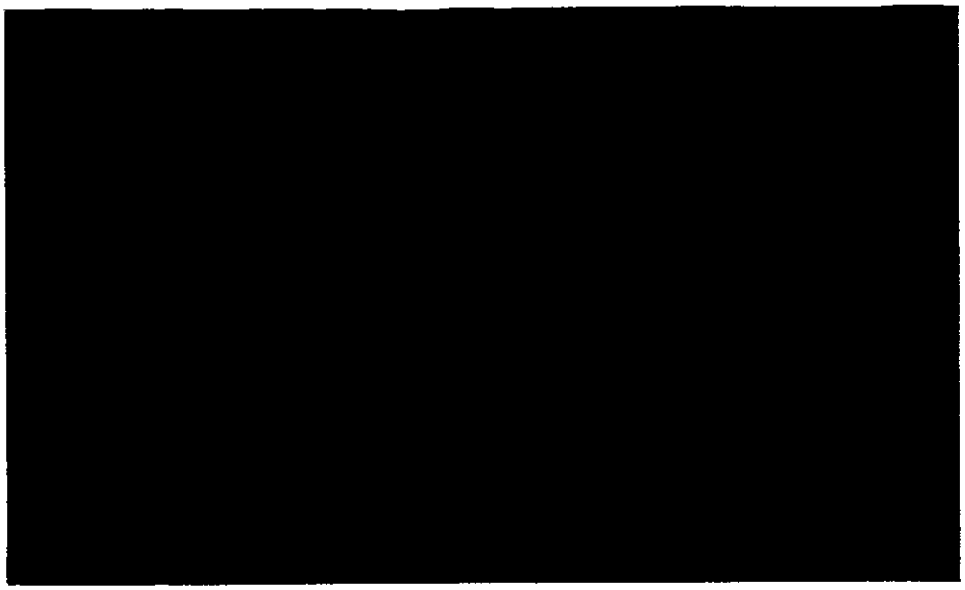
[redacted]

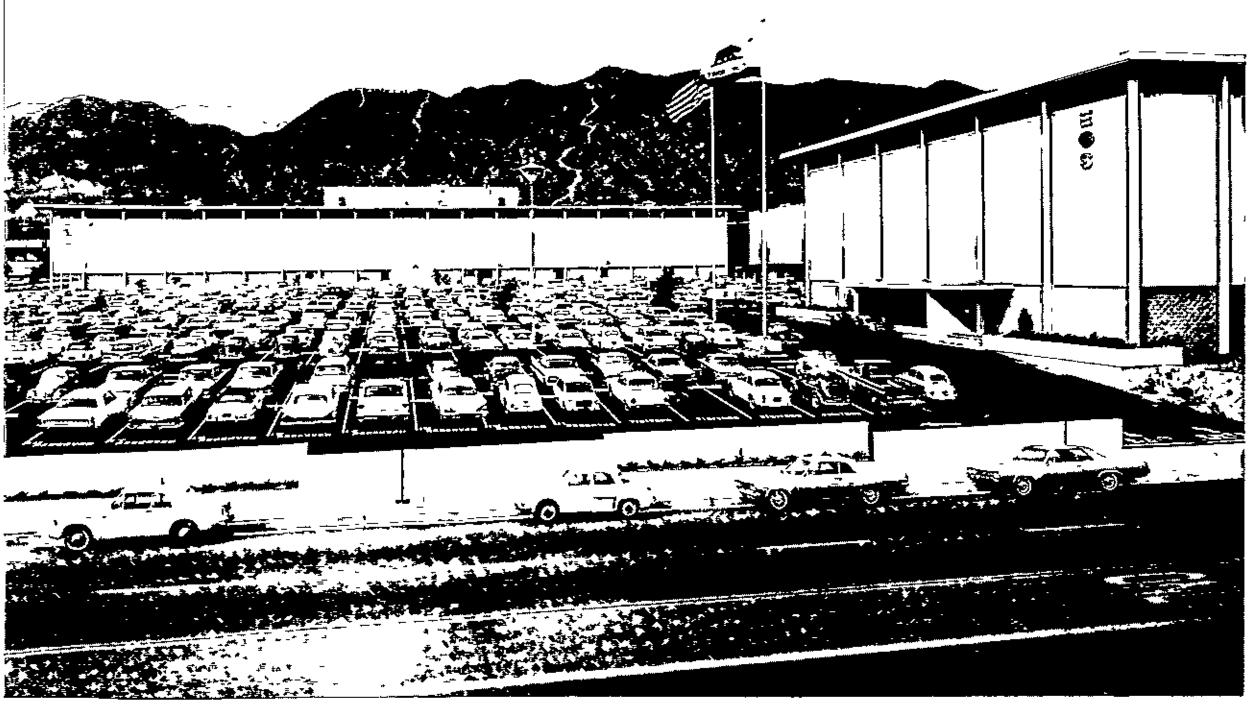
ELECTRO-OPTICAL SYSTEMS

A XEROX COMPANY

PASADENA, CALIFORNIA 91107 • 213/351-2351

13





Final Report

DEVELOPMENT OF THERMIONIC CONVERTERS

Prepared for
California Institute of Technology
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103

Contract 952255 October 1970

Prepared by
Dean Jacobson
Randy Hamerdinger

Approved by

A. O. Jensen, Vice President and Manager
Advanced Technologies Division

ELECTRO-OPTICAL SYSTEMS
A XEROX COMPANY

NEW TECHNOLOGY

Descriptive Title	Innovator	Report, Pages, Date
Split-ring ceramic for envelope-collector	Dean Jacobson Randy Hamerdinger	EOS Report 4018-Q-1, pp. 14-24, 15 Apr 69 EOS Report 4018-Final, pp. 3-1 through 3-12
Conical-convoluted emitter envelope	Peter Rouklove John Tallaksen	EOS Report 4018-Q-3, pp. 5-8, 15 Oct 69 EOS Report 4018-Final, pp. 4-1 through 4-4
Conical collector shape	John Tallaksen Randy Hamerdinger	EOS Report 4018-Q-3, pp. 5-6, 15 Oct 69 EOS Report 4018-Final, pp. 4-1 and 4-2

"This work was performed for the Jet Propulsion Laboratory, California Institute of Technology, as sponsored by the National Aeronautics and Space Administration under Contract NAS7-100."

ABSTRACT

Six ring-type cylindrical thermionic converters were designed, fabricated and tested in an iterative manner during this developmental program. Converters with characteristic low power and high efficiency were designed to be capable of integration to form a modular power supply of high power output. The central philosophy of the approach was to increase the reliability of thermionic space power supplies by redundancy of the basic component.

The improved cylindrical converters had an ultimate optimum performance of 3.86 watts/cm^2, at 0.50 volt, at a measured emitter hohlraum temperature of 1400°C. The calculated interelectrode spacing at 1400°C was 12 mils.

The final converter design featured a conical emitter envelope with a convolute for added strength, and a total converter thickness of 1.52 cm. The emitter and collector materials were CVD or wrought rhenium and the radiator was solid niobium.

PRECEDING PAGE BLANK NOT FILMED

CONTENTS

PRECEDING PAGE BLANK NOT FILMED

ILLUSTRATIONS

ILLUSTRATIONS (contd)

SECTION 1

INTRODUCTION AND SUMMARY

This was a 20 month program to design and develop low power, high efficiency thermionic converters of cylindrical geometry. The converter design provided the capability of integration to form a modular power supply. The central philosophy of the approach was to increase the reliability of thermionic space power supplies by redundancy of the basic component.

The converter development proceeded in an iterative fashion whereby each converter design was reviewed separately by JPL before fabrication. The performance data from a single converter was reviewed separately and formed the basis for the redesign of the subsequent converter.

Six converters were designed, fabricated and tested during the program. The basic design was to produce individual converters capable of being individually tested and then assembled to form a modular power supply. To enhance the power capability and minimize weight, a major objective of the program was to design a converter of minimum thickness. The concept also dictated the development of a strengthened emitter envelope and compact real design.

The design parameters of the converters are presented in Table 1-I.

TABLE 1-I

CONVERTER DESIGN CHARACTERISTICS

Converter	SC-1	SC-2a, SC-2b	SC-3a, SC-3b	SC-4
Emitter Material	CVD-Re	CVD-Re	Wrought-Re	Wrought-Re
Collector Material	CVD-Re	CVD-Re	CVD-Re	CVD-Re
Radiator Material	Nb	Nb	Nb	Nb
Emitter Envelope Material	Wrought-Re	Wrought-Re	Wrought-Re	Wrought-Re
Envelope Design	Flat-heat choke	Flat-heat choke	Conical-Convolute	Conical-Convolute
Collector Area (cm^2)	4	4	3.6	3.6

The converter design was predicated on the following goals:

a. A measured emitter hohlraum temperature of 1400°C ±7°C
b. A converter power output of 4 W/cm^2 of emitter area at 0.7V dc at an efficiency of 10 percent
c. A converter total output of 15 electrical watts

The converter performance goals were:

a. A measured emitter hohlraum temperature of 1400°C ±7°C
b. A converter power output of 4 W/cm^2 of collector area at 0.5V dc

A summary of the optimized converter data is presented in Table 1-II.

In summary, all the converter design goals were met concerning converter configuration, size, envelope strength, reliability and reproducability of fabrication. The measured output performance was 96.5 percent of the performance goals.

TABLE 1-II

OPTIMIZED CONVERTER DATA

Converter	T_E (1) (^oC)	ϕ_E(eff) (eV)	T_{cs} (^oC)	d @ 1400^oC (1) (mil)	A_c (cm^2)	I_{out} (amps)	V_{out} (2) (volts)	P_{out} (watts/cm^2)	η (3) (%)	Converter Weight (gm)	Converter Thickness (cm)
SC-1	1401	2.32	315.2	12	4.0	39.98	0.295	2.95	2.70	322	2.10
SC-2a	1415	2.44	295.5	12	4.0	33.68	0.500	4.21	4.03	325	1.92
SC-2b	1502	2.44	316	12	4.0	57.2	0.400	5.72	3.8	325	1.92
SC-3a	-	-	-	-	-	-	LEAKED AFTER FABRICATION			-	-
SC-3b	1400	2.44	318	12	3.6	27.76	0.500	3.86	2.95 (4)	320	1.52
SC-4	1406	2.48	294.6	12	3.6	27.74	0.500	3.45	2.39 (4)	320	1.52

(1) Measured hohlraum

(2) Measured at lead strap terminals

(3) Defined as measured power output divided by total power input, including that of the filament

(4) Measured without radiation shields

SECTION 2

CONVERTER SC-1

2.1 SC-1 DESIGN

The design of converter SC-1 was predicated on the following goals:

a. An emitter temperature of $1400^{\circ}C \pm 7^{\circ}C^{*}$

b. A converter power output of 4 W/cm^2 of emitter area at 0.7V dc at an efficiency of 10 percent

c. A converter total output of 15 electrical watts

The performance requirements, after the fourth converter, were a power output density of 4 W/cm^2 at 0.5 volts and a measured efficiency, with high efficiency shields, of 8 percent.

In addition to these design goals, certain general design features were incorporated into SC-1 as follows:

a. The seal diameter was reduced to a minimum for a butt seal configuration. This reduction allowed for a unity view factor radiator; that is, no part of the seal structure intercepted the line-of-sight radiation rejected from the radiator. Moreover, a compact seal geometry allowed for a more efficient converter package when stacked on a heat pipe.

b. The collector-radiator is an integral niobium unit to which the ceramic metal seal structure is electron beam welded directly (as distinguished from a molybdenum radiator in which weld rings are brazed into cutouts in the molybdenum). Interestingly enough, the decrease in thermal conductivity of niobium (over molybdenum) trades evenly against a non-interrupted heat flow path.

---

*Note: All emitter temperatures referred to in this report are measured true hohlraum temperatures.

2.1.1 EMITTER

The emitter for SC-1 is a vapor-deposited cylinder which allows for two thermocouple inserts. The material is vapor-deposited rhenium with an emitter area of 4.0 cm^2. The emitter-collector interelectrode spacing is approximately 10 mils, as determined during final assembly by depth micrometers and alignment pins. Figure 2-1 indicates the emitter structure relative to the other key components of the converter assembly. Emitter joining is performed by electron beam welding two rhenium support structures to the emitter. It is noteworthy that all joining in this converter is accomplished by electron beam welding except for the ceramic metal seal.

2.1.2 COLLECTOR-RADIATOR

The first task involved in the collector-radiator design was a computation of the collector heat load. From a design current load of 40 to 45 amperes, an emitter operating temperature of 1400°C and an interelectrode spacing of 10 mils, the following calculations were performed:

$$Q_{coll} = Q_{eh} + Q_{rad} + Q_{cs\ cond} \tag{1}$$

$$Q_{eh} = I\left(\phi_{coll} + \frac{\epsilon k T_{p\ell}}{e}\right) \tag{2}$$

for vapor-deposited rhenium ϕ_{coll} = 1.45 or 1.47 eV

$T_{p\ell} \simeq 4000°K$

ϵ = 1.4 (dependent upon selection of defined quantities in integration)

I = 44 amperes (total current for 5 to 5.5 cm^2 collecting area)

Substituting these values into (1), Q_{eh} = 90.2 watts.

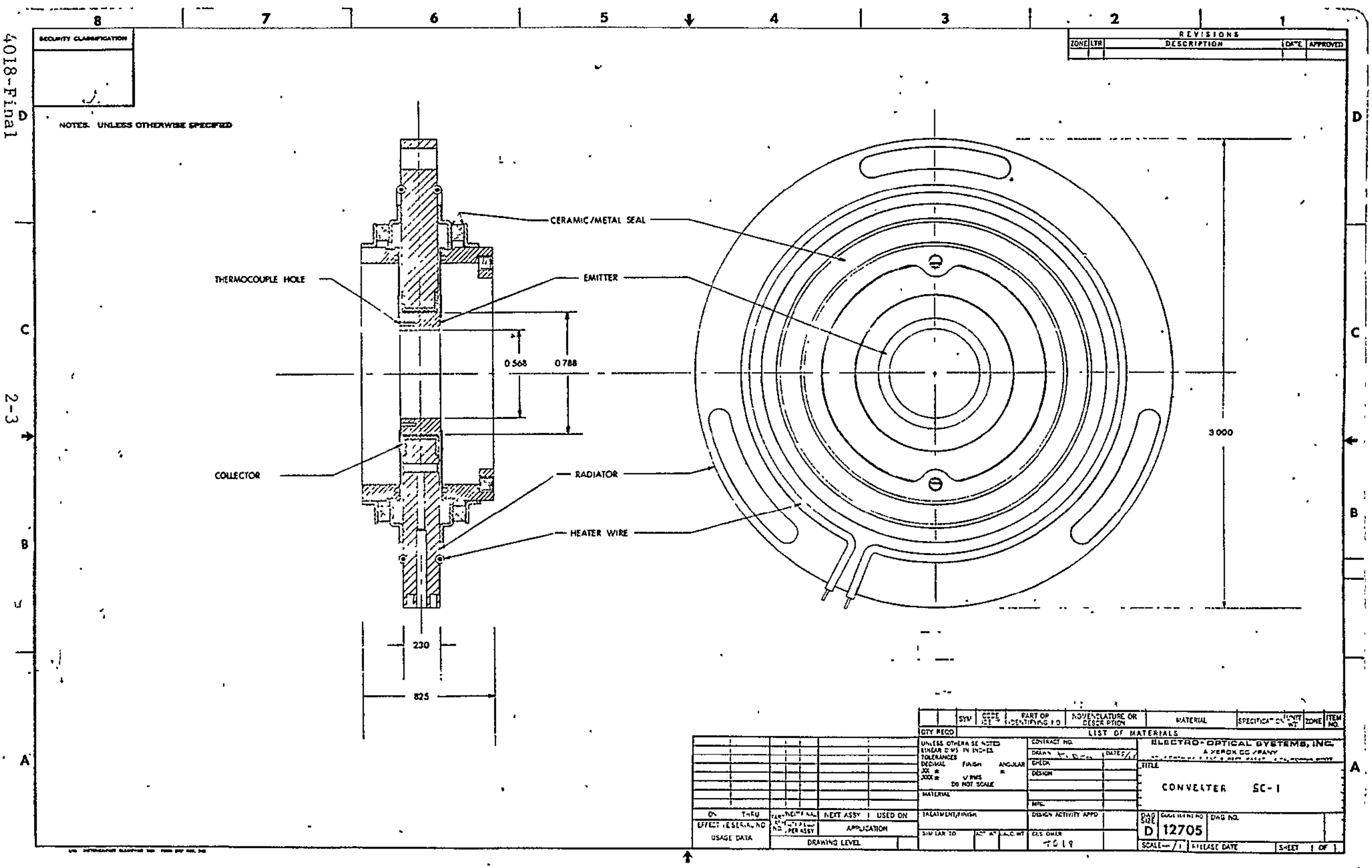


Figure 2-1. Converter SC-1 Schematic

$$Q_{eh} \simeq 90 \text{ watts}$$
$$Q_{cs} \text{ cond} \simeq 10 \text{ watts (including sidewall contributions)}$$
$$Q_{rad} \simeq 35 \text{ watts (including sidewall contributions)}$$
$$Q_{coll} \simeq 135 \text{ watts}$$

The second design task was the problem of sizing the radiator. The radiator in Fig. 2-1 has approximately 48 cm^2 of radiating area which operates at an average temperature of 640°C. A first order, piece-wise solution to this problem is as follows:

$$\Delta T = \frac{\ell n\left(r_o/r_i\right)Q}{k2\pi\ell} \tag{3}$$

where

$$Q \simeq 135 \text{ watts}$$
$$k \text{ is} \simeq 0.67 \text{ W/cm (for Nb)}$$
$$\ell \text{ is} \simeq 0.230 \text{ inch}$$
$${}^{*}r_i \simeq 0.402 \text{ in.}$$
$$r_o \simeq 2.5 \text{ cm}$$
$$T_{coll} \simeq 700^{\circ}\text{C}$$

$$\Delta T = \frac{0.916 \times 135 \text{ watts}}{0.67 \text{ W/cm} \times 6.28 \times 0.23 \text{ in.} \times \frac{2.54 \text{ cm}}{\text{in.}}}$$

$$\Delta T = \frac{123.8}{2.45} = 50^{\circ}\text{C}$$

Therefore the temperature at collector root $\simeq$ 650°C (assuming no loss by radiation from Section I).

---

*First section (Section I) from collecting face to flange radius.

Section II (beginning of radiator to radiator midpoint)

r_i = 2.5 cm

r_o = 3.0 cm

Q = 135 watts

k = 0.67 W/cm for Nb

$$\Delta T = \frac{\ln\left(r_o/r_i\right)Q}{k2\pi\ell} = \frac{0.182 \times 135}{2.45} = 24.6 = 10^{\circ}C$$

$T_{average}$ = of Section II $\simeq$ 645°C

$$A = \pi r_o^2 - \pi r_i^2 \qquad (4)$$

$$A = (9 - 6.25)\,\pi = 8.65\ cm^2$$

$Q_{rad\ lost}$ Sect II $= \epsilon A \sigma T^4$ ϵ = 0.78 for Rokide "C"

$$Q_{rad\ lost} = 3.1\ \frac{watts}{cm^2} \times 8.65\ cm^2 = 26.8\ watts/side$$

$$Q_{rad\ lost} = 26.8\ watts \times 2\ sides = 53.6\ watts$$

Section III (middle of radiator to end of radiator)

r_i = 3.0 cm

r_o = 3.75 cm

Q = 135 - 53.6 watts = 81.4 watts

k = 0.66 W/cm for Nb

$$\Delta T = \frac{\ln\left(r_o/r_i\right)Q_2}{k2\pi\ell} = \frac{0.223 \times 81.4}{2.45} = \frac{24.2}{2.45} = 7.35\ degrees$$

$T_{average}$ of Section III $= 641^{\circ}C$

$$A_{rad\ Section\ III} = \pi r_o^2 - \pi r_i^2$$

$$= 5 \times 3.14\ cm^2 = 15.7\ cm^2$$

$$Q_{rad\ Section\ III} = \frac{3.0\ watts}{cm^2} \times 15.7\ cm^2 \times 2\ sides$$

$$= 94.1\ watts$$

$$Q_{rad\ total} = 94.1\ watts + 53.6\ watts = 147.7\ watts$$

which provides a 10 percent safety factor over 135 watts computed heat load. Small ceramic discs were brazed on the collector radiator to elevate and insulate the envelope from the collector. This provides a 0.012 in. side wall spacing.

2.2 SC-1 FABRICATION

The SC-1 emitter is solid polycrystalline rhenium with a layer of 0.020-in.-thick, vapor-deposited rhenium on the emitting surface. The collector is niobium with vapor-deposited rhenium over the collecting surface.

The collector was thermal cycled to $1700^{\circ}C$, with no deterioration, peeling, or warpage of the vapor-deposited rhenium. This test was performed to insure integrity and lifetime during subsequent operation.

The collector heater wires, the ceramic disc and cesium reservoir tubulation adapter were brazed to the collector. Ceramic-metal seals and emitter envelope-lead straps were brazed into the subassembly configuration. The converter subassemblies, shown in Fig. 2-2, were then welded into the final configuration. Three alignment pins for centering the emitter are shown. After welding the emitter in place, the alignment pins were removed and plugs (shown in Fig. 2-2) were welded into the alignment pin holes in the collector. The subassemblies were welded on a 6.5 kW Hamilton Standard electron beam welder into the final converter configuration. Some new welding parameters (Table 2-I) were determined from feasibility studies.

TABLE 2-I

WELDING PARAMETERS

	Filament Current (A)	Accelerating Voltage (kV)	Beam Current (mA)
Collector seal flange to collector	1.75	150	2.5
Emitter flange to emitter lead strap	1.75	150	2.5
Heat choke to emitter	1.75	130	2
Collector plugs	1.75	110	5
Reservoir to collector	1.75	110	2

Complete detailed welding, brazing, and firing schedules for converter SC-1 are given in Appendix 2. The chemical cleaning procedures used for each material is also given. Since these procedures remained the same for each material, the information is presented once in Appendix 1.

After completion of fabrication, the diode emitter was heated to 1400°C for 6 hours by electron bombardment until the pressure was 1.8×10^{-7} torr. The cesium loading tubulation was kept at 285°C during the bake-out. A copper pinch-off was then made and the cesium was driven for 1 hour at 300°C.

2691

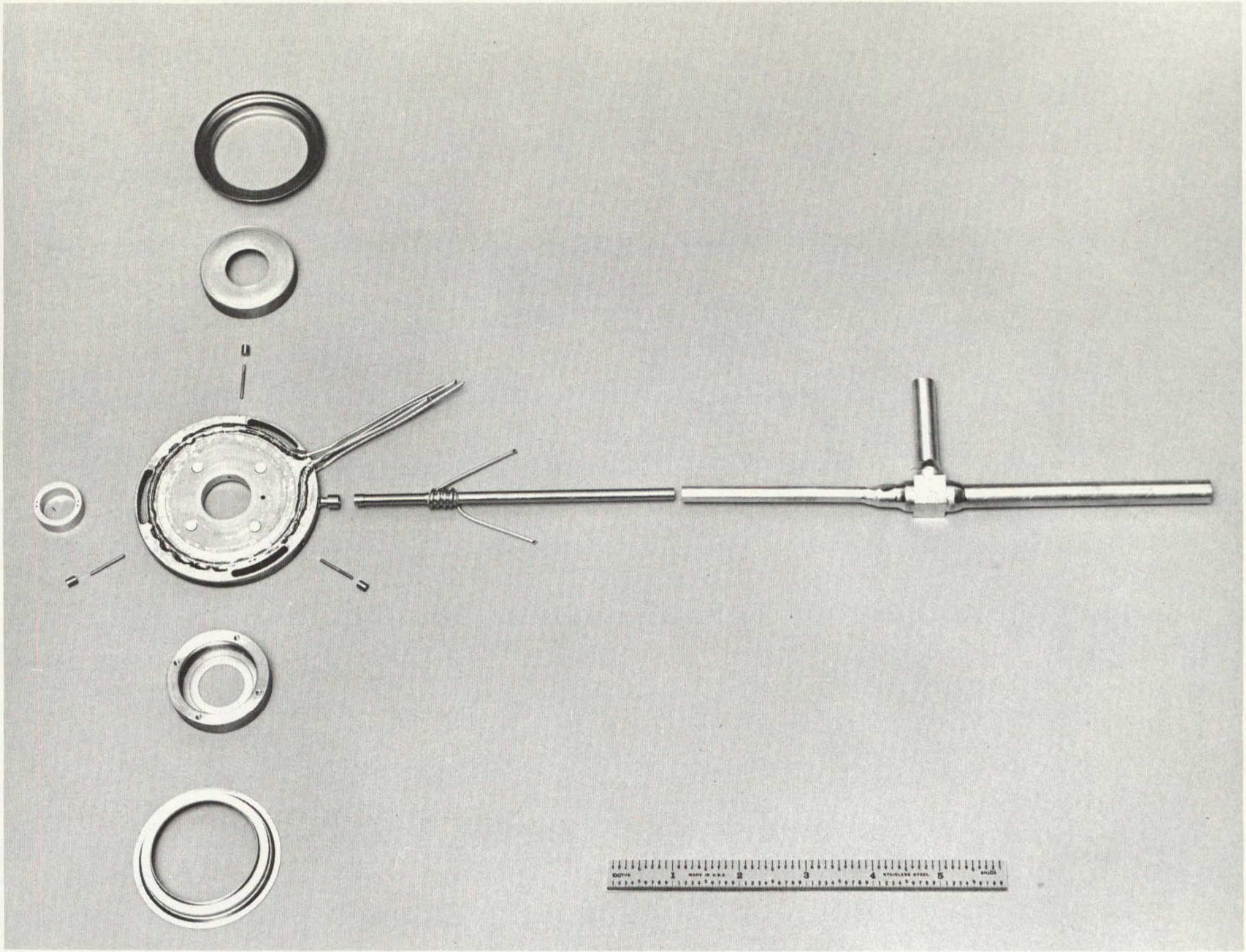


Figure 2-2. Converter SC-1 Subassemblies

Figure 2-3 is a composite drawing of SC-1 with the high efficiency electron gun in place with radiation shields. The 0.47 inch OD filament is shown in Fig. 2-4. The 0.020 inch diameter tungsten wire filament was counterwound to avoid undesirable induced magnetic fields. The filament was held and set centrally in the bore of the emitter by two 1/8 inch thick by 1/4 inch wide niobium legs. The niobium legs were fastened to the lead strap. The filament legs were insulated from the emitter by flat precision Al_2O_3 insulators. The two legs were held apart by a ceramic insulator.

To reduce end losses from the emitter cavity, radiation shields were installed. The high efficiency radiation shields were fabricated from niobium with layers of niobium and tantalum sheets as shields.

It was found that high temperature annealing of the filaments, while in a vertical position, helped to reduce distortion and occasional shorting of the filament windings when the filament was subsequently heated in the horizontal position during converter testing. The filaments were normally heated to temperatures required for converter testing.

2.3 SC-1 PERFORMANCE TEST

At the outset of the program a test plan and detailed test methods were established for the evaluation of (1) emitter and collector work functions, (2) estimation of interelectrode spacing at 1400°C emitter temperature, and (3) sizing of the radiator design. These are given in the following paragraphs.

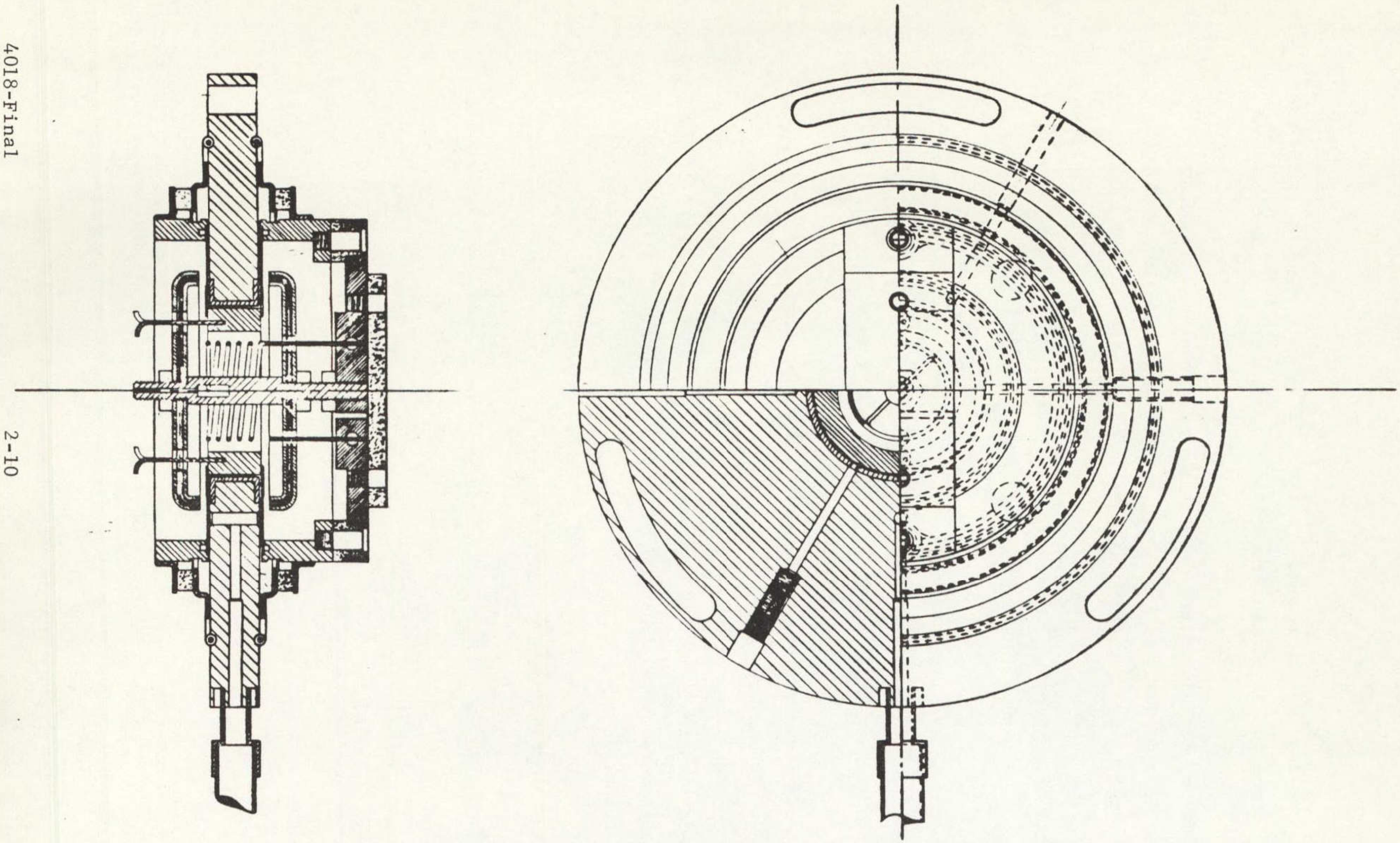


Figure 2-3. Converter SC-1 with Electron Gun

67043

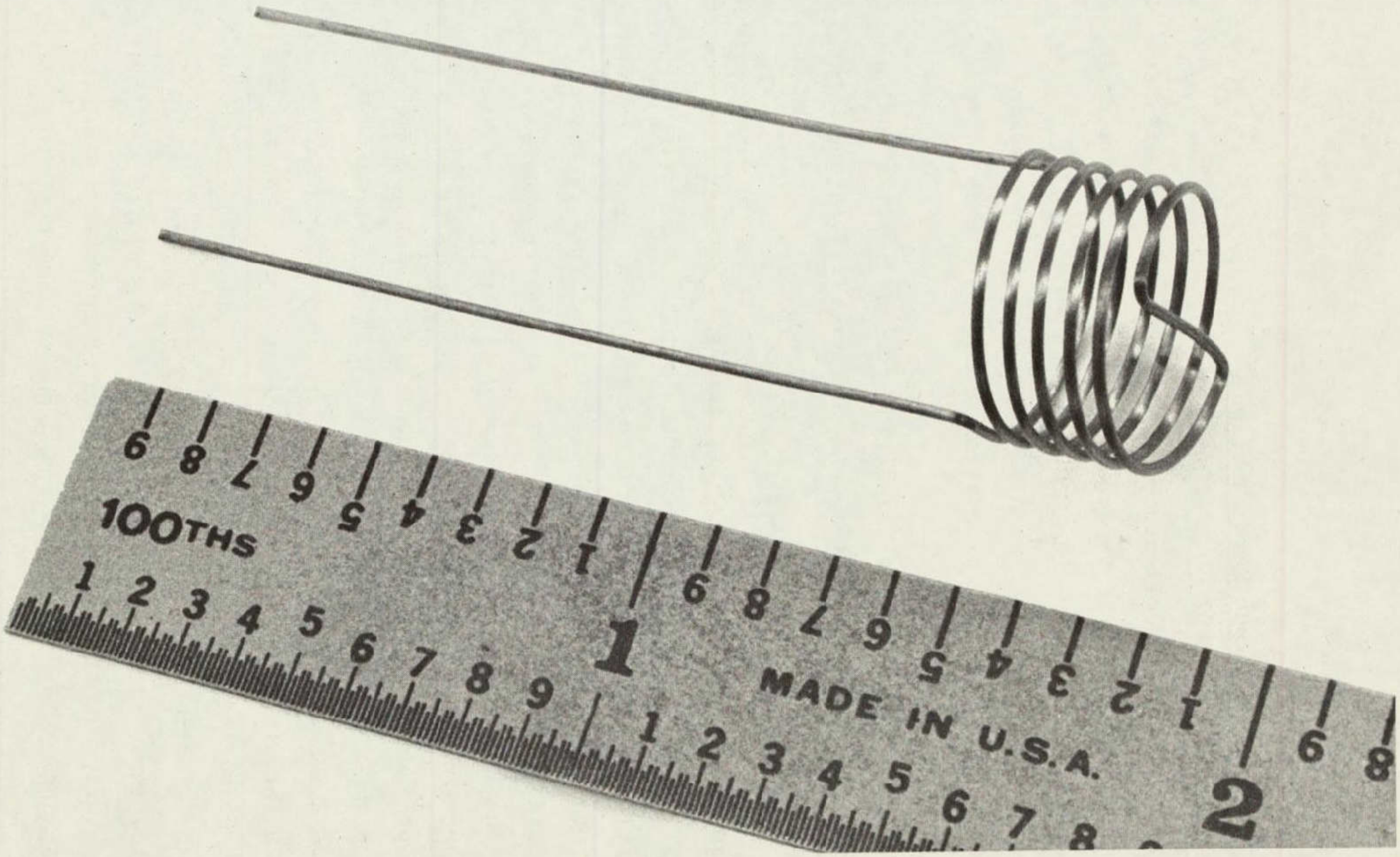


Figure 2-4. 0.047 inch O.D. Filament

2.3.1 TEST PLAN

2.3.1.1 Electrode Work Functions

The emitter and collector work functions (i.e., effective work function, φ_{eff}, assuming an A value of 120 $A/cm^2 - {}^oK^2$ and assuming a collecting area of 4 cm^2) are obtained by the measurement of two observables, electrode temperature and saturated electron emission. The effective work function is a calculation using these measurables.

Cesiated effective work function for the emitter and collector is obtained from the volt-ampere characteristic by combined dc and ac sweep methods.

This method is utilized since it traces an instantaneous characteristic at fixed parameter temperatures. The dc operating point is usually set by an electronic load. The sweep transformer then sweeps out a portion of the I-V characteristic about this dc point after it is ascertained that all element temperatures are constant. Collected current is measured by the voltage drop across a calibrated, 0.1 percent accurate shunt, and displayed on the y-axis of an x-y oscilloscope. Applied voltage or generated voltage is measured directly and displayed on the x-axis of the oscilloscope. To accurately determine saturated emission it is sometimes necessary to sweep the arc voltage as much as 2V into the applied voltage quadrant. Since the Zener diodes in the electronic load cannot hold off more than 0.5V in the forward direction, the electronic load is replaced by a resistive load. A low inductance, low impedance, stepdown transformer is employed as a sweep source. The saturated emission is defined as the intersection of the extrapolated Schottky slope and the slope of the plasma region.

Exact determination of temperature is a very important part of accurate electron emission measurements. For all temperature determinations other than the emitter, chromel-alumel thermocouples are used.

The emitter temperature is obtained by using calibrated, immersion tungsten/tungsten-rhenium thermocouples. These thermocouples are calibrated against a 10:1 blackbody hole using a calibrated micro optical pyrometer.

2.3.1.2 Estimation of Interelectrode Spacing

An estimation of interelectrode spacing is determined by using experimental measurement of the cesium conduction. Cesium temperature, bombardment input power, and electrode temperature can be measured accurately the the use of calibrated thermocouples and precision meters..

To measure the heat transfer from a thermionic emitter due to cesium vapor conduction requires the detection of small changes in heat input to the emitter. Therefore, it is desirable to reduce or completely omit electron emission from the emitter during the course of these measurements, since the heat transfer associated with electron evaporation from an emitting surface may be ten times that of cesium conduction. Therefore, measurements of cesium conduction heat transfer are almost always taken at a condition of no current flow.

The procedure for taking cesium conduction measurements is as follows:

a. The emitter temperature is set at 1400°C true; the collector temperature is set at approximately 550°C; and the external circuit is opened to prevent current flow.

b. The cesium reservoir temperature is set at some initial low value such as 300°C, and the electron bombardment input power is measured for the preset conditions of T_E = 1400°C (true), and T_{coll} = 550°C.

c. Progressively increasing cesium reservoir temperatures are established and the increase in bombardment power to maintain the preset emitter temperature is recorded. The collector temperature is fixed by a temperature controller which regulates the heater input power to the collector to account for the additional heat input via cesium conduction. Measurements are also taken by decreasing the cesium vapor pressure to reproduce the data.

The sources of possible error in these measurements are: reading accuracy of the meters which is about 0.1 percent, thermocouple readings of the reservoir and emitter which is a ±1 percent for chromel-alumel thermocouple, and ±1/2 percent calibrated emitter thermocouple.

Also, the electrode area determination is a source of error since the collecting or emitting area are not guard-ringed. It is assumed that the electrode areas are 4 cm^2 for interelectrode spacing determination.

Electrode spacing determination by the cesium conduction method was attempted but was found impractical due to the converter spacings. More details will be explained later.

2.3.1.3 Radiator Sizing

Radiator sizing data is obtained at the design operating point; i.e., output power density of 4 W/cm^2 for an emitter area of 4 cm^2 at 0.7V output at an emitter temperature of 1400°C.

The collector is instrumented with two immersion thermocouples to measure and record the collecting surface temperature. The radiator is instrumented with a number of thermocouples accurately placed along the radiator. The collector-radiator temperature profile can be determined. Examination of this temperature profile provides an experimental cross-check of the design calculations, and allows an optimization of the radiators for subsequent converters. Generally, during testing it was found that the radiator thermocouples indicated close agreement to calculated design temperatures.

2.3.2 CONVERTER SC-1 TESTING

Figure 2-5 shows the emitter thermocouple calibration curve for converter SC-1. Platinum-platinum/10 percent rhodium thermocouples were used on the converter emitters. They were calibrated with the indicated true hohlraum temperatures. Thermocouples were used so that the high efficiency radiation shields would not require view holes for hohlraum readings. In this way the maximum efficiency was anticipated. On SC-1, though, holes through the shields were necessary for calibration purposes.

The performance testing of SC-1 was dictated to a large extent by an intermittent shorting condition internal to the converter. Data at an emitter temperature of 1300°C and some data at 1400°C were obtained. The shorted condition was prevalent above 1400°C and was unpredictable at lower temperatures.

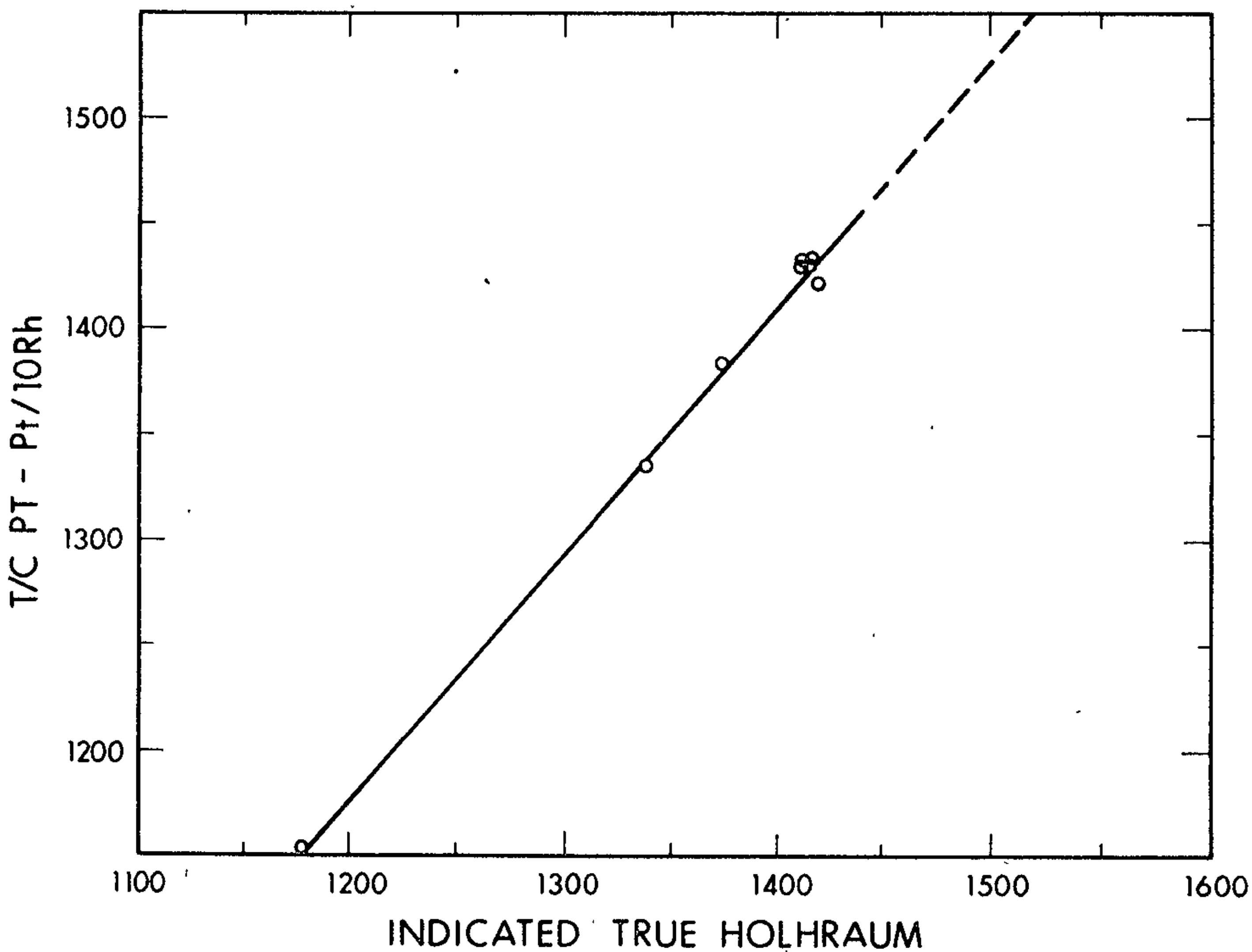


Figure 2-5. Thermocouple Calibration

The shorting appeared to be due to deflections of the emitter envelope coming into contact with the collector. The cause may have been residual stresses built up by electron-beam-welding the envelope to the emitter, with subsequent flexure as the emitter and envelope temperatures were varied. The converter output voltage (dc) at constant current was optimized as a function of the cesium reservoir temperature at emitter temperatures of 1300°C and 1400°C.

At an emitter temperature of 1300°C, performance optimization was obtained at constant current levels of 20, 30, and 40 amperes, as shown in Figs. 2-6, 2-7 and 2-8, respectively. At 20 amperes, the maximum voltage achieved is 0.29V at a reservoir temperature of 280°C. The power output is thus 5.8W, giving a power density of 1.45 W/cm^2.

An approximate comparison can be made with the performance data previously taken with an EOS rhenium electrode variable parameter vehicle with a 2 cm^2 collector (Ref. 1). At an emitter temperature of 1330°C and a cesium reservoir temperature of 281°C, the voltage output is 0.20V at 24.5A, giving a power output at 4.06W. Since the emitter temperature in this case is 30°C higher than for the case of the converter, the voltage can be adjusted approximately by noting in Reference 1 that 1°C is equivalent to a change of 0.002V. This would mean that the variable parameter vehicle data can be extrapolated as being 0.14V at 24.5A for a power output of 3.43W at an emitter temperature of 1300°C. The power density is 1.72 W/cm^2.

Thus, the output of the first 4 cm^2 cylindrical converter is approximately 15 percent less than that of the variable parameter vehicle.

In Fig. 2-7, at an emitter temperature of 1300°C, a collector temperature of 683°C, and a constant current level of 30A, the optimum voltage is 0.25V at a cesium reservoir temperature of 295°C. The power output is thus 7.5W.

