOWN TO AID IN MAKING ADJUSTMENTS. DETAIL HAS BEEN REMOVED.



Resistance Between Pins

Pierce Ground P-G _____Ω

Pierce Cathode P-C _____Ω

Pierce Filament P-F _____Ω

Cathode Filament C-F _____Ω