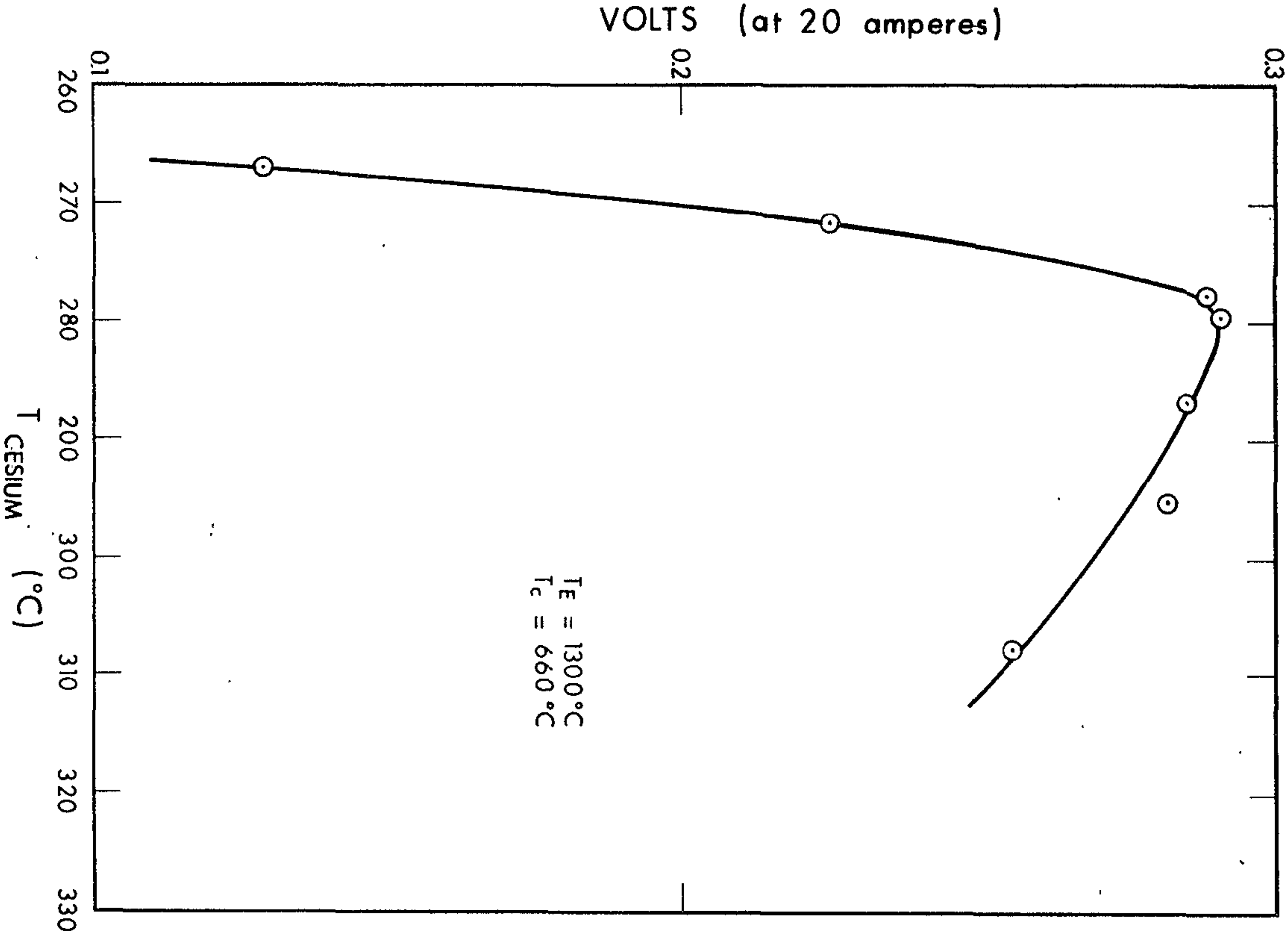


Figure 2-6. Converter SC-1 Performance Optimized for T_E = 1300°C at 20 Amperes

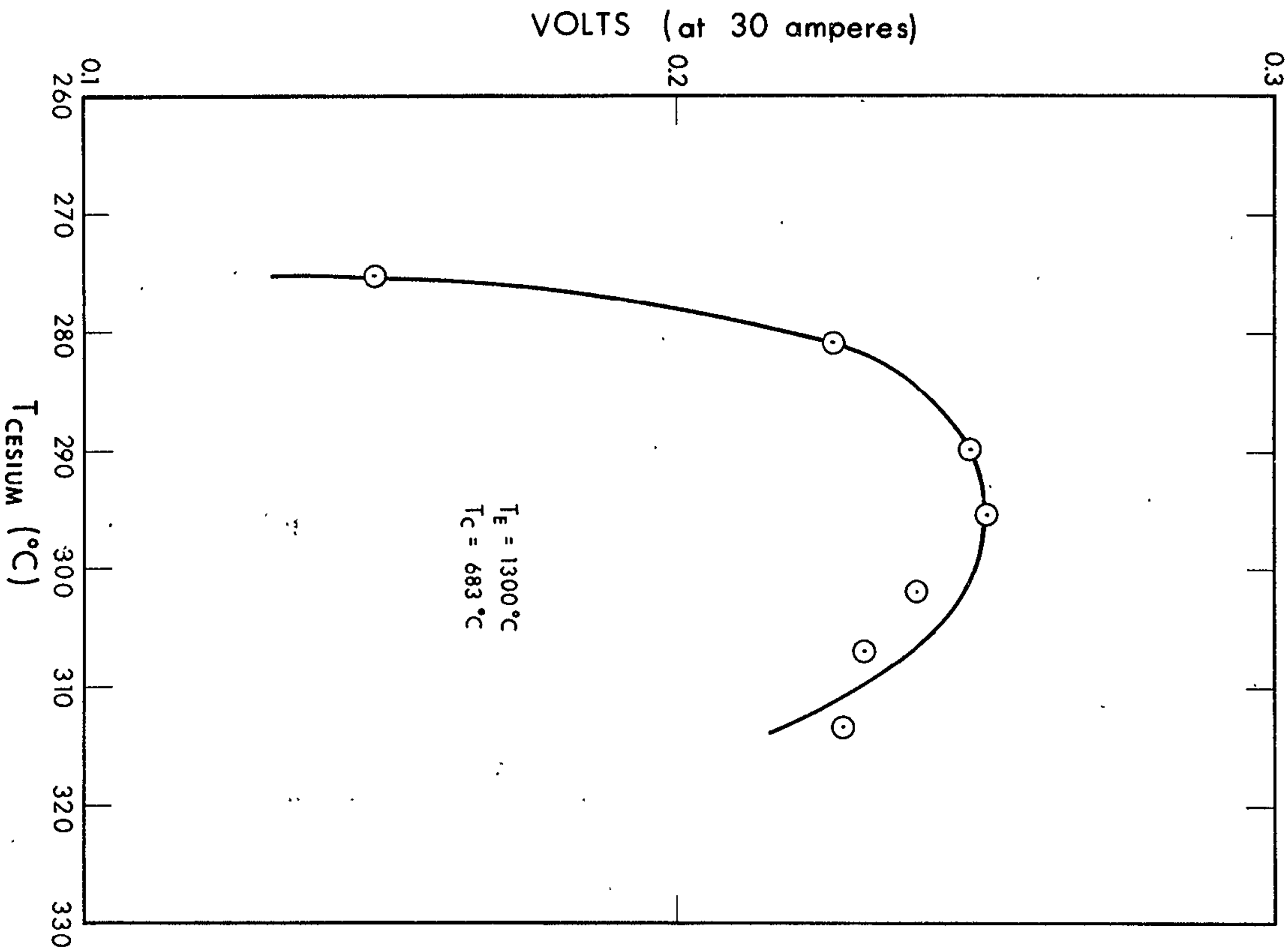


Figure 2-7. Converter SC-1 Performance Optimized for T_E = 1300°C at 30 Amperes

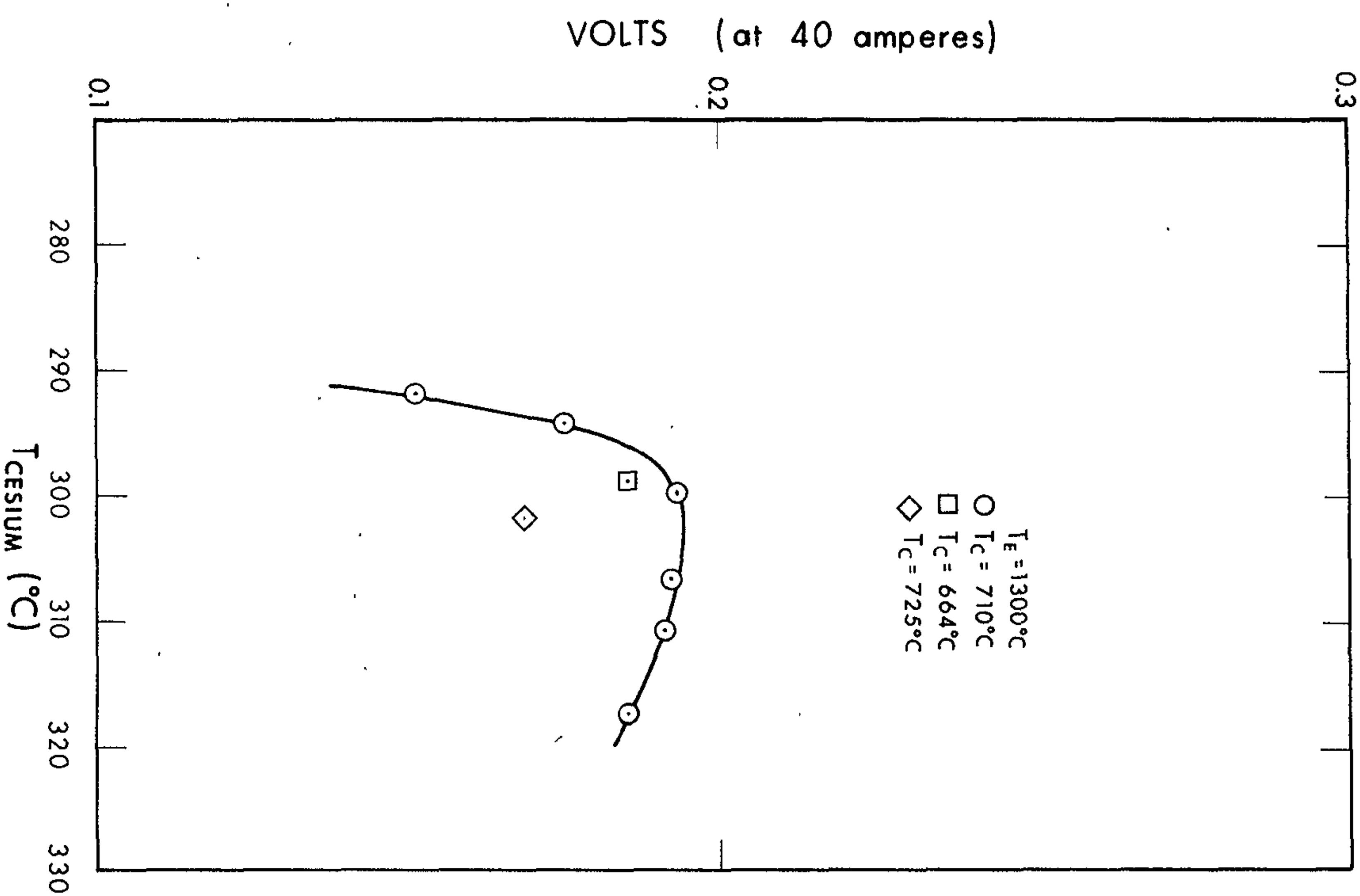


Figure 2-8. Converter SC-1 Performance Optimized for T_E = 1300°C at 40 Amperes

At an emitter temperature of 1300°C and a constant current level of 40A, the optimized voltage from SC-1 is 0.194V (7.76W output) at a reservoir temperature of approximately 303°C and a collector temperature of 710°C, as shown in Fig. 2-8. An optimized collector temperature of 710°C was determined as shown in Fig. 2-8. This shows that previously optimized collector temperatures for rhenium electrode systems found by EOS are unchanged (Ref. 2). Collector temperatures above 725°C and below 664°C indicate that 710°C is optimum.

In Fig. 2-9, at an emitter temperature of 1400°C, a collector temperature of 738°C, and a constant current level of 40A, the optimum voltage output is 0.295V at a reservoir temperature of 304°C. The power output is thus 11.8W.

Also observed, at 1400°C emitter temperature and a constant current of 53A, was an optimum voltage output of 0.21V, producing a power output of 11.13W. It was not possible to produce a full optimization curve at these parameters. This was because of intermittent, internal short circuits attributed to movement of the emitter envelope coming into contact with the collector. Emitter temperatures from 1400°C and above aggravated this condition, prohibiting the acquisition of data at these temperatures.

Figure 2-10 is a performance plot of the data from Figs. 2-6 through 2-9 for the optimized conditions.

Figure 2-11 is a photograph of SC-1 without the electron gun.

The test data sheets and current-voltage characteristics for converter SC-1 are given in Appendix 2.

Table 2-II gives the measured efficiency of converter SC-1.

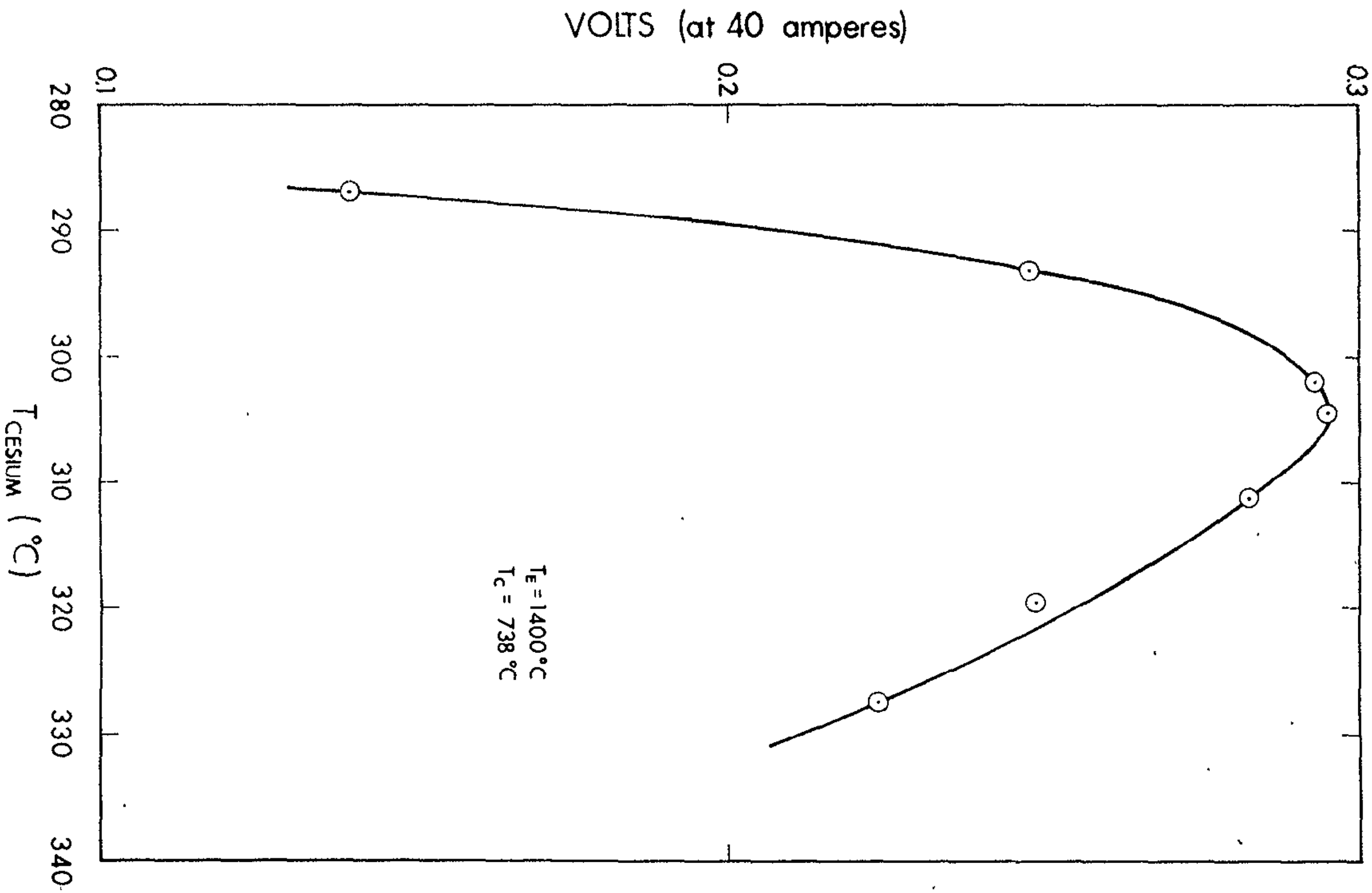


Figure 2-9. Converter SC-1 Performance Optimized for T_E = 1400°C at 40 Amperes

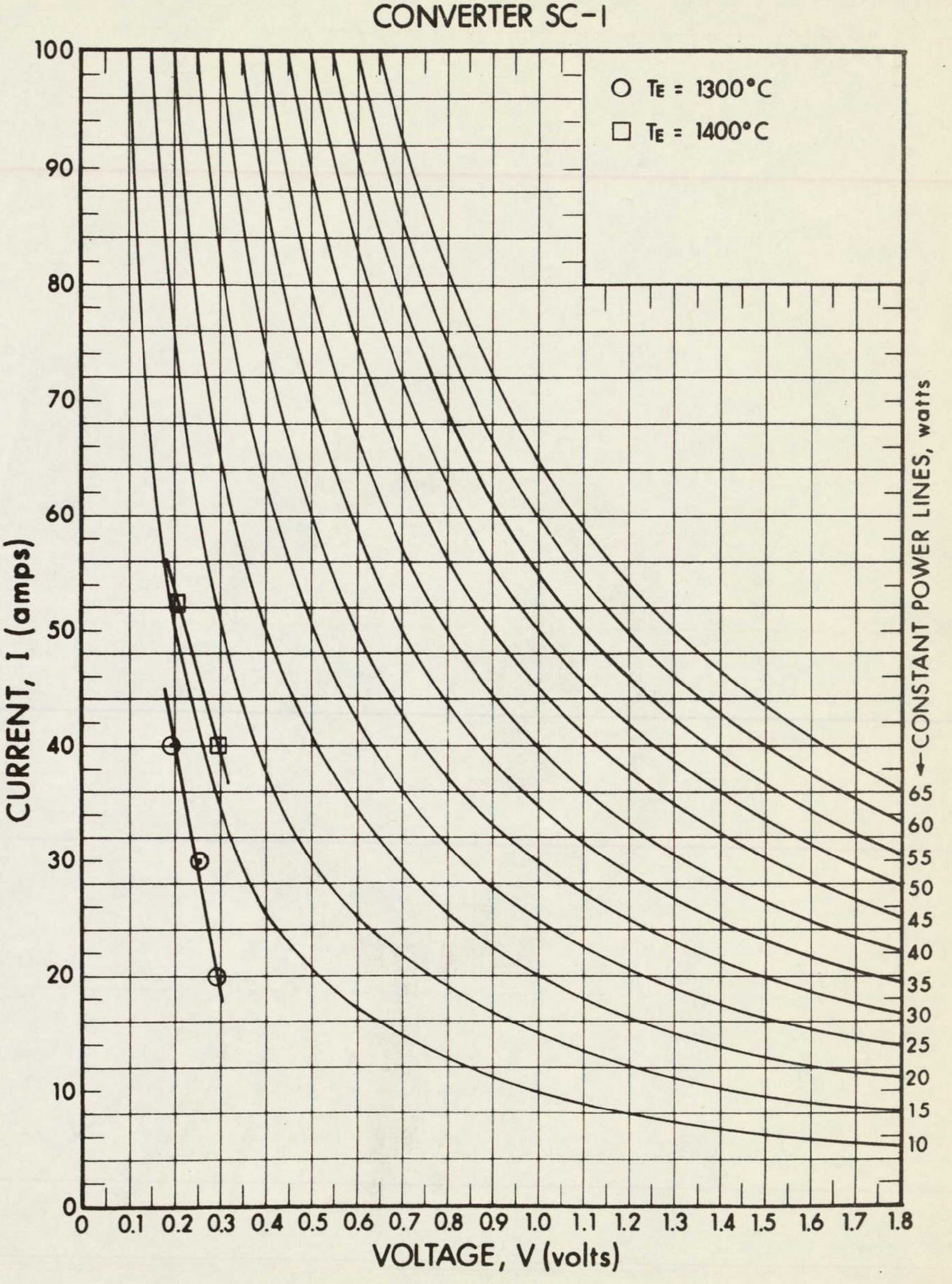


Figure 2-10. Converter SC-1 Performance Plot

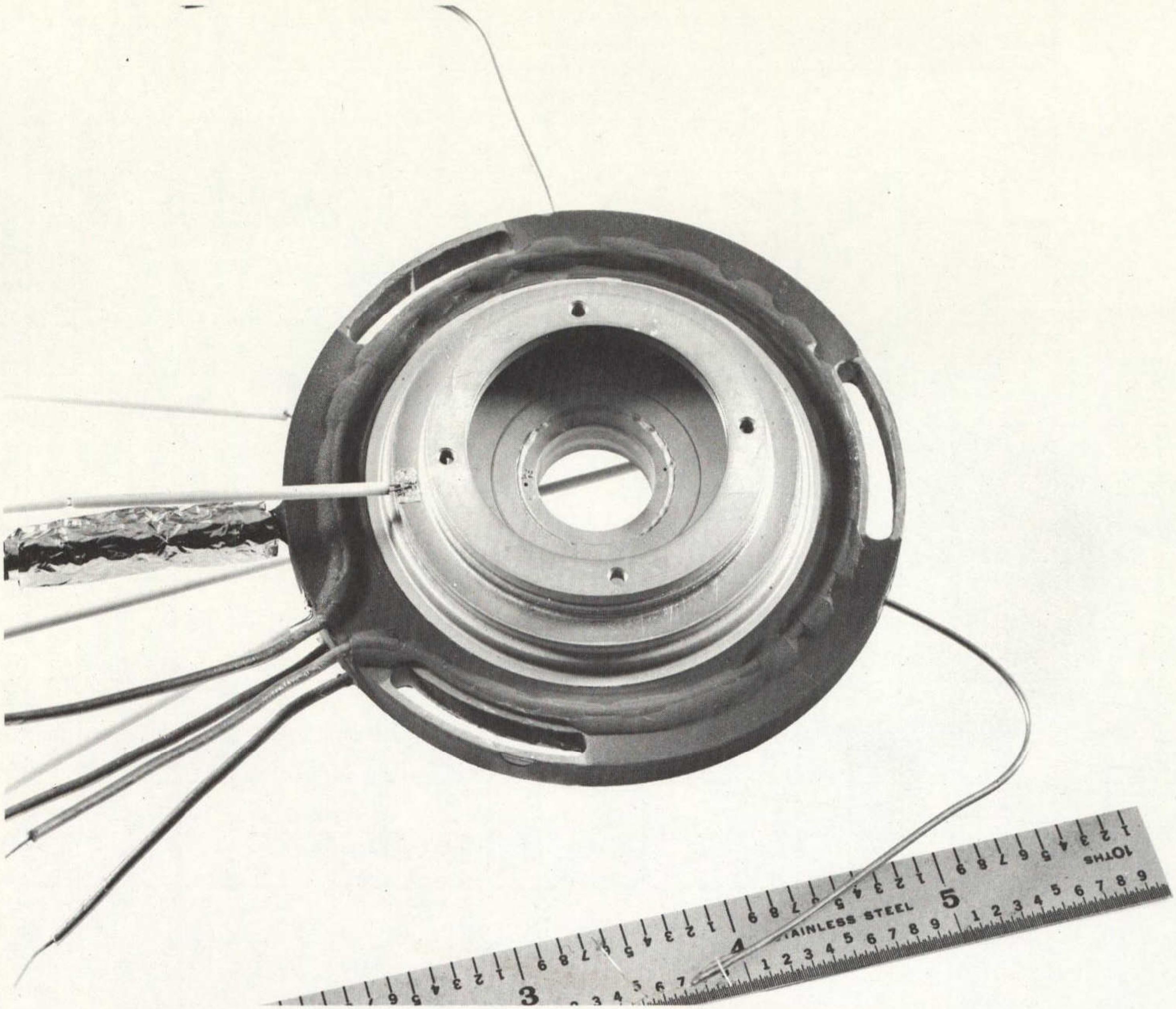


Figure 2-11. Converter SC-1 After Performance Testing

TABLE 2-II

CONVERTER SC-1 MEASURED EFFICIENCY
(Measured Terminal Voltage)

T_E (^oC)	I_{out}(A)	V_{out}(V)	η(%)
1400	40	0.295	2.7
1300	40	0.195	2.0
1300	20	0.285	1.6
1300	30	0.25	2.0

The efficiency measurements reported in Table 2-II were taken with only one side of the converter having a radiation shield so that pyrometer readings of the hohlraum could be more easily taken for thermocouple calibration. The efficiency is defined as the ratio of the converter power output and the total filament power input (filament heating plus electron bombardment power).

Interelectrode spacing measurements of SC-1 were attempted by using the cesium conduction method. However, due to the large spacing (0.010 in.), changes in the input power due to cesium conduction were not detected.

From the empirical equation of Ketrilakis and Meeker (Ref. 3), the heat transferred by the cesium gas at an emitter temperature of 1400^{o}C and a collector temperature of 500^{o}C and a cesium reservoir pressure of from 10 to 100 torr, is 0.5 watt. Thus one would have to detect changes of 0.5 watt out of 200 to 250 watts, which makes this measurement impractical.

After testing, the converter weight was determined as follows:

Converter	321.6 gms
Radiation Shields	12.0 gms
Electron Gun	17.0 gms
Total Weight	350.6 gms

SECTION 3

CONVERTERS SC-2a AND SC-2b

3.1 CONVERTERS SC-2a AND SC-2b DESIGN

The following design improvements were initiated during the design review for SC-2a.

a. Attach electron gun to the collector, rather than to the emitter, to allow envelope-lead strap-seal iterations without associated gun mount design changes.

b. Replace the ceramic disk spacers of SC-1 with split ring for collector-envelope spacing for added strength.

c. Improve cesium reservoir tubulation by rolling and welding the final closure rather than utilizing a pinch-off.

d. Improve filament by increasing wire diameter from 20 mils to 30 mils.

e. Improve electron gun design by removing the center post used in SC-1 shown in Fig. 3-1, reducing thermal losses.

The design of SC-2a was based upon the performance of SC-1. Special attempts were made to eliminate the shorting condition experienced in SC-1 by changing from the four small, disk-type, collector-envelope ceramic spacers shown in Fig. 2-1 to a large, split-ring ceramic shown in Fig. 3-1, which is an assembly drawing of SC-2a. The split ring provides a much stronger emitter support system and is closer to the collecting surface than the disks were in SC-1.

Figure 3-2 is a drawing of the collector showing the cutout for the ceramic ring. Because of concern that the emitter envelope temperature could cause a reaction with the ceramic ring, where contact is made, a piece-wise heat transfer calculation was made to determine the temperature at the point on the envelope where the thickness is

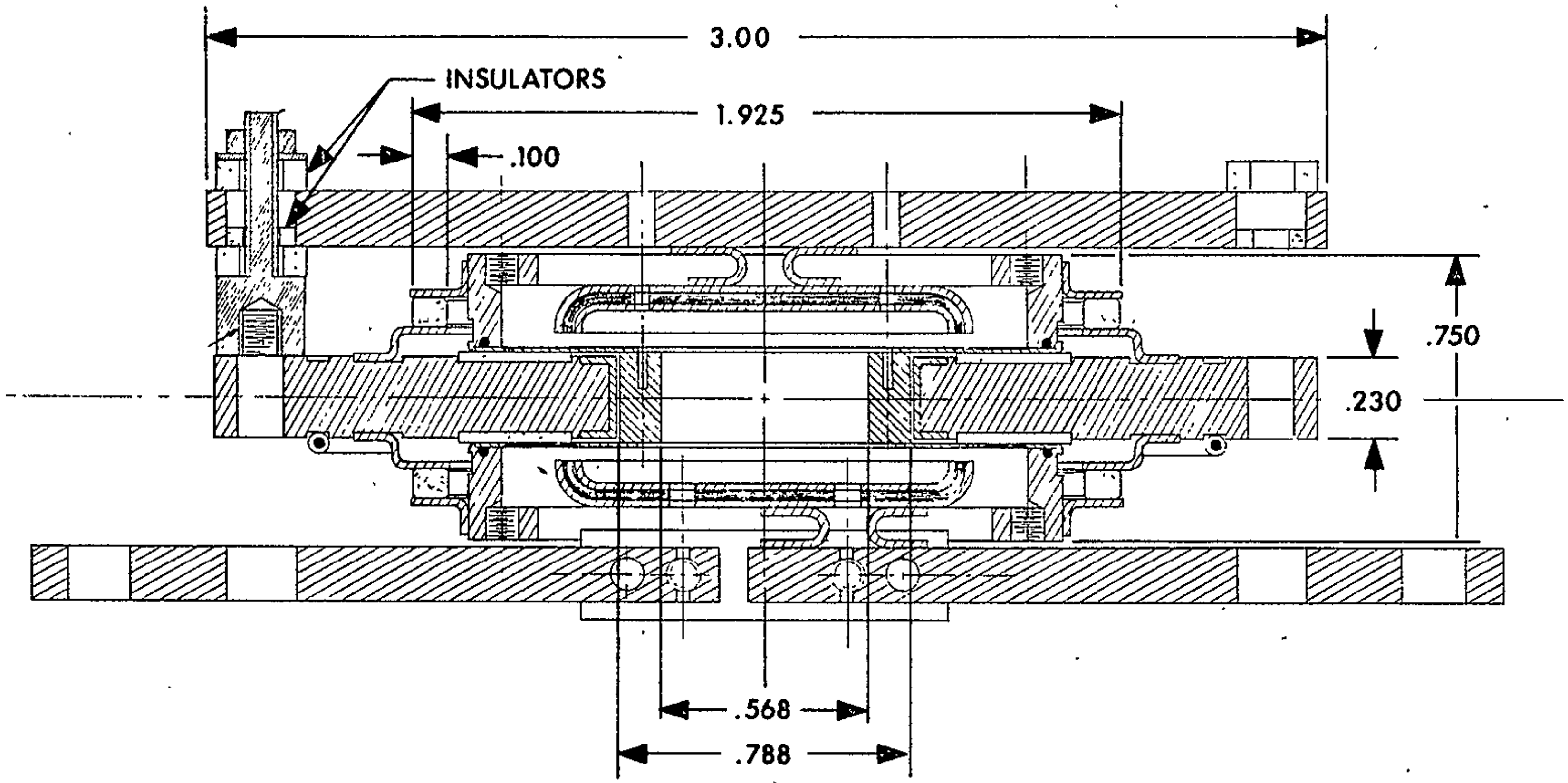


Figure 3-1. Converter SC-2a Assembly Drawing

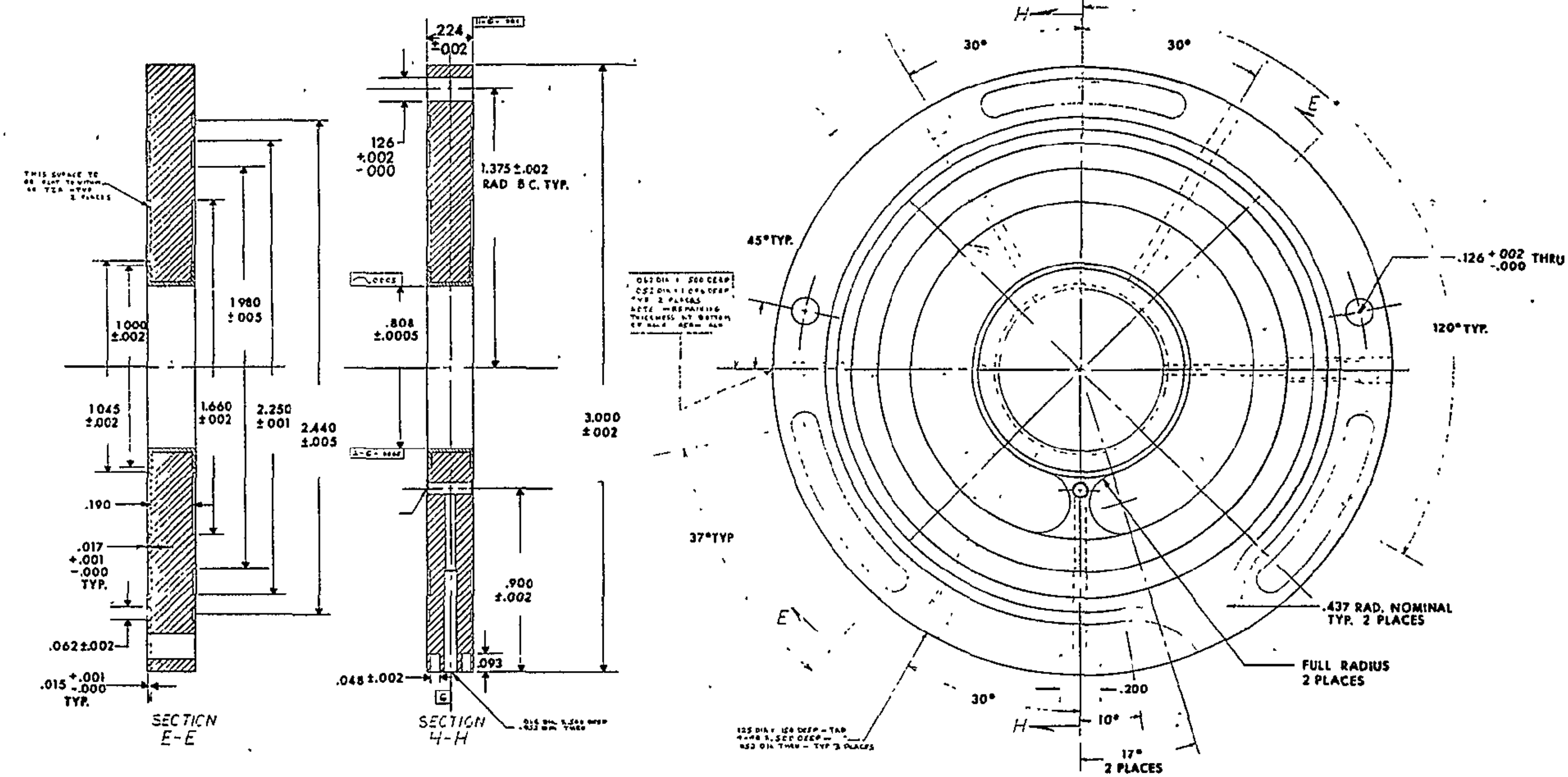


Figure 3-2. Converter SC-2 Collector Drawing

heat-choked from 0.010 in. to 0.005 in. This point was chosen to afford a safety factor, as the ceramic contacts the envelope two mils farther down the heat-choked area.

Conditions chosen for the calculation are as follows: an emitter temperature of 1675°K, emitter lead strap temperature of 963°K (determined experimentally from SC-1 data), constant current of 40 amperes, and a collector temperature of 923°K.

Figure 3-3 is a sketch of the area of concern. The heat conducted from A to B through the envelope is given by

$$Q_{C(A-B)} = \frac{k_A 2\pi \ell_{A-B} (T_A - T_B)}{\ell n \left(\frac{r_B}{r_A}\right)} - \frac{i^2 \rho \, \ell n \left(\frac{r_B}{r_A}\right)}{4\pi \ell_{(A-B)}} \qquad (5)$$

where k is the thermal conductivity of rhenium taken at T_A, ℓ_{A-B} is the envelope thickness of section A-B, r are the radii, and ρ is the electrical resistivity at T_A for rhenium.

On the collector side of the envelope, heat is transferred by atom conduction, radiation, and electron cooling. The atom conduction may be estimated by

$$q_p = \frac{\lambda_m (T_A - T_C) A_{(A-B)}}{d + \frac{(1.15)(10^{-2})(T_A + T_C)}{P}} \qquad (6)$$

where λ_m is a constant, $A_{(A-B)}$ is the envelope area (A-B), T_C is the collector temperature, d is the envelope-collector spacing, and P is the cesium pressure.

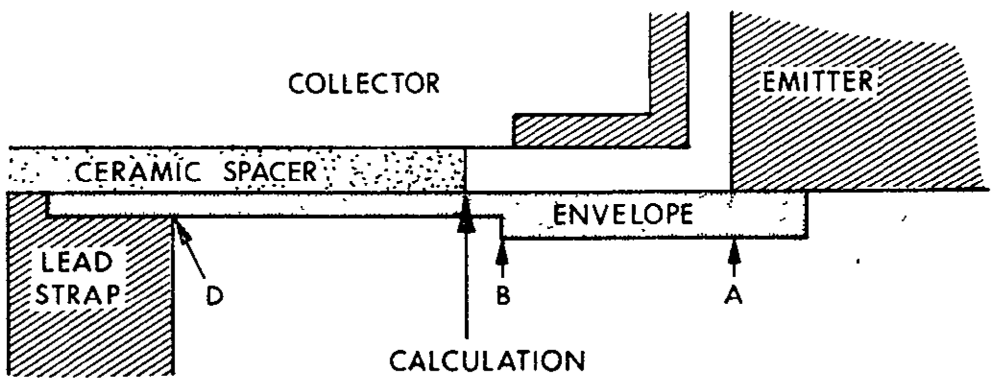


Figure 3-3. Sketch of Collector-Ceramic-Emitter Area for Heat Transfer Calculations

The electron cooling term is given by

$$q_{ec_{(A-B)}} = i \left(\phi_A + \frac{2kT_A}{e} + V_m\right) A_{(A-B)} \tag{7}$$

where ϕ_A is the emitter-envelope work function taken at A and V_m is the electron space charge given by

$$V_m = \frac{kT_A}{e} \ell n \frac{J_{sat}}{J} \tag{8}$$

J_{sat} is the saturation current at T_A.

The heat lost by radiation is given by

$$q_{r_{(A-B)}} = \epsilon\sigma \left(2T_A^4 - T_C^4\right) A_{(A-B)} \tag{9}$$

where $\sigma = (5.67)\ (10^{-12})$ and $\epsilon = 0.16$.

The term $2T_A^4$ includes radiation from both sides of the envelope.

The total heat lost in the section from B to D can be estimated by Eq. 10, assuming that only the conduction and radiation terms are significant.

$$Q_{C(B-D)} = \frac{k2\pi\ \ell_{(B-D)}(T_B - T_D)}{\ell n \left(\frac{r_D}{r_B}\right)} - \frac{i^2\rho\ \ell n\left(\frac{r_D}{r_B}\right)}{4\pi\ell_{(B-D)}} \tag{10}$$

The radiation losses from B to D are given by

$$q_r = \epsilon\ \sigma\ A_{(B-D)}\ \left(2T_B^4 - T_C^4\right) \tag{11}$$

where the factor 2 is to include radiative losses from both sides of the envelope.

The total heat balance from A to D is given by Eq. 12.

$$Q_{C(A-B)} = Q_{C(B-D)} + q_p + q_{ec(A-B)} + q_{r(A-B)} + q_{r(B-D)} \qquad (12)$$

From the boundary conditions,

$$q_p = (1.767)(10^{-2}) \text{ watts}$$

$$q_{ec(A-B)} = 101.4 \text{ watts}$$

$$q_{r(A-B)} = 30.4 \text{ watts}$$

$$q_{r(B-D)} = (0.907)(10^{-12})(2T_B^4 - T_C^4).$$

Since T_B occurs in $Q_{C(A-B)}$ and $Q_{C(B-D)}$ to the first power, and in $q_{r(B-D)}$ to the fourth power, in the solution for T_B, $q_{r(B-D)}$ will be neglected to avoid the transcendental equation; in the iteration, the effect of $q_{r(B-D)}$ on the final answer can be determined.

In Eqs. 5 and 10, the thermal conductivity of rhenium, k, is taken to be 0.51 watt/cm $^\circ$C, and the resistivity is taken to be 80 x 10^{-6} ohm-cm. T_B is found to be 1167°K by solving Eq. 12. With this value for T_B, an iteration can be made assuming linear temperature gradients between A and B and B and D, solving for T_B'. The temperatures will be T_{AB}' = 1420°K and T_{BD}' = 1065°K. As seen before, the atom conduction loss is small and will be neglected in the iteration. Under the new conditions,

$$q_{eC(A-B)}' = 97.385 \text{ watts}$$

$$q_{r(A-B)}' = 15.5 \text{ watts}$$

$$q_{r(B-D)}' = 1.995 \text{ watts}$$

Again, solving Eq. 12 with these temperature gives $T_B' = 1206^{\circ}K$.

A second iteration using T_B' gives temperature gradients of $T_{AB}'' = 1440^{\circ}K$ $T_{BD}'' = 1084^{\circ}K$. Under these conditions,

$$q''_{eC(A-B)} = 97.87 \text{ watts}$$

$$q''_{r(A-B)} = 16.43 \text{ watts}$$

$$q''_{r(B-D)} = 2.258 \text{ watts}$$

Solving Eq. 12 with the temperatures from the first iteration gives $T_B'' = 1203^{\circ}K$, showing that the ceramic spacers between the collector and emitter envelope will not be subjected to temperatures which might decompose or otherwise damage them.

Although this method of analysis is not as precise as fin treatment, for example, it is felt that the results yielded are sufficient for this problem.

The electron guns of SC-2a and SC-2b are held in place by insulated supports on the collector. The SC-1 electron gun was mounted on the emitter lead straps. It was felt that the new mounting on the collector permitted future converter-emitter redesigns without affecting the SC-2 electron gun mounting. Two holes were drilled in collector-radiator to accommodate the gun's insulated supports

The collector of SC-1 received a layer of Rokide-C to raise the emissivity of the radiating area to insure that the collector could be cooled to desired operating temperatures. During the testing of SC-1, it was found that the opposite effect occurred. Because of the very large area provided by the cylindrical geometry, the collector had a tendency to be cooler than originally expected. The following calculations show the approximate heat rejection from the niobium collector without Rokide-C.

The heat input to the collector is given by Eq. 13.

$$Q_c = Q_{eh} + Q_r + Q_{CS} \tag{13}$$

where Q_{eh} is the electron heating of the collector given by

$$Q_{eh} = i_{dc} \left(\phi_C + \frac{\epsilon k \; T_{p\ell}}{e} \right) \tag{14}$$

ϕ_C is the collector work function and $T_{p\ell}$ is the plasma temperature. The heat transferred from the emitter to the collector by radiation is given by

$$Q_r = \sigma \; \epsilon \; (T_E^4 - T_C^4) \; A_C \tag{15}$$

where σ and ϵ have the usual meaning, and A_C is the collector area. The cesium conduction term is given by

$$Q_p = \frac{\lambda_m \; (T_E - T_C) \; A_C}{d + \dfrac{(1.15)(10^{-2})(T_E + T_C)}{P}} \; . \tag{16}$$

The following values are used in determining the heat input to the collector:

ϕ_C = 1.45 eV
T_p = 4000°K
T_E = 1723°K
T_C = 973°K
i_{dc} = 40 amperes

Equations 14, 15, and 16 then give the following results:

Q_r = 35.9 watts,
Q_{eh} = 77.32 watts
Q_{CS} = 10.00 watts.

The total heat input to the collector of SC-2a is thus 123.22 watts.

The collector is shielded from the collecting surface back to the insulator-collector flange. From Fig. 13 the diameter of the flange is seen to be 1.98 in. The problem is to determine the temperature drop from the collecting surface to the flange radius. Since the collector is shielded over this region, only conduction heat transfer will be considered. This is given by Eq. 17, including the joule heating term.

$$\Delta T = \frac{\ell n \frac{r_2}{r_1}}{k2\pi t} \left[Q_T + \frac{i^2\rho \ \ell n \left(\frac{r_2}{r_1}\right)}{4\pi t} \right] \tag{17}$$

r_1 and r_2 are the collecting surface and the flange radii, respectively, Q_T is the total heat input to the collector, and t is the collector thickness from Fig. 13. The values are as follows:

r_1 = 1.026 cm
r_2 = 2.515 cm
Q_T = 123.22 watts
k = 0.67 watts/cm (for niobium)
t = 0.4826 cm
T_C = 973^oK
i_{dc} = 40 amperes
ρ = 4.5×10^{-5} ohm-cm

T_C is the collector surface temperature. The temperature at the flange (at r_2) is determined from Eq. 17 to be $T_2 = 919^oK$.

Assuming that the heat conducted down the collector is ultimately dissipated by radiation, a piece-wise solution is attempted in determining the collector-radiator temperature. The first portion will be taken to 3 cm. The following values apply in determining the temperature at 3 cm by the conduction term:

$T_2 = 919^oK$
$r_2 = 2.515$ cm
$r_3 = 3.00$ cm
$Q_T = 123.22$ watts
$k = 0.67$
$t = 0.4826$ cm

T_3 is found to be 908^oK. Using $(T_3 + T_2)/2$ as an average temperature for radiation over this region, the heat radiated may be found from Eq. 18.

$$Q_r = \epsilon \, \sigma \, T^4_{(3-2)} \pi \, (r_3^2 - r_2^2) \, (2) \qquad (18)$$

where $\epsilon = 0.1$ for niobium
$T_{(3-2)} = 914^oK$
$\sigma = 5.67 \times 10^{-12}$ watts/cm^2 $^oK^4$

The solution of Eq. 18 gives $Q_r = 6.66$ watts.

In the last section the heat conduction is determined from the following values:

$T_3 = 908^oK$
$r_4 = 7.62$ cm
$Q_3 = 116.56$ watts

Solving Eq. 17 with these parameters gives $T_4 = 895^{\circ}K$. The radiation over the area from 3 to 4 at an average temperature of $902^{\circ}K$ is 12 watts. Thus the average temperature of the collector-radiator is $907^{\circ}K$. These calculations thus show that the cutouts for the ceramic rings do not impede the heat rejection required of the collector-radiator. The results from the above calculations were used as a guide in the design of converter SC-2a. Converter SC-2a was fabricated according to the design agreed upon through the design iteration procedure.

During postoperative examination of SC-1, the filament winding impressions were evident on the outside of the emitter. This led to the conclusion that some temperature gradients might have thus been the result of the small distance between filament and emitter. The emitter was probably hotter in areas directly adjacent to the filament wires. This problem was reduced considerably by fabricating a filament with a diameter of 0.25 in. O.D., shown in Fig. 3-4. The filament was a 10-turn counterwound 0.020 in. diameter tungsten wire filament. The filament diameter section was 0.5 in. long. The smaller diameter provided for more uniform heating and reduced the criticality of centering the filament with respect to the emitter.

3.2 CONVERTER SC-2a AND SC-2b FABRICATION

Converter SC-2 had the same design parameters as SC-1; i.e., a power density of 4 W/cm^2 at 0.7V at a measured hohlraum emitter temperature of $1400^{\circ}C$. The refinements of SC-2 were predicted upon the performance of SC-1, the large split ring ceramic introduced in an effort to eliminate shorting.

The cleaning procedures for the SC-2 parts are given in Appendix 1. The brazing, firing and electron beam welding parameters for each of the components are given in Appendix 3.

67044

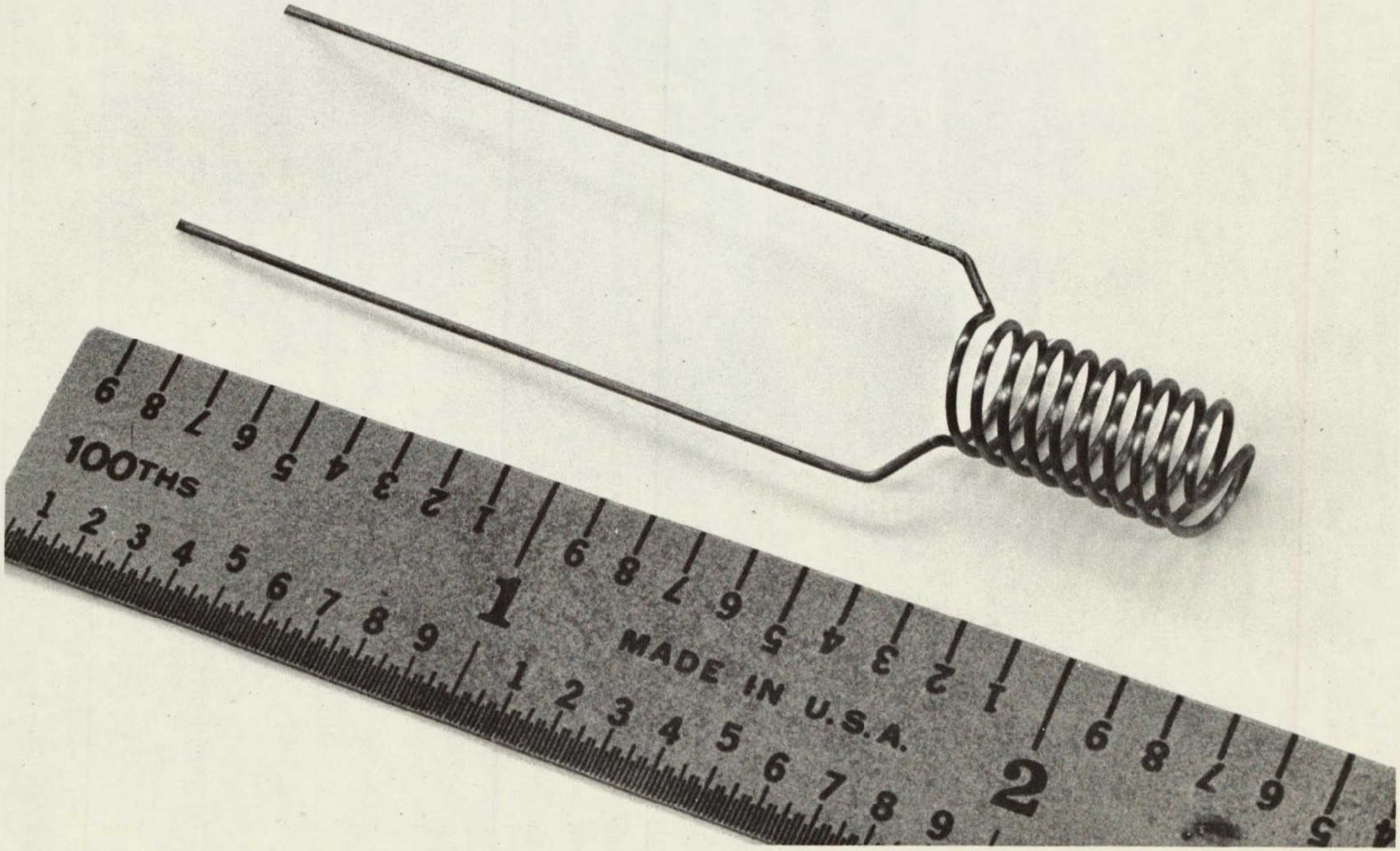


Figure 3-4. 0.25 inch O.D. Filament

Initial testing of SC-2a revealed a failure of the electron beam weld of the emitter envelope to the emitter. The failure appeared to be due to thermally induced stresses in the envelope. The condition was aggravated by the bombardment of the envelope by the high efficiency radiation shields. This created thermally induced stresses in the envelope by unequal heating of the envelope.

A feasibility weld was performed with the welding parameters used on the device. The resulting cross-section of the weld shown in Fig. 3-5 indicates that the weld was reliable under normal operating conditions.

SC-2b was fabricated by reworking SC-2a. The device was cleaned with distilled water and alcohol. The envelope was then rewelded to the emitter and SC-2b was processed and loaded with cesium in the usual manner.

Figure 3-5 is the photomicrograph of the feasibility weld of a rhenium envelope to a cylindrical rhenium emitter. The magnification is 150X. The penetration of the weld is approximately 0.017 in. The small grain size provides good strength and reliability.

The weld parameters were as follows:

Filament current	=	1.75 (amperes)
Accelerating voltage	=	150 (kV)
Beam current	=	3.4 (mA)

3.3 CONVERTERS SC-2a AND SC-2b PERFORMANCE TESTING

Figure 3-6 is a current optimization curve at a constant voltage of 0.2V, an emitter temperature of 1300°C, and a collector temperature of 730°C. The optimum cesium reservoir temperature is 298°C at a current of 47.8A.

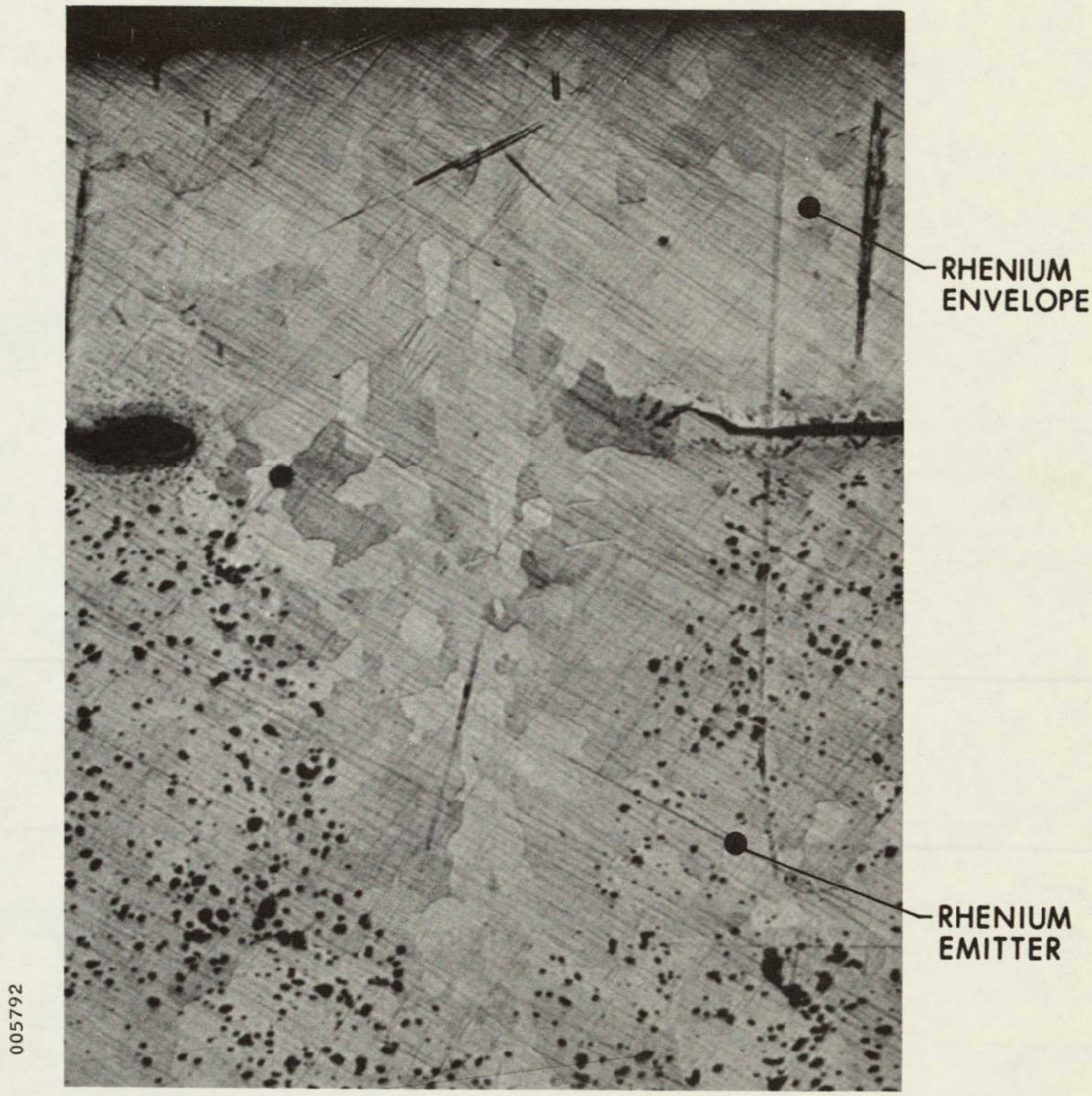


Figure 3-5. Photomicrograph of the Rhenium Envelope-to-Emitter Electron Beam Weld on Feasibility Samples. Magnification: 150X

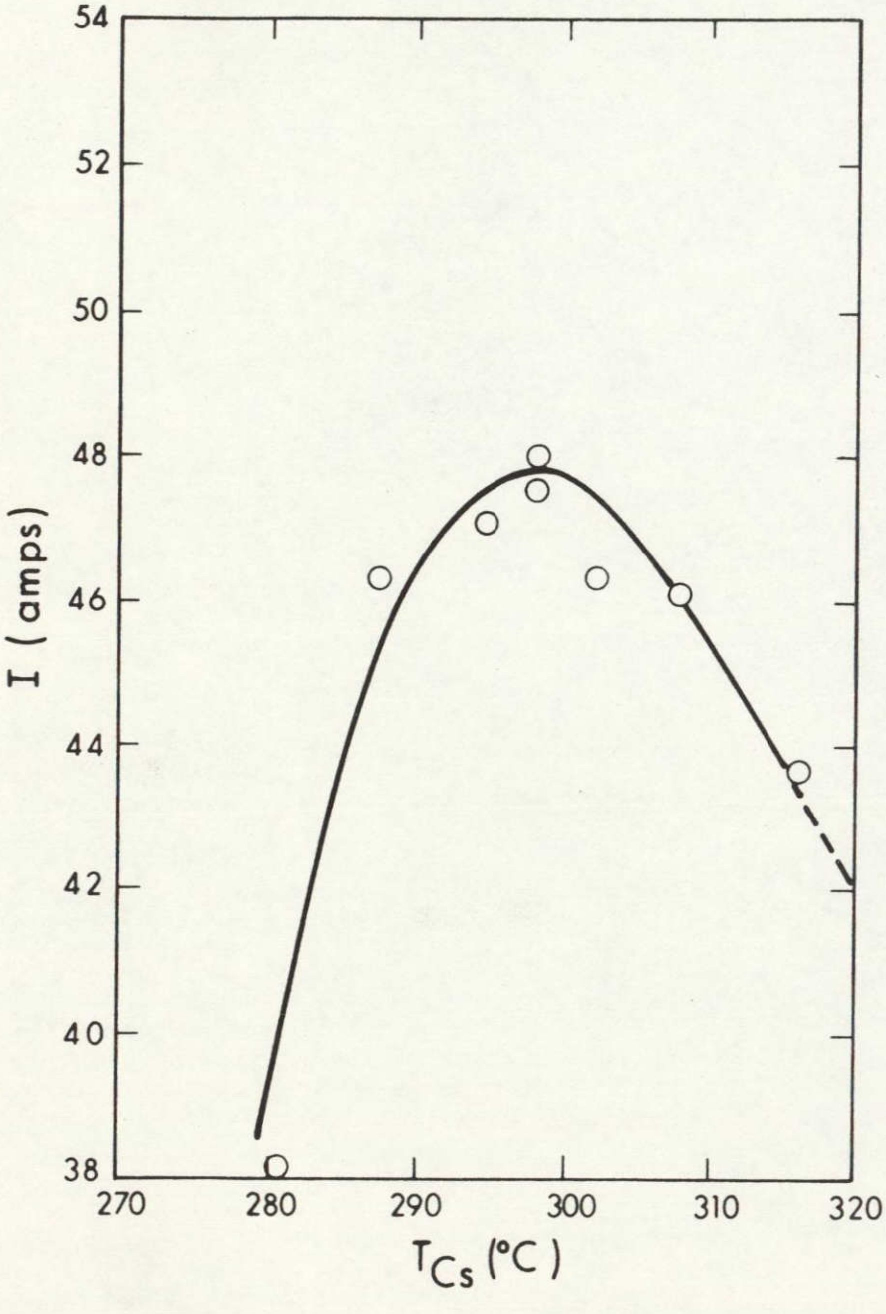


Figure 3-6. Current Optimization Plot for SC-2a Taken at T_E = 1300°C, T_C = 730°C and a Constant Voltage of 0.2 Volt

Figure 3-7 is a current optimization curve at a constant voltage of 0.4V at an emitter temperature of 1300°C and a collector temperature of 648°C. The optimum cesium reservoir temperature is 272°C at a current of 9.9A.

In Fig. 3-8, at a constant voltage of 0.6V the optimum cesium reservoir temperature is 254°C with a current of 1.34A. The emitter temperature was 1300°C and the collector was 630°C.

Figure 3-9 is a performance plot for SC-2a at an emitter temperature of 1300°. The data at voltages above 0.5V are not truly optimum because it was impossible to obtain the high collector temperatures required. The device was designed and built to operate at 1400°C with a current of 45A.

At an emitter temperature of 1400°C optimizations were performed at 0.4V and 0.5V. In Fig. 3-10, at 0.4V the optimum cesium reservoir temperature was found to be 299°C with a current of 44.8A. The collector temperature was 730°C.

At a constant voltage of 0.5V, the cesium reservoir temperature was found to be 294°C with a current of 33.9A as shown in Fig. 3-11.

Figure 3-12 is a performance plot for SC-2a at an emitter temperature of 1400°C.

As shown in Fig. 3-12, at 0.5V, a current of 33.68A was obtained at 1400°C. The power density is therefore 4.21 W/cm^2 assuming a 4 cm^2 emitter area.

In Fig. 3-12, data at 0.3, 0.4, 0.5, and 0.6V were taken under steady state dc conditions. After these data were taken, the emitter-envelope weld opened up.

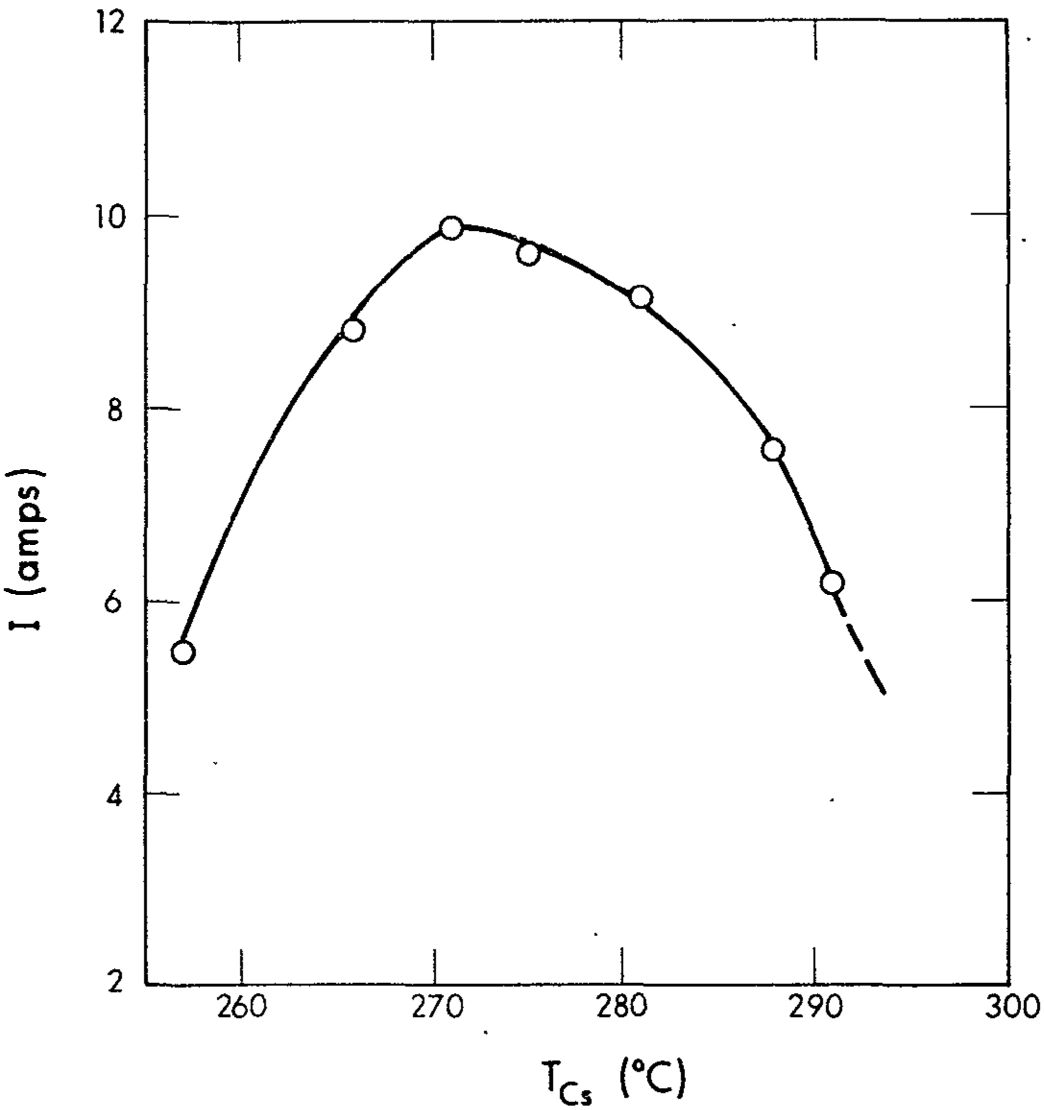


Figure 3-7. Current Optimization Plot for SC-2a Taken at $T_E = 1300^oC$, $T_C = 648^oC$ and a Constant Voltage of 0.4 Volt

35209

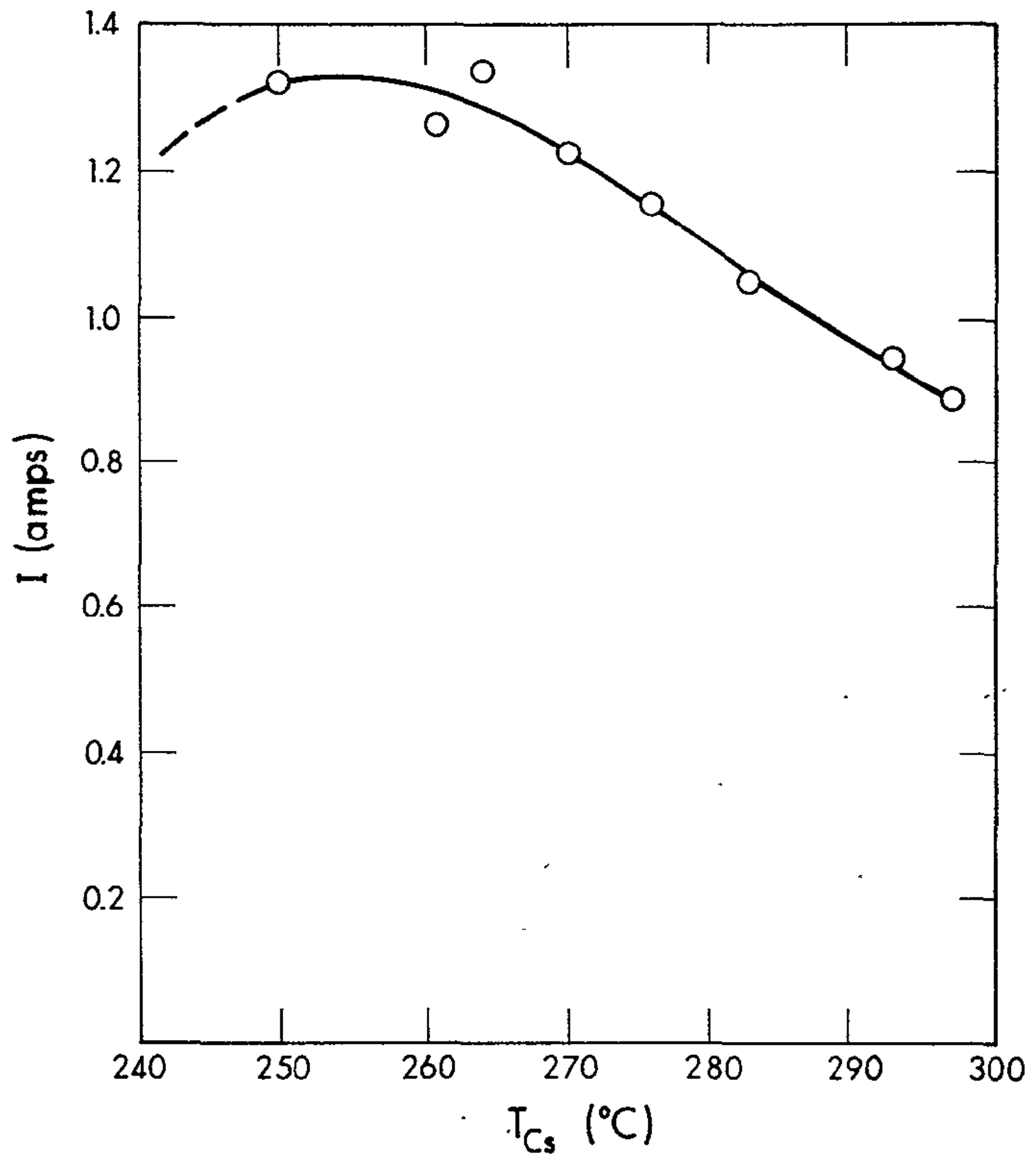


Figure 3-8. Current Optimization Plot for SC-2a Taken at T_E = 1300°C, T_C = 630°C and a Constant Voltage of 0.6 Volt

35305

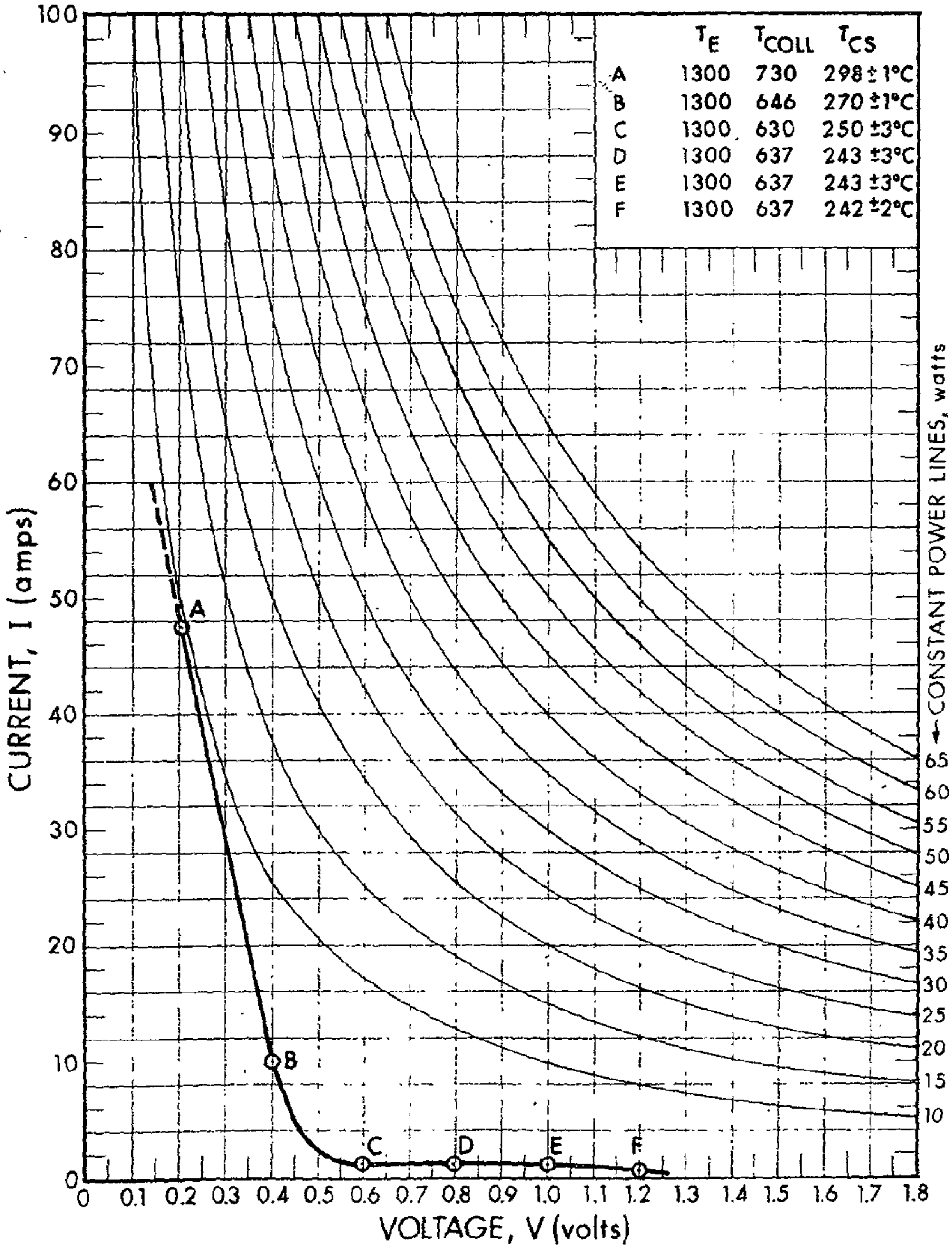


Figure 3-9. Performance Plot for SC-2a at T_E = 1300°C

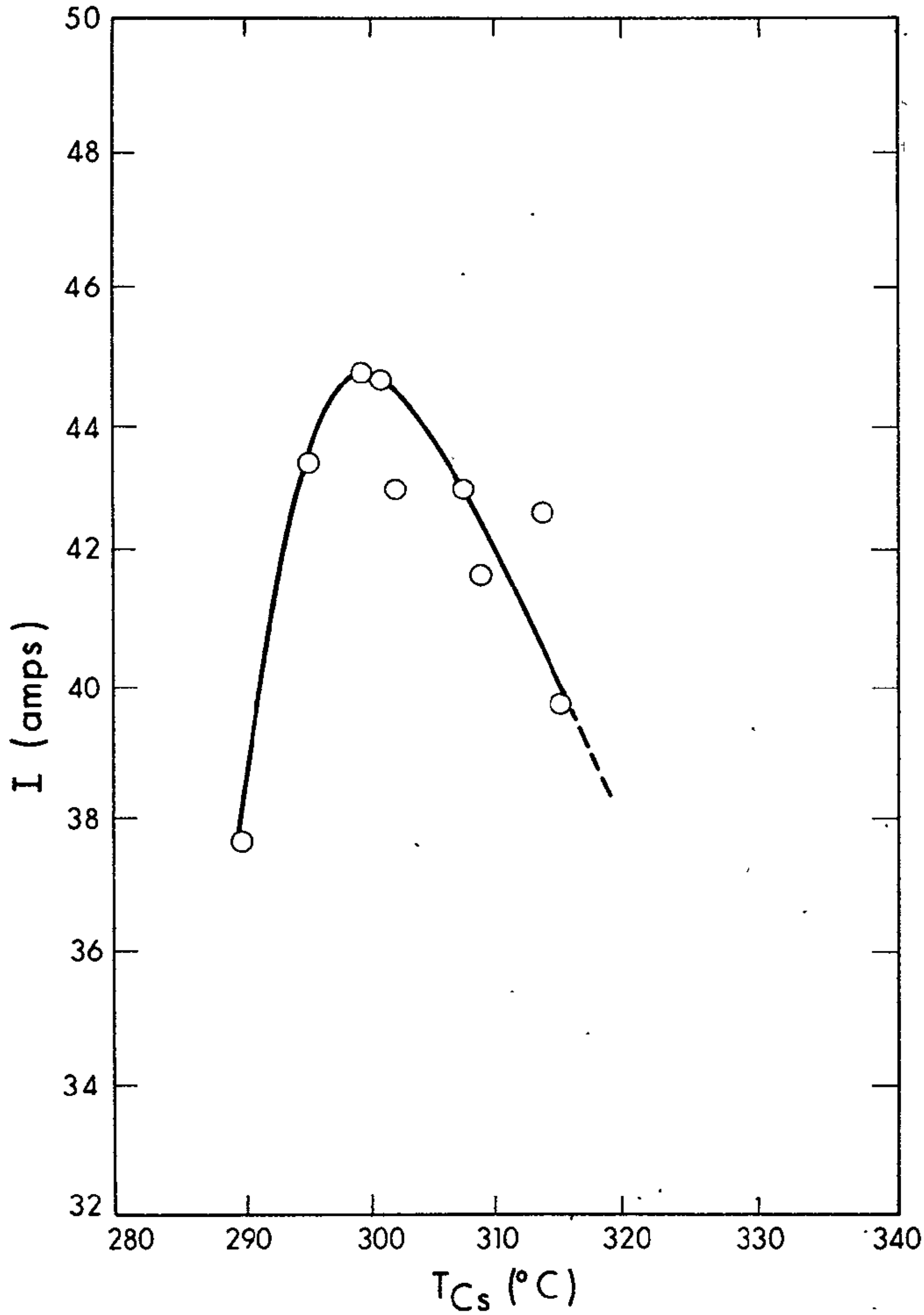


Figure 3-10. Current Optimization Plot for SC-2a at T_E = 1400°C and T_C = 730°C at a Constant Voltage of 0.4 Volt

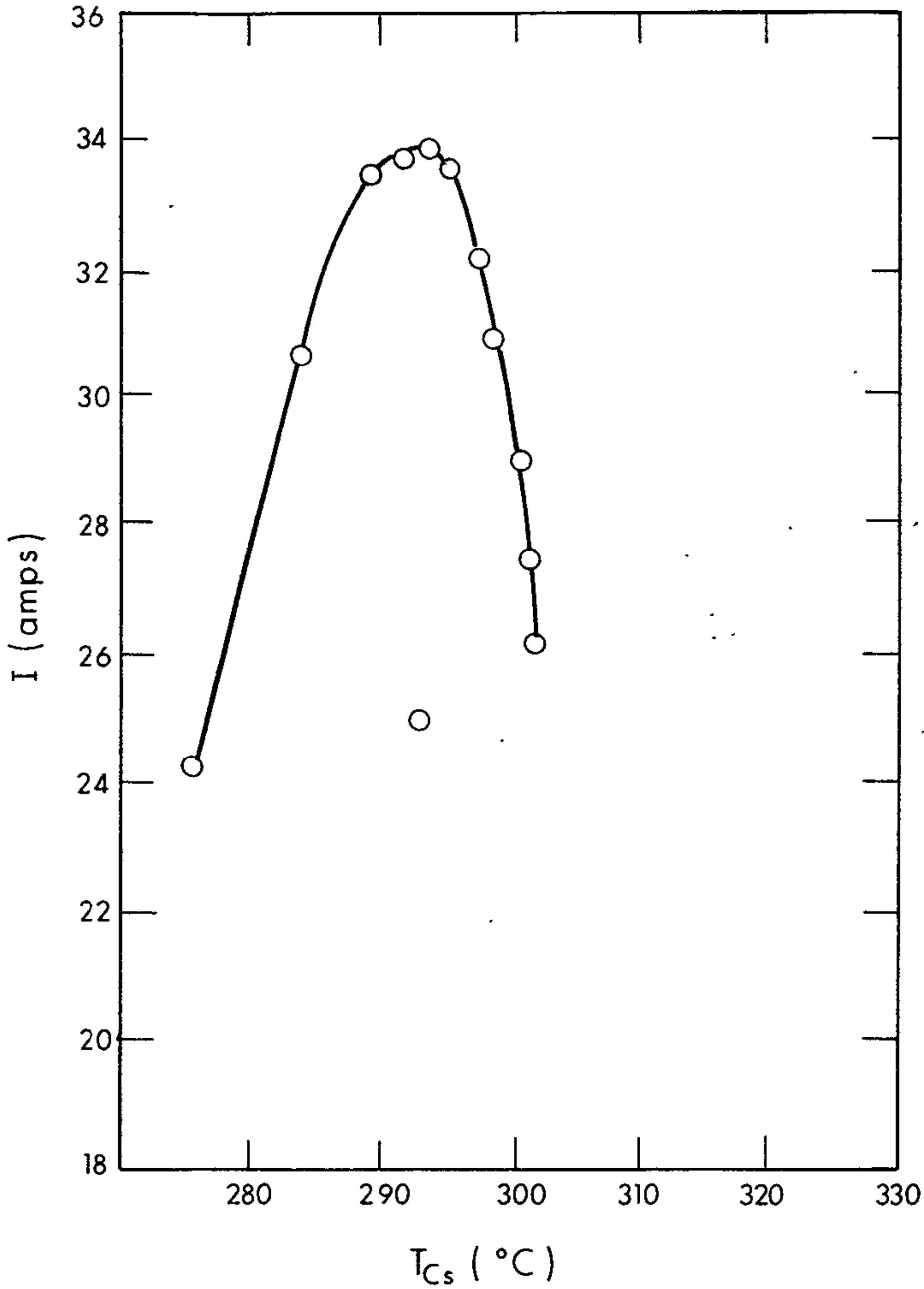


Figure 3-11. Current Optimization for SC-2a at T_E = 1400°C and T_C = 685°C at a Constant Voltage of 0.5 Volt

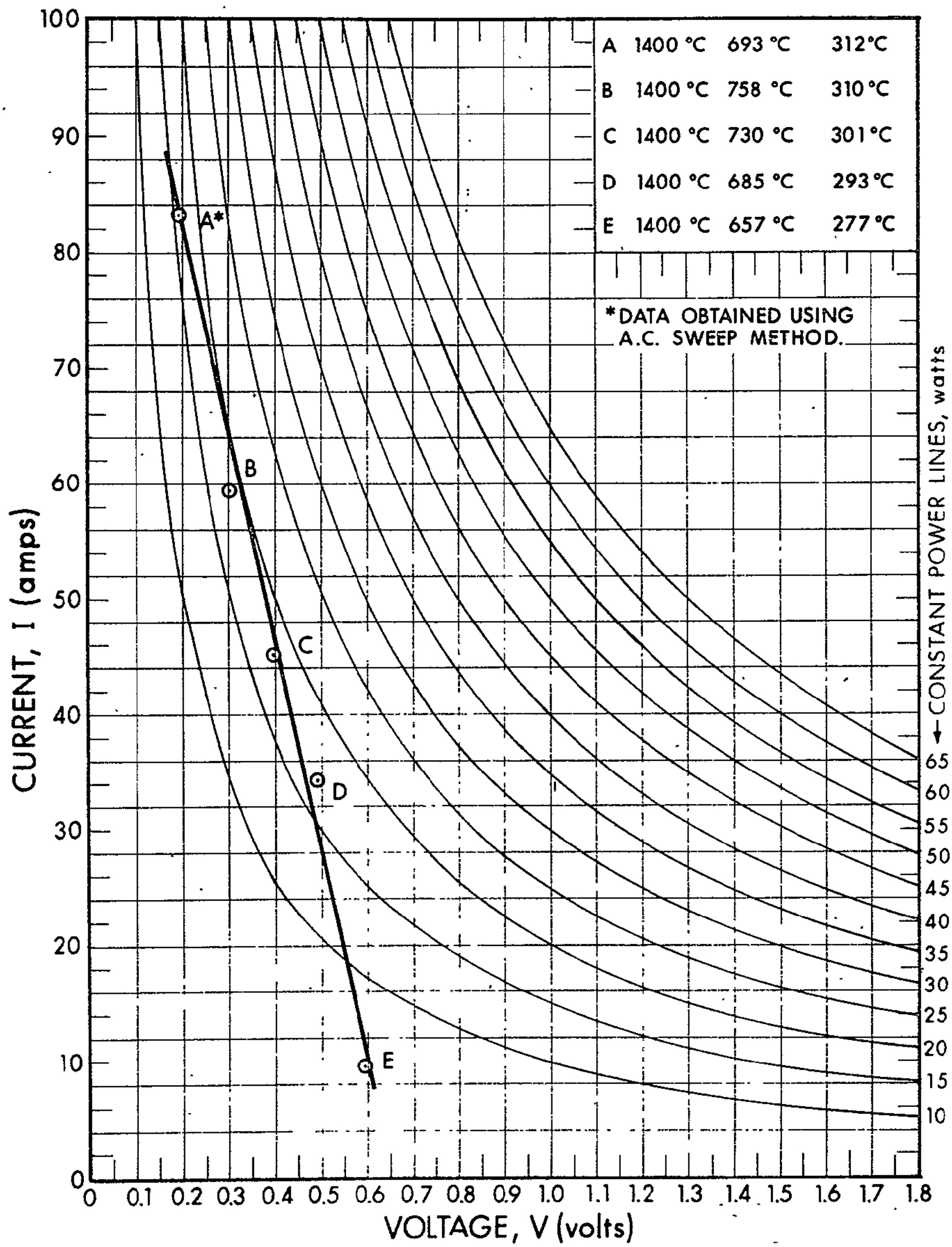


Figure 3-12. Performance Plot for SC-2a at $T_E = 1400^\circ C$

35212

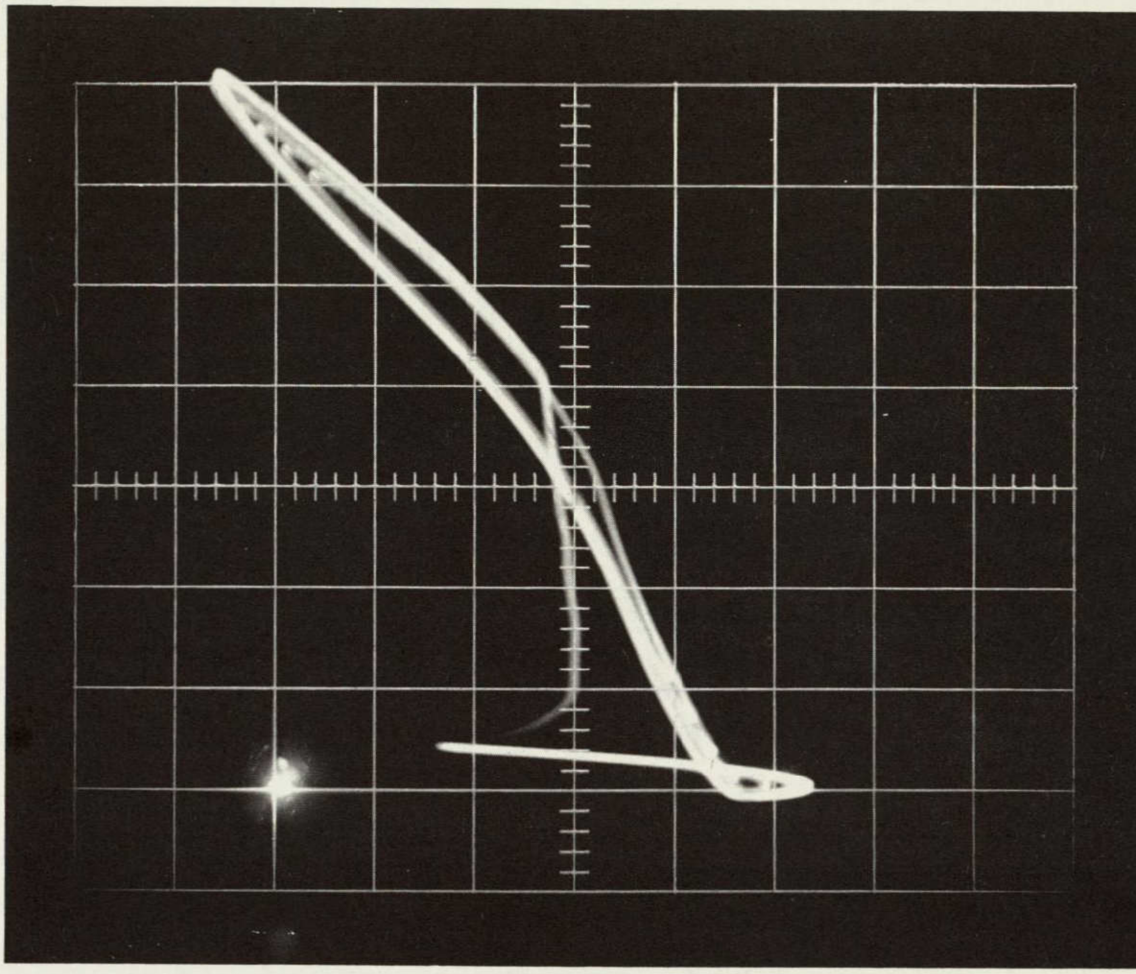
The apparent cause and solution of this failure was discussed in the last section on fabrication. The device was ultimately reloaded and tested.

Upon testing the device again, it was found that the 1300°C data could be reproduced. At 1400°C and above, it was extremely difficult to reproduce data due to apparent emitter-collector shorting. Apparently the second welding created a certain misalignment of the emitter with respect to collector. This manifested itself as shorts at elevated temperatures. One method used in an attempt to realign the emitter was to cycle the converter a number of times to a high temperature (1700°C). This operation permitted reproduction of various 1400°C data. At 1500°C the criticality of the temperature on shorting allowed only ac data to be taken.

Figure 3-13 is a current-voltage ac sweep oscillograph. The emitter temperature was 1500°C, the collector temperature was 768°C. The cesium reservoir temperature was 323°C. From this information, the performance plot, Fig. 3-14, was generated.

Figure 3-15 is a current-voltage ac sweep oscillograph at a cesium reservoir temperature of 305°C and a collector temperature of 733°C. The performance plot, Fig. 3-14, shows the optimum data from Fig. 3-15 at 0.35V and a current of 56A. This is a power density of 4.9 W/cm^2.

The 1500°C performance plot is shown in Fig. 3-16. At 0.4V, the current was 53A giving a power density of 5.3 W/cm^2. The collector temperature was 775°C at a reservoir temperature of 325°C. At 0.5V the current was 36A for a power density of 4.5 W/cm^2. The collector temperature was 762°C and the reservoir temperature was 325°C. At 0.6V the current was 22A for a power density of 3.7 W/cm^2. The collector temperature was 704°C with a reservoir temperature of 300°C.



005790

Figure 3-13. Oscillograph from SC-2b at T_E = 1500°C and T_C = 768°C at T_{CS} = 323°C.
Scale: X = 0.1 volt/division, Y = 20 amps/division

The bright spot in lower left hand corner of photo indicates the zero axis.

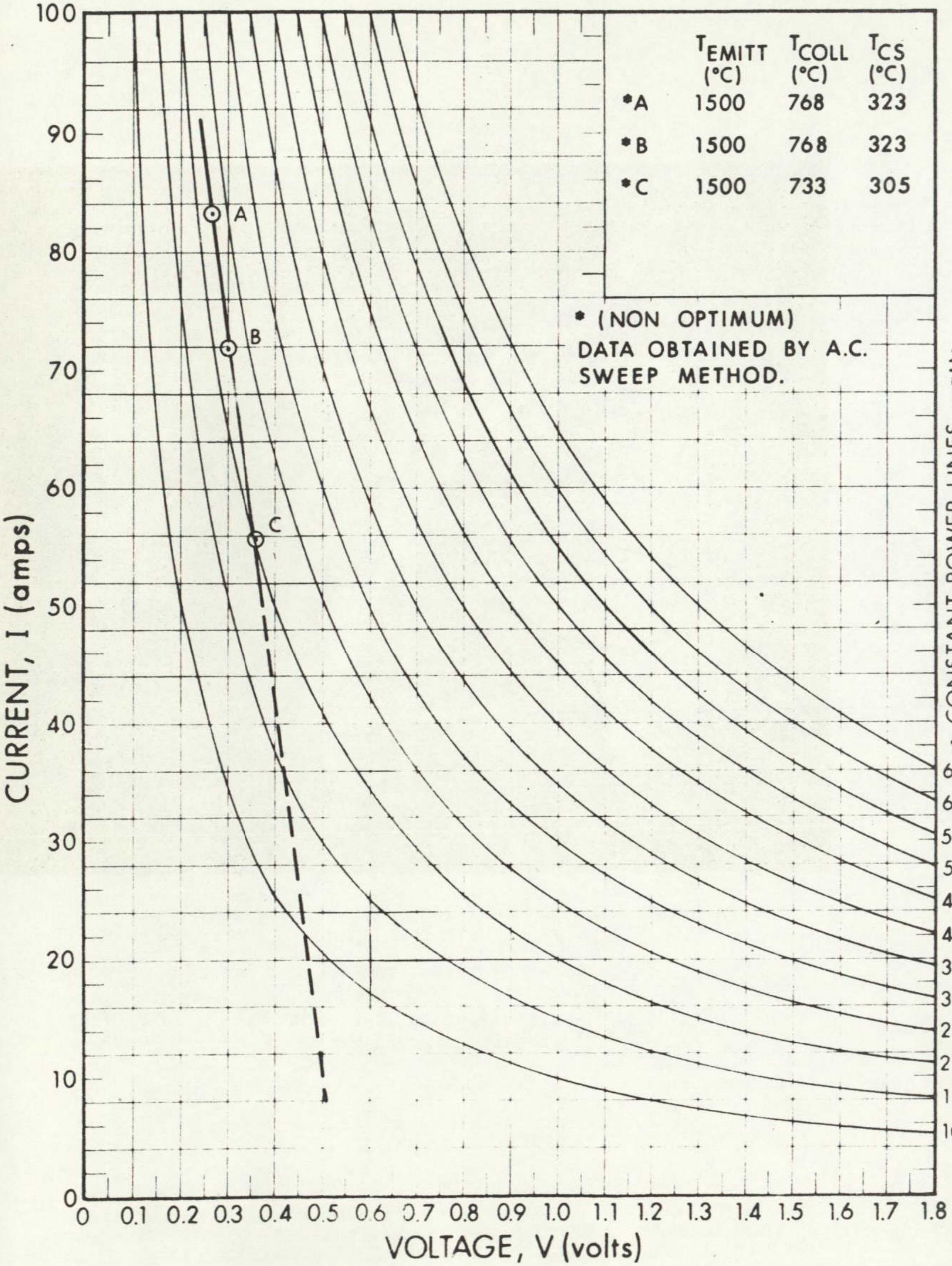
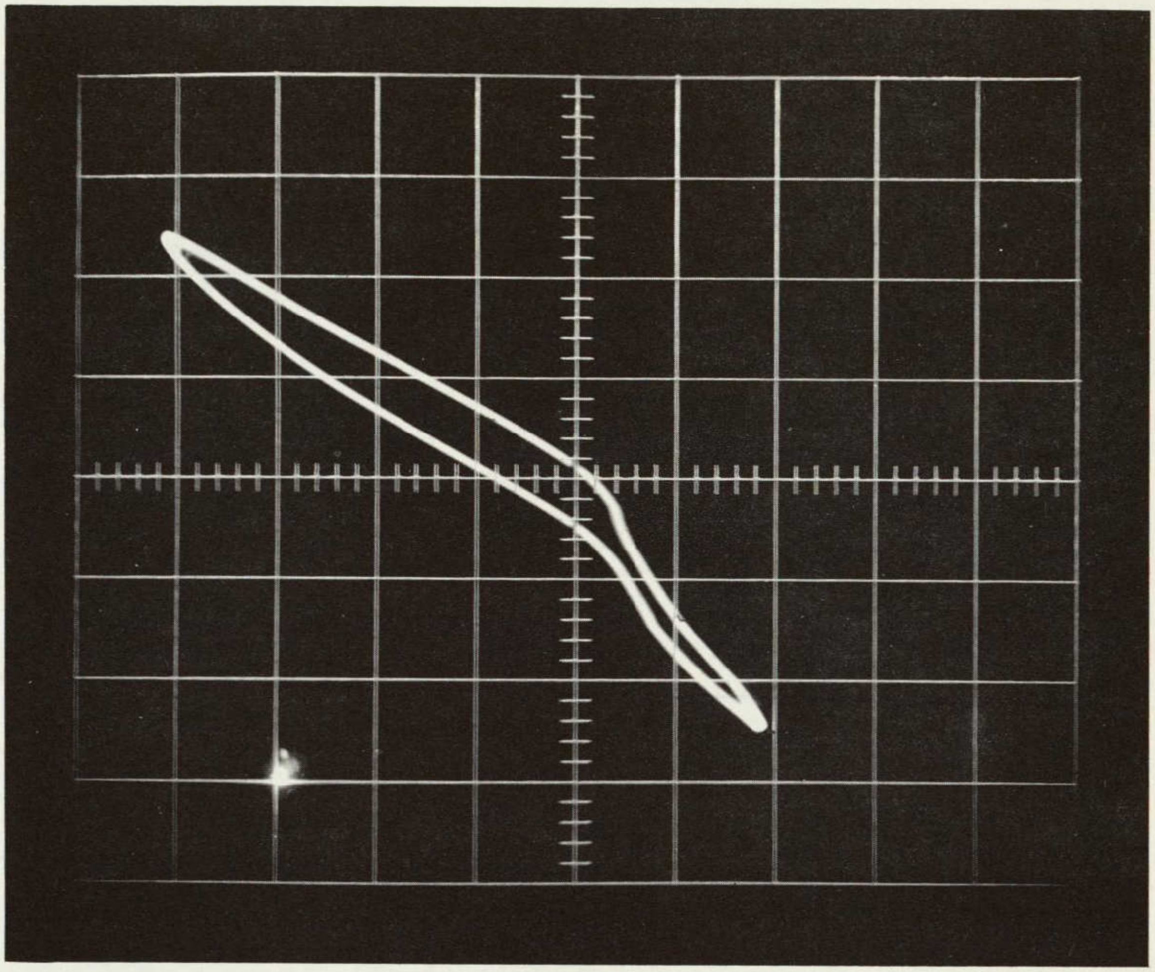


Figure 3-14. Performance Plot for SC-2b at T_E = 1500°C



005791

Figure 3-15. Oscillograph from SC-2b at T_E - $1500^{o}C$ and T_C = $733^{o}C$ at T_{CS} = $305^{o}C$.
Scale: X = 0.1 volt/division, Y = 20 amps/division

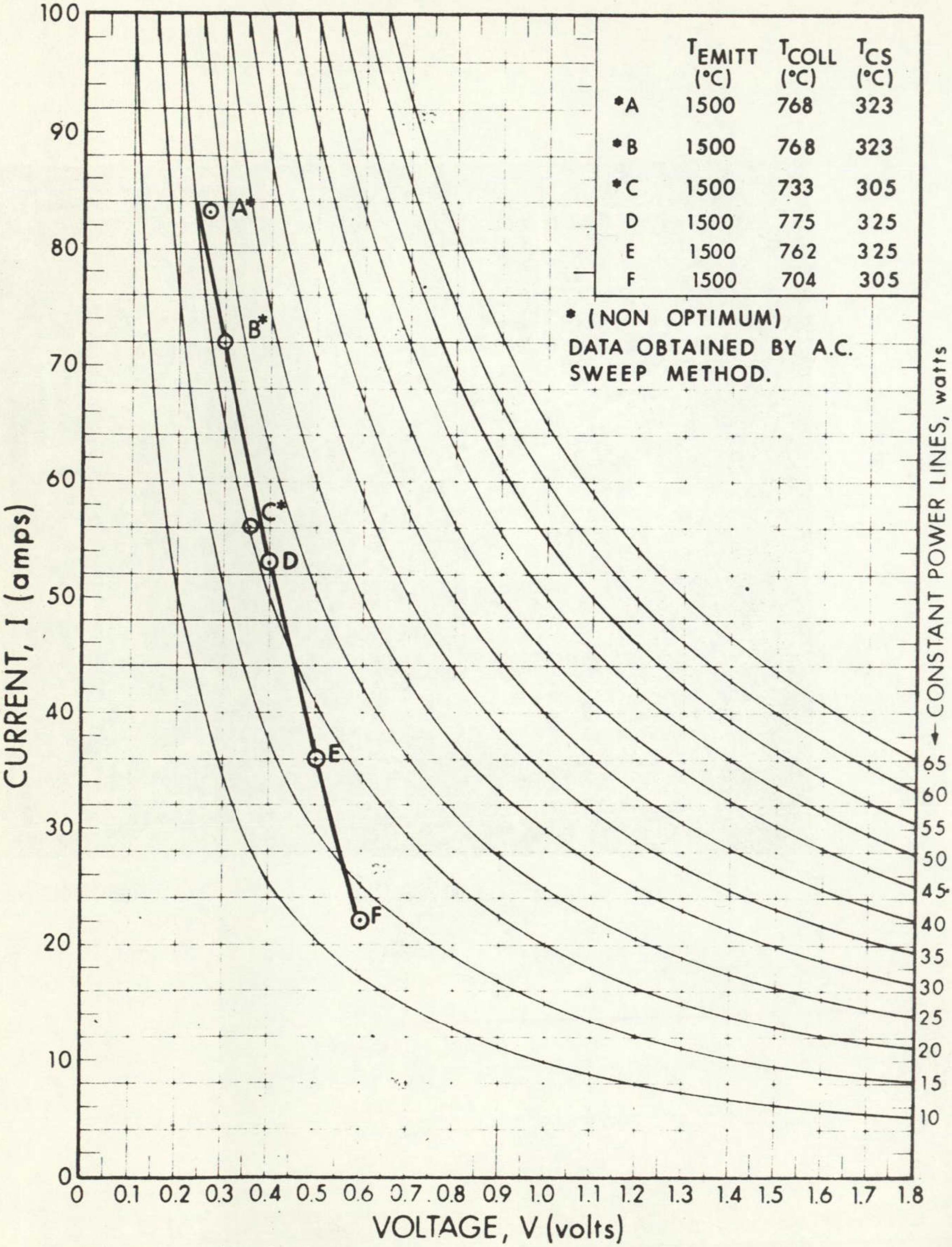


Figure 3-16. Performance Plot for SC-2b at T_E = 1500°C

Figure 3-17 is a photograph of SC-2b after removal from the test gantry following performance testing.

The data sheets and I-V characteristics for SC-2a and SC-2b are given in Appendix 4.

76911

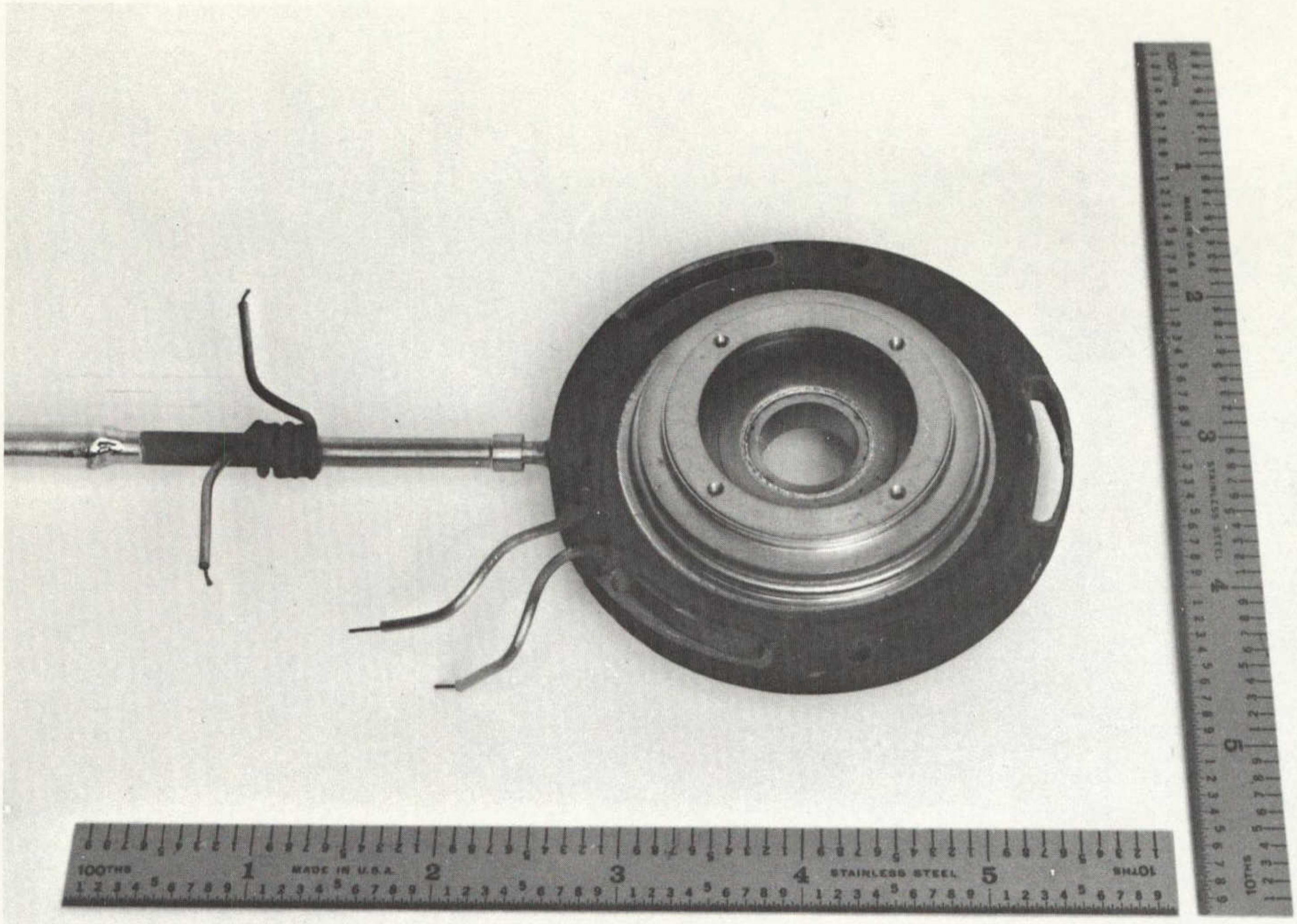


Figure 3-17. Converter SC-2b

SECTION 4

CONVERTERS SC-3a AND SC-3b

4.1 CONVERTERS SC-3a AND SC-3b DESIGN

Converter SC-3 was designed to improve upon SC-2 in the following areas:

a. Stronger emitter support system for resistance to environmental stress by a convolute and conical bend in the rhenium envelope

b. More compact converter - reduce emitter lead strap width by 20 percent

c. Better radiator sizing

Figure 4-1 is an assembly drawing of SC-3a. The conical shape of the envelopes with the convolute is shown. The emitter is slightly longer to accommodate the envelope. Converter SC-2 emitter area was 4 cm^2. Converter SC-3 has a 4.06 cm^2 emitter. Wrought rhenium was used for the emitter, replacing CVD rhenium, to reduce the cost. The CVD rhenium was not oriented and therefore no performance difference should be attributed to this change.

The thickness of the converter was reduced by designing a fabricated ceramic metal seal with a convolute in the flange. The convolute in the flange allows for thermal expansion. With this design, the ceramic subassembly was electron-beam welded directly to the collector, with the plane of the bottom of the ceramic coincident with the collector surface. This allows the overall thickness of the converter to be reduced from 1.92 cm to 1.52 cm.

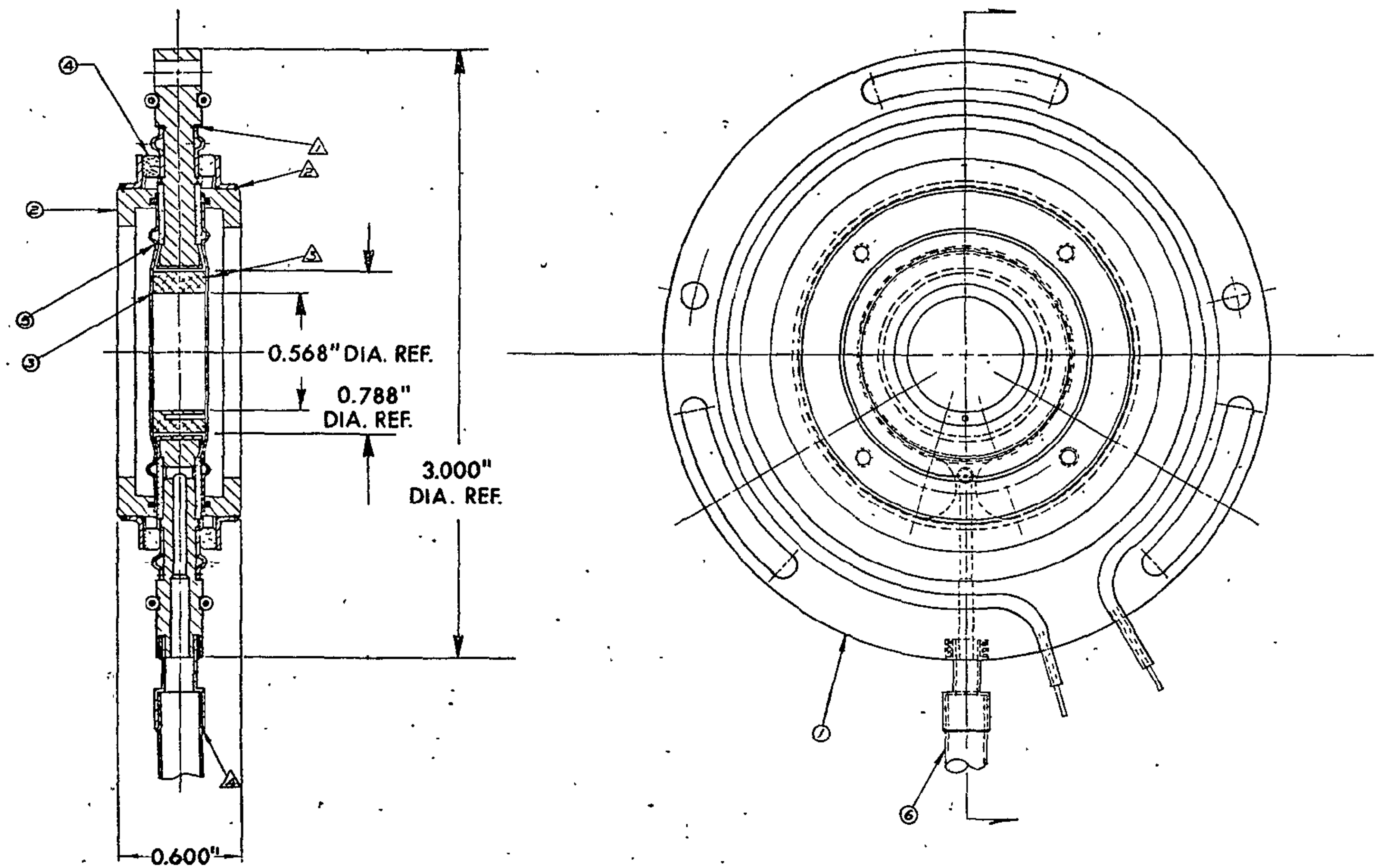


Figure 4-1. Converter SC-3a Assembly Drawing

The collector area was reduced to 3.67 cm^2 because the thickness was reduced. The side wall spacing of SC-1, SC-2a and SC-2b is 0.010 inch The added 0.020 in. of SC-3a and SC-3b provided by the new envelope design set the side wall spacing at 0.030 in. at the plane of the collector face. Side wall emission collection from the envelope for SC-3a and SC-3b was thus negligible.

During the testing of SC-2a and SC-2b it was noted that the high efficiency radiation shields were possibly causing excess heating of the emitter envelope, causing warping and therefore apparent emitter-collector shorting. It was thus decided to forego further attempts at producing a high efficiency electron gun and concentrate only on converter performance.

Figure 4-2 is a drawing of the emitter support structure (envelope). A stronger emitter support system was accomplished by a single convolution and a conical bend in the rhenium envelope. The convolution allows the envelope to expand radially with temperature. The conical bend also provides added strength to the envelope for resistance to environmental stresses.

4.2 CONVERTERS SC-3a AND SC-3b FABRICATION

The envelope convolution and bend are cold-formed in the rhenium. Two vacuum interstage anneals of 15 minutes each at 1700°C were required during the fabrication of the structure.

Figure 4-3 shows the ceramic-to-metal seal assembly for SC-3a. The overall converter thickness was reduced by providing a convolution in the collector flange of the seal assembly. The seal subassembly was electron-beam welded to the collector-radiator assembly. The plane of the seal flange is coincident to the plane of the collector-radiator.

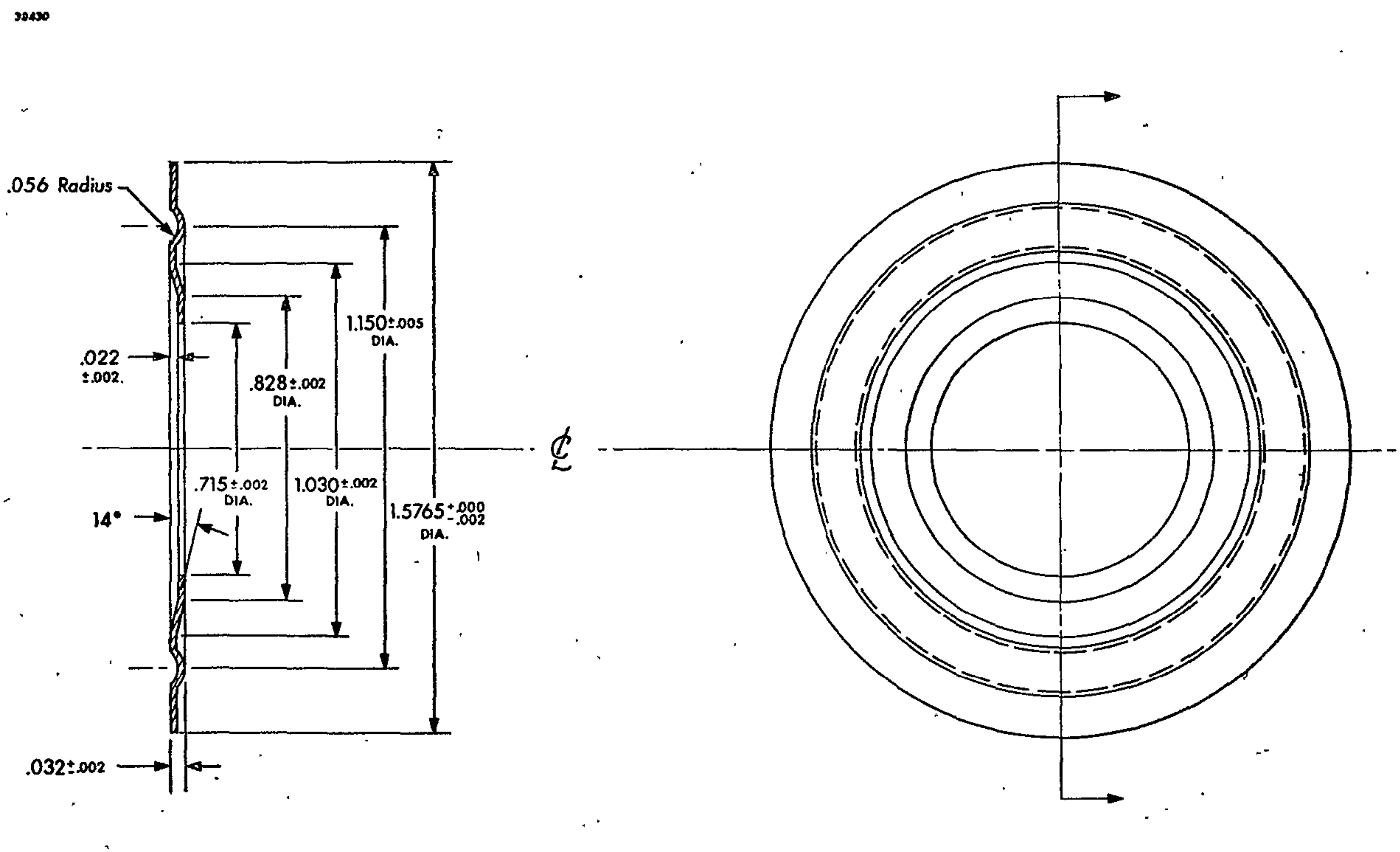


Figure 4-2. Emitter Support Structure

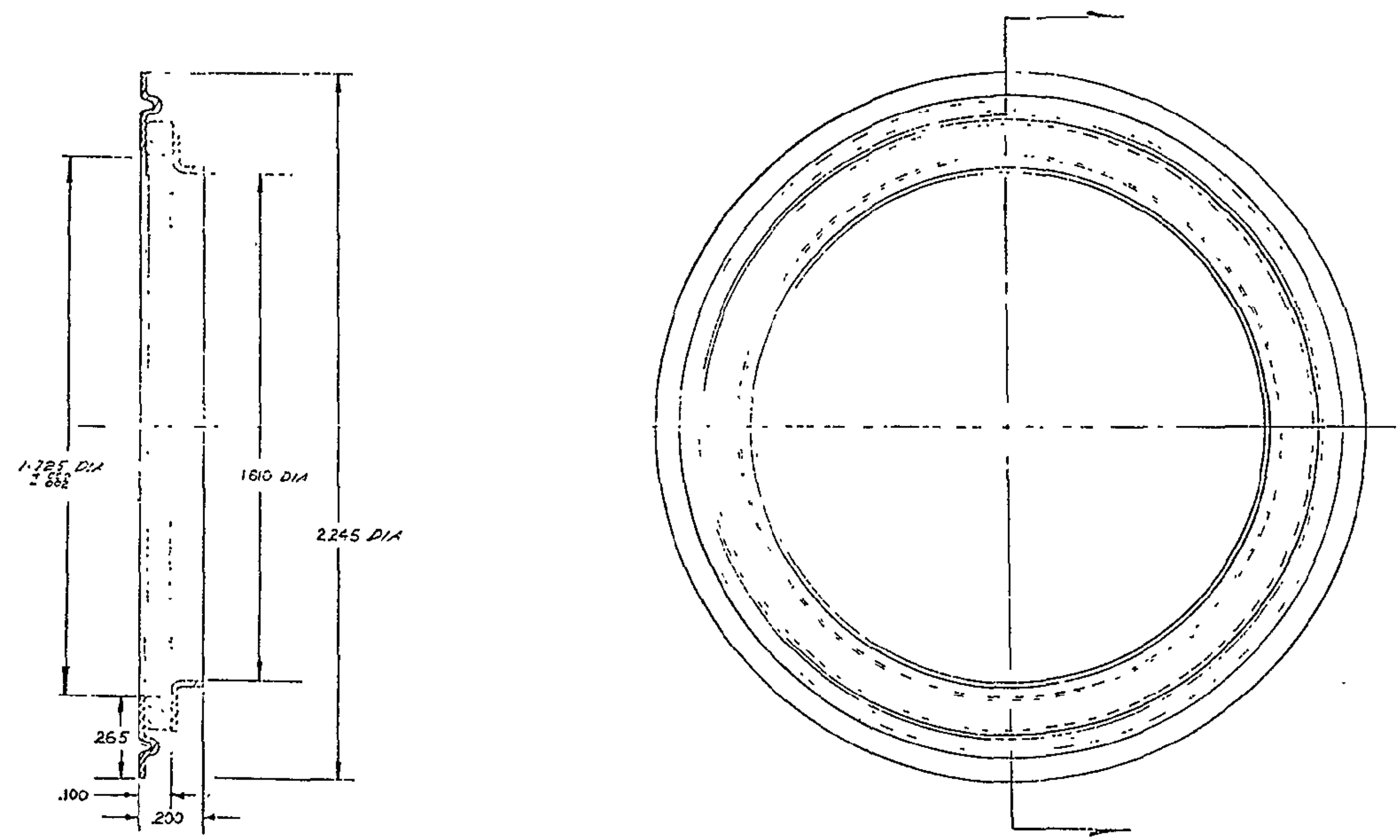


Figure 4-3. Ceramic-to-Metal Seal Assembly

During the electron-beam welding of SC-3a the ceramic seal leaked. It was found that the outside flange weld to the collector was not satisfactory since mechanical and thermal strains put the ceramic in tension. Therefore, SC-3b was fabricated by welding the seal flange on the inside; the ceramic was ultimately put into compression.

The brazing, firing and electron beam welding schedules for SC-3a and SC-3b are given in Appendix 4.

4.3 CONVERTER SC-3b PERFORMANCE TESTING

The cesium reservoir and collector temperatures were optimized during testing by visual means. Lengthy plotting procedures were eliminated in order to save time and conserve funds. The optimizations were achieved in iterative manner until no charge could be detected.

Figure 4-4 is the performance plot for SC-3b taken at the design emitter temperature of 1400°C. At 0.4V the current was 39.0A, giving a power density of 4.33 W/cm^2 based on a collection area of 3.6 cm^2. The optimum collector and reservoir temperatures were 654°C and 321°C. At 0.5V the current was 27.8A, giving a power density of 3.86 W/cm^2 based on collection area. The optimum collector and reservoir temperatures were 630°C and 318°C. The collector temperatures at 0.4V and 0.5V were achieved without the use of any external power input to the collector-radiator heaters.

Figure 4-5 is the performance plot taken at 1300°C (100°C, below the design emitter temperature). At 0.3V the current was 30A, giving a power density of 2.5 W/cm^2. At 0.4V the current was 15.8A, giving a power density of 2 W/cm^2.

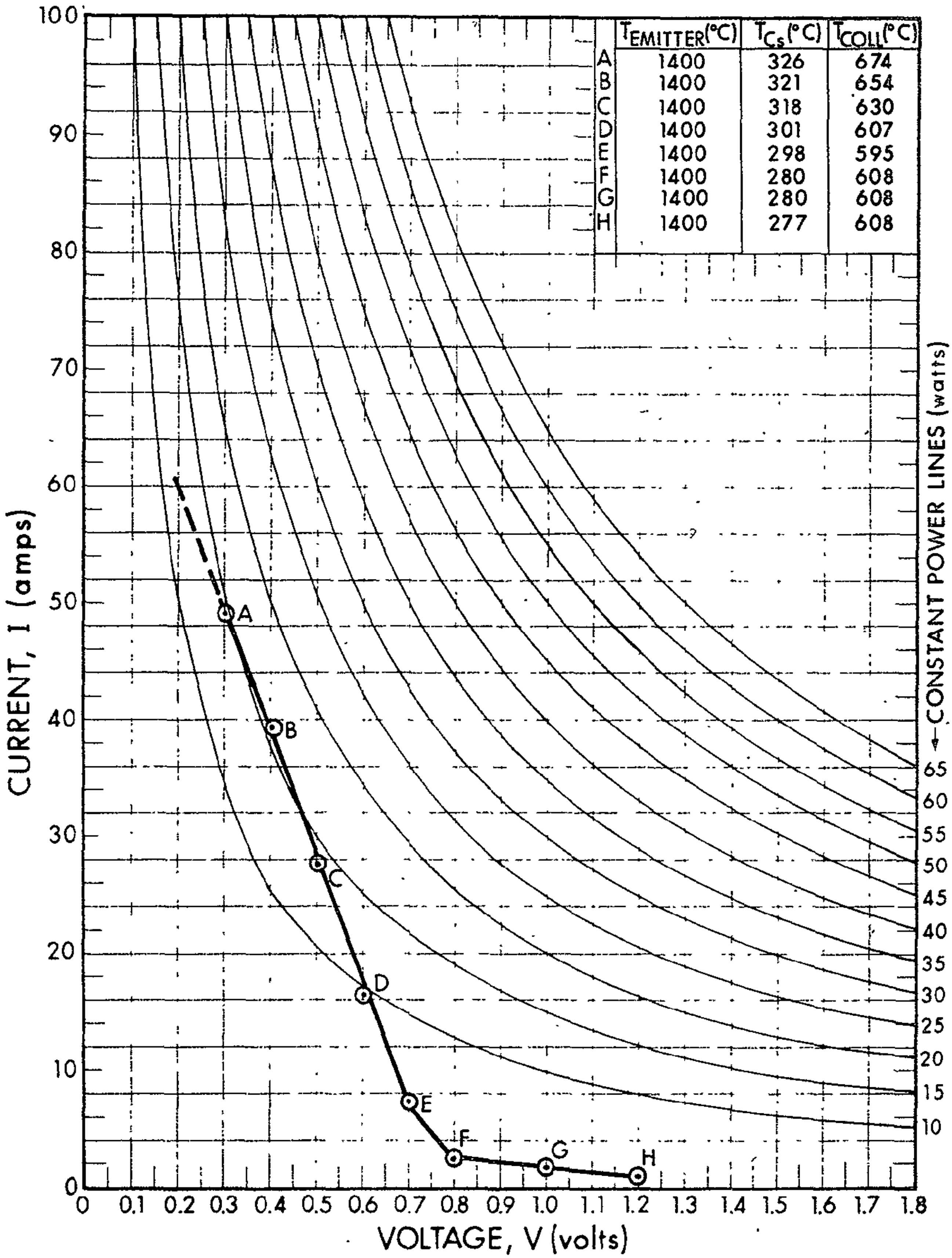


Figure 4-4. Performance Plot of SC-3b Taken at the Design Emitter Temperature of 1400°C

36143

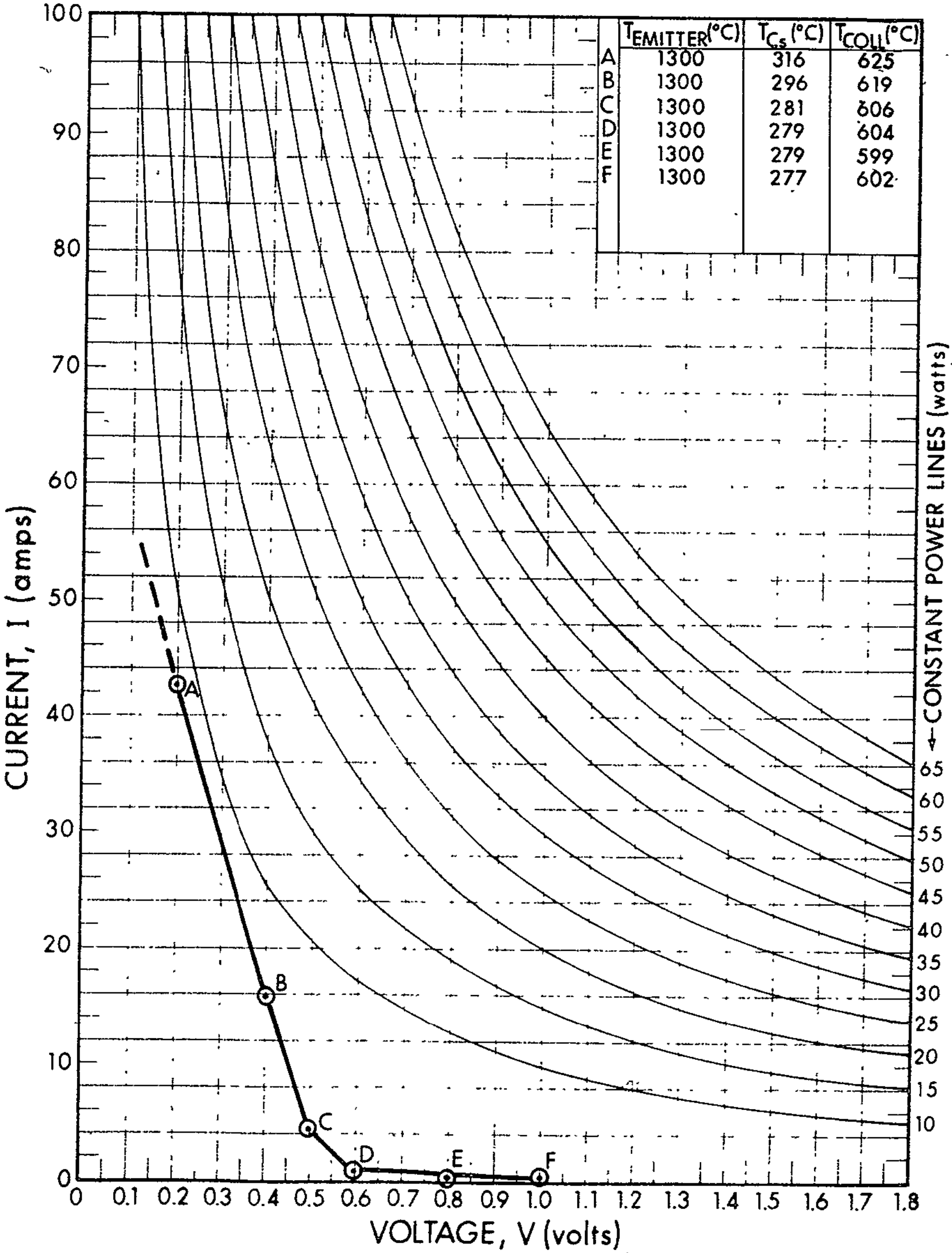


Figure 4-5. Performance Plot of SC-3b Taken in an Emitter Temperature of 1300°C

Figure 4-6 is the optimum performance plot taken at 1500°C (100°C above the design emitter temperature). At 0.4V the current was 48.2A, giving a power density of 5.35 W/cm^2. At 0.6V the current was 31.0A, yielding a power density of 5.15 W/cm^2. At 0.7V the current from the plot is 22.0A, giving a power density of 4.27 W/cm^2.

Figure 4-7 shows a performance composite of SC-3b taken at 1300°C, 1400°C and 1500°C.

The shorting conditions displayed by SC-1a and b and SC-2a and b were eliminated in SC-3b. The successful testing of SC-3b provided the ultimate goal of the program; the achievement of the performance goals of the program with the new cylindrical coverter design. By operational T_E = 1400°C with a power density of 3.86 W/cm^2 at 0.5V, 96.5 percent of the performance goals were met.

The data sheets and I-V characteristics for converter SC-3b are presented in Appendix 4.

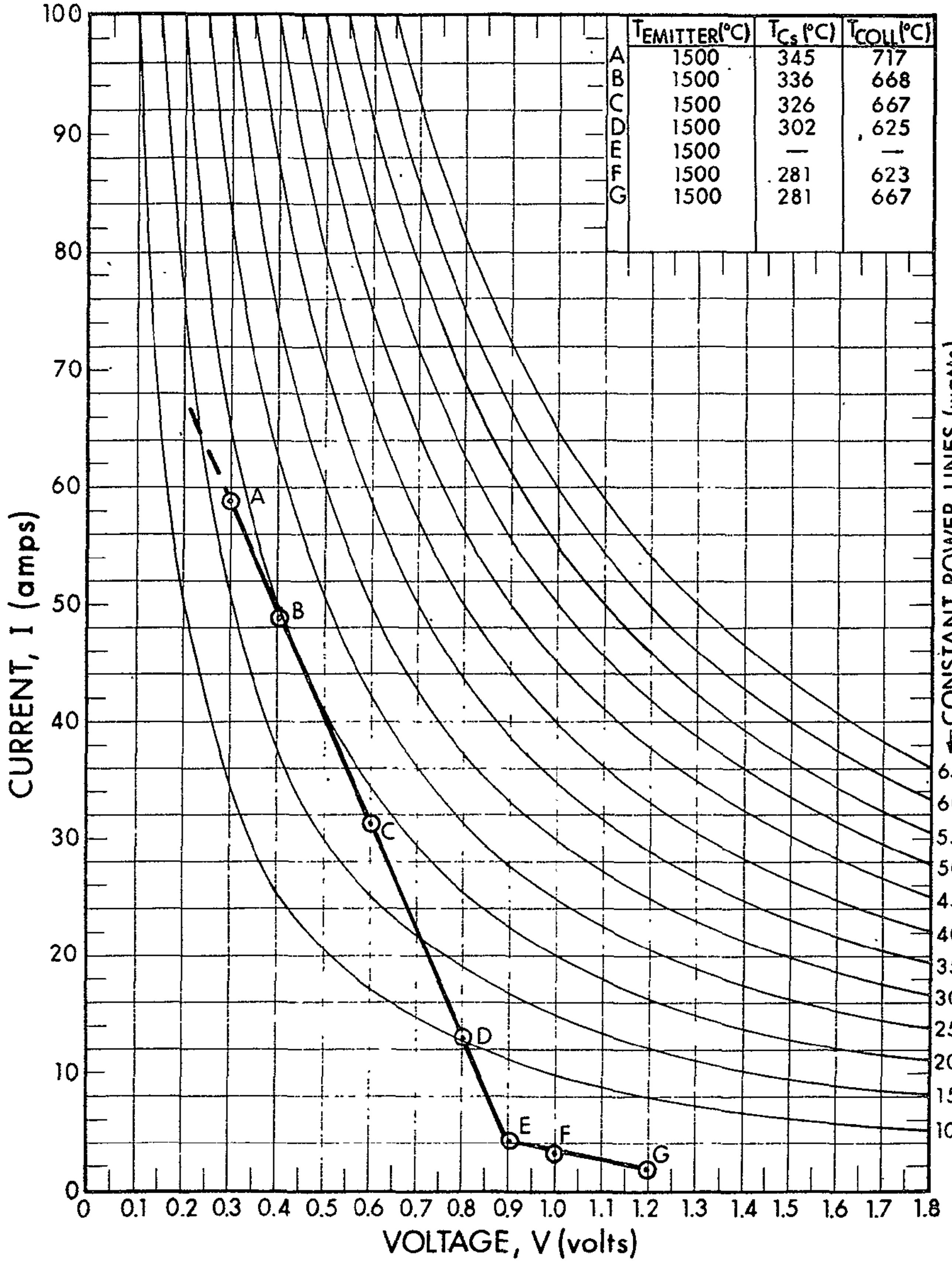


Figure 4-6. Performance Plot of SC-3b Taken at an Emitter Temperature of 1500°C

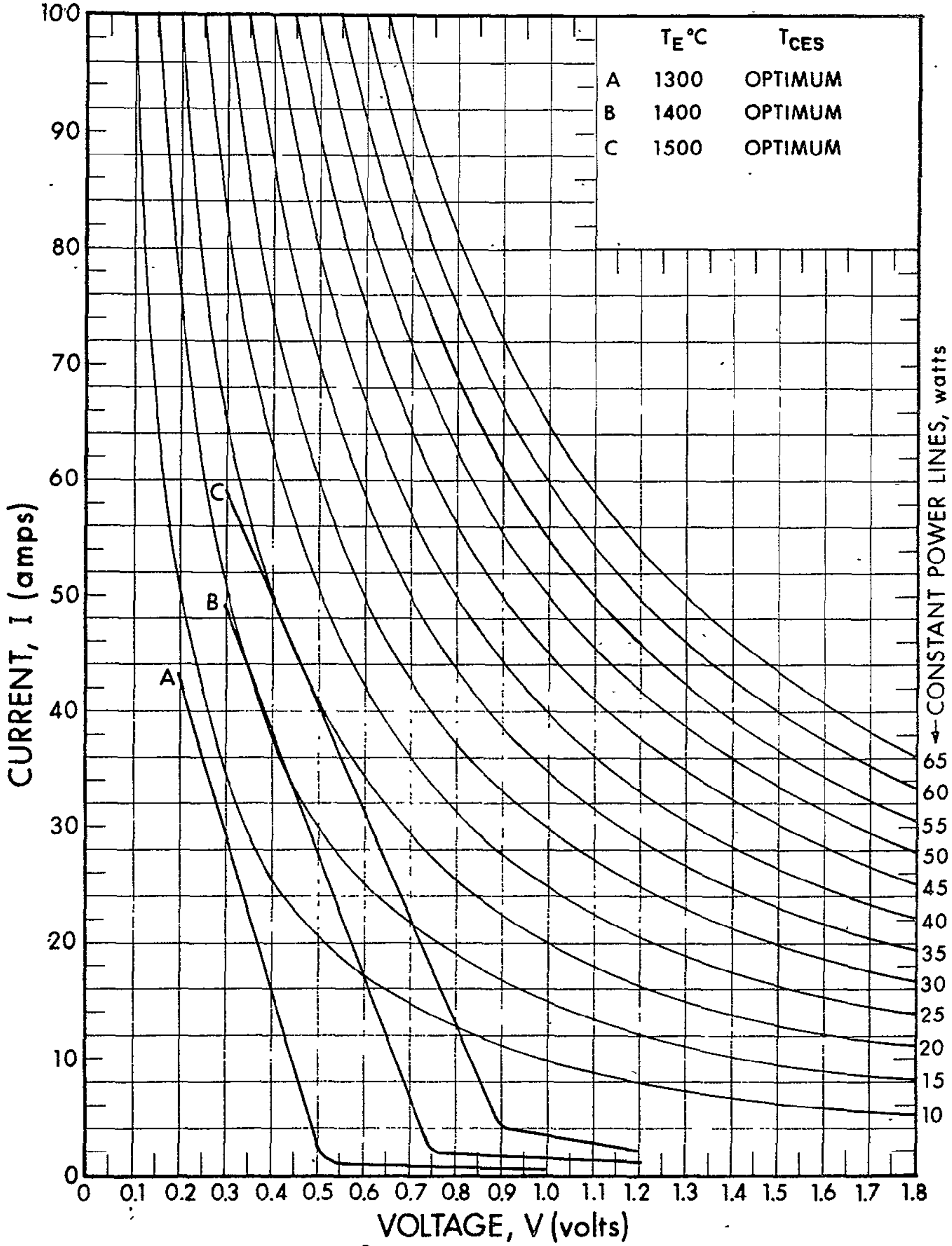


Figure 4-7. Performance Composite of SC-3b Taken at Specified Temperature

38417

SECTION 5

CONVERTER SC-4

5.1 CONVERTER SC-4 DESIGN

With the success of converter SC-3b dictating the design of SC-4, only the improvement of converter fabrication was pursued in designing SC-4. This was accomplished by a variation in the seal design.

Figure 5-1 is an assembly drawing of SC-4. The insulator subassembly is electron-beam-welded to the collector at the inside radius of the seal flange. Previous seals were designed so that the weld would be made on the outside radius of the seal flange. In fabricating SC-3a, it was found that the outside weld was not completely satisfactory since mechanical and thermal strains put the ceramic in tension. By welding the flange on the inside, the ceramic is ultimately put in compression. This design allows the use of a thinner insulator subassembly, thus reducing the converter overall thickness by approximately 20 percent, but is was not accomplished in this converter.

The design parameters of SC-4 were the same as for SC-1, SC-2a, SC-2b and SC-3a and SC-3b; i.e., a power density of 4 W/cm^2 at 0.7V at an emitter temperature of 1400°C.

5.2 CONVERTER SC-4 FABRICATION

Converter SC-4 was fabricated in the same manner as SC-3b. The brazing, firing and electron beam welding schedules are presented in Appendix 5.

36513

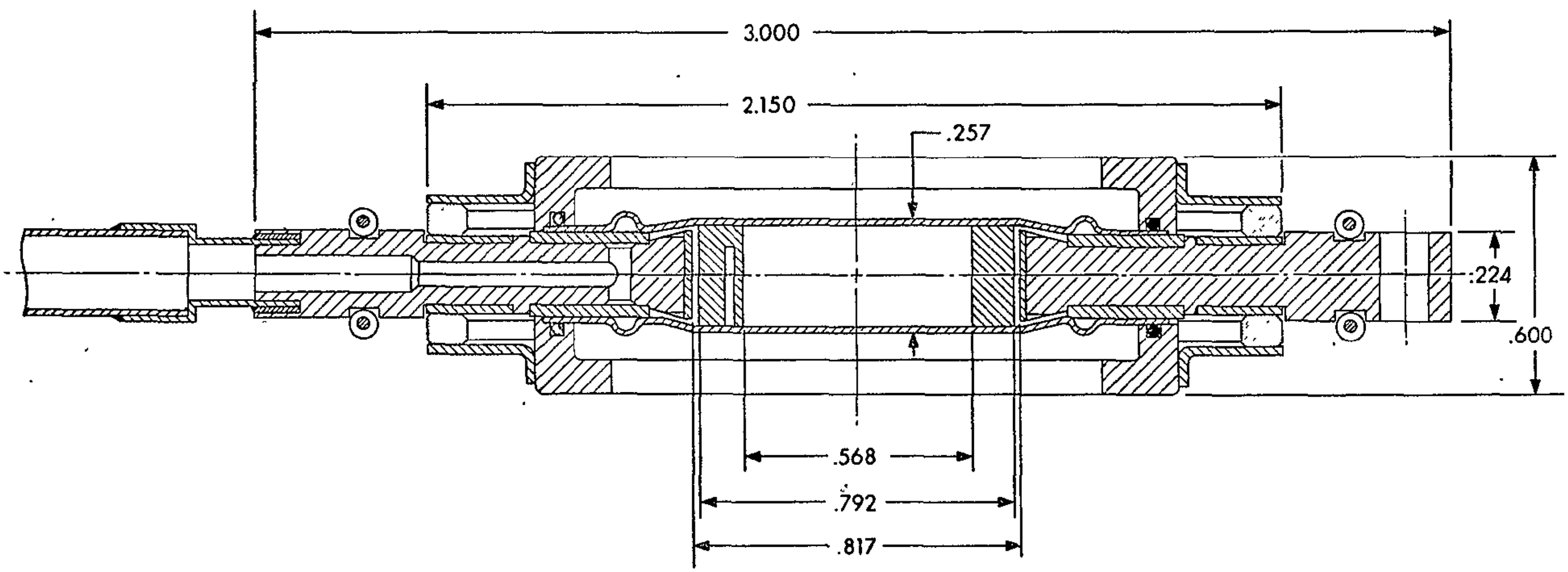


Figure 5-1. Converter SC-4 Assembly Drawing

5.3 CONVERTER SC-4 PERFORMANCE TESTING

Figure 5-2 is the performance plot for SC-4 taken at the design emitter temperature of 1400°C. At 0.4V the current was 38.0A, giving a power density of 4.23 W/cm^2 based on a collection area of 3.6 cm^2. The optimum collector and reservoir temperatures were 742°and 322.5°C. At 0.5V the current was 25A, giving a power density of 3.47 W/cm^2. The optimum collector and reservoir temperatures were 702°C and 295°C. The collector temperatures at 0.4V and 0.5V were achieved without the use of an external power input to the collector-radiator heaters. This indicates that the radiator is properly sized.

Figure 5-3 is the performance plot taken at 1300°C (100°C below the design emitter temperature). At 0.3V the current was 25A, giving a power density of 2.08 W/cm^2. At 0.2V the current was 43A, giving a power density of 2.4 W/cm^2.

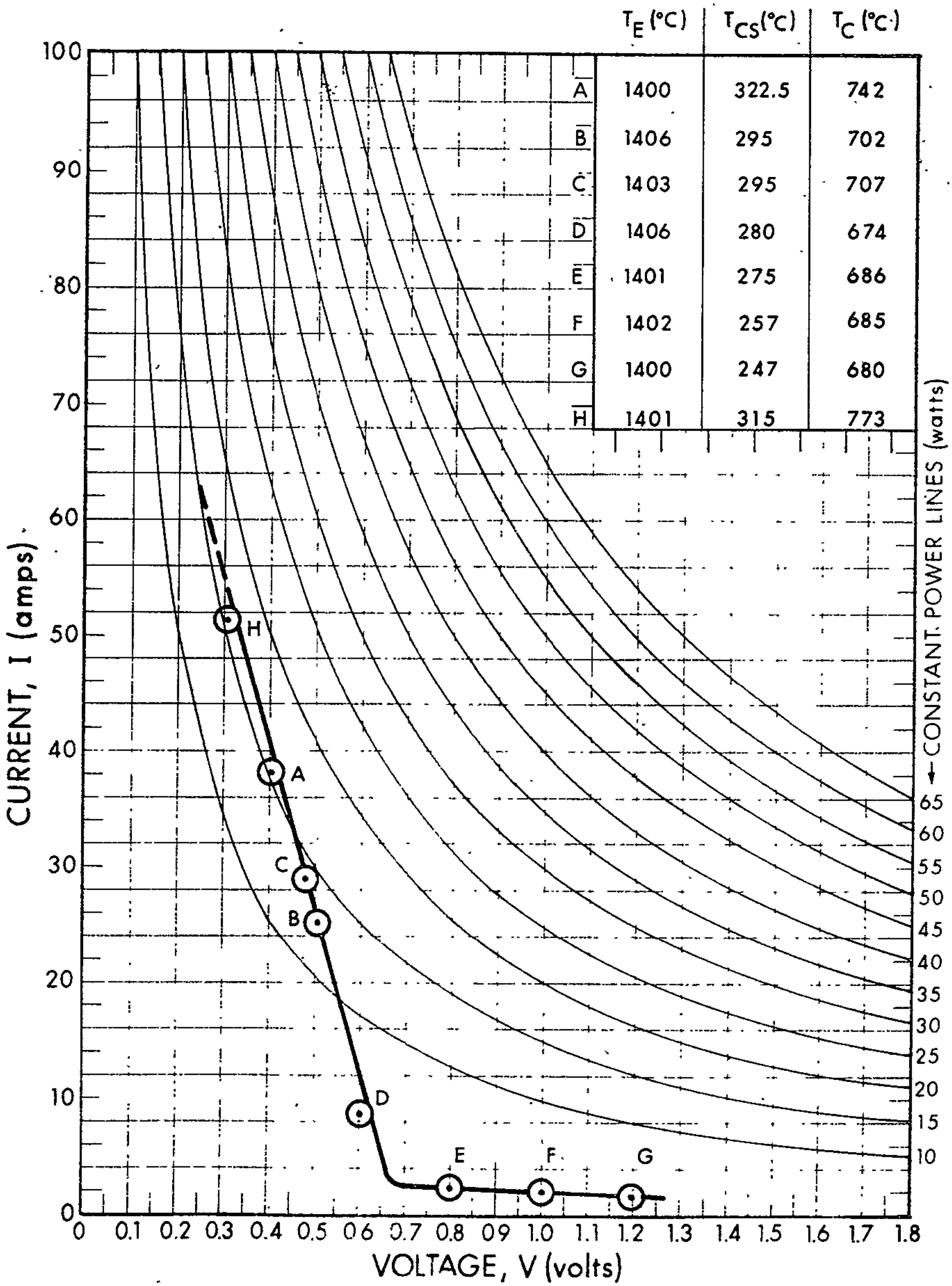
Figure 5-4 is the optimum performance plot taken at 1500°C (100°C above the design emitter temperature). At 0.4V the current was 50A, giving a power density of 5.55 W/cm^2. At 0.6V the current was 28.5A, yielding a power density of 4.75 W/cm^2. At 0.7V the current from the plot is 18.0A, giving a power density of 3.5 W/cm^2.

Figure 5-5 is the optimum performance plot taken at 1440°C. At 0.5V the current was 35.5A, giving a power density of 4.94 W/cm^2. At 0.7V the current was 11.5A, for a power density of 2.24 W/cm^2.

Figure 5-6 is a performance composite of SC-4.

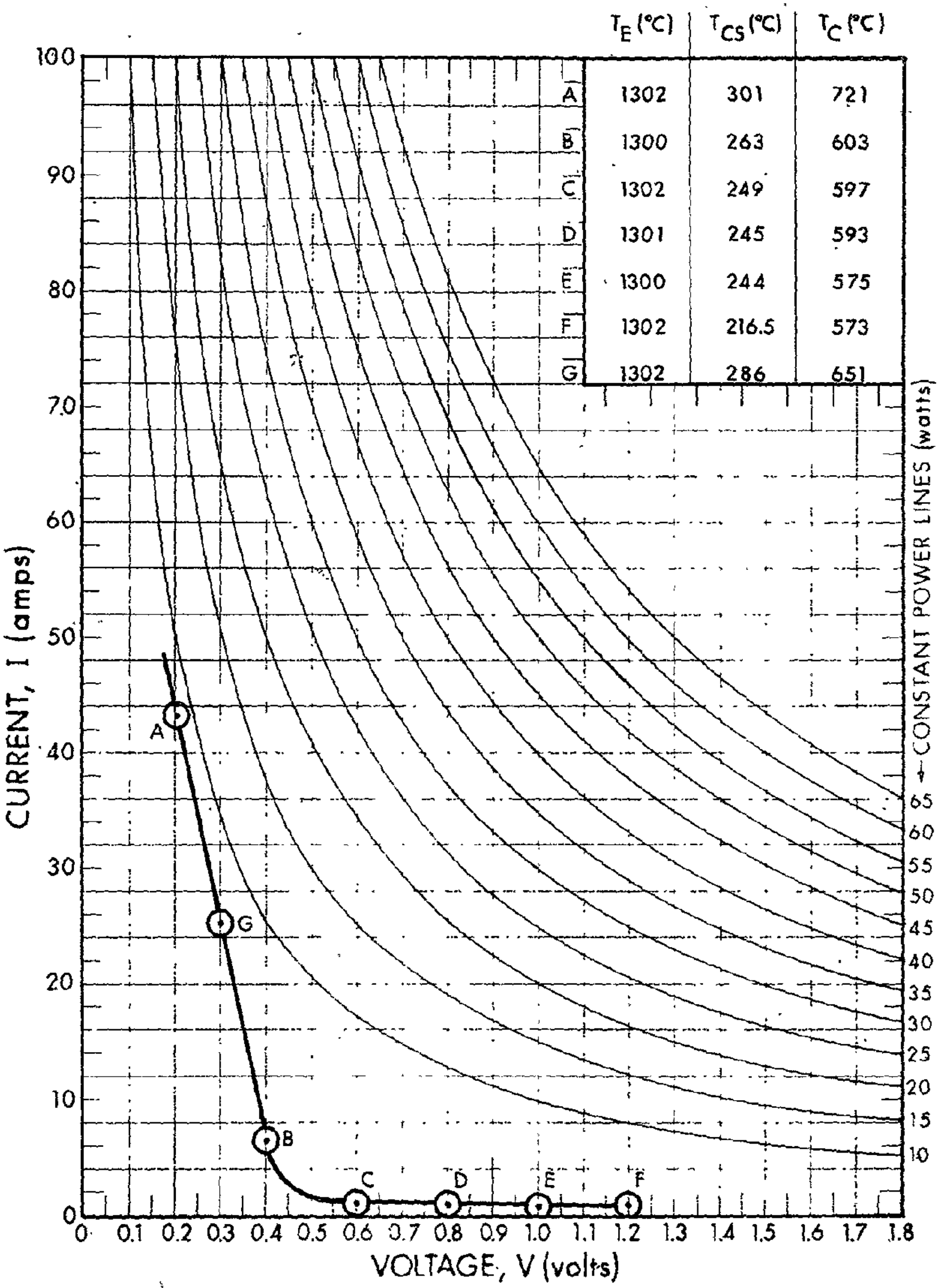
Figure 5-7 is a composite plot comparing the performance of the four final converter designs.

The data sheets and I-V characteristics are presented in Appendix 5.



36740

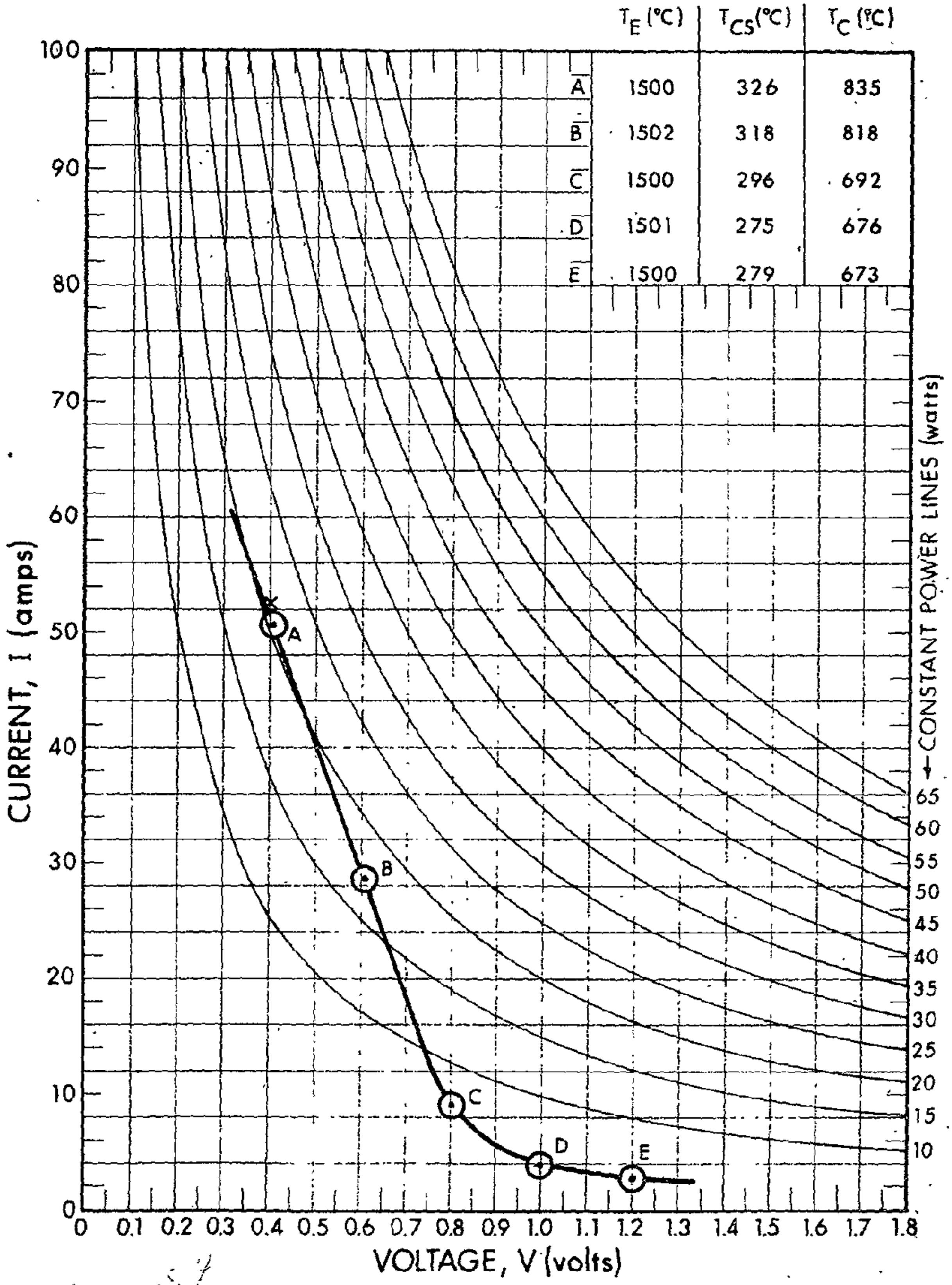
Figure 5-2. Performance Plot of SC-4 Taken at the Design Emitter Temperature of 1400°C



	T_E (°C)	T_{CS} (°C)	T_C (°C)
A	1302	301	721
B	1300	263	603
C	1302	249	597
D	1301	245	593
E	1300	244	575
F	1302	216.5	573
G	1302	286	651

36741

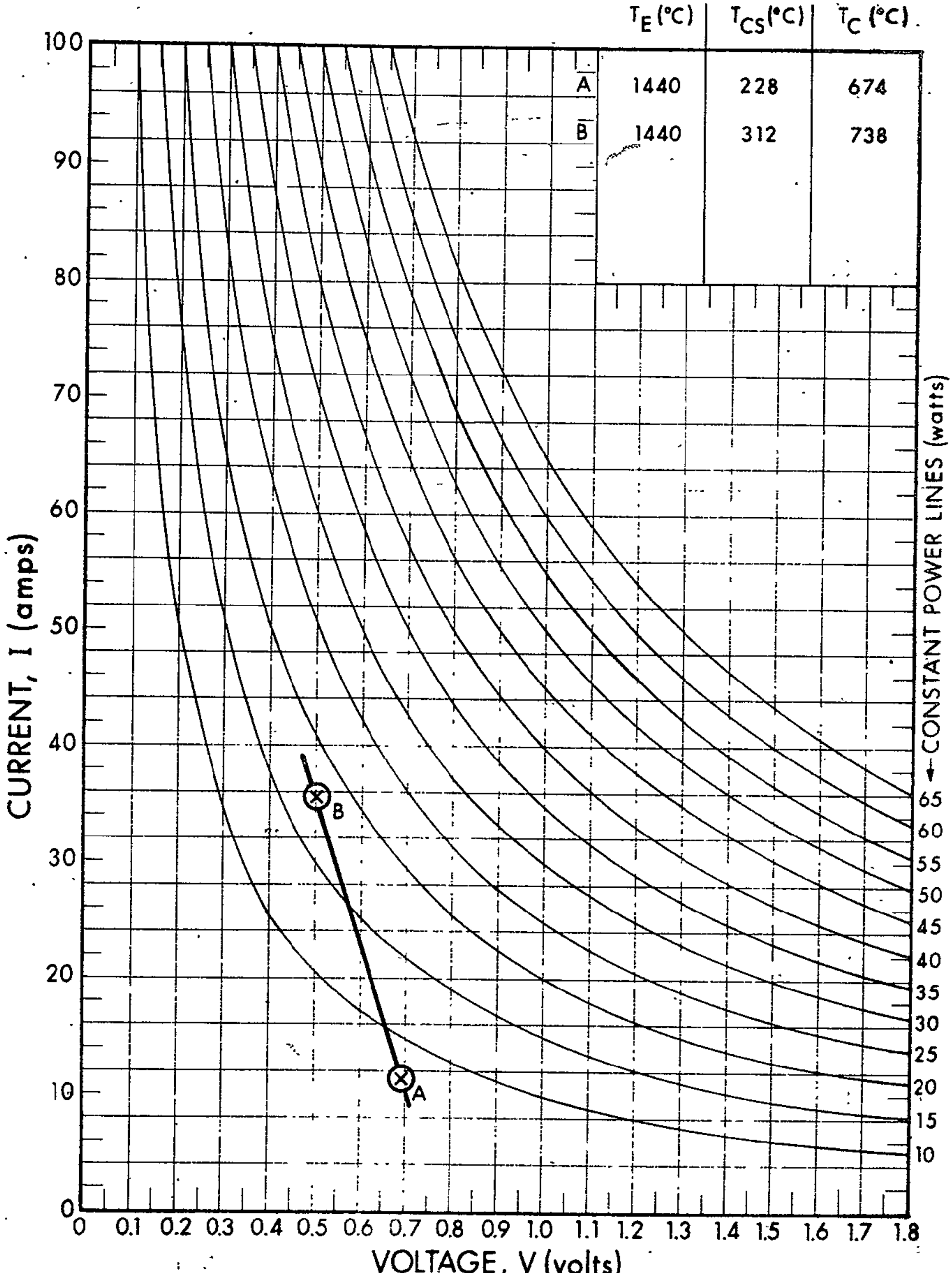
Figure 5-3. Performance Plot of SC-4 Taken at an Emitter Temperature of 1300° C



	T_E (°C)	T_{CS} (°C)	T_C (°C)
A	1500	326	835
B	1502	318	818
C	1500	296	692
D	1501	275	676
E	1500	279	673

36742

Figure 5-4. Performance Plot of SC-4 Taken at an Emitter Temperature of 1500°C



36743

Figure 5-5. Performance Plot of SC-4 Taken at an Emitter Temperature of 1440°C

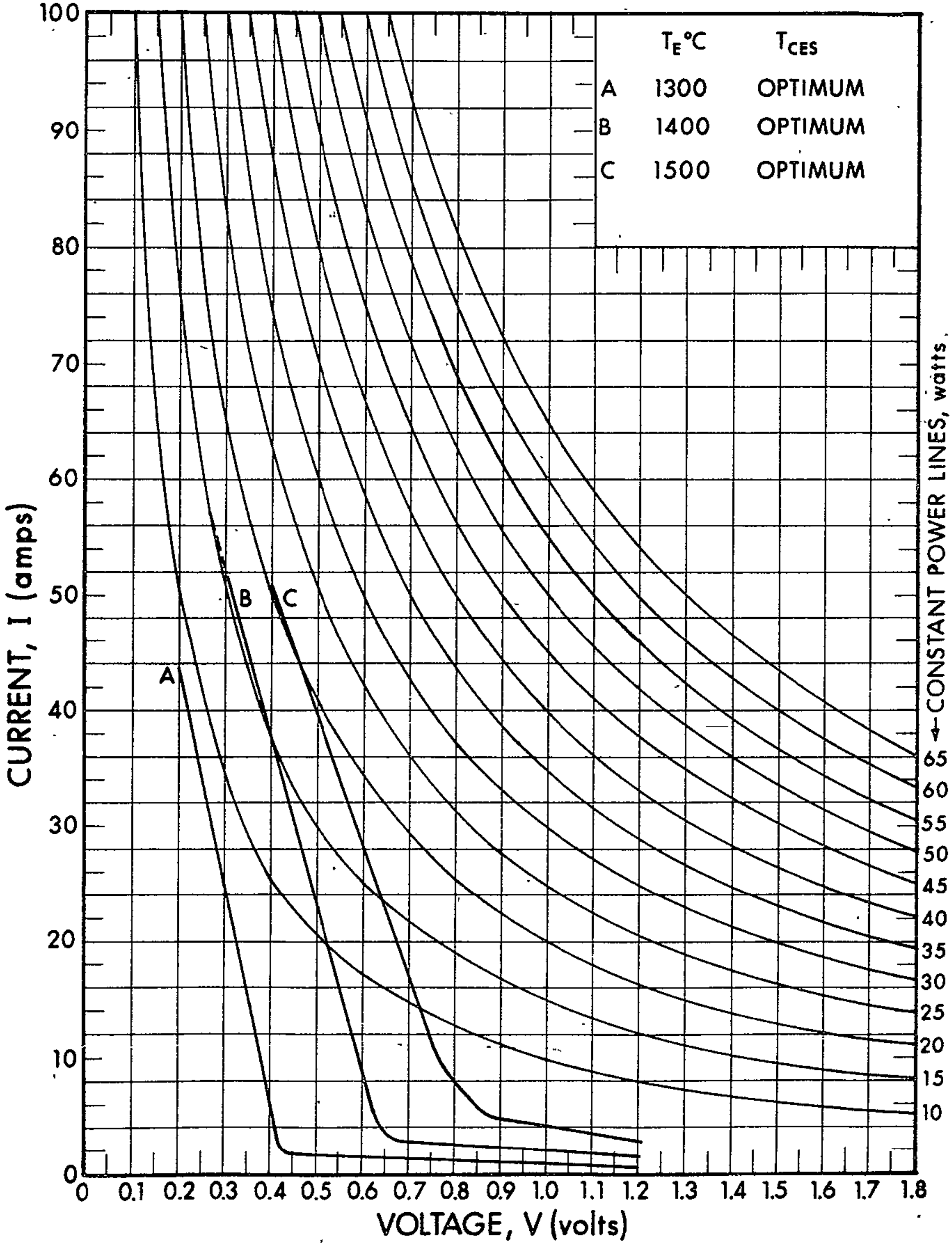


Figure 5-6. Performance Composite of SC-4 Taken at Specified Temperatures

38416

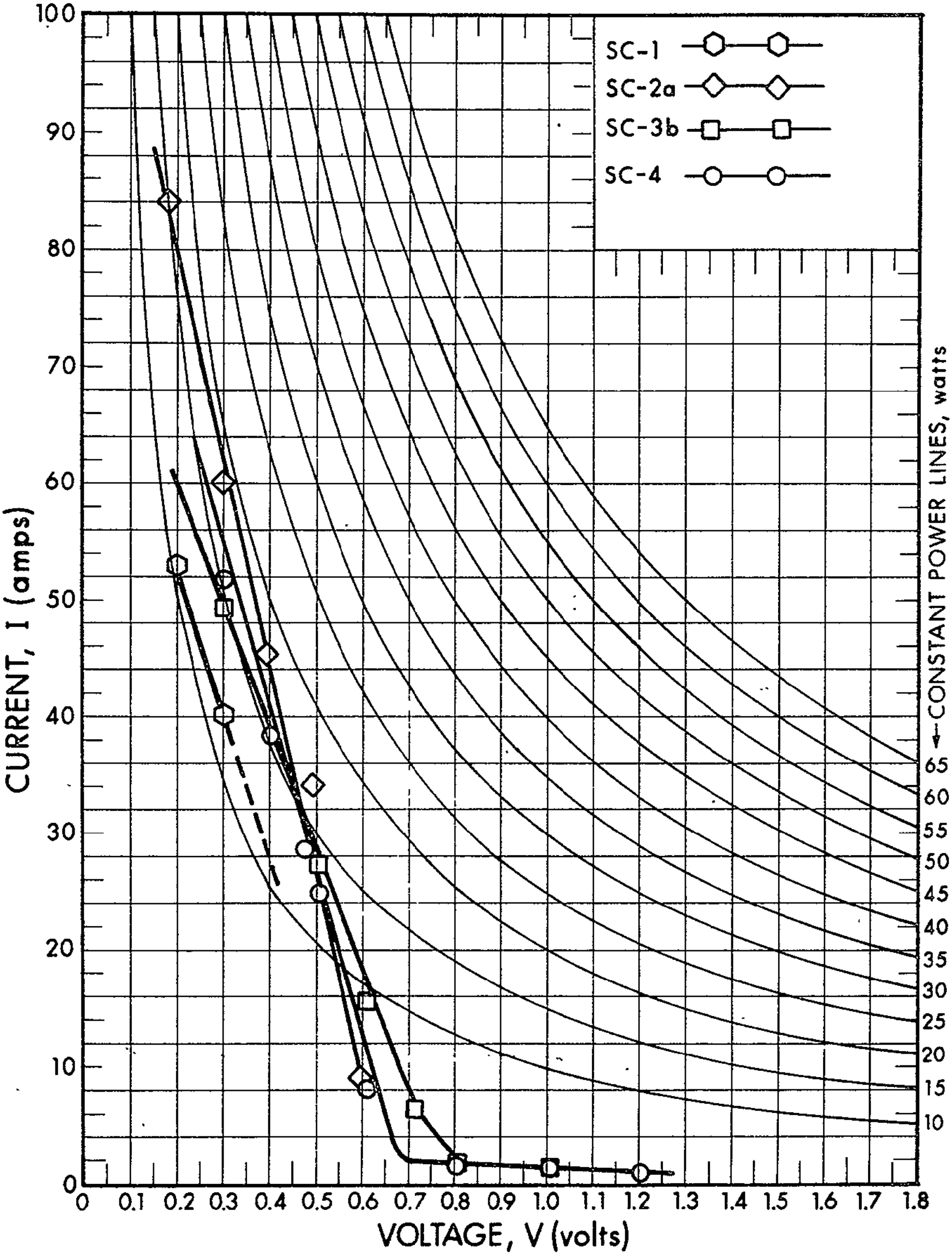


Figure 5-7. A Composite Performance Plot of the Four Final Converter Designs, Taken at 1400°C Emitter with Cesium Optimum

38418

SECTION 6

CONCLUSIONS AND RECOMMENDATIONS

The measured output performance, exemplifying the finished product of this work, was 96.5 percent of the performance goals. Within the framework of these program goals, the converter physical size was minimized and the performance and structure were optimized. New technology in the form of conical and convoluted rhenium emitter envelope structures was developed, along with the split ring ceramic for the envelope-collector and the conical collector.

During the development of SC-1 and SC-2a and SC-2b, all the problems mentioned during this program were solved. Converters SC-3b and SC-4 were fabricated and tested providing the successful conclusion of the program.

The performance of these converters has been established during this program. It is recommended that this design be incorporated into a generator in order to evaluate the performance in a simulated multiple converter configuration. Other developmental considerations such as emitter and collector heat pipes must be pursued in order to achieve the ultimate thermionic conversion generation system.

APPENDIX 1

CHEMICAL CLEANING PROCEDURES

APPENDIX 1

CHEMICAL CLEANING PROCEDURES

1.1 RHENIUM

a. General oakite procedure
b. Place in hydrochloric acid and boil for 15 minutes
c. Rinse with distilled water
d. Rinse in two boiling baths of distilled water
e. Ultrasonic in alcohol for 30 seconds
f. Hot air dry
g. Wrap in lint free, sulpher free paper
h. Store in a plastic bag

1.2 OAKITE

1 - part powdered oakite
8 - parts distilled H_2O

Stir and partially dissolve oakite in cold water, then heat to $80^{\circ}C$ and use at that temperature. Place parts in oakite.

1.3 MOLYBDENUM

a. Oakite cleaning procedure
b. Place in hydrochloric acid and boil for 15 minutes
c. Rinse with distilled water
d. Rinse in two boiling baths of distilled water
e. Ultrasonic in alcohol for 30 seconds

f. Hot air dry

g. Wrap in lint free, sulpher free paper

h. Store in a plastic bag

1.4 TANTALUM

a. General oakite cleaning procedure

b. Place in hydrochloric acid and boil for 15 minutes

c. Rinse with distilled water

d. Rinse in two baths of boiling distilled water

e. Ultrasonic in alcohol for 30 seconds

f. Hot air dry

g. Wrap in lint free, sulpher free paper

h. Store in a plastic bag

1.5 NIOBIUM

a. Oakite cleaning procedure

b. Place in cold niobium dip for two minutes

c. Rinse with distilled water

d. Rinse in two boiling baths of distilled water

e. Ultrasonic in alcohol for 30 seconds

f. Hot air dry

g. Wrap in lint free, sulpher free paper

h. Store in a plastic bag

1.6 OAKITE

a. Heat oakite solution to 80°C

b. Heat two rinse baths of distilled water

c. Soak parts in hot oakite for 15 minutes (during the soak the oakite should be cooling in air; i.e., no fire under beaker)

d. Rinse parts in hot tap water until sudsing ceases

e. Rinse in distilled water

f. Boil in distilled water rinse baths

g. Ultrasonic in alcohol (30 seconds)

h. Dry with hot air gun

i. Wrap in lint free, sulpher free paper

j. Store in a plastic bag until ready for use

1.7 NIOBIUM DIP

400 ml acetic acid

1000 ml sulfuric acid

100 ml hydrochloric acid

Combine sulfuric acid to acetic very slowly (creates a lot of heat). Allow to cool, then very slowly add hydrochloric acid.

APPENDIX 2

CONVERTER SC-1

BRAZING/FIRING SCHEDULE

DATE: 9-5-68

PART DESCRIPTION: Nb Converter Flanges

BRAZE TYPE: Outgas Flanges at 1400°C Observed 10 Minutes

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0941							9×10^{-7}	9	RF On
	0946							1.5×10^{-5}	9	
	0948							5×10^{-6}	10	
	0950	950°	PYROMETER					2×10^{-6}	11	
	0953	1070						8×10^{-7}	12	
	0955	1230						8×10^{-7}	13	
	1001	1350						5×10^{-7}	14	
X	1002	1410						9×10^{-7}	14	
	1006	1450						7.5×10^{-7}	14	
X	1012	1430						7×10^{-7}	11½	
	1017									RF Off

EOS FORM NO. 896 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 1-23-69

PART DESCRIPTION: Mo Fixture for Lead Straps

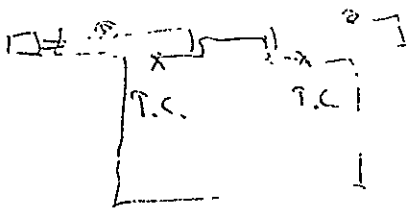
BRAZE TYPE: Outgas

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1536	ROOM						4×10^{-7}	9	RF On
	1539							6×10^{-7}	10	
	1542		5.46					3.2×10^{-7}	11	
	1545		9.46					2.5×10^{-7}	12	
	1549		15.62					3×10^{-7}	13	
	1551		19.22					3×10^{-7}	14	
	1553½		23.07					3.4×10^{-7}	15	
	1556		25.52					5.4×10^{-7}	16	
	1559½		27.44					1×10^{-6}	17	
	1603		28.54					1×10^{-6}	17½	
	1605		28.90					1×10^{-6}	18	
X	1607		29.32						18½	
	1608		29.60					1.6×10^{-6}	18½	
	1609		29.67					1.6×10^{-6}	18¾	
	1610		29.67						18¾	
	1611		29.75						18¾	
X	1612		29.82						16	
	1615		26.50						13	
	1618		22.50						10	
	1620									RF Off

BRAZING/FIRING SCHEDULE



29.0 - 29.3   1.5 min

DATE: 12-16-68

PART DESCRIPTION: 4 cm^2 Collector (Heater Wire and R&S Add)

BRAZE TYPE: Ti

WA NO. Conv

OPERATOR: PH

	TIME	TEMP.°C No. 1	mV 1 Outside	TEMP.°C No. 2	mV 2 Inside	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1441		0.44		0.41			1.5×10^{-6}	8	
	1445		3.4		1.6			2.3×10^{-5}	9	
	1448		9.0		5.5			8.4×10^{-5}	8	
	1454		10.0		6.6			8.4×10^{-5}	9	
	1459		12.5		9.1			9.7×10^{-5}	10	
	1502		15.2		12.3			2.8×10^{-5}	11	
	1505		18.1		16.3			1.8×10^{-5}	12	
	1509		22.5		21.6			8.0×10^{-6}	13	
	1512		25.7		25.4			1.1×10^{-5}	14	
	1514		27.3		27.3			1.6×10^{-5}	14½	
	1516		28.3		28.4			3.2×10^{-5}	15	
	1517		29.0		29.1			5.0×10^{-5}	15½	
	1518^{30}		29.5		29.7			3.0×10^{-5}	15½-14	
	1524									Off

BRAZING/FIRING SCHEDULE

DATE: 12-17-68

PART DESCRIPTION: 4 cm^2 (Rebraze) Heater Wire/Res. DDA

BRAZE TYPE: Ti

WA NO. Conv

29.0 - 29.7 1.5 min

OPERATOR: PH

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1514							1.0×10^{-6}	8	On
	1517		2.5		1.4			8.6×10^{-6}	9	
	1520		7.0		4.3			1.2×10^{-5}	10	
	1523		12.4		9.3			5.6×10^{-6}	11	
	1526		16.9		14.8			4.0×10^{-6}	12	
	1529		21.1		18.8			5.4×10^{-6}	13	
	1532		25.0		24.3			1.0×10^{-5}	14	
	1534		27.3		27.0			1.2×10^{-5}	14½	
	1536		28.2		28.1			1.3×10^{-5}	15	
	1537		29.1		29.0			1.1×10^{-5}	15X	
	1538½		29.7		29.7			1.0×10^{-5}	15X	
	1544									Off

BRAZING/FIRING SCHEDULE

DATE: 1-24-69

PART DESCRIPTION: Lead Strap - Nb - Re

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1451	ROOM						2×10^{-7}	9	RF On
	1454							1×10^{-6}	10	
	1457		3.92					1×10^{-6}	11	
	1500		8.30					1×10^{-6}	12	
	1504		14.80					5×10^{-7}	13	
	1508		20.30					4×10^{-7}	14	
	1511		23.47					4.6×10^{-7}	15	
	1514		25.70					7.3×10^{-7}	16	
	1518		27.42					1.2×10^{-6}	17	
	1521		28.64					2×10^{-6}	17½	
X	1522¼		29.00					2.4×10^{-6}	17½	
	1523¼		29.14					2.4×10^{-6}	17½	
X	1523¾		29.18						14	
	1525		27.81						13	
	1526		26.28						12	
	1528		23.60						11	
	1529		22.55						10	
	1530		21.39						9	
	1531		20.10						7	RF
	1532		18.88							Off

BRAZING/FIRING SCHEDULE

DATE: 1-24-69

PART DESCRIPTION: Lead Strap (Nb to Re)

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0940	ROOM						1×10^{-7}	9	RF On
	0943		0.84					6×10^{-7}	10	
	0946		3.36					6×10^{-7}	11	
	0950		8.36					6×10^{-7}	12	
	0954½		15.22					4×10^{-7}	13	
	0958		20.17					3.6×10^{-7}	14	
	1001		23.60					4×10^{-7}	15	
	1004		25.80					5.6×10^{-7}	16	
	1007½		27.44					9.2×10^{-7}	17	
	1010½		28.38					1.4×10^{-6}	17½	
	1012		28.78					1.4×10^{-6}	18	
X	1012½		28.96						18	
	1013		29.04						17½	
	1013½		29.14							
X	1014		29.10						14½	
	1015		27.70						14	
	1016		26.40						13	
	1017		25.08						12	
	1019		22.70						11	
	1020		21.84						10	
	1021		20.64						9	
	1023		18.87							RF Off

BRAZING/FIRING SCHEDULE

DATE: 2/6/69

PART DESCRIPTION: 4 cm^2 Converter Final

~~BRAZE TYPE~~: degas, C_s loading and T/C calibration

WA NO.

OPERATOR: Dave Pyle

Anode to Cathode resistance 5.5 kΩ

Bottom hole emitter pyro obs.

TIME		TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
		Emitter PT/PT Rh	(TOP)	Emitter PT/PT 10% Rh		Loading Tee		Int. / Ext.		
				(BOTTOM)						
2036								1×10^{-7}		
								2×10^{-7}		Filament on
	Fil. shorted to it's own turns									
	Installed new fil. 2/7/69									
1413								8×10^{-9}		
								1×10^{-7}		Fil. and bomb
1430	Gun holder starting to short									on
	power off									
1630	Mounted Al_2O_3 board across back of gun									Fil. on
										bomb on
1645	1240°C	1229°C	12.28	1245°C	12.47	Gun looks OK				
B.J.C.	10							2×10^{-7}		
	1250°C							1×10^{-7}		
1650	Reducing power									
1700	Power off									

BRAZING/FIRING SCHEDULE

DATE: 2/8/69

PART DESCRIPTION: 4 cm^2 Converter

~~BRAZE TYPE~~: T/C Calibration degas and C_s Loading

WA NO.

OPERATOR: Pyle

TIME	Hole Obs. Pyro Top	Hole Obs. Pyro Bottom	T/C Emitt Top TEMP.°C No. 1	mV 1	T/C Emitt Bottom TEMP.°C No. 2	mV 2	Loading Tee TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
									Int. / Ext.		
0750									5 x 10^{-9}		Fil. & bomb on
									1 x 10^{-7}		
0820		990°C	889°C	8.31	895°C	8.38			1.8 x 10^{-8}		
									1.8 x 10^{-7}		
0830		1140°C	1111°C	10.87	1128°C	11.07			1.5 x 10^{-7}		
									4 x 10^{-7}		
0839		1312°C	1275	12.83	1307	13.22			7 x 10^{-7}		Emitt surface temp.
									7 x 10^{-7}		Top 1290°C, Bottom 1330°C
		Seals and collector running about 700°C at this point.									
0859		1400°C	1358°C	13.83	1403°C	14.37		2.72	1.5 x 10^{-6}		Emitt surface; top
									6 x 10^{-7}		1352°C, bottom 1395°C
0912		1400°C						2.75	8 x 10^{-7}		Surface; top 1355°C,
									5 x 10^{-7}		bottom 1390°C
		Tee heater on, power in at 1400°C emitter									
		Fil. 13.0V x 14.5 A bomb 310V x 485 mA									Surface temp; top
3924		1400°C						8.03			1350°C, bottom 1400°C
0938		1395	1357	13.82	1385	14.15	289°C	11.75	1.0 A input to tee heater		
									1.5 x 10^{-6}		
									4 x 10^{-7}		
1027	1375°C	1400°C	1363°C	13.89	1395	14.28	285°C	11.60	5 x 10^{-7}		Surface; top 1350°C,
									8 x 10^{-7}		bottom 1400°C
1117		1400°C					285	11.60	4.5 x 10^{-7}		
									2.5 x 10^{-7}		
1150		1395°C					284	11.55	4.0 x 10^{-7}		
									2.2 x 10^{-7}		
1245		1395°C					284	11.56	3.0 x 10^{-7}		
									2 x 10^{-7}		

BRAZING/FIRING SCHEDULE

DATE: 2/8/69

PART DESCRIPTION: 4 cm^2 Converter

BRAZE TYPE: T/C calibration degrees and C_s loading

WA NO.

OPERATOR: Pyle

TIME	Hole Obs. Pyro Top	Hole Obs. Pyro Bottom TIME	T/C Emitt Top TEMP.°C No. 1	mV 1	T/C Emitt Bottom TEMP.°C No. 2	mV 2	Loading Tee TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
1330		1400°C					286	11.63	2.0×10^{-7} /		
									2.0×10^{-7}		
1352		1400°C					285°C	11.60	1.8×10^{-7} /		
									2.0×10^{-7}		
		Internal pressure on log scale reads 1.8×10^{7} torr current scale reads 85 μA									
		≈ 1.2×10^{-7} torr using current vs pump pressure graph									
		Reducing power input									
1403		All power off									
1420		Device @ 200°C internal pressure, on current scale 37 μA, vented jar to 10" Hg									
		of Argon with no increase in internal pressure.									

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

1221 = 300°C for 1 hr

DATE: 2/10/69

PART DESCRIPTION: 4 cm^2 Converter

~~BRAZE TYPE~~: Cs loading

WA NO.

OPERATOR:

TEE

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	Vented jar checked resistance anode to cathode, it was 1.4 kΩ									
	1420									1A input
	1435	300°C	12.21					2×10^{-7}		to tee heater
	1500	300	12.21					6×10^{-8}		0.6A input
	1517	300	12.21					7.0×10^{-8}		0.6A input
	1530	296	12.10					5.0×10^{-8}		0.6A input
	1545								Power off	
	1630	Vented jar and removed converter, pinched off loading tee.								Opened
	.	loading tee no Cs inside, looks clean. Resistance anode to cathode 0Ω								

BRAZING/FIRING SCHEDULE

DATE: 1-23-69

PART DESCRIPTION: Conv Seal Test 4 cm^2

BRAZE TYPE: Test

WA NO. 4018-001-001

OPERATOR: PH

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0939	JIG-BOTTOM		JIG-TOP				5.0×10^{-7}	14	On
B-03	0942	53	0.32	50	0.30			1.2×10^{-6}	16	
T-02	0945	86	0.54	88	0.56			2.6×10^{-6}	18	
T-13	0948	124	0.82	137	0.92			2.4×10^{-6}	20	
T-27	0951	164	1.14	191	1.36			2.4×10^{-6}	22	
T-41	0954	219	1.60	260	1.96			3.2×10^{-6}	24	
T-67	0957	296	2.28	363	2.90			5.4×10^{-6}	26	
T-96	1000	393	3.18	490	4.12			4.2×10^{-6}	28	
T-119	1003	514	4.36	633	5.56			8.4×10^{-6}	30	
			GOING DOWN							

BRAZING/FIRING SCHEDULE

DATE: 1-23-69

PART DESCRIPTION: Mo Fixture for Lead Straps

BRAZE TYPE: Outgas

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1536	ROOM						4×10^{-7}	9	RF On
	1539							6×10^{-7}	10	
	1542		5.46					3.2×10^{-7}	11	
	1545		9.46					2.5×10^{-7}	12	
	1549		15.62					3×10^{-7}	13	
	1551		19.22					3×10^{-7}	14	
	1553½		23.67					3.4×10^{-7}	15	
	1556		25.52					5.4×10^{-7}	16	
	1559½		27.44					1×10^{-6}	17	
	1603		28.54					1×10^{-6}	17½	
	1605		28.90					1×10^{-6}	18	
X	1607		29.32						18½	
	1608		29.60					1.6×10^{-6}	18½	
	1609		29.67					1.6×10^{-6}	18¾	
	1610		29.67						18¾	
	1611		29.75						18¾	
X	1612		29.82						16	
	1615		26.50						13	
	1618		22.50						10	
	1620									RF Off

BRAZING/FIRING SCHEDULE

DATE: 1-24-69

PART DESCRIPTION: Lead Strap (Nb to Re)

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0940	ROOM						1×10^{-7}	9	RF On
	0943		0.84					6×10^{-7}	10	
	0946		3.36					6×10^{-7}	11	
	0950		8.36					6×10^{-7}	12	
	0954½		15.22					4×10^{-7}	13	
	0958		20.17					3.6×10^{-7}	14	
	1001		23.60					4×10^{-7}	15	
	1004		25.80					5.6×10^{-7}	16	
	1007½		27.44					9.2×10^{-7}	17	
	1010½		28.38					1.4×10^{-6}	17½	
	1012		28.78					1.4×10^{-6}	18	
X	1012½		28.96						18	
	1013		29.04						17½	
	1013½		29.14							
X	1014		29.10						14½	
	1015		27.70						14	
	1016		26.40						13	
	1017		25.08						12	
	1019		22.70						11	
	1020		21.84						10	
	1021		20.64						9	
	1023		18.87							RF Off

BRAZING/FIRING SCHEDULE

DATE: 1-24-69

PART DESCRIPTION: Lead Strap - Nb - Re

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1451	ROOM						2×10^{-7}	9	RF On
	1454							1×10^{-6}	10	
	1457		3.92					1×10^{-6}	11	
	1500		8.30					1×10^{-6}	12	
	1504		14.80					5×10^{-7}	13	
	1508		20.30					4×10^{-7}	14	
	1511		23.47					4.6×10^{-7}	15	
	1514		25.70					7.3×10^{-7}	16	
	1518		27.42					1.2×10^{-6}	17	
	1521		28.64					2×10^{-6}	17½	
X	1522¼		29.00					2.4×10^{-6}	17½	
	1523¼		29.14					2.4×10^{-6}	17½	
X	1523¾		29.18						14	
	1525		27.81						13	
	1526		26.28						12	
	1528		23.60						11	
	1529		22.55						10	
	1530		21.39						9	
	1531		20.10						7	RF
	1532		18.88							Off

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

Station 1 Coil 8"

Grid 75

Tap 6

14.8 mV - 5 min

DATE: 1/30/69

PART DESCRIPTION: 4 cm^2 Converter

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: PH

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1405		Bottom		Top			1.6×10^{-6}	14	RF on
B - 13	1408	131	0.88	118	0.78			1.2×10^{-6}	16	
B - 19	1411	188	1.34	169	1.18			1.4×10^{-6}	18	
B - 17	1414	233	1.72	216	1.57			2.0×10^{-6}	20	
B - 14	1417	265	2.00	251	1.88			2.3×10^{-6}	22	
B - 10	1420	324	2.59	314	2.44			3.2×10^{-6}	24	
B - 09	1423	378	3.09	369	2.96			4.0×10^{-6}	26	
B - 16	1426	451	3.74	436	3.59			4.2×10^{-6}	28	
B - 06	1429	540	4.62	534	4.56			4.6×10^{-6}	30	
T - 11	1433	717	6.44	728	6.56			2.3×10^{-6}	32	
T - 22	1437	843	7.80	865	8.04			2.9×10^{-6}	34	
T - 35	1441	1073	10.42	1108	10.84			2.5×10^{-6}	36	
T - 26	1443	1197	11.9	1223	12.21			3.8×10^{-6}	38	
T - 16	1445	1339	13.6	1355	13.8			1.0×10^{-6}	40+	
T - 17	1446	1422	14.6	1439	14.8			5.0×10^{-6}	37	Braze
T - 07	1448	1447	14.99	1454	14.98			4.0×10^{-6}	35½	
	1451	1442	14.84	1449	14.84			2.6×10^{-6}	36-30	
	1452								28	
	1502									off

OS FORM-NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

Station 1 Coil 8"

Grid 75

Tap 6

14.8 mV - 5 min

DATE: 1/30/69

PART DESCRIPTION: 4 cm^2 Seal (Conv) cyl

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: PH

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0902		Bottom		Top			9.0×10^{-7}	14	RF on
T - 11	0905	97	0.62	108	0.70			1.0×10^{-6}	16	
T - 06	0908	157	1.08	163	1.13			1.1×10^{-6}	18	
-0-	0911	208	1.50	208	1.50			1.4×10^{-6}	20	
B - 07	0914	249	1.86	242	1.80			2.2×10^{-6}	22	
B - 11	0917	314	2.44	303	2.34			2.2×10^{-6}	24	
B - 13	0920	384	3.10	371	2.98			2.4×10^{-6}	26	
B - 10	0923	457	3.50	447	3.70			2.4×10^{-6}	28	
T - 02	0926	546	4.68	548	4.70			2.2×10^{-6}	30	
T - 21	0929	637	5.60	658	5.82			2.9×10^{-6}	32	
T - 34	0932	788	7.20	822	7.57			3.4×10^{-6}	34	
T - 50	0935	953	9.03	1003	9.60			3.0×10^{-6}	36	
T - 45	0938	1122	11.00	1167	11.54			4.2×10^{-6}	38	
T - 23	0941	1347	13.7	1370	13.98			8.5×10^{-6}	41	
T - 21	0942	1414	14.5	1435	14.75			4.6×10^{-6}	37	Braze
T - 06	0944	1444	14.86	1450	14.94			2.4×10^{-6}	35½	
-0-	0947	1445	14.88	1445	14.88			2.0×10^{-6}	35-30	
	0948								28	
	0958								off	

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

SHEET NO. 1062
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO. Collector Flange — ASSEMBLY NO. ____

— WELDED TO — — ASSEMBLY NAME ____

ITEM NO. Collector — SERIAL NO./S Collector-Flange

FILLER METAL ____ — G.W.R. NO. 1-4 cm

W.A. NO. 4018-001-001 — M.O. NO. ____

DATE 2/3/69 — SHOP TRAVELER NO. ____

REQUESTER P. Hora — PHONE 2878 — PLANNER J. Tallaksen

OPERATOR J. Frey — OBSERVER P. Hora

E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER 308-1

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS			COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	7	(Inches)					
FILAMENT CURRENT	1.75	(Amps)					
ACCELERATING VOLTAGE	120	(kV)					
BEAM CURRENT	3.0	(mA)					
BEAM SPOT DIAMETER	ACTUAL 0.008 VIEWER 5	(10^{-3} Inches) (Increments)					
BEAM FOCUS	511	(Dial)					
D.C. DEFLECTION	YES X NO						
A.C. DEFLECTION	X Y						
CIRCLE GENERATION	YES NO						
CIRCLE O.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
CIRCLE I.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
LINEAR SPEED OR R.P.M.	10						
SPEED INDICATOR	60	(Dial)					
TIMER	off	(Seconds)					
SLOPE CONTROL	RISE FALL 60%	(Percent) (Percent)					
PULSER SETTINGS	WIDTH FREQ.	(Milli Sec.) CPS					
VACUUM	5×10^{-5}	(mm of Hg)					

REMARKS
Butt weld Nb to Nb 0.020 flange 2.250 dia

EOS FORM NO. 866 (11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

(PIERCE)

SHEET NO. 1063
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO. Emitter Flange — ASSEMBLY NO. ____

— WELDED TO —

ASSEMBLY NAME Cyl. Converter

ITEM NO. Emitter Lead Strap — SERIAL NO./S: 1-4 cm

FILLER METAL ____ — G.W.R. NO. ____

W.A. NO. 4018-001-001 — M.O. NO. ____

DATE 2/3/69 — SHOP TRAVELER NO. ____

REQUESTER P. Hora — PHONE 2878 — PLANNER J. Tallaksen

OPERATOR J. Frey — OBSERVER P. Hora

E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER 308-2

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS		COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	7 (Inches)		7"			7"
FILAMENT CURRENT	1.75 (Amps)		1.75			1.75
ACCELERATING VOLTAGE	150 (kV)		150			150
BEAM CURRENT	2.5 (mA)		3.7			3.7
BEAM SPOT DIAMETER	ACTUAL min (10^{-3} Inches) VIEWER ____ (Increments)		min			min
BEAM FOCUS	558 (Dial)		553			553
D.C. DEFLECTION	YES X NO ____					
A.C. DEFLECTION	X ____ Y ____					
CIRCLE GENERATION	YES ____ NO ____					
CIRCLE O.D.	ACTUAL ____ (10^{-3} Inches) VIEWER ____ (Increments)					
CIRCLE I.D.	ACTUAL ____ (10^{-3} Inches) VIEWER ____ (Increments)					
LINEAR SPEED OR R.P.M.	25		23			23
SPEED INDICATOR	130 (Dial)		120			120
TIMER	2.3 (Seconds)		2.6			2.6
SLOPE CONTROL	RISE ____ (Percent) FALL 60% (Percent)		60%			60%
PULSER SETTINGS	WIDTH ____ (Milli Sec.) FREQ. ____ CPS					
VACUUM	8×10^{-5} (mm of Hg)					8×10^{-5}

REMARKS Pierce weld 0.030 from edge around 1.650 dia thru 0.020 thick flange
(Nb to Nb)

EOS FORM NO. 866 (11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

SHEET NO. 1064
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO. Heat Choke (Re) ASSEMBLY NO. ____

— WELDED TO — ASSEMBLY NAME Cyl. Converter

ITEM NO. Emitter SERIAL NO./S 1-4 cm

FILLER METAL ____ G.W.R. NO. ____

W.A. NO. 4018-001-001 M.O. NO. ____

DATE 2/3/69 SHOP TRAVELER NO. ____

REQUESTER P. Hora PHONE 2878 PLANNER J. Tallaksen

OPERATOR J. Frey OBSERVER P. Hora

E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER 284-1-4 cm

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS			COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	7	(Inches)			7"		
FILAMENT CURRENT	1.75	(Amps)			1.75		
ACCELERATING VOLTAGE	130	(kV)	No Good	140	140		
BEAM CURRENT	2.0	(mA)		2.5	4.0		
BEAM SPOT DIAMETER	ACTUAL min	(10^{-3} Inches)			0.010		
	VIEWER	(Increments)			15		
BEAM FOCUS		(Dial)			549		
D.C. DEFLECTION	YES X				Fillet		
	NO						
A.C. DEFLECTION	X						
	Y						
CIRCLE GENERATION	YES						
	NO						
CIRCLE O.D.	ACTUAL	(10^{-3} Inches)					
	VIEWER	(Increments)					
CIRCLE I.D.	ACTUAL	(10^{-3} Inches)					
	VIEWER	(Increments)					
LINEAR SPEED OR R.P.M.	40				30		
SPEED INDICATOR	200	(Dial)			150		
TIMER	1.4	(Seconds)			2.1		
SLOPE CONTROL	RISE	(Percent)					
	FALL 60%	(Percent)					
PULSER SETTINGS	WIDTH	(Milli Sec.)					
	FREQ.	CPS					
VACUUM	7×10^{-5}	(mm of Hg)					

REMARKS Come straight down around i.d. of heat choke 0.725 dia
(Re to Re)

EOS FORM NO. 866 (11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

SHEET NO. 1065
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO. Collector Flange
ASSEMBLY NO. ____

— WELDED TO —
ASSEMBLY NAME Cyl. Converter

ITEM NO. Collector
SERIAL NO./S 1-4 cm

FILLER METAL ____
G.W.R. NO. ____

W.A. NO. 4018-001-001
M.O. NO. ____

DATE 2/3/69
SHOP TRAVELER NO. ____

REQUESTER P. Hora
PHONE 2878
PLANNER J. Tallaksen

OPERATOR J. Frey
OBSERVER ____

E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER 308-3

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS			COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	7	(Inches)		7"			
FILAMENT CURRENT	1.75	(Amps)		1.75			
ACCELERATING VOLTAGE	150	(kV)		1			
BEAM CURRENT	3.7	(mA)					
BEAM SPOT DIAMETER	ACTUAL min	(10^{-3} Inches)					
	VIEWER	(Increments)					
BEAM FOCUS	553	(Dial)					
D.C. DEFLECTION	YES X						
	NO						
A.C. DEFLECTION	X						
	Y						
CIRCLE GENERATION	YES						
	NO						
CIRCLE O.D.	ACTUAL	(10^{-3} Inches)					
	VIEWER	(Increments)					
CIRCLE I.D.	ACTUAL	(10^{-3} Inches)					
	VIEWER	(Increments)					
LINEAR SPEED OR R.P.M.	17						
SPEED INDICATOR	95	(Dial)					
TIMER	3.7	(Seconds)					
SLOPE CONTROL	RISE	(Percent)					
	FALL 60	(Percent)					
PULSER SETTINGS	WIDTH	(Milli Sec.)					
	FREQ.	CPS					
VACUUM	6×10^{-5}	(mm of Hg)					

REMARKS Pierce weld through 0.020 flange (Nb to Nb) 2.150 dia

EOS FORM NO. 866 (11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

BUTT

SHEET NO. 1066
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO. Plug
ASSEMBLY NO.

— WELDED TO —

ASSEMBLY NAME Cyl. Converter
ITEM NO. Collector
SERIAL NO./S 1-4 cm
FILLER METAL
G.W.R. NO.
W.A. NO. 4018-001-001
M.O. NO.
DATE 2/4/69
SHOP TRAVELER NO.
REQUESTER P. Hora
PHONE 2878
PLANNER
OPERATOR J. Frey
OBSERVER P. Hora
E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER 269-5

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS			COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	6	(Inches)					6"
FILAMENT CURRENT	1.75	(Amps)					1.75
ACCELERATING VOLTAGE	110	(kV)					110
BEAM CURRENT	5.0	(mA)					5.0
BEAM SPOT DIAMETER	ACTUAL min VIEWER	(10^{-3} Inches) (Increments)					min
BEAM FOCUS	498	(Dial)					498
D.C. DEFLECTION	YES X NO						X
A.C. DEFLECTION	X Y						
CIRCLE GENERATION	YES NO						
CIRCLE O.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
CIRCLE I.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
LINEAR SPEED OR R.P.M.	40						40
SPEED INDICATOR	200	(Dial)					200
TIMER	1.4	(Seconds)					1.4
SLOPE CONTROL	RISE FALL 60%	(Percent) (Percent)					60%
PULSER SETTINGS	WIDTH FREQ.	(Milli Sec.) CPS					
VACUUM	7×10^{-5}	(mm of Hg)					7×10^{-5}

REMARKS Butt weld to seal flange around 1/8 plug (Nb to Nb)

EOS FORM NO. 866 (11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

SHEET NO. 1067
PAGE ____ OF ____

ELECTRON BEAM WELDING RECORD

ITEM NO.	Reservoir	ASSEMBLY NO.	
— WELDED TO —		ASSEMBLY NAME	Cyl. Converter
ITEM NO.	Collector	SERIAL NO./S	1-4 cm
FILLER METAL		G.W.R. NO.	
W.A. NO.	4018-001-001	M.O. NO.	
DATE	2/4/69	SHOP TRAVELER NO.	
REQUESTER	P. Hora	PHONE	2878
PLANNER			
OPERATOR	J. Frey	OBSERVER	291-1

E/B WELD SCHEDULE DEVELOPMENT DATA SHEET NUMBER ____

ELECTRON BEAM WELDING DATA

PARAMETER SETTINGS			COMP.	REWORK	REWORK	REWORK	ACCEPT.
DISTANCE TO WORK	7	(Inches)					
FILAMENT CURRENT	1.75	(Amps)					
ACCELERATING VOLTAGE	110	(kV)					
BEAM CURRENT	2.0	(mA)					
BEAM SPOT DIAMETER	ACTUAL 0.010 VIEWER 7	(10^{-3} Inches) (Increments)					
BEAM FOCUS	525	(Dial)					
D.C. DEFLECTION	YES X NO						
A.C. DEFLECTION	X Y						
CIRCLE GENERATION	YES NO						
CIRCLE O.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
CIRCLE I.D.	ACTUAL VIEWER	(10^{-3} Inches) (Increments)					
LINEAR SPEED OR R.P.M.	40						
SPEED INDICATOR	200	(Dial)					
TIMER	1.4	(Seconds)					
SLOPE CONTROL	RISE FALL 60%	(Percent) (Percent)					
PULSER SETTINGS	WIDTH FREQ.	(Milli Sec.) CPS					
VACUUM	9×10^{-5}	(mm of Hg)					

REMARKS

Butt weld at 45° on interface between reservoir and adapter (Ta to Ta)

EOS FORM NO. 866 (11/67)

CONVERTER NO. SC 1 SHEET 1 OF 8.

DATE		2/13	2/13	2/13	2/13	2/13	2/13	2/13
TIME		1332		1426		1517		1730
PRESSURE								
10^{-6} TORR		.4	.35	5.0		3	.5	ALL
								OFF
V_b			70			325		
I_b			.210			.600		
V_f		12.0	12.0	12.0		12.3		
I_f		14.7	14.7	14.7		14.9		
T_r	°C		364.5	480	511	560.6	499	
	°C		369	499	529	580	515	
T_c	°C		388.5	515	553	635	531	
	°C		386	527	571.6	662	523	
COL.	V					10.8		
HTR.	I					7.0		
T_s	°C		431	534.5	571	635	572	
	°C							
T_{res}	°C		155.5	310	306	305	215.5	
	°C		152	301	296	296	209	
RES.	V					187		
HTR.	I					3.82		
T_e	°C		947	1091	1167	1362	1165	
	°K							
T_{1s}	°C		445	536.5	570.5	636	575	
OUTPUT								
VOLTS							1.25	
AMPS							O.C.	
WATTS								
PHOTO #								

CONVERTER NO. SC1 SHEET 2 OF 8

DATE		2/14	2/14	2/14	2/14	2/14	2/14	2/14
TIME		1000	1030	1105				1400
PRESSURE								
10^{-6} TORR								
V_b		ON						
I_b								
V_f		ON						
I_f								
T_r	°C		399	513	548	598	635	647.5
	°C		406	513	548	603	650	663.4
T_c	°C		422	567	618.5	666	723	728.5
	°C		411	590	643	675.6	733	738
COL. HTR.	V							
	I							
T_s	°C		467	588	627	658	694	702
	°C							
T_{res}	°C		206	290	294.4	342	313	331.2
	°C		201.5	281	284.5	330	302	319.5
RES. HTR.	V							
	I							
T_e	°C		946	1293	1401	1295	1390	1393
	°K							
T_{1s}	°C		473.4	547	635	653	681	691
OUTPUT								
VOLTS			.951	.017	.024	.1	.237	.249
AMPS			O.C.	O.C.	O.C.	26	49	40
WATTS						2.6	11.61	12.95
PHOTO #								

CONVERTER NO. SC 1 SHEET 3 OF 8

DATE		2/14	2/14	2/14	2/14	2/14	2/14	2/14
TIME							1500	1650
PRESSURE								
10^{-6} TORR								
V_b		315	320	320	320	320	325	325
I_b		.785	.780	.790	.790	.760	.760	.955
V_f		12.6	12.6	12.7	12.7	12.7	12.7	11.9
I_f		15.0	15.0	14.9	14.9	15.0	15.0	14.7
T_r	°C	640	640.5	639	643	638	637	
	°C	658	658.5	658	661	657	656	675
T_c	°C	720.5	721	720	725	722	720	747
	°C	730	730.4	729	734	728	727	755
COL. HTR.	V	11.9	11.9					
	I	7.38	7.38					
T_s	°C	696	697	697	699	695.5	694	697
	°C							
T_{res}	°C	340	323	315.2	313	296.5	303.5	325.5
	°C	327.5	311.5	304.5	302	286.8	293.2	315
RES. HTR.	V		1.88					
	I		3.85					
T_e	°C	1391	1390	1392	1392	1392	1392	1392
	°K							
T_{1s}	°C	685	685.4	685	688	682.5	682.5	696
OUTPUT		~~2~~						
VOLTS		.224	.283	.295	.293	.140	.248	.210
AMPS		39.4	40	39.98	40.4	40.2	40	52.6
WATTS		8.83	11.32	11.80	11.84	5.63	9.92	11.05
PHOTO #								

SC-1

2/14 1500

Device is shut down. Will go into jar and remove the PT/10% Rh thermo-couple so it will be possible to take the emitter to 1700 °c

2/14 1630

Removed thermo-couple. Pumping down.

2/14 1700

Bomber and filament on, emitter was taken to 1800 °C for 5 min. as observed by pyrometer... noticed a ΔT of ≅ 100 °c when device was shorted? Lowered emitter to 1400 and observed .285 V. @ 40 A.

2/14 1740

All power off

2/17 1528

Filament on pressure 8×10^{-7} torr after installation of end shields and emitter thermo couple.

CONVERTER NO. SC 1 SHEET 4 OF 8

DATE		2/17	2/17	2/17	2/18	2/18	2/18	2/18
TIME		1700						
PRESSURE								
10^{-6} TORR						1.5		
V_b			240	238		360	361	360
I_b			1.0	1.05		.580	.580	.575
V_f			11.9	11.9		11.4	11.4	
I_f			14.7	14.7		14.2	14.2	
T_r	°C							
	°C	626	672.5	685	629	630	631	631
T_c	°C	670	744	761	674.5	674	675.4	676
	°C	676.5	757.5	775	681	680	679	678
COL. HTR.	V							
	I							
T_s	°C	656	694.2	706	669	669	670	670
	°C							
T_{res}	°C	312.5	337.5	336	310	304.5	295	289
	°C	302	324	322	295	290	281	275.2
RES. HTR.	V							
	I							
T_e	°C	1359	1414	1425	1280	1288	1288	1288
	°K							
T_{1c}	°C	658.5	693	705	656	656	656.5	656
OUTPUT								
VOLTS		.332	.211	.211	.236	.249	.226	.148
AMPS		26.14	56.84	57.92	30.12	30.12	29.92	30.08
WATTS		8.68	11.99	12.22	7.11	7.50	6.76	4.45
PHOTO #								

6

CONVERTER NO. SC 1 SHEET 5 OF 8

DATE		2/18	2/18	2/18	2/18	2/18	2/18	2/18
TIME					1406			
PRESSURE								
10^{-6} TORR								
V_b		352	342	335		350	343	342
I_b		.610	.625	.645		.685	.680	.685
V_f		11.3		11.4		11.3	11.3	11.3
I_f		14.2		14.3		14.2	14.2	14.2
T_r	°C							
	°C	632	632.4	631	634.5	650	630.5	647
T_c	°C	677	677.5	679	679.5	704	690	702
	°C	683	685	687	688	714	698	711
COL. HTR.	V					11.9	11.9	11.9
	I					7.5	7.5	7.5
T_s	°C	672.5	673.5	675	675.4	685.6	676	683.5
	°C							
T_{res}	°C	311	318	324.5	330.5	335	328.2	323
	°C	295.5	302	307	313.5	317.5	311	307
RES. HTR.	V							
	I							
T_e	°C	1288	1288	1287	1288	1287	1287	1287
	°K							
T_{1s}	°C	658.5	659	661	661	672	664	670
OUTPUT								
VOLTS		.252	.240	.231	.228	.185	.191	.192
AMPS		30.14	30.10	29.98	30.02	40.18	40.06	40.16
WATTS		7.60	7.22	6.93	6.84	7.43	7.65	7.71
PHOTO #								

CONVERTER NO. SC 1 SHEET 6 OF 8

DATE		2/18	2/18	2/18	2/18	2/18	2/18	2/18
TIME		1426		1440				1500
PRESSURE								
10^{-6} TORR								
V_b		350	345	355	300	300		
I_b		.680	.670	.680	.650	.640		
V_f		11.3	11.3	11.3	11.3	11.3		
I_f		14.2	14.2	14.2	14.2	14.2		
T_r	°C							
	°C	642	647	647	620.6	617	616	616.4
T_c	°C	702.5	702	703	656	651.6	651	652
	°C	710.5	708.5	710	665	660	657.5	657
COL. HTR.	V	11.9	11.9	11.9	11.9	11.9		
	I	7.5	7.5	7.5	7.5	7.5		
T_s	°C	683.5	683	683.5	665	661.6	661	661.6
	°C							
T_{res}	°C	313	306.5	310	311	302	294	292
	°C	300	292	294.5	295.5	287	279.8	278
RES. HTR.	V							
	I							
T_e	°C	1293	1288	1288	1288	1287	1288	1288
	°K							
T_{1s}	°C	670	669	670	656	652.5	652	652.5
OUTPUT								
VOLTS		.193	.151	.175	.282	.285	.291	.289
AMPS		40.2	39.96	40.28	20.16	20.22	20.24	20.0
WATTS		7.76	6.03	7.05	5.69	5.76	5.89	5.78
PHOTO #								

CONVERTER NO. SC 1 SHEET 7 OF 8

DATE		2/18	2/18	2/18	2/18	2/18	2/18	2/18
TIME			1520					
PRESSURE								
10^{-6} TORR								
V_b		310	312	298	339	348	320	
I_b		.605	.610	.670	.730	.720	.740	
V_f			11.4					
I_f			14.2					
T_r	°C							
	°C	616	615.5	620	596	594.4	660	660
T_c	°C	649	649	653	661	659	713	716
	°C	652	653	663	667	664	723	728
COL. HTR.	V				Off			
	I							
T_s	°C	659	659	664	6564	654	687	695
	°C							
T_{res}	°C	280.2	285.5	325	323.5	315	318.2	335.2
	°C	267	271.7	308	307	299	302	317
RES. HTR.	V							
	I							
T_e	°C	1288	1288	1289	1287	1288	1287	1337
	°K							
T_{ls}	°C	649	650	655.5	651	649	677	687.5
OUTPUT								
VOLTS		.129	.225	.256	.191	.170	.169	.27[illegible]
AMPS		20.22	20.22	20.06	40.04	40.12	40.24	39.04
WATTS		2.61	4.55	5.14	7.65	6.82	6.80	10.58
PHOTO #								

CONVERTER NO. SC 1 SHEET 8 OF 8.

DATE		2/18	2/18	2/18	2/19	2/19	2/19	2/19
TIME				1517		1430	1440	1443
PRESSURE								
10^{-6} TORR								
V_b						280	310	320
I_b						.890	.960	1.00
V_f						11.2		
I_f						14.5		
T_r	°C							
	°C	692.5	704	698	658	658	686	693
T_c	°C	761	768	758	708.4	708.4	756	769.5
	°C	775	780	772	717	717	763	777.5
COL. HTR.	V							
	I							
T_s	°C	721	730.4	725	672.5	673	699	705
	°C							
T_{res}	°C	338	350	347	332.5	331	331	333
	°C	322	331	329	317	315	316	317
RES. HTR.	V							
	I							
T_e	°C	1377	1378	1378	1279	1280	1340	1352
	°K							
T_{1s}	°C	713	724	719	674	674.5	702.5	709
OUTPUT								
VOLTS		.221	.282	.269	.163	.174	.125	.085
AMPS		51.26	40.04	40.00	40.14	40.06	40.08	40.04
WATTS		11.33	11.29	10.76	6.54	6.98	5.01	3.40
PHOTO #					1-SC-1	2-SC-1	3-SC-1	4-SC-1

SC 1

2/25 1020

Removed front shield to check concentricity of gun. It was suspected that this condition might be the cause for not being able to reproduce previous data. Gun was out of concentricity.

Replaced gun with one that had already been 'hot-set'. Put both shields back on gun and connected emitter thermo-couples. This proved to have little effect. We were unable to reproduce the previous data. The Gun was completely removed and both shields taken off. At this time we are operating in this condition so that we will be able to examine the entire gun to check whether the emitter is being heated evenly. Front to back Δt will be read and several readings taken on the circumference of the emitter surface.

2/25 1300

Before above data could be taken a ceramic insulating the electron gun from the emitter broke down and shorted the bombardment voltage to ground. Went back into jar and replaced ceramic

2/25 1600

Coming down ... cannot get converter in arc. varied collector, cesium and emitter temperature, even applied 1.5 V. battery ... NO ARC .. .. coming down as per D. J. —

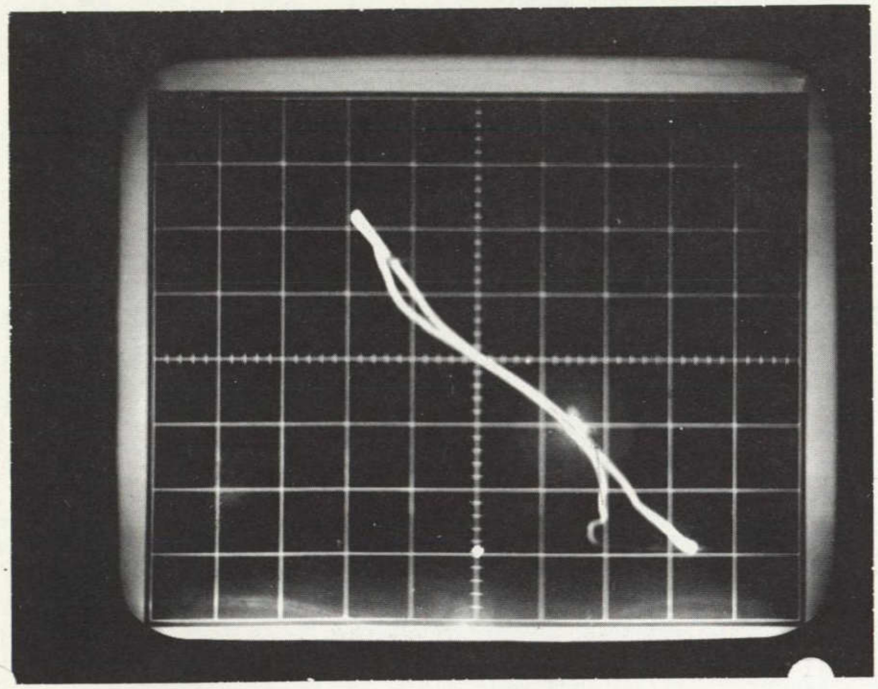


Photo No. 1-SC-1

SC-1 T_E = 1279°C
T_C = 717°C
T_{CS} = 317°C
X axis = 0.1V/div.
Y axis = 20A/div.

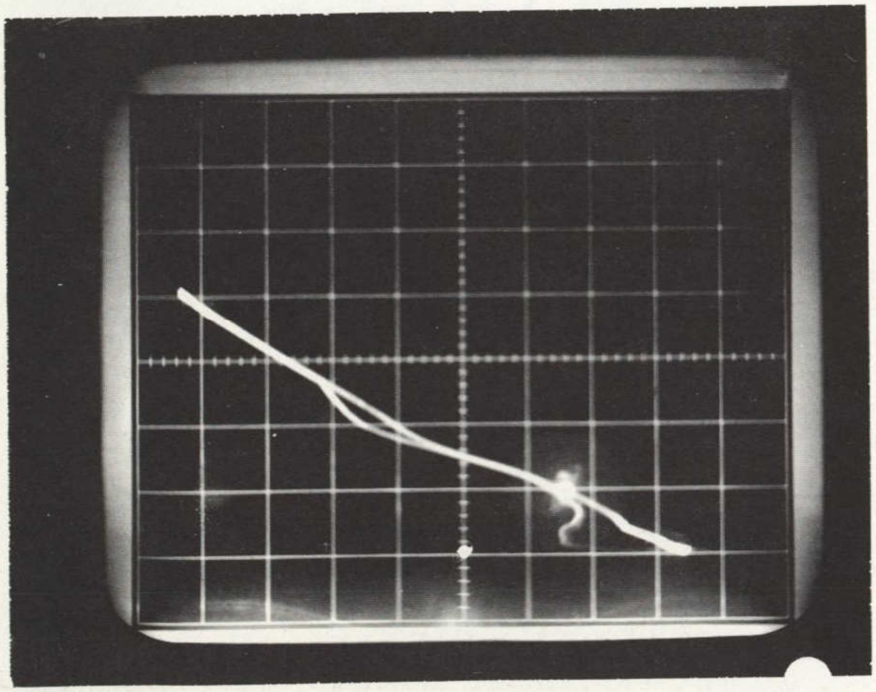


Photo No. 2-SC-1

SC-1 T_E = 1280°C
T_{COLL} = 717°C
T_{CS} = 315°C
X axis = 0.1V/div.
Y axis = 40A/div.

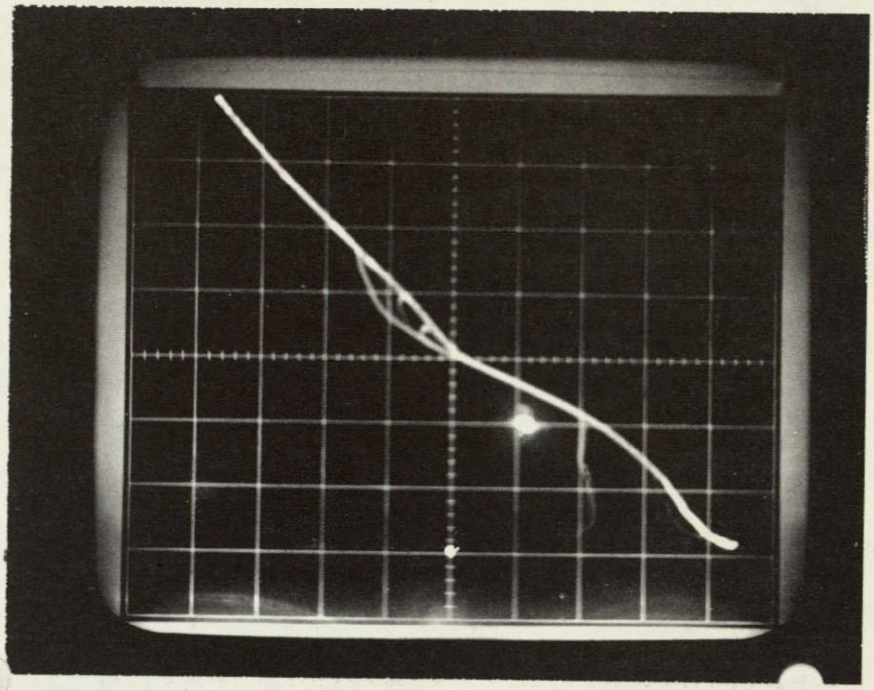


Photo No. 3-SC-1

SC-1 $T_E = 1340^\circ C$

$T_{COLL} = 763^\circ C$

$T_{CS} = 316^\circ C$

X axis = 0.1V/div.

Y axis = 20A/div.

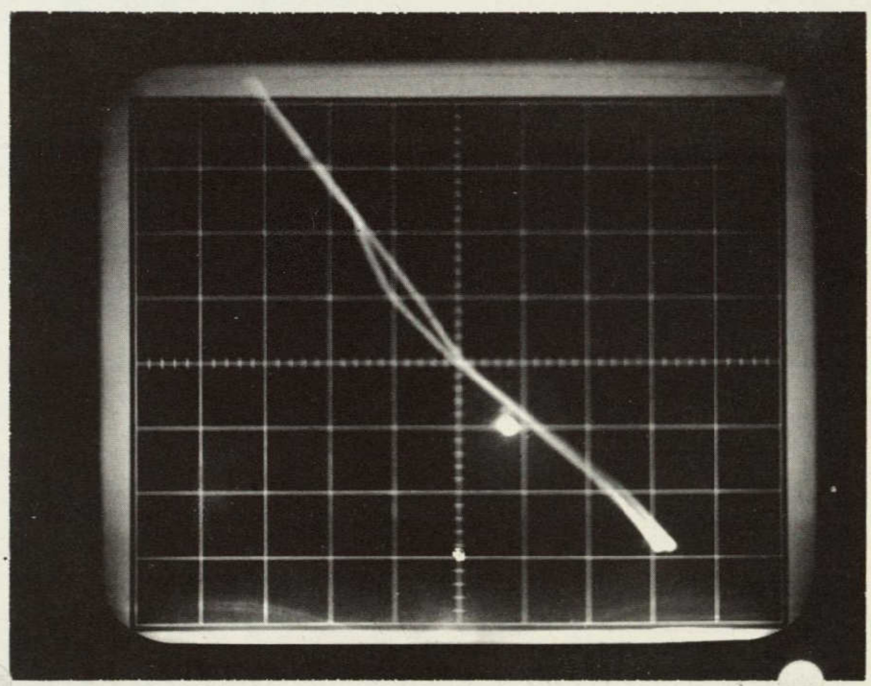


Photo No. 2-SC-1

SC-1 $T_E = 1352^\circ C$

$T_{COLL} = 777.5^\circ C$

$T_{CS} = 317^\circ C$

X axis = 0.1V/div.

Y axis = 20A/div.

APPENDIX 3

CONVERTERS SC-2a AND SC-2b

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 5-18-69

PART DESCRIPTION: Re Lead Strap

BRAZE TYPE: Anneal to Ti Braze Temp (4 Sq.)

WA NO.

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1048	Room						8×10^{-7}	9	RF ON
	1050							3.5×10^{-6}	10	
	1052							1.8×10^{-6}	11	
	1054		14.98					1.4×10^{-6}	12	
	1056		17.35					9×10^{-7}	13	
	1058		20.60					1.4×10^{-6}	14	
	1100		23.54					1.8×10^{-6}	15	
	1103		26.35					6×10^{-6}	16	
	1105		27.86					6×10^{-6}	17	
	1107		28.74					9.8×10^{-6}	17.5	
X	1107½		29.00					1.4×10^{-5}	17.5	
	1110		29.38					1.1×10^{-5}	17.5	
X	1112½		29.48							
	1117									RF OFF

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 5-20-69

PART DESCRIPTION: Nb Flange Re Lead Strap 4 cm^2

BRAZE TYPE: T_1

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0836	Room						6×10^{-7}	9	RF ON
	0837							1.4×10^{-6}	10	
	0841							2.4×10^{-6}	11	
	0845		10.10					2.1×10^{-6}	12	
	0848		13.90					1×10^{-6}	13	
	0851		17.00					1×10^{-6}	14	
	0854		20.10					1.4×10^{-6}	15	
	0857		25.58					4×10^{-6}	16	
	0900		27.88					9×10^{-6}	17	
X	0901½		29.00					1.4×10^{-5}	17	
	0902½		29.40					1.4×10^{-5}	17	
X	0903½		29.42						14½	
	0907									RF OFF

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 5-19-69

PART DESCRIPTION: Heater and Res Adapter 4 cm^2

BRAZE TYPE: T_1

WA NO.

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1529	Room						8×10^{-7}	9	RF ON
	1532							1×10^{-6}	10	
	1534								11	
	1536		15.38					5.8×10^{-5}	12	
	1538½		19.22					2.5×10^{-5}	13	
	1540½		22.75					1.7×10^{-5}	14	
	1542½		25.42					6.5×10^{-6}	15	
	1545		27.56					6.6×10^{-6}	16	
	1547½		29.00					1.6×10^{-5}	16¼	
	48		29.10					1.7×10^{-5}	16¼	
	48½		29.20							
	1549		29.28					1.6×10^{-5}	13½	
	1553									RF OFF
5-20-69	1138	Room						6×10^{-7}	9	RF ON
	1140								10	
	1142								11	
	1144		9.40					4.5×10^{-6}	12	
	1146		14.58					1.6×10^{-6}	13	
	1148		21.70					2.6×10^{-6}	14	
	1150		25.70					3.6×10^{-6}	15	
	1152		27.50					6.6×10^{-6}	16	
	1154		28.88						16½	
X	1154½		29.00					8.8×10^{-6}	16½	
	1155		29.50					8.4×10^{-6}	16½	
X	1156½		29.70						14	
	1202									RF

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 5-20-69

PART DESCRIPTION: Nb Flange Re Lead Strap 4 cm^2

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1409	Room						2×10^{-6}	9	RF ON
	1412		2.10					1.5×10^{-6}	10	
	1415		7.20					1.5×10^{-6}	11	
	1417		9.82					2×10^{-6}	12	
	1420		16.28					1.7×10^{-6}	13	
	1423		21.12					2×10^{-6}	14	
	1426		24.76					2×10^{-6}	15	
	1429		27.50					3.7×10^{-6}	16	
	1432		28.70					4.6×10^{-6}	17	
X	1432½		29.00					8×10^{-6}	17	
	1433									
X	1434		29.60						15	
	35								14	
	1440									RF OFF

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 5-20-69

PART DESCRIPTION: Heater and Res Adapter 4 cm^2

BRAZE TYPE: T_1

WA NO.

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1702	Room						2×10^{-6}	9	RF ON
	1705							2.2×10^{-6}	10	
	1708								11	
	1710		11.60					1.4×10^{-6}	12	
	1712		17.80					1.1×10^{-6}	13	
	1714		22.50					1.5×10^{-6}	14	
	1716		26.72					2×10^{-6}	15	
	1718		27.33					2×10^{-6}	15.5	
	1720		28.00					2.3×10^{-6}	16	
	1722½		28.72					2.5×10^{-6}	16.5	
X	1723		29.00					3×10^{-6}	16.5	
	24		29.30					3×10^{-6}	17.0	
	25		29.70					4.4×10^{-6}	17.0	
X	25½		29.94						15	
	1735									RF OFF

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

$1700^{\circ}C$ UBS (SURFACE)

↓ ↑

$1000^{\circ}C$ UBS (SURFACE)

DATE: 5-28-69

PART DESCRIPTION: 4 cm^2 Emitter E.B. weld

~~XXXXXXXXX~~: Thermal cycle

WA NO. 4018-001-001

OPERATOR:

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0815									Fil On
	0825									Bomb On
	0837	1600						6×10^{-6}		
		1700								
		1700								
15		1700								
20	sec	1700								
15	per	1200								
15	cycle									

BRAZING/FIRING SCHEDULE

DATE: 6-30-67

PART DESCRIPTION: 4 cm^2 Converter

~~BRAZE TYPE:~~ Outgas at 600°C (rework converter, leaked around heat choke)

WA NO.

VAC - ION OVEN

OPERATOR:

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0845							4×10^{-8}		POWER ON
	0905	250°C						1×10^{-7}		
	0935	350°C						4×10^{-7}		
	1000	500°C						4×10^{-7}		
	1020	500°C						2×10^{-7}		
	1100	500°C						1.8×10^{-7}		POWER OFF

ELECTRO-OPTICAL SYSTEMS

(60 mg)

BRAZING/FIRING SCHEDULE

DATE: 6-11-69

PART DESCRIPTION: SC No. 2

BRAZE TYPE: Final Outgas 1500°C

WA NO.

OPERATOR: EGK

	TIME	TEMP.°C No. 1 (OBSERVED)	mV 1	TEMP.°C No. 2 (Tee)	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1130	1500						3.2×10^{-6}		POWER ON
								170 μa		
Off for lunch										
									Fil	12.5V 14A
									Bomb	700V 0.31A
	1310							1.2×10^{-6}		POWER ON
								250 μa		
	1320	1500		257	10.42			1.2×10^{-6}		
								320 μa		
	1330	1550		280	11.40			1.4×10^{-6}		
								430 μa		
	1345	1515		304	12.38			1.1×10^{-6}		Something Shorted
								470 μa		
6-12-69	0840							5×10^{-7}		POWER ON
								5 μa		
	0850	1250			4.14			1.5×10^{-6}		
								10 μa		
	0900	1520			6.72			1.3×10^{-6}		
								33 μa		
	0915	1505			10.84			7.3×10^{-7}		
								27 μa		
	0930	1520		300	12.21			6.9×10^{-7}		
								30 μa		
	0935	1600		305	12.46			8×10^{-7}		
								35 μa		

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 6-11-69

PART DESCRIPTION: SC No.2

BRAZE TYPE: Final Outgas 1500°C

WA NO.

OPERATOR: EGK

	TIME	TEMP.°C No. 1 (OBSERVED)	mV 1	TEMP.°C No. 2 (Tee)	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
6-12-69	0945	1600		312	12.72			7.6×10^{-7}		POWER DOWN
								35 μa		AND OFF
		Final pressure at pinch						14 μa		
Cs drive	1120	Room	1.0					5.8×10^{-6}		POWER ON
	1125		6.76					5.2×10^{-6}		
	1140		12.28					4.8×10^{-6}		
	1200		12.36					4.5×10^{-6}		
	1315		11.60					4×10^{-6}		POWER OFF

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 7-2-69

PART DESCRIPTION: 4 cm^2 Converter Rework

BRAZE TYPE: Outgas and Cs Loading

WA NO. 4018-001-001

OPERATOR: Don Gresham FIL BOMBER

Pyro	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 4	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)		REMARKS
Bottom / Top	1520/ 1530							INT / EXT		
	0955	753	31.37	749	31.20	281	11.42	14 μa / 1×10^{-6}	13.6V / 165A	590V/780μa
	1000	Coming down slowly								
	1020	Bomber off								
	1025	Filament off								

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

280°C Max. on T

BRAZING/FIRING SCHEDULE

(Emitter temp 1600° max. (1580°C obs))

Max. int pressure
$1\ mA = 1 \times 10^{-6}$ torr
Max. on seal is 750°C
No. 1 - COLLECTOR
No. 4 - BACK SEAL
No. 3 TC - T

DATE: 7-2-69

PART DESCRIPTION: 4 cm^2 Converter Rework

BRAZE TYPE: Outgas and Cs Loading

WA NO. 4018-001-001

OPERATOR: Don Gresham

Pyro	TIME	COLL TEMP.°C No. 1	mV 1	SEAL TEMP.°C No. 4	mV 2	T TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	Fil. V/A	REMARKS (BOMBER V/A)
								INT / EXT		15A
Bottom Top	1145							6×10^{-7}		POWER ON
								15 μa		
	1200									ALL POWER OFF
	1308					ht off		1.5×10^{-7}		
								18 μa		FILAMENT ON
	1323	322	13.12	355	14.52	33	1.34	4×10^{-7}		BOMBER ON
								150 μa		
	1330	347	14.17	378	15.50	39	1.58	5.5×10^{-7}	11.4V	100V / 50 mA
								50 μa	15A	
	1340	399	16.35	442	18.18			2×10^{-6}	11.4V	200V / 130 mA
								60 μa	15A	
	1350	466	19.20	507	20.95	51	2.06	2.2×10^{-6}	11.4V	770V / 140 mA
								50 μa	15A	
Top 1081	1400	517	21.37	572	23.71			2×10^{-6}		1 kV / 150 mA
Bottom 1110								50 μa		
Top 1081	1415	645	26.80	695	28.95	70	2.85	2.2×10^{-6}	12V	1050V / 310 mA
Bottom 1110								80 μa	15.5A	
Top 1415	1430	647	26.81	721	30.00			1.9×10^{-6}	12V	1000V / 350 mA
Bottom 1450								100 μa	15.5A	
Bottom 1515	1435	684	28.45	751	31.26			2×10^{-6}		
Top 1500								110 μa		
Top 1515	1445	689	28.70	747	31.10	ht on	5.75	2×10^{-6}	13.5V	610V / 720 mA
Bottom 1550								120 μa	16.5A	
1575/1545	1455	750	31.35	756	31.45	249	10.1	2.1×10^{-6}	13.5V	600V / 780 mA
								500 μa	16.5A	
1570/1545	1505	702	29.24	754	31.39	277	11.27	1.9×10^{-6}	13.5V	600V / 780 mA
								340 μa	16.5A	

OS FORM NO. 806 (7/67)

280°C Max. on T

BRAZING/FIRING SCHEDULE

(Emitter temp 1600° max. (1580°C obs))

Max. int pressure
1 mA = 1 x 10^{-6} torr
Max. on seal is 750°C
No. 1 - COLLECTOR
No. 4 - BACK SEAL
No. 3 TC -T

DATE: 7-2-69
PART DESCRIPTION: 4 cm^2 Converter Rework
BRAZE TYPE: Outgas and Cs Loading
WA NO. 4018-001-001
OPERATOR: Don Gresham

Pyro	TIME	COLL TEMP.°C No. 1	mV 1	SEAL TEMP.°C No.4	mV 2	T TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	Fil. V/A	BOMBER V/A REMARKS
1569/1545	1522	705	29.35	756	31.49	277	11.26			600V / 770 mA
1460/1410	1545	648	26.95	697	29.11	278	11.29	1 x 10^{-6} /		500V / 650 mA
								600 μa		
1480/1410	1600	648	26.98	701	29.20	279	11.35	7 x 10^{-7} /		500V / 660 mA
								600 μa		
1462/1419	1615	648	27.00	698	29.05	281	11.49	6 x 10^{-7} /	13.5V /	500V / 660 mA
								600 μa	16.5A	
	1630			Heater	off -	coming down slowly				
	1638	Bomber off								
	1645	All power off								
7-7-69	0900	Filament						7 x 10^{-7} /	13.6V /	13A / 9.8V file
								30 μa	16.5A	
	0910	Bomber on								
/1175	0915	509	21.00	550	22.77	31	1.26	2 x 10^{-7} /	13.6V /	400V / 500 mA
								10 μa	16.5A	
/1440	0925	667	27.76	692	28.80			1 x 10^{-6} /	13.6V /	540V / 720 mA
								16 μa	16.5A	
1440/1445	0930		28.77		30.10		2.9	1 x 10^{-6}	13.6V / 16.5A	580V / 780 mA
1540/1500	0935	738	30.31	751	31.28		heater on			
1532/1520	0950	743	30.97	751	31.29	277	11.27	1 x 10^{-6} /	13.6V /	590V / 780 mA
								13.5 μa	16.5A	

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 7-7-69

PART DESCRIPTION: SC-2 Rework

300°C
1 hour

BRAZE TYPE: Cesium Drive

WA NO.

OPERATOR: EGK

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1500	Room	1.0					4×10^{-7}		POWER ON
	1510	3	13.3					3.4×10^{-7}		
	1520		13.4					2×10^{-7}		
	1535		13.2					1.1×10^{-7}		
	1550		13.1					1×10^{-7}		
	1615		13.1					9×10^{-8}		POWER OFF

BRAZING/FIRING SCHEDULE

.005 Ti Foil

6 rings
.015 Ti

DATE: 8-5-69

PART DESCRIPTION: Re to Nb

BRAZE TYPE: Ti

WA NO. 4018

OPERATOR: Mitchner

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1632	Room						3.5×10^{-7}	9	R.F. ON
	1634		1.50					6.3×10^{-6}	10	
	1636		6.88					3.8×10^{-6}	11	
	1638		15.04					3.7×10^{-6}	12	
	1640		19.8					3.4×10^{-6}	13	
	1642		23.5					4.2×10^{-6}	14	
	1644		25.9					4.3×10^{-6}	15	
	1646		27.1					8.7×10^{-6}	16	
	1648		28.7					1.5×10^{-5}	17	
Braze	1648½		29.16					1.4×10^{-5}	17	
	1649½		29.40					1.5×10^{-5}	17	
Out of Braze	1650		29.42					3.4×10^{-6}	14	GOING
	1657							R.F.	OFF	DOWN

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 8-7-69

PART DESCRIPTION: Re Disc for 4 cm^2 .

BRAZE TYPE: Outgas Converter

WA NO.

OPERATOR: R.K.

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1515							3×10^{-7}	8	R.F. ON
	1518	260	4.0					2×10^{-6}	10	
	1521	630	11.00					1×10^{-6}	12	
	1524	970	17.50					2×10^{-6}	14	
	1527	1400	25.00					4×10^{-6}	16	
*	1528	1700	29.53					6×10^{-6}	16	Hold 15 cm
1	1533	1700	29.53					5×10^{-6}	16	
2	1538	1700	29.53					4×10^{-6}	16	
3*	1543	1700	29.53					3.5×10^{-6}	16	Take down
	1548	Cooling						1×10^{-7}	OFF	to off

BRAZING/FIRING SCHEDULE

$1700^{\circ}C$ - 15 min.
(29.5 mV)

DATE: 8-11-69

PART DESCRIPTION: Re Discs 4 cm^2 Converter

BRAZE TYPE: Anneal

WA NO. 4018-001-001

OPERATOR: Mitchner

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1059	Room						0.8×10^{-6}	9	R.F. ON
	1101		0.92					1.3×10^{-6}	10	
	1103		5.70					1.2×10^{-6}	11	
	1105		10.22					1.4×10^{-6}	12	
	1107		13.88					1.2×10^{-6}	13	
	1109		19.70					1.5×10^{-6}	14	
	1111		24.0					2.7×10^{-6}	15	
	1113		26.1					5.8×10^{-6}	16	
	1115		27.7					8×10^{-6}	17	
	1117		28.6					0.8×10^{-5}	18	
X	1119		29.5					0.9×10^{-5}	18	
	1124		29.5					0.7×10^{-5}	18	
	1129		29.54					0.5×10^{-5}	18	
X	1134		29.56					8.2×10^{-6}	18	Going
										Down
	1140								R.F.	OFF

BRAZING/FIRING SCHEDULE

DATE: 8-12-69

PART DESCRIPTION: Nb to Lucalox to Re

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0945	Room						8×10^{-7}	8	R.F. ON
	0948		0.90	134				1.2×10^{-6}	9	
	0951		3.10	384	3.10			2.4×10^{-6}	9½	
	0954½		5.22	600	5.22			2.4×10^{-6}	10	
	0957½		6.88	759	6.88			2×10^{-6}	10½	
	1000½		8.14	874	8.14			1.6×10^{-6}	11	
	1003½		9.22	970	9.22			1.3×10^{-6}	11½	
	1005		10.50	1079	10.50			1.5×10^{-6}	12	
	1006½		11.18	1137	11.18			1.5×10^{-6}	13	
	1008		12.82	1273	12.82			2.2×10^{-6}	14	
XXX	1009½		14.34	1400	14.34			4×10^{-6}	14	
	1010¼		14.68	1429	14.68				13½	
	1010¾		14.68	1429	14.68			$2.2. \times 10^{-6}$	13	
	1011¼		14.38	1404	14.38			2×10^{-6}	13	
	1011¾		14.34	1401	14.34			2×10^{-6}	13¼	
	1013		14.38	1404	14.38			2×10^{-6}	13¼	
	1013½		14.38	1404	14.38			2×10^{-6}	13¼	
XXX	1014½		14.40	1405	14.40			2×10^{-6}	13¼	
	1022									R.F. OFF
8-12-69	Leak check 10 x 1 TIGHT									
Heat cycle bring to 1000°C at rate of 150°C per min.										
	1551	Room						3×10^{-7}	8	R.F. ON
	1555		2.10	150				1.2×10^{-6}	9	
	1556½		5.00	310				3.2×10^{-6}	10	
	1557½		7.60	450				2.4×10^{-6}	11	
	1558½		11.20	640				1×10^{-6}	10½	
	1559½		14.10	785				5.5×10^{-7}	10½	
	1600½		16.20	900				6×10^{-7}	10½	- 11¼

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

1000°C
Heat cycle 3 times
to up ~ 150°C per min.
Cool to 200°C before recycle

DATE: 8-12-69

PART DESCRIPTION: Nb to Lucalox to Re

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1601¾		18.30	1010				7.5×10^{-7}	11¼	
	1602¾		19.10						9	R.F. OFF
	1625			160	2.30			5.5×10^{-7}	8	R.F. ON
	1627			210	3.10			7×10^{-7}	9	
	1628			300	4.70			9×10^{-7}	9½-10	
	1629			430	7.20			2×10^{-6}	10-10½	
	1630			590	10.30			1.4×10^{-6}	10½-10¾	
	1631			750	13.40			1×10^{-6}	10¾-11	
	1632			890	16.10			8.2×10^{-6}	11-11¼	
	1633			1005	18.20				10	
	1634									R.F. OFF
	1640	Quick Cool			9.60					
	1654		2.30	160				6×10^{-7}	9	R.F. ON
	1656		4.30	275				1.1×10^{-6}	9-9½-10	
	1657		6.80	410				2.1×10^{-6}	10	
	1658		9.90	570				2.4×10^{-6}	10-10½	
	1659		12.80	720				1.2×10^{-6}	10½-11	
	1700		16.00	890				1.4×10^{-6}	11-11½	
	1701		18.20	1000					10	
	1701½									R.F. OFF

BRAZING/FIRING SCHEDULE

DATE: 8-20-69

PART DESCRIPTION: 4^2 Lead Strap to Heat Choke (3-1)

BRAZE TYPE: T_1

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1547							2×10^{-7}	9	R.F. ON
	1549							1.2×10^{-6}	10	
	1552		6.34					1.3×10^{-6}	11	
	1555		10.52					2×10^{-6}	12	
	1558		14.52					1.6×10^{-6}	13	
	1601		18.90					1.5×10^{-6}	14	
	1604		23.10					1.8×10^{-6}	15	
	1607		25.80					2.2×10^{-6}	16	
	1610		27.28					3.6×10^{-6}	17	
X	1612		29.00					5.4×10^{-6}	17-17½	
	1613		29.32					5.8×10^{-6}	17.5	
X	1613½		29.50						14	
	1621									R.F. OFF
										Cool over night
										stayed - Flat

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 8-21-69

PART DESCRIPTION: Re Choke Nb Lead Strap (3-2)

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0959	Room						6×10^{-7}	9	R.F. ON
	1002		1.80					1×10^{-6}	10	
	1005		5.56					1×10^{-6}	11	
	1008		9.90					1.2×10^{-6}	12	
	1011		14.18					1×10^{-6}	13	
	1014		18.52					1.1×10^{-6}	14	
	1017		23.00					1.2×10^{-6}	15	
	1020		25.60					2×10^{-6}	16	
	1023		27.60						17½	
X	1024½		29.00					$5. \times 10^{-6}$	18-17½	
	1025½		29.50					6.6×10^{-6}	14	
X	1026		29.50							R.F. OFF
	1030				(Qe at 300°C)					

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 8-21-69

PART DESCRIPTION: Lead Strap Assembly Nb Lead Strap Re Heat Choke

BRAZE TYPE: Ti

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1415	Room						9.2×10^{-7}	9	R.F. ON
	1419							3.2×10^{-6}	10	
	1422		5.75					1.6×10^{-6}	11	
	1425		9.95					2×10^{-6}	12	
	1428		14.40					1.2×10^{-6}	13	
	1431		19.00					1.3×10^{-6}	14	
	1434		23.20					1.6×10^{-6}	15	
	1437		26.16					2.2×10^{-6}	16	
	1440		27.62					3.5×10^{-6}	17	
	1443		28.80					5.5×10^{-6}	17.5	
X	1443½		29.00					5.8×10^{-6}	17.5	
	1444		29.50							
X	1445		29.50					5.5×10^{-6}	14½	
	1450									R.F. OFF

BRAZING/FIRING SCHEDULE

(Conv) - Re - Heat Choke
Nb - Lead Strap

DATE: 8-22-69

PART DESCRIPTION: Lead Strap Assembly (No. 3-4)

BRAZE TYPE: Ti

WA NO. 4018

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1109	Room						2×10^{-7}	9	R.F. ON
	1111		2.00					1×10^{-6}	10	
	1114		5.58					8×10^{-7}	11	
	1117		9.75					1.5×10^{-6}	12	
	1120		14.00					1×10^{-6}	13	
	1123		18.88					1×10^{-6}	14	
	1126		23.20					1.2×10^{-6}	15	
	1129		29.10					2.4×10^{-6}	16	
	1132		27.60					3.4×10^{-6}	17	
	1135		28.66					5×10^{-6}	17.5	
X	1135¾		29.00					6×10^{-6}	17.5	
	1136¾		29.10							
X	1137¼		29.20					5×10^{-6}	14½	
	1142									R.F. OFF

BRAZING/FIRING SCHEDULE

COLLECTOR
2 - HEATERS
RESERV. ADAPTER

DATE: 8-25-69

PART DESCRIPTION: 4^2 Converter

BRAZE TYPE: Ti

WA NO. 4018

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1537	Room						6×10^{-7}	9	R.F. ON
	1539½							8×10^{-6}	10	Outgas mucho
	1545		11.54					3.5×10^{-5}	11	
	1547		15.94					2.6×10^{-5}	12	
	1549		20.92					1.1×10^{-5}	13	
	1551		25.30					6.4×10^{-6}	14	
	1553		27.90					1.1×10^{-5}	14.5	
	1553½		28.48					1.6×10^{-5}	15	
X	1554		29.00					2×10^{-5}	15	
	1555		29.32					1.9×10^{-5}	15	
X	1555½		29.42					1.8×10^{-5}	11½	
	1600									R.F. OFF
	1035	Room						4×10^{-6}	9	R.F. ON
	1037		3.38					2.5×10^{-6}	10	
	1039		7.16					1.6×10^{-6}	11	
	1041		14.08					1.6×10^{-6}	12	
	1043		21.32					2×10^{-6}	13	
	1045		25.32					4×10^{-6}	14	
	1047		27.66					8×10^{-6}	15	
	1049		28.74					1×10^{-5}	15.5	
X	1049¼		29.00					1.4×10^{-5}	15.5	
	0949¾		29.30					1.4×10^{-5}	15.5	
	1150¼		29.48					1.2×10^{-5}	15.5	
X	1050¾		29.56					1×10^{-5}	12	
	1055									R.F. OFF

BRAZING/FIRING SCHEDULE

DATE: 8-27-69

$1400^{o}C$ = 25.03 mV

$1400^{o}C$ for 10 min.

PART DESCRIPTION: Seal Braze Flanges 4^2

BRAZE TYPE: Anneal Before Forming at $1400^{o}C$

WA NO. 4018

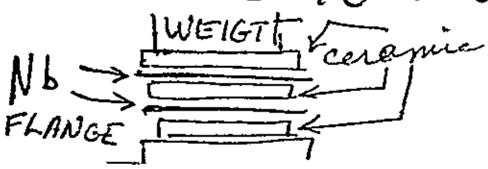
OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1551	Room						5×10^{-7}	9	R.F. ON
	1553							3.8×10^{-6}	10	
	1555½		6.88					4.2×10^{-6}	11	
	1557		13.40					2.4×10^{-6}	12	
	1559		19.94					2.2×10^{-6}	13	
	1601		22.88					3.2×10^{-6}	14	
X	1602¾		25.03					4×10^{-6}	14	
	1605		25.03					3.4×10^{-6}	14	
	1607		25.10					2.8×10^{-6}	14	
	1612		25.20					1.4×10^{-6}	14	
										R.F. OFF
		NO GOOD	SCHE	DULE TOO	HIGH					

ELECTRO-OPTICAL SYSTEMS

1000°C = 18.12 mV
1100°C = 19.94 mV
FOR ANNEAL Nb

1000°C To 1100°C



BRAZING/FIRING SCHEDULE

DATE: 8-28-69 Nb with converter

PART DESCRIPTION: (2 Pcs) 4^2 Convert flanges

BRAZE TYPE: Anneal at 1000 - 1100°C
Hold 5 min.

WA NO.

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1428	Room						8×10^{-7}	9	R.F. ON
	1430		3.4					1.4×10^{-6}	10	
	1432		6.90					3×10^{-6}	11	
	1434		10.00					2.4×10^{-6}	12	
	1436		12.30					2×10^{-6}	13	
	1439		15.61					1.8×10^{-6}	14	
	1440	930	16.90					2.2×10^{-6}	14	
	1441	970	17.50					2.2×10^{-6}	14.5	
X	1441½	1020	18.50					2.6×10^{-6}	14.3	
	1442½	1060	19.18					2.4×10^{-6}	14	
	1444	1080	19.62						13.75	
	1445	1080	19.54					2×10^{-6}	13.4	
	1446	1075	19.48					1.6×10^{-6}	13.4	
X	1446½	1080	19.56					1.6×10^{-6}	10.5	
	1452									R.F. OFF

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER ____
PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Re SPECIFICATION ____
THICKNESS 0.010 P.O. NO. ____ FORM ____
DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

WELDED TO

MATERIAL Re SPECIFICATION ____
THICKNESS 0.250 P.O. NO. ____ FORM ____
DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

FILLER METAL

MATERIAL ____ P.O. NO. ____ FORM ____ CERTS YES ____ NO ____

TYPE OF WELD JOINT Pierce PENETRATION REQUIRED 0.020
REQUESTOR OR CUSTOMER D. Pyle W.A. NO. 4018-001-001
OPERATOR J. Frey DATE 5-27-69
JOB DESCRIPTION Flexibility sample for 4 cm converter 0.750" O.D. (Re emitter to Re heat choke)

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE		*						
Q.A. APPROVAL								
SAMPLE NUMBER		1	2					
RUN NUMBER		1	1					
DISTANCE TO WORK (Inches)		7"	7"					
FILAMENT CURRENT (Amps)		1.80	1.80					
ACCELERATING VOLTAGE (kV)		140	150					
BEAM CURRENT (mA)		3.0	3.4					
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	min	min					
	VIEWER (Increments)							
BEAM FOCUS (Dial Setting)		535	554					
D.C. DEFLECTION	YES							
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		40	40					
SPEED INDICATOR (Dial Setting)		200	200					
TIMER (Seconds)		1.4	1.4					
SLOPE CONTROL (%)	RISE							
	FALL	60%	60%					
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		$1x10^{-4}$	$1x10^{-4}$					

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER 323

PAGE ______ OF ______

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA (CONT'D)

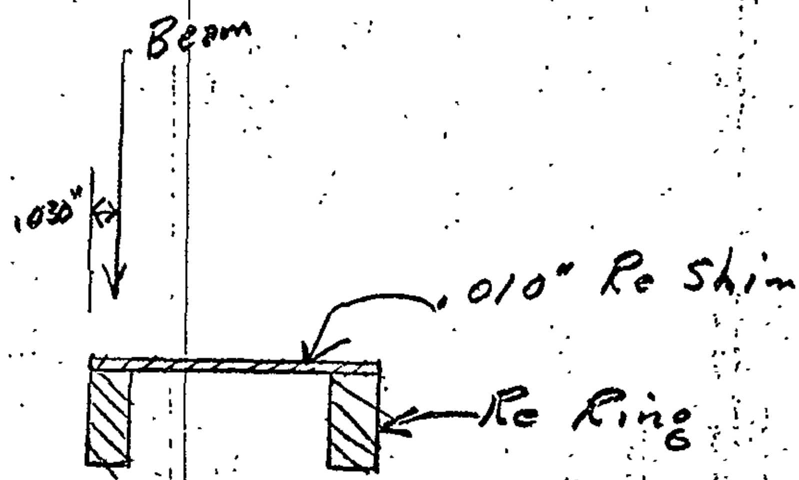
SAMPLE NO.

RUN NO.

SPECIAL TECHNIQUES

RESULTS

ATTACHMENTS



EOS FORM NO. 6202A (REV. 11/67)

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER ________
PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Arc Cast Mo and Nb SPECIFICATION ________
THICKNESS ________ P.O. NO. ________ FORM ________
DRAWING OR SKETCH NO. ________ CERTS YES ____ NO ____

WELDED TO

MATERIAL Arc Cast Mo and Nb SPECIFICATION ________
THICKNESS ________ P.O. NO. ________ FORM ________
DRAWING OR SKETCH NO. ________ CERTS YES ____ NO ____

FILLER METAL

MATERIAL ________ P.O. NO. ________ FORM ________ CERTS YES ____ NO ____

TYPE OF WELD JOINT ________ PENETRATION REQUIRED 0.005 - 0.010
REQUESTOR OR CUSTOMER Pyle W.A. NO. ________
OPERATOR J. Frey DATE 6-5-68
JOB DESCRIPTION Seal 1/8" hole with plug inserted

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE					*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	2	2	3	4	5 & 6	
RUN NUMBER		1	1	2	1	1	1	
DISTANCE TO WORK (Inches)		7"	7"	7"	7"	7"	7"	
FILAMENT CURRENT (Amps)		1.65	1.65	1.65	1.65	1.65	1.80	
ACCELERATING VOLTAGE (kV)		110	110	110	110	110	110	
BEAM CURRENT (mA)		3.0	4.0	4.0	4.0	4.0	5.2	
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015	0.010	0.015	0.015	0.015	min	
	VIEWER (Increments)	10	7	10	10	10	6	
BEAM FOCUS (Dial Setting)		487	484	493	493	493	483	
D.C. DEFLECTION	YES						✓	
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X			DOUBLE	DOUBLE	DOUBLE		
	Y			PASS	PASS	PASS		
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		HAND	40	40	40	40	40	
SPEED INDICATOR (Dial Setting)		TRACK-	200	200	200	200	200	
TIMER (Seconds)		ING	1.4	1.4	1.4	1.4	1.4	
SLOPE CONTROL (%)	RISE							
	FALL		60%	60%	60%	60%	60%	
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		10^{-4}					10^{-8}	

ELECTRO-OPTICAL SYSTEMS, INC.

A XEROX COMPANY

DATA SHEET NUMBER ______ 3

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL TA SPECIFICATION ____

THICKNESS 0.015 P.O. NO. ____ FORM Tube

DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

WELDED TO

MATERIAL TA SPECIFICATION ____

THICKNESS 0.015 P.O. NO. ____ FORM Tube

DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

FILLER METAL

MATERIAL ____ P.O. NO. ____ FORM ____ CERTS YES ____ NO ____

TYPE OF WELD JOINT Fillet PENETRATION REQUIRED 0.010

REQUESTOR OR CUSTOMER Hammerdinger W.A. NO. 1006-03-01

OPERATOR J. Frey DATE 6-8-69

JOB DESCRIPTION Join tube to spherical converter

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE								
Q.A. APPROVAL								
SAMPLE NUMBER		1						
RUN NUMBER		1						
DISTANCE TO WORK (Inches)		7"						
FILAMENT CURRENT (Amps)		1.80						
ACCELERATING VOLTAGE (kV)		110						
BEAM CURRENT (mA)		2.0						
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015						
	VIEWER (Increments)	10						
BEAM FOCUS (Dial Setting)		485						
D.C. DEFLECTION	YES	X						
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		40						
SPEED INDICATOR (Dial Setting)		200						
TIMER (Seconds)		1.4						
SLOPE CONTROL (%)	RISE							
	FALL	60%						
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)			70					

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER 308

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA (CONT'D)

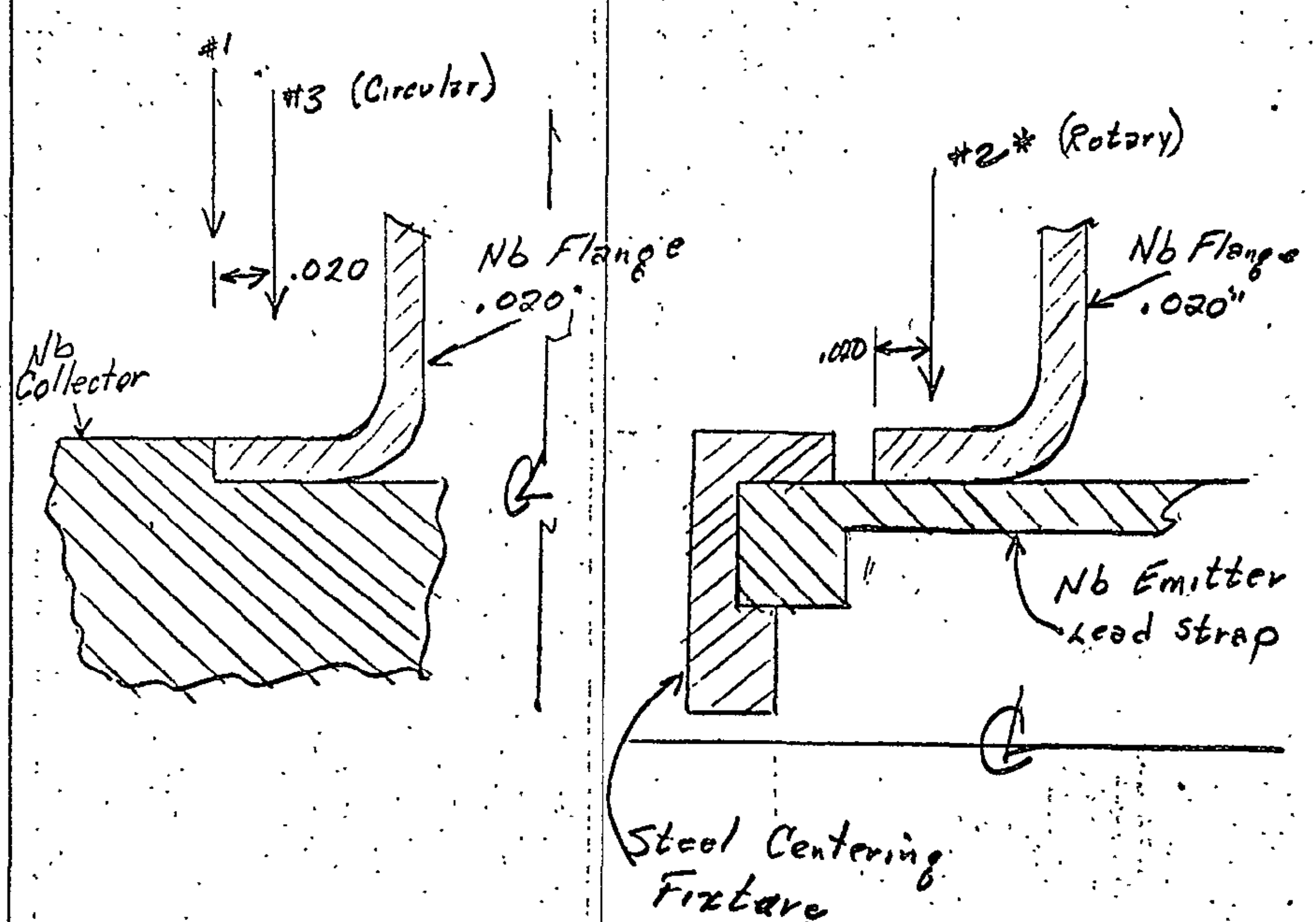
SAMPLE NO.

RUN NO.

SPECIAL TECHNIQUES

RESULTS
#1 Circular Butt Weld
#2 Rotary Pierce Weld
#3 Circular Pierce Weld

ATTACHMENTS



EOS FORM NO. 6302A (REV. 11/67)

ELECTRO-OPTICAL SYSTEMS, INC.

A XEROX COMPANY

DATA SHEET NUMBER

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Nb SPECIFICATION

THICKNESS 0.020 P.O. NO. FORM

DRAWING OR SKETCH NO. CERTS YES NO

WELDED TO

MATERIAL Nb SPECIFICATION

THICKNESS 0.020 P.O. NO. FORM

DRAWING OR SKETCH NO. CERTS YES NO

FILLER METAL

MATERIAL P.O. NO. FORM CERTS YES NO

TYPE OF WELD JOINT #1 Circular butt #2 Rotary Pierce ~~#3 Circular Pierce~~ PENETRATION REQUIRED #1 .020 #2 .020

REQUESTOR OR CUSTOMER P. Hora W.A. NO. 4018-001-001

OPERATOR J. Frey DATE 6-8-69

JOB DESCRIPTION Cylindrical Converter Assembly (4 cm)

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

				Flange to Coll	Flange to Emitter Lead Strap			
OPTIMUM WELD SCHEDULE		*		*	*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	1	1	1			
RUN NUMBER		1	2	3	2 rerun			
DISTANCE TO WORK (Inches)		7"	7"	7"	7"			
FILAMENT CURRENT (Amps)		1.75	1.75	1.75	1.75			
ACCELERATING VOLTAGE (kV)		120	150	150	150			
BEAM CURRENT (mA)		3.0	7.5	3.7	3.7			
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.008	min.	min.	min.			
	VIEWER (Increments)	5						
BEAM FOCUS (Dial Setting)		511	558	553	553			
D.C. DEFLECTION	YES	x	x	x	x			
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		10	25	17	23			
SPEED INDICATOR (Dial Setting)		60	130	95	120			
TIMER (Seconds)			23	3.7	2.6			
SLOPE CONTROL (%)	RISE							
	FALL	60%	60%	60%	60%			
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		$5x10^{-5}$	$8x10^{-5}$	$6x10^{-5}$	$7x10^{-5}$			

EOS FORM NO. 6301A (REV. 11/67)

CONVERTER NO. SC 2a SHEET 1 OF 27

DATE		6/13	6/13	6/13	6/13	6/13	6/13	6/16
TIME		1305	1435	1437			1735	0855
PRESSURE								
10^{-6} TORR		.8						.05
V_b		ON					ALL	
I_b							OFF	
V_f		ON						ON
I_f								
T_r	°C							
	°C							
T_c	°C		421	528.5	613	746		
	°C		420	520	601.6	698		
COL. HTR.	V							
	I							
T_s	°C		478	576	653	714		
	°C		469.5	563.5	640	712		
T_{res}	°C		237	275	244	296		
	°C		240	287.6	253.5	306		
RES. HTR.	V							
	I							
T_e	°C		910	1185	1370	1318		
	°K							
T_{1s}	°C		494	589	663	728		
OUTPUT								
VOLTS			.921	.001	.002	.165		
AMPS			O.C.	SHORT	SHORT	40.5		
WATTS						6.68		
PHOTO #								

CONVERTER NO. SC 2a SHEET 2 OF 27

DATE		6/16	6/16	6/16	6/16	6/16	6/16	6/16
TIME		0905	0909		1513	1550	1603	1610
PRESSURE								
10^{-6} TORR		.07	.08				5	
V_b		ON				120	175	
I_b						.375	.490	
V_f		ON						
I_f								
T_r	°C							
	°C							
T_c	°C		269	349	332.5	463.5	565	616
	°C		320.5	386	390	497	573	605.4
COL. HTR.	V							
	I							
T_s	°C		331	410	423	551	637	673
	°C		328.9	409.5	415	538	620.4	654.5
T_{res}	°C		105	104.4	127	152	184	219
	°C		82	107	107	135	171.5	217
RES. HTR.	V							ON
	I							
T_e	°C		783	913	920	1180	1273	1325
	°K							
T_{1s}	°C		352	431	446.7	567.5	651.5	686.7
OUTPUT								
VOLTS			1.15	.001	.001	.001	.001	.002
AMPS			O.C.	SHORT	SHORT	SHORT	SHORT	SHORT
WATTS								
PHOTO #								

CONVERTER NO. SC 2a SHEET 3 OF 27

DATE		6/16	6/16	6/16	6/16	6/16	6/16	6/16
TIME		1620	1629		1639	1645	1646	
PRESSURE								
10^{-6} TORR								
V_b			545					
I_b			.380					
V_f			12.0					
I_f			16.0					
T_r	°C							
	°C							
T_c	°C	693	706	711.5	691	712	808	711
	°C	656	664	668.5	653.5	666	731.5	643
COL. HTR.	V							
	I							
T_s	°C	722	726.5	731	708	736	765.6	731
	°C	701	708	711	694.6	714	756	718.5
T_{res}	°C	305	291	293	294	279	307	269
	°C	316	298	300	302	282	317.5	274
RES. HTR.	V							
	I							
T_e	°C	1395	1405	1442	1320	1448	1372	1392
	°K							
T_{1s}	°C	732	738.5	742.5	725.5	744.7	774.5	756
OUTPUT								
VOLTS		.002	.002	.002	.247	.003	.075	.138
AMPS		SHORT	SHORT	SHORT	.38	SHORT	SHORT	18.16
WATTS					.094			2.51
PHOTO #								

CONVERTER NO. SC 2a SHEET 4 OF 27

DATE		6/16	6/16	6/16	6/17	6/17	6/17	6/17
TIME								0915
PRESSURE								
10^{-6} TORR		:						
V_b		410						
I_b		.701						
V_f		12.1						
I_f		16.0						
T_r	°C							
	°C							
T_c	°C	759	715.5	675	708.4	786	790	716
	°C	671	662	648	661.4	711	714.4	661
COL. HTR.	V							
	I							
T_s	°C	717.5	714	701	705	750	752.5	719
	°C	708.4	703	690	698.4	743	746	710
T_{res}	°C	304	289	293	285.4	315.9	318.5	308.5
	°C	318	292	303	297	328.9	332	320
RES. HTR.	V							
	I							
T_e	°C	1412	1410	1400	1325	1400	1400	1400
	°K							
T_{1s}	°C	742	740.5	726	726.5	770.3	772.5	742
OUTPUT								
VOLTS		.349	.5	.5	.270	.260	.252	.4
AMPS		44.76	22	25	40.2	64.00	64.32	45.16
WATTS		15.62	11	12.5	10.85	16.64	16.21	18.06
PHOTO #								

SC 2a

6/17 0830

After thermal treating at 1500 °C the device was brought down to 1400 °C The maximum voltage out obtainable was .270 Trying to go any higher caused the emitter V + I to vary radically. It was also noticed that large variations in collector current had little effect on the emitter temperature or the collector temperature. When the collector and emitter began to vary it was also noticed that the bombardment voltage and current did not change. When the collector current was reduced inorder to obtain a higher voltage out ~~it~~ there was little change in the emitter collector voltage.

6/17 1130

After optimizing at .4 Volts the efficiency was figured and photo #1 taken.

4.13% eff

It was noticed that couple #4 the deep collector was shorted to the gantry. Will go into the jar for repairs

6/17 1145

All power off

CONVERTER NO. SC 2a SHEET 5 OF 27

DATE		6/17	6/17	6/17	6/17	6/17	6/17	6/17
TIME		1015					1105	
PRESSURE								
10^{-6} TORR								
V_b		375	364	362	355	360	362	
I_b		.610	.625	.625	.615	.620	.630	
V_f		12	12	12	12	12	12	
I_f		16	16	16	16	16	16	
T_r	°C							
	°C							
T_c	°C	724	725	724.5	721	720	720	737
	°C	668	669	669	667	666	667	722.5
COL. HTR.	V							
	I							
T_s	°C	724.5	725	723.6	724	728	722	726
	°C	715	715	715.5	714	713	712.5	716.5
T_{res}	°C	302	313	308.5	314	294.6	295	299
	°C	314.5	320	322	328.5	308	314.5	312
RES. HTR.	V							
	I							
T_e	°C	1400	1400	1400	1400	1400	1401	1400
	°K							
T_{ls}	°C	747.3	747.8	747.8	746	746	744.5	754.5
OUTPUT								
VOLTS		.4	.4	.4	.4	.4	.4	.4
AMPS		43.06	42.66	41.66	39.76	40.50	43.44	44.82
WATTS		17.22	17.06	16.66	15.90	16.20	17.38	17.93
PHOTO #							1	

CONVERTER NO. SC 2a SHEET 6 OF 27

DATE		6/17	6/17	6/17	6/17	6/17	6/17	6/17
TIME					1609			
PRESSURE								
10^{-6} TORR								
V_b		385	370	368	300	310		305
I_b		.625	.625	.625	.590	.585		.590
V_f		12	12	12.1	12	12		12
I_f		16	16	16.0	15.9	16		16
T_r	°C							
	°C							
T_c	°C	737	736.5	725	697.5	708	706	708
	°C	722	724	719	696	703	701.5	703
COL. HTR.	V							
	I							
T_s	°C	726.5	727	724	719.5	726.5	725	726.5
	°C	716.5	716.5	713	708	714	713	714.9
T_{res}	°C	301	307	290	310.5	283	290	285
	°C	314	320.5	302	323	294	302	297
RES. HTR.	V							
	I							
T_e	°C	1400	1408	1412	1415	1410	1410	1410
	°K							
T_{1s}	°C	754.5	754.5	753.5	745	738.5	750	752.3
OUTPUT								
VOLTS		.4	.4	.4	.5	.5	.5	.5
AMPS		44.66	42.98	37.78	16.36	18.2	19.95	19.60
WATTS		17.86	17.19	15.11	8.18	9.1	9.98	9.8
PHOTO #								

CONVERTER NO. SC 2a

DATE		6/17	6/17	6/17	6/17	6/17	6/18	6/18
TIME					1720	1730	0845	0856
PRESSURE								
10^{-6} TORR								
V_b		293		290	Off	All		
I_b		.590		.690			Off	All
V_f		12.1		12.1		Off		On
I_f		16		16			On	
T_r	°C							
	°C							
T_c	°C	702	706.5	705.5				
	°C	699	702	702				
COL. HTR.	V							
	I							
T_s	°C	725	726	726				
	°C	712.5	719	713.5				
T_{res}	°C	274	297.5	305				
	°C	285	309.6	317				
RES. HTR.	V							
	I							
T_e	°C	1412	1411	1411				
	°K							
T_{1s}	°C	751.5	751.5	751.5				
OUTPUT								
VOLTS		.5	.5	.5				
AMPS		15.72	19.68	17.34				
WATTS		7.86	9.84	8.67				
PHOTO #								

CONVERTER NO. SC 2a SHEET 8 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME								
PRESSURE								
10^{-6} TORR					.01			
V_b		389		392	385		380	250
I_b		.649		.628	.628		.675	.575
V_f		11.7		11.9	11.8		11.8	11.8
I_f		15.9		15.9	15.9		15.9	15.9
T_r	°C							
	°C							
T_c	°C	762	752	758.5	771	770	769	672
	°C	745.5	740.5	745	751	750.5	750	678
COL. HTR.	V	Off		Off				ON FULL
	I							
T_s	°C	741.6	738	740	745.5	745	744.5	715
	°C	731	727	729.5	735	734	734	702
T_{res}	°C	320	301.5	310.6	306.5	312.5	310	284
	°C	335	312	322.5	319	326	323.5	292.5
RES. HTR.	V							
	I							
T_e	°C	1399	1400	1400	1399	1400	1400	1424
	°K							
T_{1s}	°C	768	766.5	766.8	772.3	771	771.3	744
OUTPUT								
VOLTS		.3	.3	.3	.3	.3	.3	.6
AMPS		54.52	52.86	58.78	56.92	58.62	57.94	2.8
WATTS		16.36	15.86	17.63	17.08	17.59	17.38	1.68
PHOTO #								

CONVERTER NO. SC 2a SHEET 9 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME								
PRESSURE								
10^{-6} TORR								
V_b		346		495		292		
I_b		.728		.625		.650		
V_f				11.9		11.9		
I_f				15.9		13.9		
T_r	°C							
	°C							
T_c	°C	747	728.5	730	730	731	730.6	730
	°C	739	724	725	724	725	724.5	724
COL. HTR.	V	Off						
	I							
T_s	°C	744	720.4	721	720	721	721	720
	°C	732.5	713	714	713	714	714	713.5
T_{res}	°C	302	302	294.5	287	308	307	307
	°C	315	314.5	306.5	298.5	321	320.5	320
RES. HTR.	V							
	I							
T_e	°C	1430	1310	1310	1310	1310	1310	1305
	°K							
T_{1s}	°C	774	742	743	743	743	742.8	742.3
OUTPUT								
VOLTS		.4	.2	.2	.2	.2	.2	.2
AMPS		48.2	46.32	47.06	46.26	46.08	46.08	46.04
WATTS		19.28	9.26	9.41	9.25	9.22	9.22	9.21
PHOTO #								

CONVERTER NO. SC 2a SHEET 10 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME						1405	1410	
PRESSURE								
10^{-6} TORR								
V_b							209	
I_b							.550	
V_f							11.75	
I_f							15.9	
T_r	°C							
	°C							
T_c	°C	731.5	731	725.6	725.6	648	642	650
	°C	725	725	721	720	658	653.5	
COL. HTR.	V							
	I							
T_s	°C	720.4	720	723	718	688	683.5	
	°C	714	714	714.6	711	678.5	674	
T_{res}	°C	298	298	280	316	283	291	
	°C	310	310	291.5	330	294	303	292
RES. HTR.	V							
	I							
T_e	°C	1304	1305	1310	1312	1320	1321	1328
	°K							
T_{1s}	°C	742.8	742.3	745.5	740.5	714	709.3	
OUTPUT								
VOLTS		.2	.2	.2	.2	.4	.4	.4
AMPS		47.5	47.92	38.42	43.78	6.54	6.30	8.00
WATTS		9.5	9.58	7.68	8.76	2.62	2.52	3.20
PHOTO #								

CONVERTER NO. SC 2a SHEET 11 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME			1440	1445	1450			1530
PRESSURE								
10^{-6} TORR								
V_b				229				382
I_b				.551				.532
V_f								11.8
I_f								15.9
T_r	°C							
	°C							
T_c	°C	645	641	645	647	646	650	630
	°C							645
COL. HTR.	V							ON FULL
	I							11.5
T_s	°C							676
	°C							667
T_{res}	°C					261	281	293
	°C	278	269	287	300	283	293	305
RES. HTR.	V							
	I							
T_e	°C	1328	1328	1328	1324	1324	1324	1322
	°K							
T_{1s}	°C							703.5
OUTPUT								
VOLTS		.4	.4	.4	.4	.4	.4	.6
AMPS		8.98	5.54	9.16	7.76	9.92	9.24	.95
WATTS		3.59	2.22	3.66	3.10	3.97	3.70	.57
PHOTO #								

CONVERTER NO. SC 2a SHEET 12 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME		1538	1550	1653	1655			1710
PRESSURE								
10^{-6} TORR								
V_b		392	397	400	400			405
I_b		.540	.525	.520	.520			.500
V_f		11.8	11.7		11.8			11.75
I_f		15.9	15.0		16			15.9
T_r	°C							
	°C							
T_c	°C	629.5	627.5	627.5	627	627	624.4	624
	°C	644	642	642	641.6	641.6	640	639
COL. HTR.	V							
	I							
T_s	°C	675.4	675	675	675	675.4	674	674
	°C	666	665.4	665.6	665.6	666	664.5	665
T_{res}	°C	297	283	276	270	264	261	242
	°C	310	295	287	280	274.5	271	259
RES. HTR.	V							
	I							
T_e	°C	1324	1328	1329	1328	1327	1327	1329
	°K							
T_{1s}	°C	702.5	702.5	707.5	703	703.5	702	702.5
OUTPUT								
VOLTS		.6	.6	.6	.6	.6	.6	.6
AMPS		.89	1.05	1.16	1.23	1.25	1.27	1.33
WATTS		.53	.63	.70	.74	.75	.76	.80
PHOTO #								

CONVERTER NO. SC 2a SHEET 13 OF 27

DATE		6/18	6/18	6/18	6/18	6/18	6/18	6/18
TIME				1720		1745	1755	1800
PRESSURE								
10^{-6} TORR								
V_b		201	201			292		250
I_b		.500	.500			.725		.650
V_f								11.8
I_f								15.9
T_r	°C							
	°C							
T_c	°C	623.5	621.5	620	661	676	667	657
	°C	638	637	636	677.5	685.4	675	656.4
COL. HTR.	V							
	I							
T_s	°C	674	673	672	696	705	711	701
	°C	664.5	663.5	663	686	695	699.5	690.5
T_{res}	°C	243	243	242	303	303	277	277
	°C	252	251	251	314	315	287	289
RES. HTR.	V							
	I							
T_e	°C	1325	1329	1328	1415	1410	1420	1410
	°K							
T_{1s}	°C	702.5	701.5	701	727.5	736	739.3	732.5
OUTPUT								
VOLTS		.8	1.0	1.2	.5	.5	.6	.6
AMPS		1.16	.845	.366	33.04	29.70	7.75	10.0
WATTS		.93	.85	.44	16.52	14.85	4.65	6.00
PHOTO #								

CONVERTER NO. SC 2a SHEET 14 OF 27

DATE		6/19	6/19	6/19	6/19	6/19	6/19	6/19
TIME		1305	1354	1400	1445	1450	1500	1508
PRESSURE								
10^{-6} TORR		2	2	5	1.5			.82
V_b		~~OFF~~	~~ON~~	263	230	229	225	220
I_b				.502	.930	.922	.958	.957
V_f				12	12	12	12	12
I_f		~~ON~~	~~ON~~	16	16	16	16	16
T_r	°C		401.5	481	618	619	619	616.6
	°C							
T_c	°C		411	497	674	675	675	670
	°C		358	537	660.5	661	661.4	636.4
COL. HTR.	V				~~OFF~~			
	I							
T_s	°C		461	567	690	690	690	685.5
	°C		453	553	675	675	675	673
T_{res}	°C		131	136.5	293	292	297	302
	°C		140.5	146	315.4	316	321	326
RES. HTR.	V							
	I							
T_e	°C		926	1237	1415	1412	1411	1414
	°K							
T_{1s}	°C		506	627	744	744	744	742
OUTPUT								
VOLTS					.5	.5	.5	.5
AMPS				SHORT	30.8	30.9	31.06	26.22
WATTS					15.4	15.50	15.53	13.11
PHOTO #								

CONVERTER NO. SC 2a SHEET 15 OF 27

DATE		6/19	6/19	6/19	6/19	6/19	6/19	6/19
TIME		1512	1515	1520	1523	1525	1527	1530
PRESSURE								
10^{-6} TORR								
V_b		219	220	220	225	229	260	230
I_b		.942	.991	.970	.970	.975	.980	.980
V_f		12	12	12	12	12	12	12
I_f		16	16	16	16	16	16	16
T_r	°C	611.5	615	616.4	619.5	623	625	627.5
	°C							
T_c	°C	663	669	672	676	680.5	684	687
	°C	652	656.9	658.5	662	666.5	669.5	672
COL. HTR.	V							
	I							
T_s	°C	684	687	689	691	694.4	696.5	699
	°C	669	672	673	676	678.5	680.6	682.5
T_{res}	°C	301.5	301	299	298	293.5	294	292
	°C	323.5	324.5	322.6	321	318	316	314
RES. HTR.	V							
	I							
T_e	°C	1408	1412	1412	1411	1412	1416	1415
	°K							
T_{ls}	°C	738	741.4	742	745	748	750	753
OUTPUT								
VOLTS		.5	.5	.5	.5	.5	.5	.5
AMPS		27.54	29.10	30.92	32.16	33.50	33.80	33.68
WATTS		13.77	14.55	15.46	16.08	16.75	16.90	16.84
PHOTO #								

CONVERTER NO. Sc 2a

DATE		6/19	6/19	6/19	6/19	6/19	6/19	6/20
TIME		1535	1539	1545	1600	1603	1604	1520
PRESSURE								
10^{-6} TORR		.6						
V_b		261	234	200	240	280		off
I_b		.970	.957	.920	1.02	1.02		
V_f		12	12	12	12	12		on
I_f		16	16	16	16	16		
T_r	°C	627	625.5	618	630	637.4	640	
	°C							
T_c	°C	686	683	670	690	698.4	702	
	°C	673	673	665	678.5	686	688.5	
COL. HTR.	V							
	I							
T_s	°C	699	698.6	694	702.5	709	711	
	°C	682.5	682	677	686	692	694	
T_{res}	°C	289.5	284	275	294	294.5	294.5	
	°C	311.5	305	296.5	318	318	318	
RES. HTR.	V							
	I							
T_e	°C	1418	1431	1445	1438	1441	1441	
	°K							
T_{1s}	°C	753	754	751	757.5	763	763.6	
OUTPUT								
VOLTS		.5	.5	.5	.5	.5	.5	
AMPS		33.44	30.72	24.26	38.44	38.92	38.74	
WATTS		16.72	15.36	12.13	19.22	19.46	19.37	
PHOTO #						2		

SC - 2a

6/19 1604

While taking .5 Volt data a rapid increase in emitter temperature was noticed on hohlraum. It is believed that the PT/PT 10% Rh thermo-couple insulator ceramic is causing an error

6/19 1718

Bomber off

6/20

Installed nickel foil around reservoir to see if the couples would agree more closely. There didn't appear to be any apparent change when we checked the couples with a heat gun.

There appears to be a Δt from hohlraum to T.C. on emitter - no further testing will be done until the problem is resolved, or we find out why the two measurements don't agree.

x It was found that the filament was off center causing a large Δt in the emitter. The front + rear shields were removed in order to test the device and be able to observe the concentricity of the filament and to observe the Δt on the emitter periphery.

After installing a new shield on front of device a large Δt was still found.

New gun shields were installed ... found back shield shorted to emitter.

CONVERTER NO. SC 2a SHEET 17 OF 27

DATE		6/20	6/20	6/20		6/25	6/25	6/25
TIME		1535				1300	1315	1320
PRESSURE								
10^{-6} TORR								
V_b					Set			
I_b		ON			No T_{s3}	OFF	ON	
V_f								11.3
I_f		ON				ON	ON	13.9
T_r	°C		635	654				382.5
	°C							
T_c	°C		686	713				385.6
	°C		676.5	704				425
COL. HTR.	V							
	I							
T_s	°C		699	725				434
	°C		668	687.4				446
T_{res}	°C		298	297				110
	°C		306	306				138
RES. HTR.	V							
	I							
T_e	°C		1221	1271				737
	°K							
T_{1s}	°C		753.6	788				475
OUTPUT								
VOLTS			.2	.3				
AMPS			38.2	41.9				
WATTS			7.64	12.57				
PHOTO #								

CONVERTER NO. SC 20 SHEET 18 OF 27

DATE		6/25	6/25	6/25	6/25	6/25	6/25	6/26
TIME		1340	1600	1623		1457	1735	1318
PRESSURE								
10^{-6} TORR								
V_b								
I_b							~~All~~	~~All~~
V_f							~~Off~~	~~On~~
I_f								
T_r	°C	416	617	678	669	624		
	°C							
T_c	°C	436	667	747.4	738	660		
	°C	471	696.5	754	745	669		
COL. HTR.	V							
	I							
T_s	°C	486	670	735	724	693.5		
	°C	498	676	735	724	699		
T_{res}	°C	137	273	316	321	327		
	°C	163	286	325	329	335		
RES. HTR.	V							
	I							
T_e	°C	810	1330	1469	1428	1410		
	°K							
T_{1s}	°C	530	713.5	783	770.5	699		
OUTPUT								
VOLTS		1.95	.21		.4			
AMPS		Short	34.22	46.28	50.48	.46		
WATTS			7.19		20.19			
PHOTO #								

SC-2a

6/26

Removed all shields; replaced emitter T.C. leads and replaced the filament with the old one.

CONVERTER NO. SC 2a SHEET 19 OF 27

DATE		6/26	6/26	6/26	6/26	6/26	6/26	6/26
TIME		1333	1403	1418	1435	1505	1515	1516
PRESSURE								
10^{-6} TORR			8	9	7			
V_b					558	440		
I_b					.500	.570		
V_f					12.5			
I_f					16 2			
T_r	°C	289	392.5	518.5	541	544.5	598	610.5
	°C							
T_c	°C	293	411.4	438	565	565	637	657
	°C	294	432	497.5	5.94	588	648	656
COL. HTR.	V							
	I							
T_s	°C							
	°C	326	461	510	610	606	650	653
T_{res}	°C	105	138.5	238	318	339.4	397	398
	°C	96	163.5	253	326	348.6	4065	405
RES. HTR.	V							
	I							
T_e	°C	715	1038	1165	1410	1315	1300	1340
	°K							
T_{1s}	°C	363.5	525	583	700.5	687	771.4	781
OUTPUT								
VOLTS		2.81	3.56	3 27	.002	.138	.136	.141
AMPS					SHORT	.36	32.94	34.22
WATTS						.05	4.49	4.83
PHOTO #								

CONVERTER NO. SC 2a   SHEET 20 OF 27

DATE	6/26	6/26		6/26	6/26		
TIME	1318	1323		1325	1345		
PRESSURE							
10^{-6} TORR							
				GOING			
V_b	600				Off		
I_b	.710			DOWN			
V_f			SEE				
I_f							
			NOTES				
T_r °C	613	639					
T_r °C							
T_c °C	661	695					
T_c °C	678.5	711					
COL. HTR. V							
COL. HTR. I							
T_s °C							
T_s °C	667	688.5					
T_{res} °C	388	407					
T_{res} °C	398	418					
RES. HTR. V							
RES. HTR. I							
T_e °C	1395	1435					
T_e °K							
T_{1s} °C	800	688.5					
OUTPUT							
VOLTS	.136	.250					
AMPS	33.40	33.94					
WATTS	4.54	8.48					
PHOTO #							

SC 2a

6/26

we were unable to get power out at normal Cs temperatures, raised Cs temp. to 407°C and were able to get

35 A @ .250 V

* conclusion . . . converter out of cesium
or
up to air

CONVERTER NO. SC 26 SHEET 21 OF 27

DATE		7/9	7/9	7/9	7/9	7/9	7/9	7/9
TIME		0859	0905			1005	1045	1123
PRESSURE								
10^{-6} TORR								1.5
V_b			140	300		405		
I_b		ON	.065	.185		.360		
V_f								
I_f		ON						16.5
T_r	°C							
	°C							
T_c	°C		296	347.5	361.5	413	525	639
	°C		336	380.6	393	438	556	661.6
COL. HTR.	V					ON		
	I							
T_s	°C		362	428	446	500	602	695
	°C		350.4	410	429	485	586	680
T_{res}	°C	CONTAMINATED	126	164.5	167	182		318.5
	°C		124	138	141	157	304	311.5
RES. HTR.	V							
	I							
T_e	°C		950	980		1090	1170	1300
	°K							
T_{1s}	°C		378.5	446	468	526	619	711.5
OUTPUT								
VOLTS			.65	1.0			SHORTED	.24
AMPS			O.C.	O.C.				42
WATTS								10.08
PHOTO #								

CONVERTER NO. SC 2b SHEET 22 OF 27

DATE		7/9	7/9	7/9	7/9	7/9	7/9	7/9
TIME		1128	1139	1146	1155	1214	1250	1253
PRESSURE								
10^{-6} TORR								
V_b		645		645	629	655	655	522
I_b		.427		.437	.438	.435	.524	.655
V_f					11.4	11.3		
I_f					16.9	16.7		
T_r	°C							
	°C							
T_c	°C	641.6	655	657	657.5	660	678.5	674
	°C	663	673.5	674.5	675	677	708	706
COL. HTR.	V							
	I				11			
T_s	°C	696	704	703.5	702.5	704	725.6	724
	°C	681	679.4	689.4	689	691	712	710
T_{res}	°C	320	326	327	306	308	330	320
	°C	313	320	321	301	302	324	325
RES. HTR.	V							
	I							
T_e	°C	1300	1308	1305	1300	1298	1350	1345
	°K							
T_{1s}	°C	712	719	719	718	720	745	742
OUTPUT								
VOLTS		.239	.216	.200	.200	.200	.158	.178
AMPS		41.2	47.8	47.5	50.8	51.7	49	25
WATTS		9.85	10.32	9.5	10.16	10.34	7.74	4.45
PHOTO #		3		4				

SC 2b

7/9 1215

At 1400°C observed the voltage does not change a current is varied from 10 to 25 amps (V = .1V) As T_s is increased the converter performance decreases. Conclusions are difficult to draw, but the problem appears to be an internal current shunt. The ceramic side.

.175 V @ 54 A T_s = 1370
.2 V @ "0" A

We are unable to derive the power available from the device

CONVERTER NO. SC 2b SHEET 23 OF 27

DATE		7/9	7/9	7/9	7/9	7/9	7/9	7/9
TIME		1423	1431		1545	1600	1610	1620
PRESSURE								
10^{-6} TORR					.6		.6	
V_b		551	570		662	680	660	
I_b		.431	.440		.585	.557	.555	
V_f		12	12		12		12.2	
I_f		17.1	17.1		17.1		17.5	
T_r	°C							
	°C							
T_c	°C	612	616	619	694	698	693.5	694
	°C	654	657.5	660.5	728	732	725	726
COL.	V	on						
HTR.	I	full						
T_s	°C	680	682	685	746	750	745	746.5
	°C	670	672	675	735	739	734	735
T_{res}	°C	311	296	298	339	333	327	327
	°C	306	292	293	333	326	321	320
RES.	V							
HTR.	I							
T_e	°C	1300	1300	1305	1385	1408	1400	1400
	°K							
T_{1s}	°C	702	704.6	707	763	768	764	764.5
OUTPUT								
VOLTS		.3	.3	.3	.206	.225	.279	.275
AMPS		31	34.1	35.1	66.5	72.5	60.8	61.0
WATTS		9.3	10.23	10.53	13.70	16.31	16.96	16.77
PHOTO #		5	6				7A/7B	8

CONVERTER NO. SC 2b SHEET 24 OF 27

DATE		7/9	7/9	7/9	7/9	7/9	7/9	7/9
TIME		1631	1636	1645	1650	1652	1655	1705
PRESSURE								
10^{-6} TORR								
V_b		660		720			735	715
I_b		.522		.588			.620	.578
V_f								
I_f								
T_r	°C							
	°C							
T_c	°C	692	692	742	768	728.5	725.4	733
	°C	722	717	763	782.5	755.5	753.5	758
COL. HTR.	V							
	I							
T_s	°C	743	740	783	802	775	772.5	777.5
	°C	732	729	770	788.5	763.5	761	766
T_{res}	°C	315	302	328	328	328	328	310
	°C	309	297	322	323	322	322	305
RES. HTR.	V							
	I							
T_e	°C	1400	1400	1460	1500	1480	1480	1500
	°K							
T_{1s}	°C	762	759	803	822	796.4	794	798
OUTPUT								
VOLTS		.268	.182	.243	.250	.255	.255	.212
AMPS		61.0	58.9	79.5	80.2	80	83	69
WATTS		16.35	10.72	19.32	20.05	20.4	21.17	14.63
PHOTO #		9	10	11/12		13	14	15

CONVERTER NO. SC 26 SHEET 25 OF 27

DATE		7/10	7/10	7/10	7/11	7/11	7/11	7/11
TIME		1535	1600	1620	0845	0900	1028	1126
PRESSURE								
10^{-6} TORR								
				On				
V_b				Off			940	840
I_b					Off	On	.410	.410
V_f								
I_f					On	On		
T_r	°C							
	°C							
T_c	°C	703	766				746	730
	°C	163	188.5				752.5	735
COL. HTR.	V							
	I							12.5
T_s	°C	724	785				768	769
	°C	716	776				759	759
T_{res}	°C	305	332				336	307
	°C	299	324				330	302
RES. HTR.	V							
	I							
T_e	°C	1345/1300	1480/1388				1450	1510
	°K							
T_{1s}	°C	752	814.4				787.4	794
OUTPUT								
VOLTS			.283				.268	.5
AMPS			64.2				60	29.2
WATTS			18.17				16.08	14.6
PHOTO #		16	17				18	19

SC 2b

7/9 1730

all off

7/10 0900

all on

7/10

Went into jar and removed all but 4 lead strips from the collector, and tightened all copper strips

1501

all on

7/10 1700

Replaced filament

7/11 0900

all on

7/11 1300

Went into jar to recenter filament and remove 2 collector strips to make the collector run hotter.

CONVERTER NO. SC 26 SHEET 26 OF 27

DATE		7/11	7/11	7/11	7/11	7/11	7/11	7/11
TIME		1130	1530	1533				
PRESSURE								
10^{-6} TORR						1.0		1.0
V_b			762	805	815	820	830	820
I_b			.510	.522	.525	.530	.540	.515
V_f				11.3	11.3	11.3		
I_f				16.7	16.7	16.7		
T_r	°C							
	°C							
T_c	°C	702	776	752	789.5	787.4	794	789
	°C	706	779.4	755	795	793	800	794
COL. HTR.	V							
	I	13.5						
T_s	°C	748	793.5	800.5	802	798.5	805	801
	°C	738	783	767	792	789	794.5	791
T_{res}	°C	299	323	322	334.4	335	336	331.5
	°C	295	317	316	327	328.5	329.5	324.5
RES. HTR.	V							
	I							
T_e	°C	1501	1490	1502	1500	1500	1515	1515
	°K							
T_{1s}	°C	774	815	799.5	822.5	819.5	826	823
OUTPUT								
VOLTS		.5?	.400	.4	.3	.270	.275	.3
AMPS		29	49	57.2	71	76.3	78	72.8
WATTS		14.5?	19.6	22.88	21.3	20.60	21.45	21.84
PHOTO #			20	21	22	23		24

CONVERTER NO. SC 2b SHEET 27 OF 27

DATE		7/11	7/11	7/11	7/11	7/11	7/15	7/15
TIME				1704	1720	1730	ACCEPTANCE TEST	
PRESSURE								
10^{-6} TORR								
						~~AH~~		
V_b		785	790	705		OFF		
I_b		.490	.500	.460				
V_f			11.3	11.3				
I_f			16.8	16.8				
T_r	°C							
	°C							
T_c	°C	764	759	75	71	~~74~~	78	78
	°C	768.5	764	726.5	699.5		772	772
COL. HTR.	V							
	I		13.7					
T_s	°C	786	782	751	734		787.6	787.4
	°C	778	773	742	725.4		777	777
T_{res}	°C	318	315	313	305		337	331
	°C	312	310	307	299		329.5	324
RES. HTR.	V							
	I							
T_e	°C	1500	1495	1416	1415		1500	1502
	°K							
T_{1s}	°C	810	806	772	757.5		807	808
OUTPUT								
VOLTS		.4	.4	.4	.475		.4	.4
AMPS		52	49	39.5	25		54	54
WATTS		20.8	19.6	15.80	11.88		21.6	21.6
PHOTO #			25	26A/26B			28	27

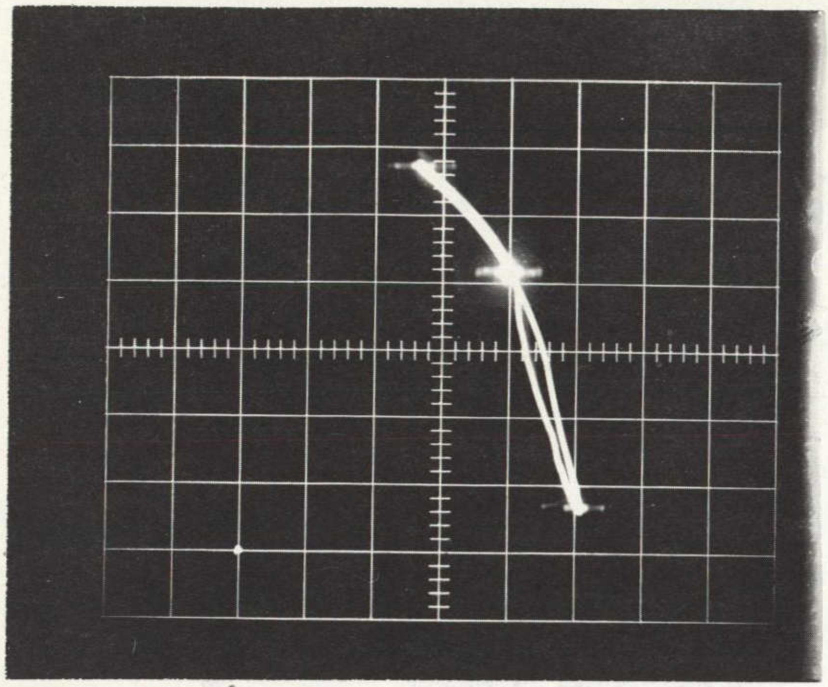


Photo No. SC2a-1

T_C = 1401°C

T_{COLL} = 720°C

T_{CS} = 295°C

X axis = 0.1V/div.

Y axis = 10A/div.

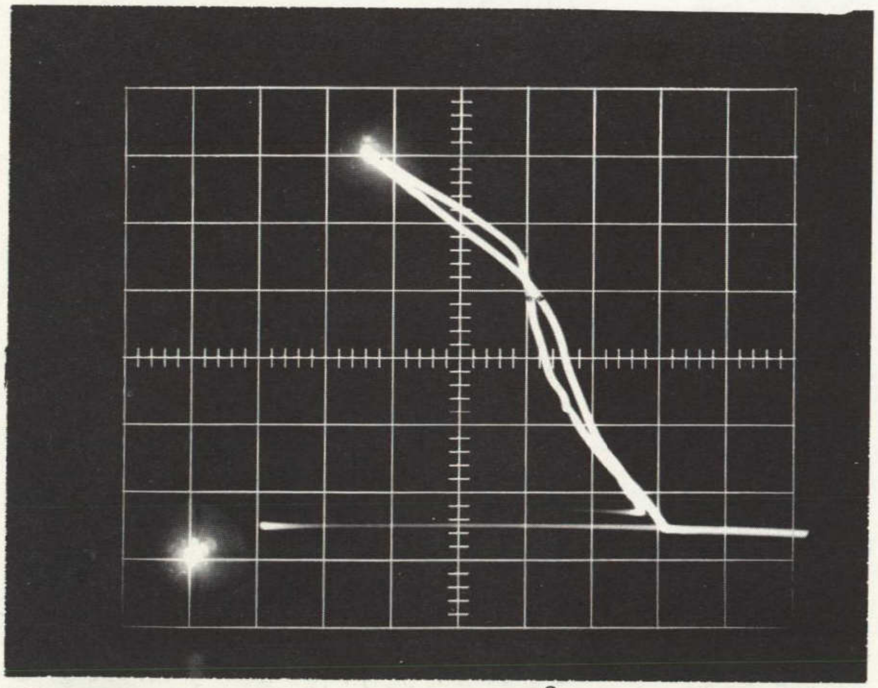


Photo No. SC2a-2

T_E = 1441°C

T_{COLL} = 698°C

T_{CS} = 294°C

X axis = 0.1V/div.

Y axis = 10A/div.

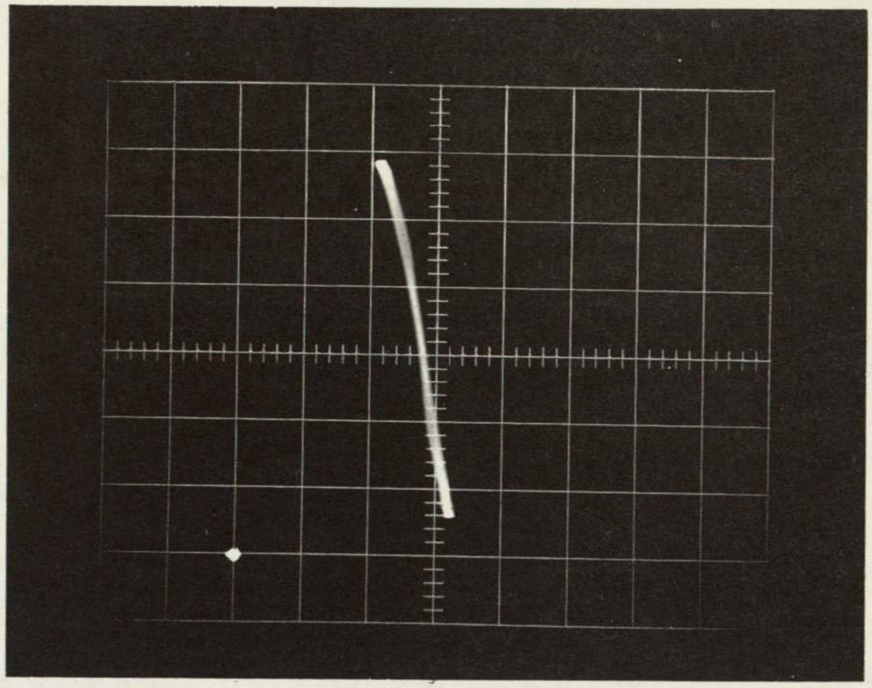


Photo No. SC2b-3

T_E = 1300°C
T_{COLL} = 663°C
T_{CS} = 313°C
X axis = 0.1V/div.
Y axis = 10A/div.

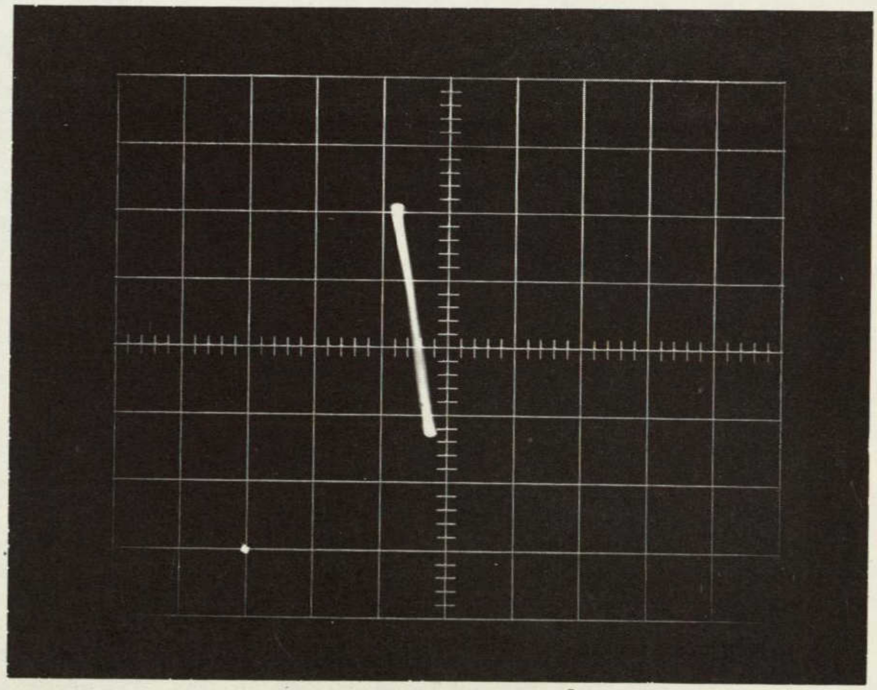


Photo No. SC2b-4

T_E = 1300°C
T_{COLL} = 642°C
T_{CS} = 313°C

X axis = 0.1V/div.
Y axis = 10A/div.

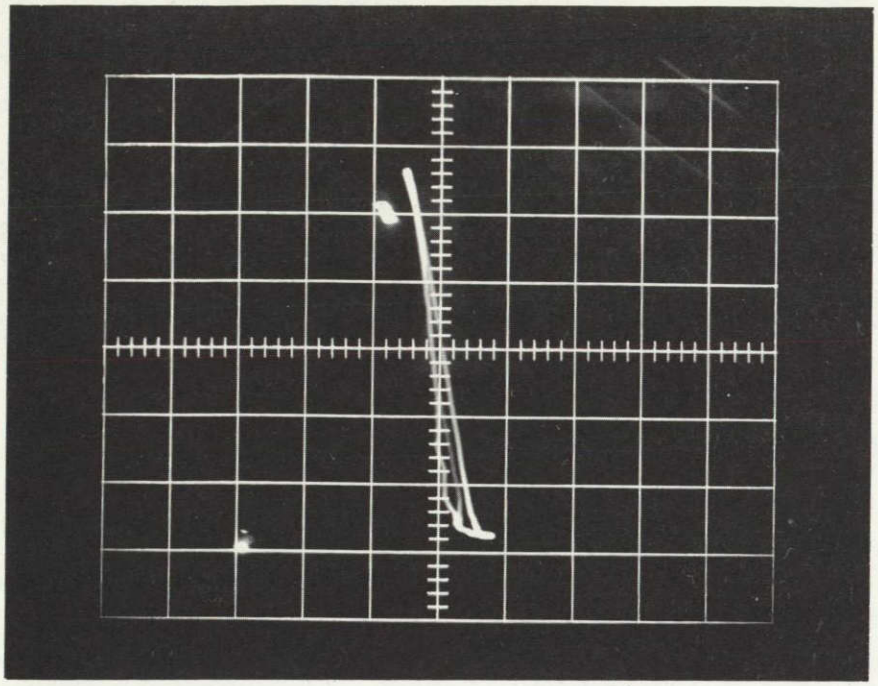


Photo No. SC2b-5

T_E = 1300°C
T_{COLL} = 654°C
T_{CS} = 306°C
X axis = 0.1V/div.
Y axis = 10A/div.

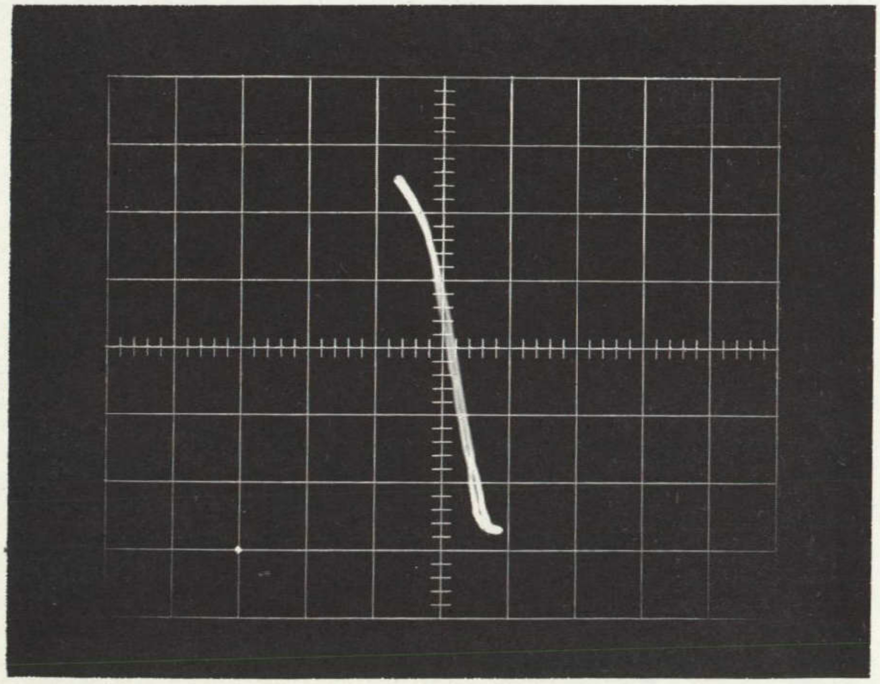


Photo No. SC2b-6

T_E = 1300°C
T_{COLL} = 657°C
T_{CS} = 292°C
X axis = 0.1V/div.
Y axis = 10A/div.

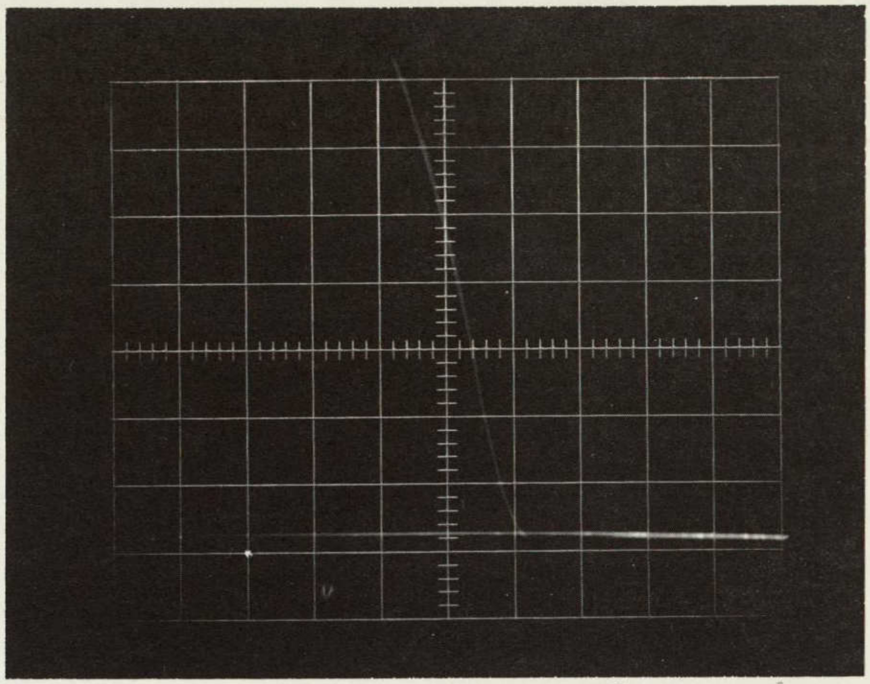


Photo No. SC2b-7A

T_E = 1400°C
T_{COLL} = 725°C
T_{CS} = 321°C
X axis = 0.1V/div.
Y axis = 10A/div.

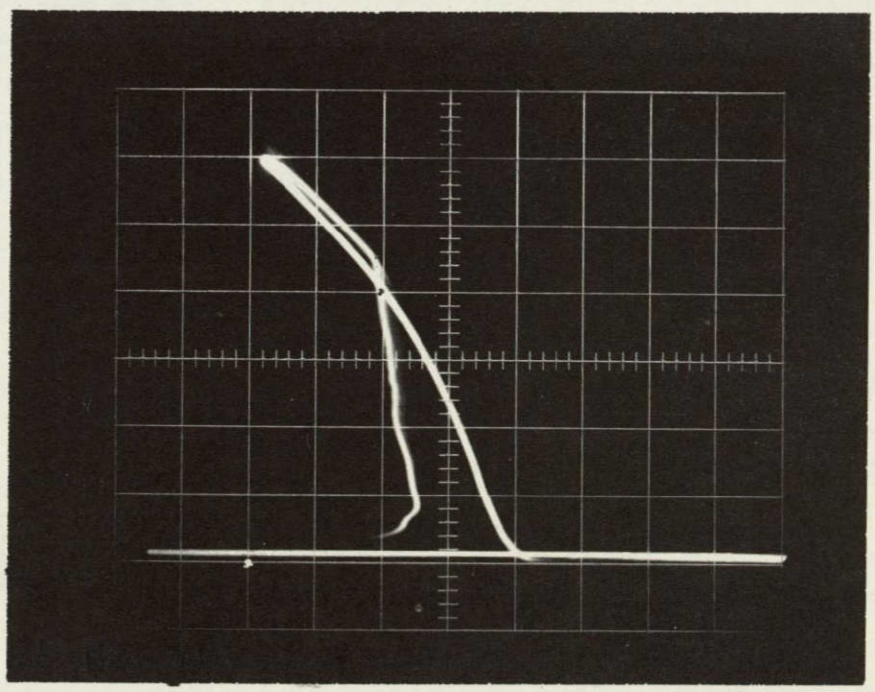


Photo No. SC2b-7B

T_E = 1400°C
T_{COLL} = 725°C
T_{CS} = 321°C
X axis = 0.1V/div.
Y axis = 20A/div.

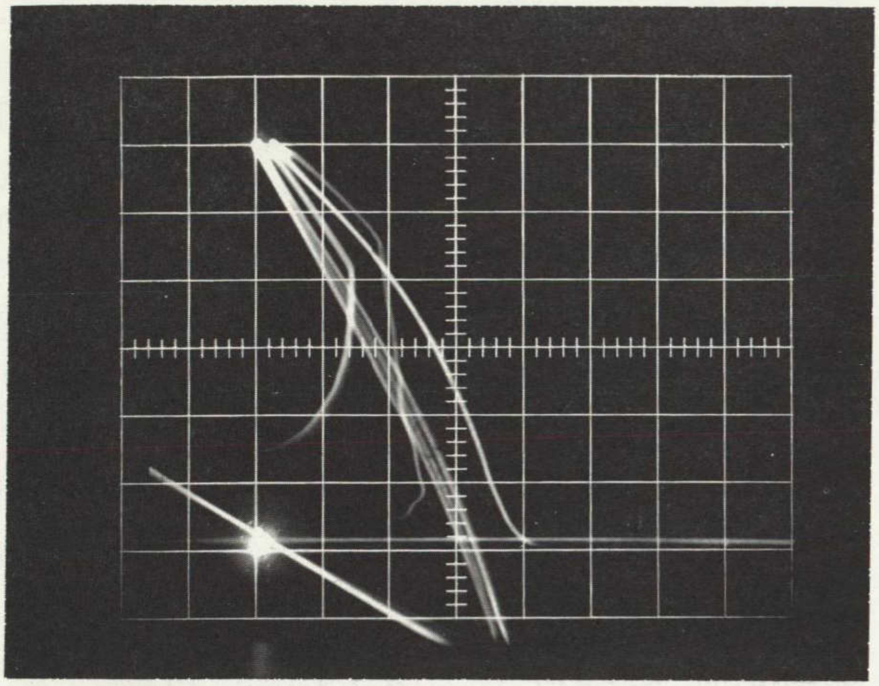


Photo No. SC2b-8

T_E = 1400°C

T_{COLL} = 726°C

T_{CS} = 320°C

X axis = 0.1V/div.

Y axis = 20A/div.

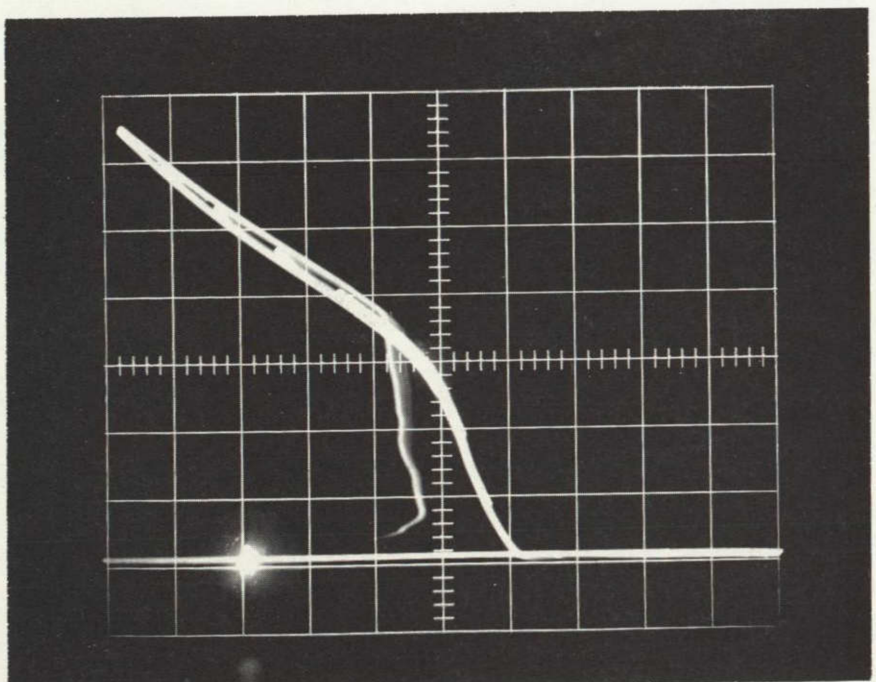


Photo No. SC2b-9

T_E = 1400°C

T_{COLL} = 722°C

T_{CS} = 309°C

X axis = 0.1V/div.

Y axis = 20A/div.

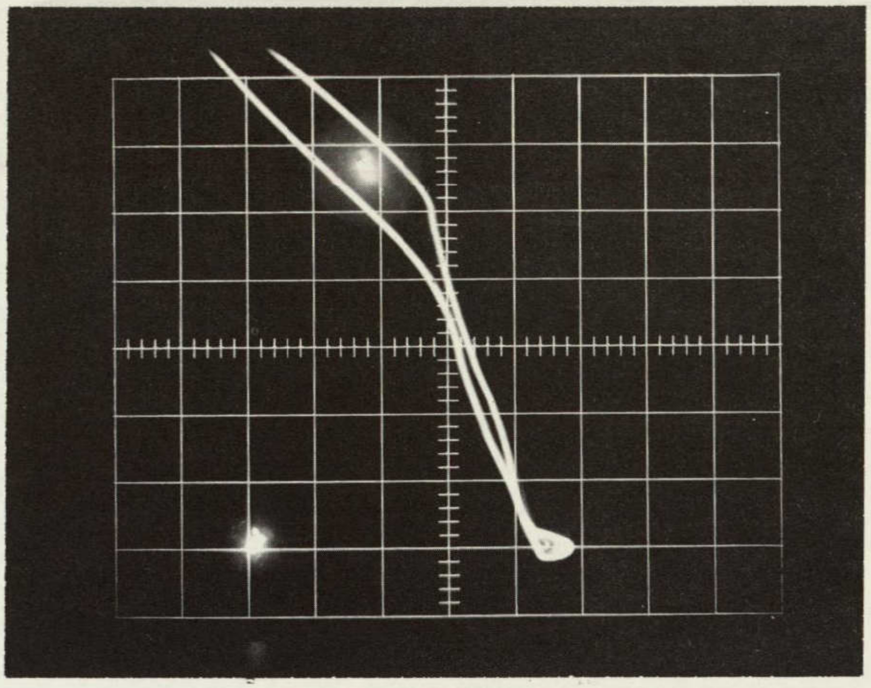


Photo No. SC-2B-10

T_E = 1400°C
T_{COLL} = 717°C
T_{CS} = 297°C
X axis = 0.1V/div.
Y axis = 10A/div.

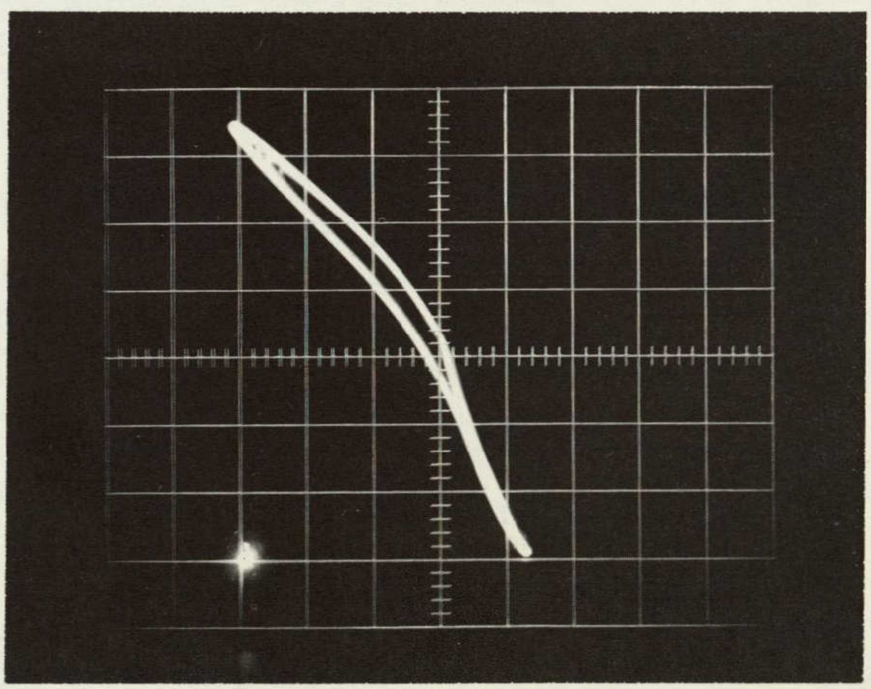


Photo No. SC-2b-11

T_E = 1460°C
T_{COLL} = 763°C
T_{CS} = 322°C
X axis = 0.1V/div.
Y axis = 10A/div.

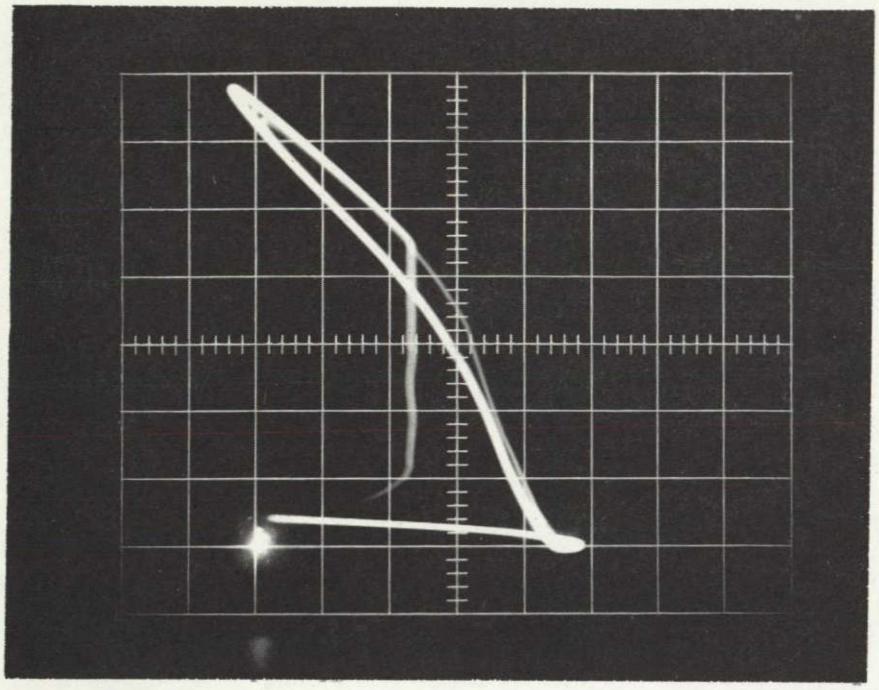


Photo No. SC-2b-12

T_E = 1460°C

T_{COLL} = 763°C

T_{CS} = 322°C

X axis = 0.1V/div.

Y axis = 20A/div.

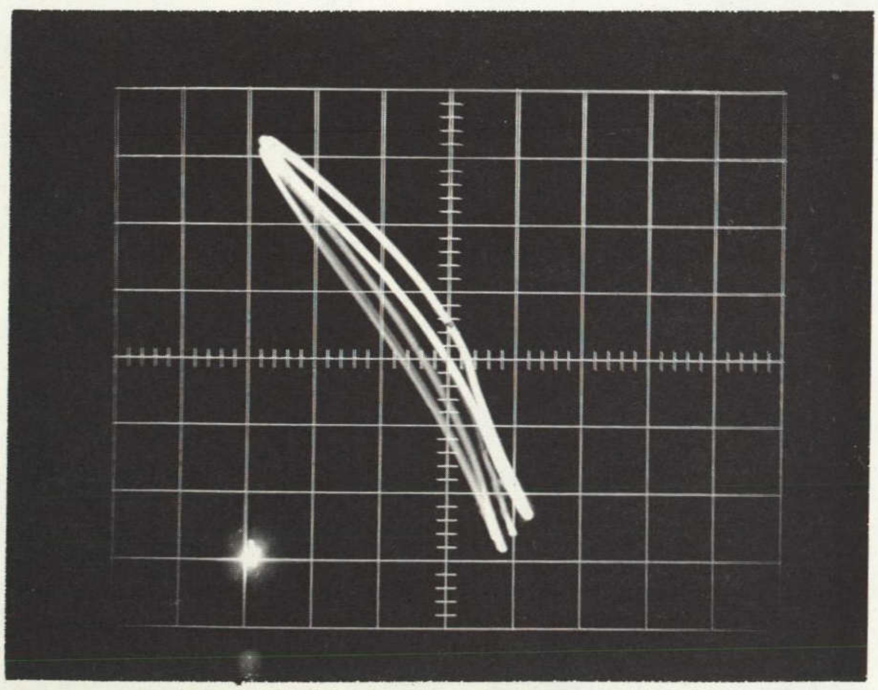


Photo No. SC-2b-13

T_E = 1480°C

T_{CCLL} = 756°C

T_{CS} = 322°C

X axis = 0.1V/div.

Y axis = 20A/div.

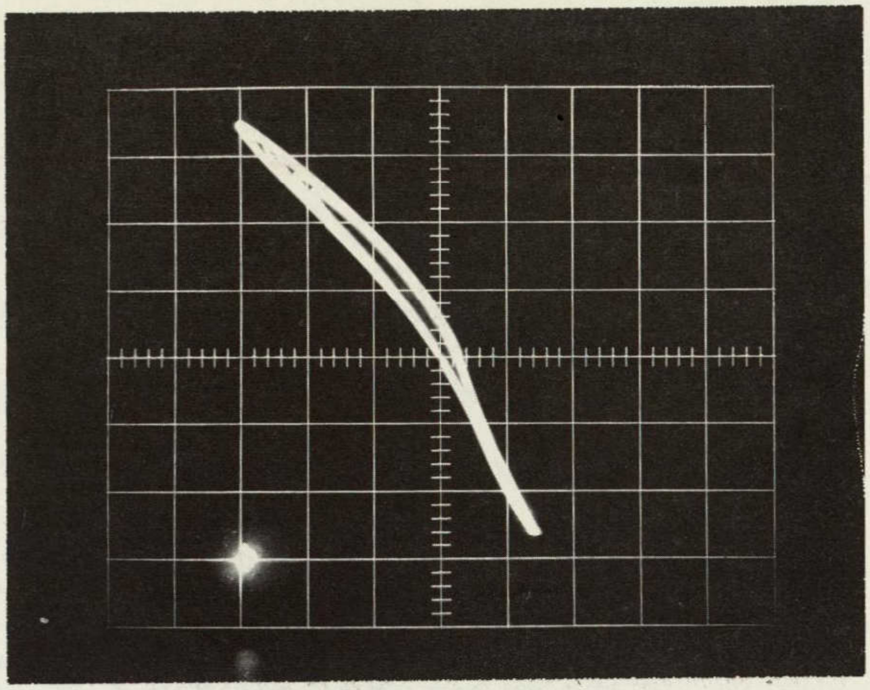


Photo No. SC-2-14

T_E = 1480°C
T_{COLL} = 753°C
T_{CS} = 322°C
X axis = 0.1V/div.
Y axis = 20A/div.

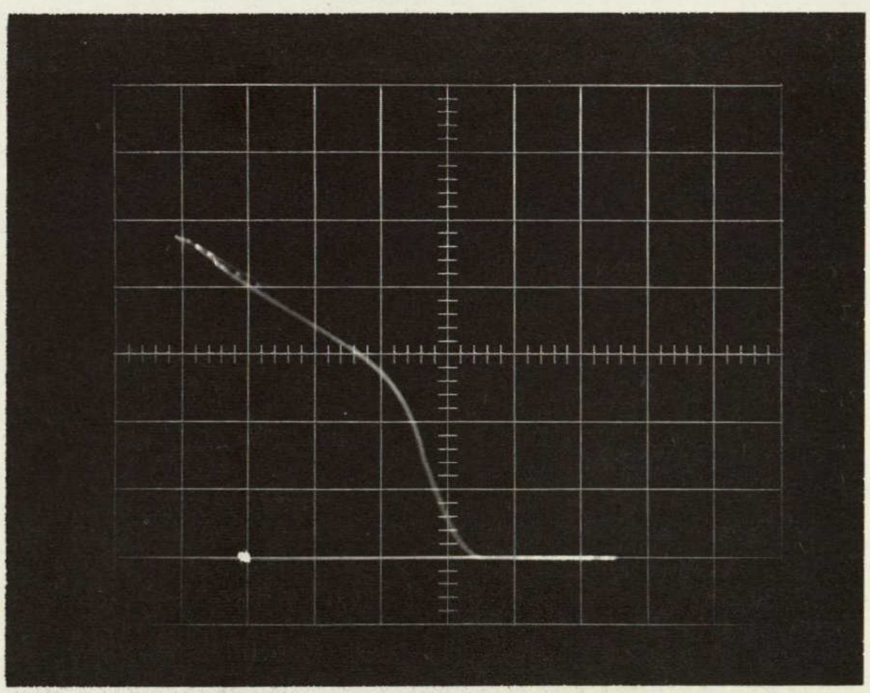


Photo No. SC-2-16

T_E = 1345°C
T_{COLL} = 703°C
T_{CS} = 295°C

X axis = 0.1V/div.
Y axis = 20A/div.

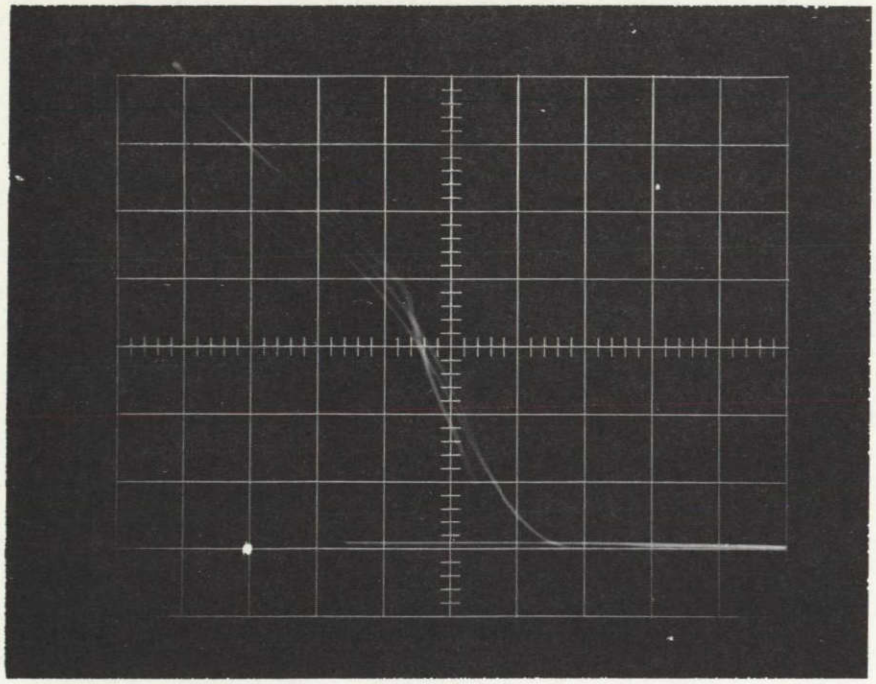


Photo No. SC-2b-17

T_E = 1480°C

T_{COLL} = 766°C

T_{CS} = 324°C

X axis = 0.1V/div.

Y axis = 20A/div.

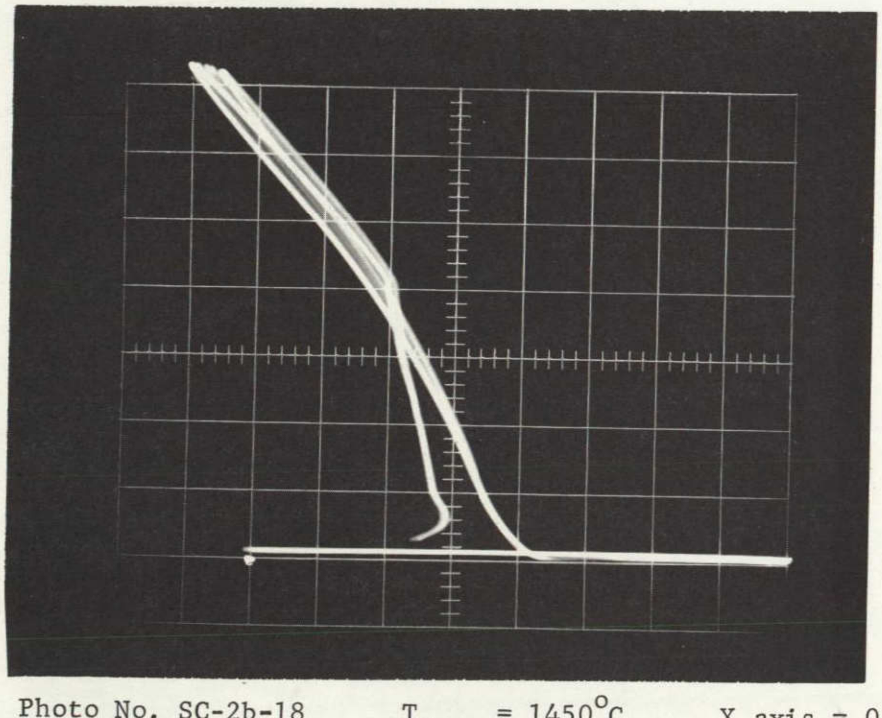


Photo No. SC-2b-18

T_E = 1450°C

T_{COLL} = 752°C

T_{CS} = 330°C

X axis = 0.1V/div.

Y axis = 20A/div.

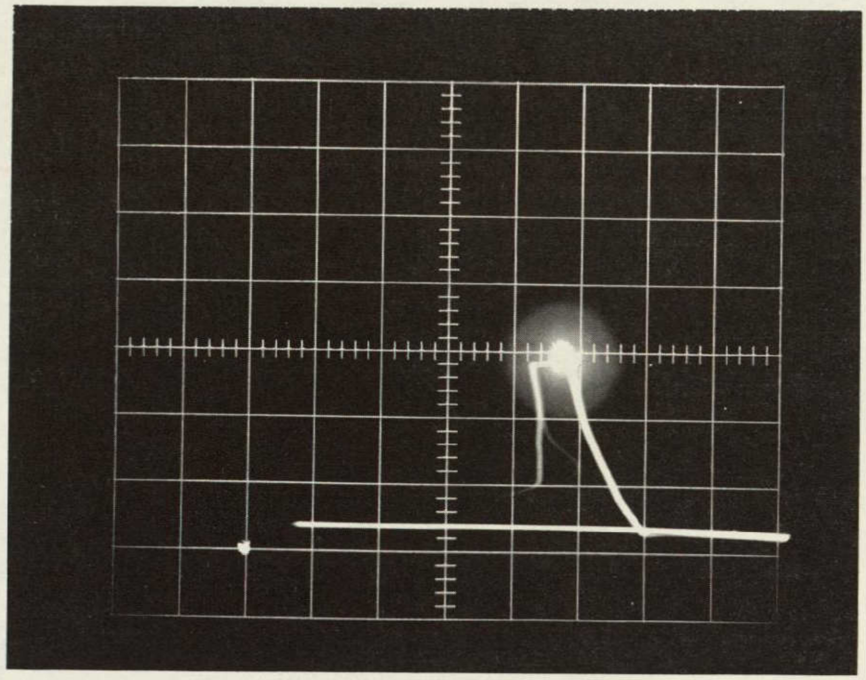


Photo No. SC-2b-19

T_E = 1510°C

T_{COLL} = 735°C

T_{CS} = 302°C

X axis = 0.1V/div.

Y axis = 10A/div.

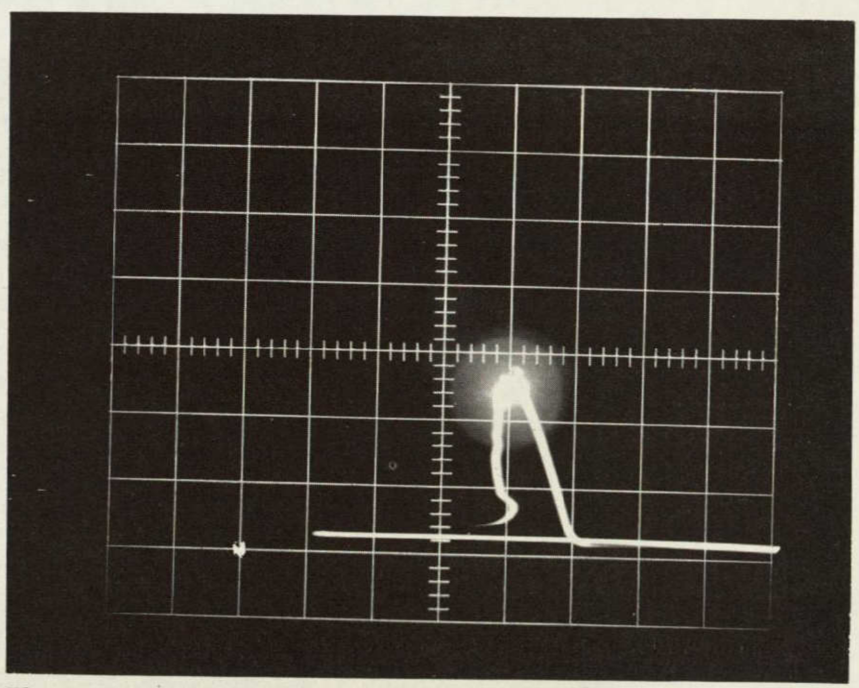


Photo No. SC-2b-20

T_E = 1490°C

T_{COLL} = 779°C

T_{CS} = 317°C

X axis = 0.1V/div.

Y axis = 20A/div.

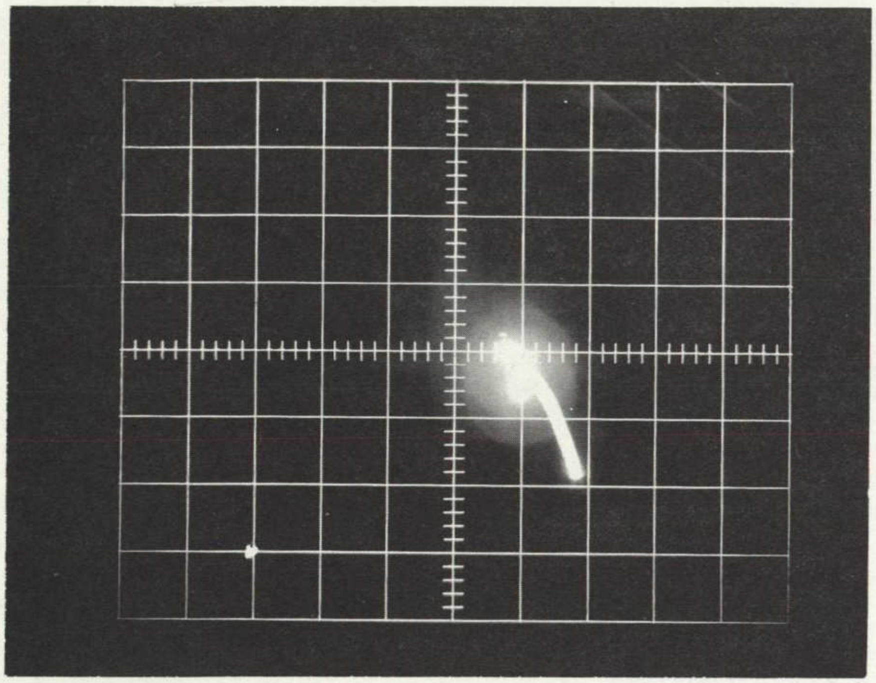


Photo No. SC-2b-21

T_E = 1502°C
T_{COLL} = 755°C
T_{CS} = 316°C
X axis = 0.1V/div.
Y axis = 20A/div.

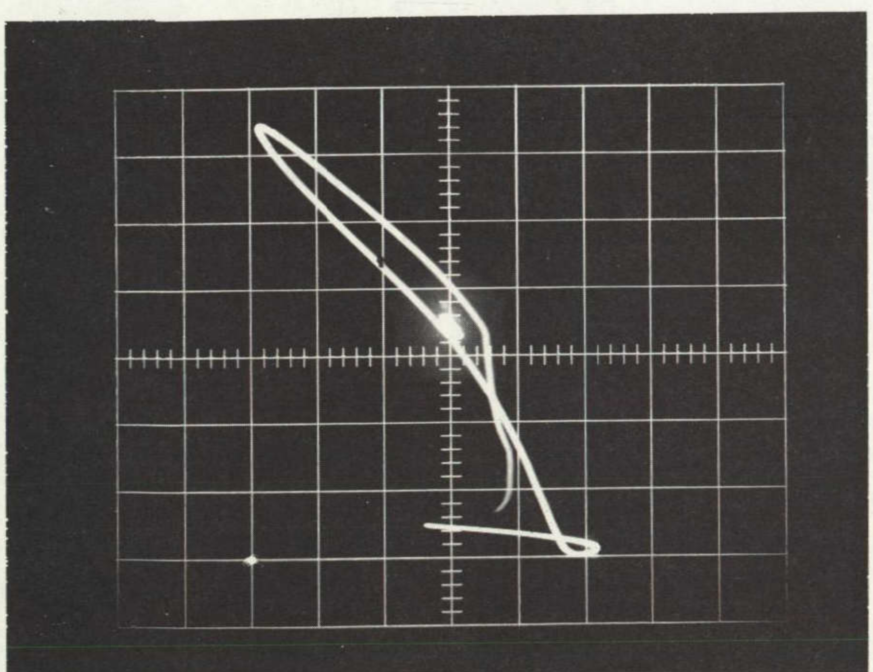


Photo No. SC-2b-22

T_E = 1500°C
T_{COLL} = 795°C
T_{CS} = 329°C

X axis = 0.1V/div.
Y axis = 20A/div.

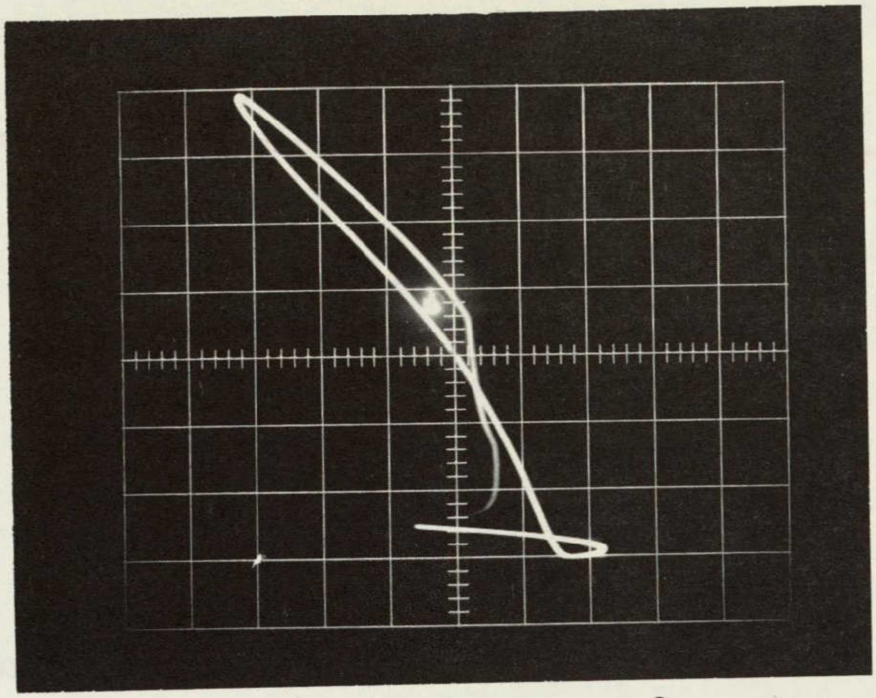


Photo No. SC-2b-23

T_E = 1500°C
T_{COLL} = 793°C
T_{CS} = 328.5°C
X axis = 0.1V/div.
Y axis = 20A/div.

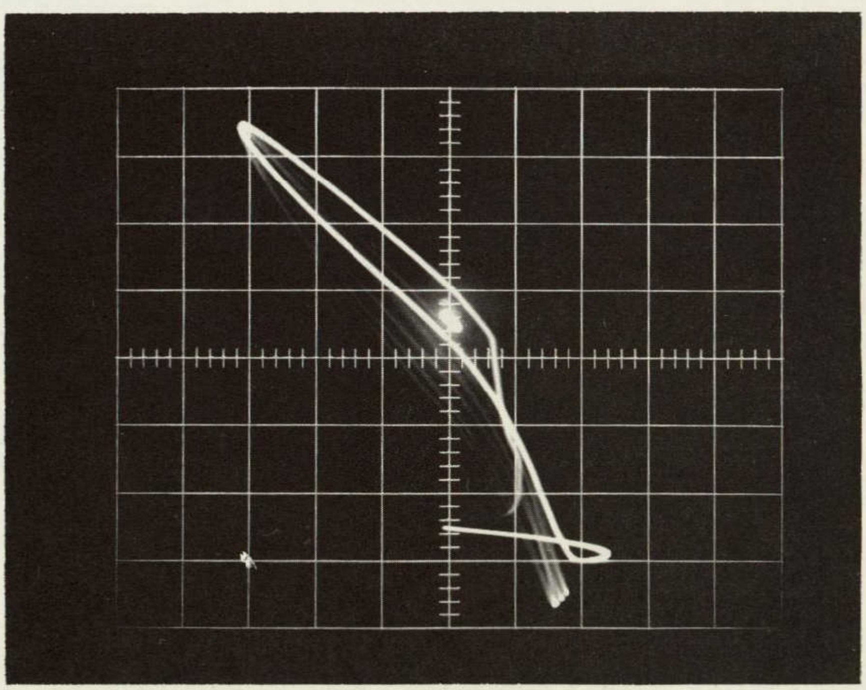


Photo No. SC-2b-24

T_E = 1515°C
T_{COLL} = 794°C
T_{CS} = 324.5°C

X axis = 0.1V/div.
Y axis - 20A/div.

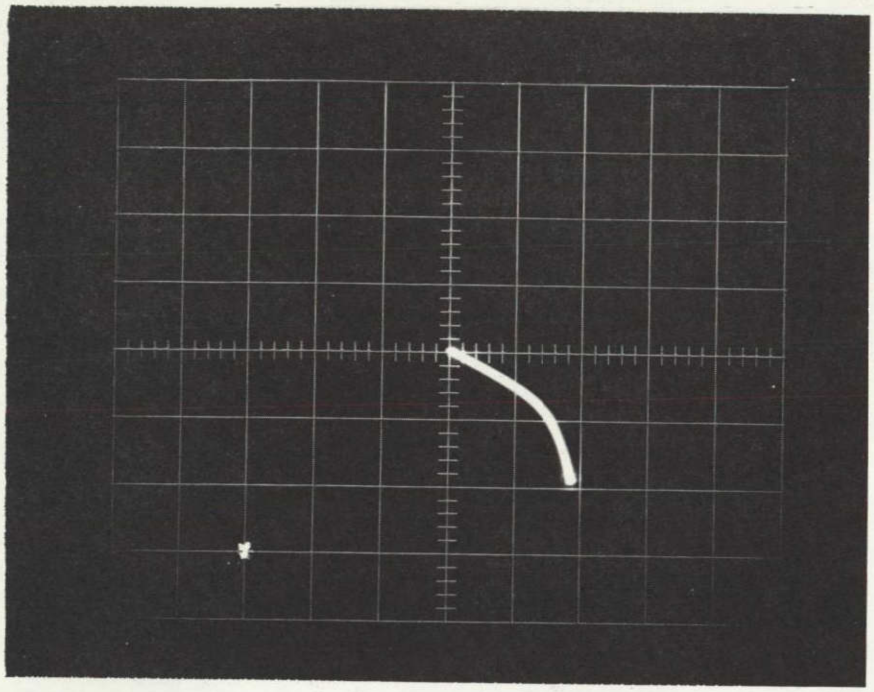


Photo No. SC-2b-25

T_E = 1495°C
T_{COLL} = 764°C
T_{CS} = 310°C
X axis = 0.1V/div.
Y axis = 20A/div.

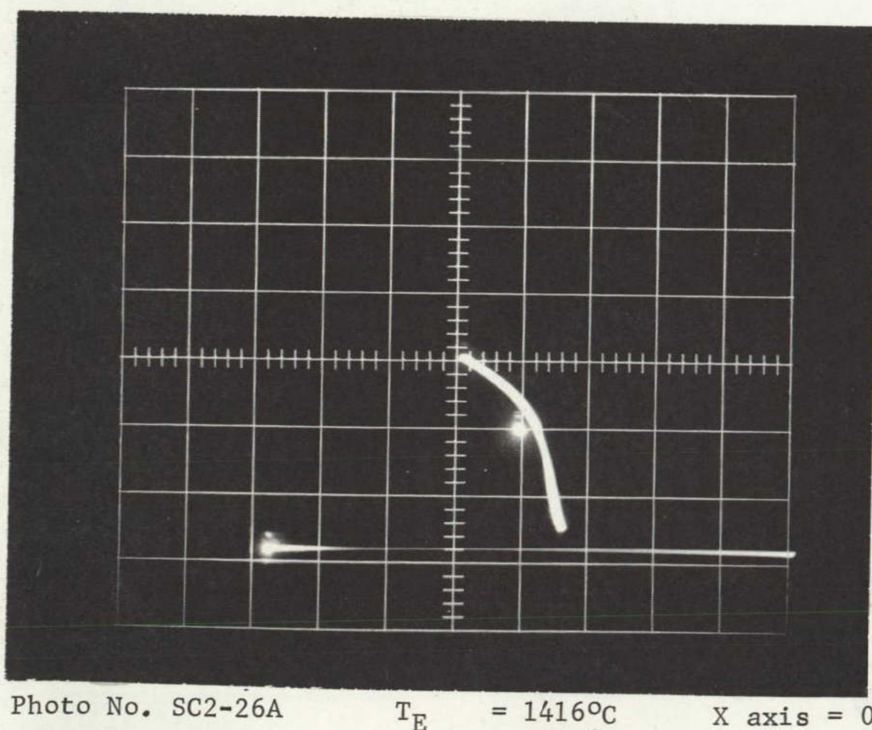


Photo No. SC2-26A

T_E = 1416°C
T_{COLL} = 726°C
T_{CS} = 307°C

X axis = 0.1V/div.
Y axis = 20A/div.

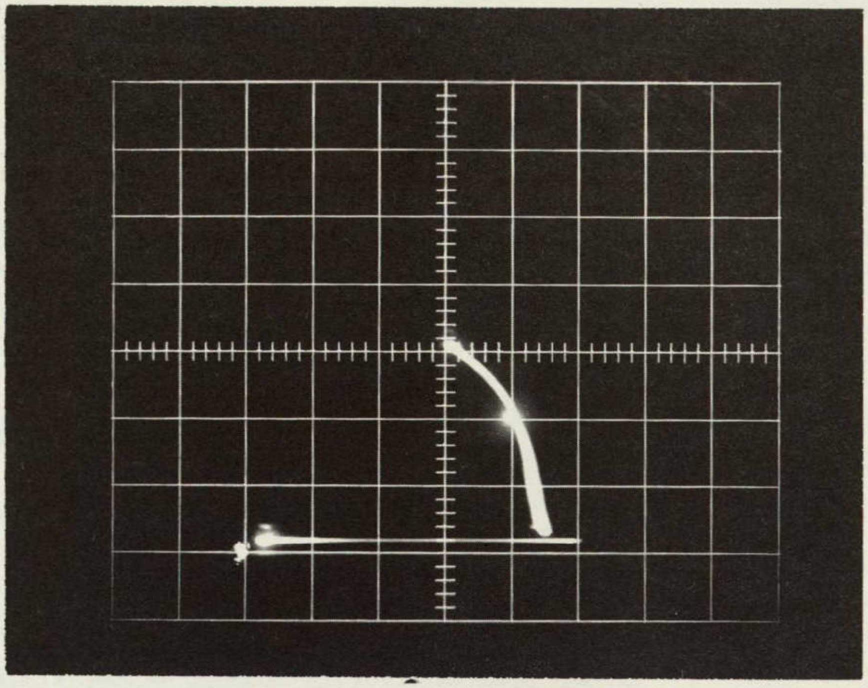


Photo No. SC-2-26B

T_E = 1416°C
T_{COLL} = 726°C
T_{CS} = 307°C
X axis = 0.1V/div.
Y axis = 20A/div.

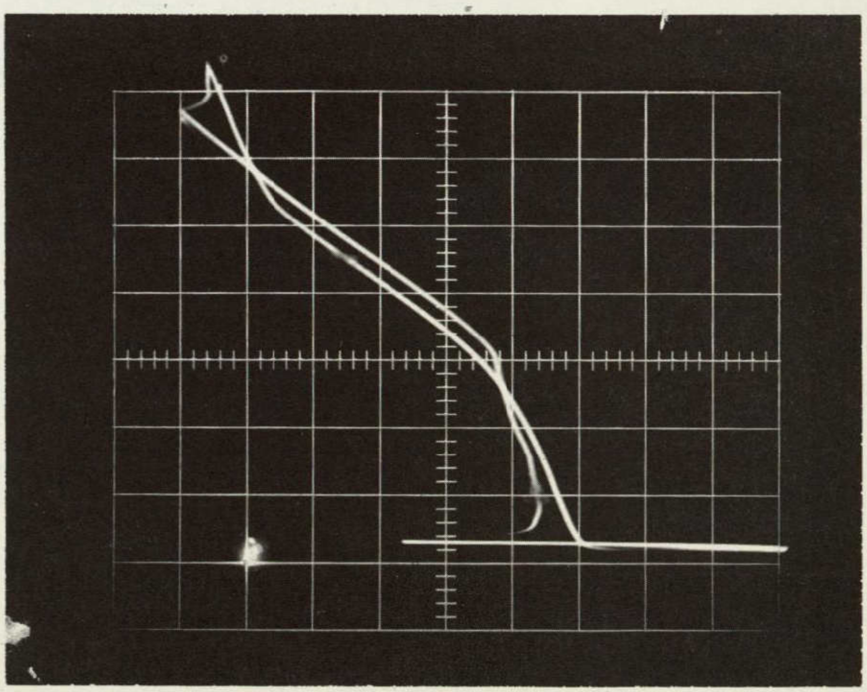


Photo No. SC-2-27

T_E = 1502°C
T_{COLL} = 772°C
T_{CS} = 324°C

X axis = 0.1V/div.
Y axis = 20A/div.

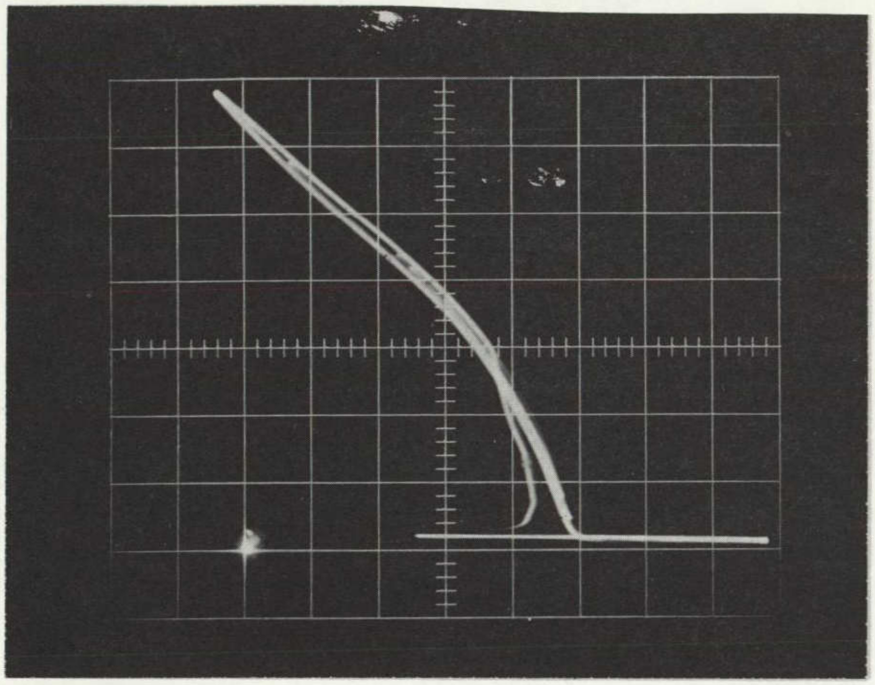


Photo No. SC-2-28

T_E = $1500^{o}C$

T_{COLL} = $772^{o}C$

T_{CS} = $329.5^{o}C$

X axis = 0.1V/div.

Y axis = 20A/div.

APPENDIX 4

CONVERTERS SC-3a AND SC-3b

BRAZING/FIRING SCHEDULE

1440^{o} to 1450^{o}C
14.815 to 14.935 mV

3 Heatshields Top

1 Coil Below Can

DATE: 10-13-69

PART DESCRIPTION: 4^{2} Convert Flange (Flat)

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1109	Room	Top		Bott.			$1.5x10^{-6}$	8.0	RF
	1112							$1.5x10^{-6}$	8.5	
	1115	115	0.75	115	0.75			$2.6x10^{-6}$	9.0	
	1118	200	1.43	200	1.43			$3.4x10^{-6}$	9.5	
	1121	300	2.32	290	2.22			$3.6x10^{-6}$	10	
	1124	411	3.35	388	3.14			$3.1x10^{-6}$	10.5	
	1127	518	4.40	485	4.07			$2.8x10^{-6}$	11.0	
40^{o}	1130	618	5.40	578	5.00			$2.8x10^{-6}$	11.5	
	1133	743	6.70	685	6.10			$2.5x10^{-6}$	12.0	
	1136	862	8.00	813	7.47			$2.5x10^{-6}$	12.5	
	1139	982	9.36	951	9.00				13.0	
	1140		10.42		10.00				13.5	
	1142		11.80		11.54				14 -	14.5
	1143	1272	12.80	1247	12.50				15 -	
	1144	1355	13.80	1339	13.60				16 -	16.5
X1510NV	1145	1464	15.80	1441	14.82					
	1146	1470	15.17	1448	14.90			$1x10^{-5}$	14.5	
	1147	1467	15.14	1445	14.88				14	
	1148	1469	15.16	1441	14.82			$7.9x10^{-6}$	13.8-	13.5
	1149	1456	15.00	1441	14.82				13.5	
X	1150	1448	14.90	1441	14.82				12	
	1203									RF OFF

BRAZING/FIRING SCHEDULE

Coil Height 1 coil Below Can For Final Setting With 10 Pcs Heat Shield on Top

Station #4

Replacement for SC-3

1425°C to 1440°C
14.63 mV Min.

DATE: October 2, 1969

PART DESCRIPTION: Flange 4^2 Converter

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1527	Room	Top		Bott.			$6.5x10^{-7}$	8	RF ON
	1530		0.52		0.60			$6.1x10^{-7}$	9	
	1534		1.50		1.66			$8x10^{-6}$	9.5	
	1537		2.52		2.72			$1.1x10^{-6}$	9.80	
	1540		3.44		3.42			$1.1x10^{-6}$	10.1	
	1543		4.38		4.10			$1.1x10^{-6}$	10.8	
	1547	643	5.66	596	5.17			$1.4x10^{-6}$	11.1	
	1550	755	6.84	698	6.24			$1.5x10^{-6}$	11.5	
			8.68		7.98					
	DROPPED COIL									
	1604		-		-			$4x10^{-7}$	9	RF ON
	1607	883	8.24	857	7.95				10	
	1610	889	8.60	915	8.30				10.5	
	DROPPED COIL		1 TURN							
	1610							$4.6x10^{-7}$	9.5	RF ON
	1613	920	8.66	899	8.42				10.0 10.4	
	1616	955	9.05	935	8.82				10.9	
	1618	1008	9.66	990	9.45				11.6	
	1619½	1053	10.19	1036	9.98				12.0	
	1621		11.10		10.85				12.3-	12.6-13.2 - 13.5
	1622	1207	12.02	1189	11.80				14 -	14.5-14.6 - 15.7
	1623½		13.80		13.54				16 -	15.8 -
X	1624½	1454	14.98	1425	14.63					
	25½	1452	14.96	1430	14.69				13½	
	1627	1449	14.92	1429	14.68				13	
	1628	1445	14.87	1427	14.66				13.1	
X	1629½		14.88		14.68				12	
	1645			LEAK CHECK TIGHT						RF OFF

BRAZING/FIRING SCHEDULE

1425°C Min = 14.63 mV

3 Heat Shields Top

DATE: 10-3-69

PART DESCRIPTION: Flange 4^2 Converter

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1440		Top		Bott.			$4x10^{-7}$	8	RF ON
	1444							$3x10^{-6}$	9	
	1447	460	3.82	490	4.12			$2.4x10^{-6}$	9.5	
	1450	578	5.00	618	5.40			$2x10^{-6}$	9.8	
	1453	613	5.35	647	5.70			$1.4x10^{-6}$	10.1	
	1456	704	6.30	759	6.88			$1.6x10^{-6}$	10.5	
	1459½	777	7.08	818	7.52			$1.4x10^{-6}$	11.0	
	1503	854	7.92	910	8.55			$1.4x10^{-6}$		
		RAISE	COIL	3/8"						
	1505								9	RF ON
	1506								10	
	1507		7.10		6.68				11	
	1508		7.34		7.34			$1.4x10^{-6}$	11.5	
	1511	906	8.50	898	8.40			$1x10^{-6}$	12.0	
	1514	980	9.34	966	9.18			$1x10^{-6}$	13	
	1515	1061	10.28	1068	10.36			$2x10^{-6}$	13.5	
	1516	1124	11.02	1124	11.02			$4x10^{-6}$	14	
	1517	1191	11.82	1191	11.82			$6x10^{-6}$	14.5	
	1518	1264	12.70	1264	12.70			$9x10^{-6}$	15.0	
	1519	1304	13.18	1290	13.00			$1x10^{-5}$	15.6	- 16.
X	1521	1449	14.92	1414	14.50					
	1522	1472	15.20	1425	14.63			$1.4x0^{-5}$	15.5	
	1523	1472	15.20	1401	14.34				15.4	
	1524	1472	15.20	1409	14.44				15.4	
	1525	1481	15.30	1414	14.50				15.2	
X	1526	1481	15.30	1414	14.50				13.5	
	1538									

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

1425°C = 14.63 mV

SC-3

DATE: 9-2-69

PART DESCRIPTION: Flange 4^2 Nb - Ceramic

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1411	Room	Top		Bott.			$8x10^{-7}$	8	RF ON
	1414							$7x10^{-7}$	9	
	1417		1.54		1.74			$1.1x10^{-6}$	9.5	
	1420		2.70		2.90			$1.1x10^{-6}$	9.8	
	1423		3.44		3.72			$1x10^{-6}$	10.1	
	1426		4.44		4.56			$1x10^{-6}$	10.8	
	1429		5.52		5.70			$1.4x10^{-6}$	11.1	
	1432		7.00		7.00			$1.8x10^{-6}$	11.5	
	1435		8.16		8.14			$1.8x10^{-6}$	11.8	
	1438½		9.52		9.35			$1.6x10^{-6}$	12.1	
	1441		10.24		10.18			$2x10^{-6}$	12.5	
	1443		11.10		11.50			$2.4x10^{-6}$	13.0	
	1445	1212	12.08	1196	11.88				13.5	
	1446½		12.70		12.68			$7.2x10^{-6}$	14	
	1447½		13.34		13.28			$8x10^{-6}$	14.5	
	1448								15	
X	1449		14.42		14.42			$1.4x10^{-5}$		
	1450		14.64		14.58			$1x10^{-5}$	14.2	
	1451		14.68		14.62			$1x10^{-5}$	14.0	
	1452		14.74		14.66			$1.1x10^{-5}$	13.9	
	1453		14.74		14.62			$8.5x10^{-6}$	13.9	
X	1454		14.64		14.58				12	
	1456								11	
	58								10	
	1500								9	
	1502								8	
	1503									RF OFF

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

@ 1425°C = 14.63 mV

SC-3

DATE: 8-29-69

PART DESCRIPTION: Flange 4^2 Nb and Ceramic

BRAZE TYPE: Seal

WA NO. 4018-001-001

Station #4

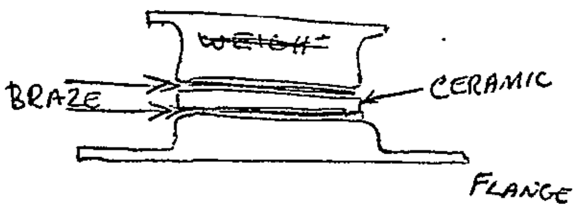
OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1400	Room	Top		Bott.			$1x10^{-6}$	8	RF ON
	1403		-		-			$1.4x10^{-6}$	9	
	1406		1.40		1.58			$1.6x10^{-6}$	9.5	
	1409		2.28		2.50			$1.6x10^{-6}$	9.80	
	1414½							$1.6x10^{-6}$	10.0	
	1416		4.30		4.54			$1.8x10^{-6}$	10.5	
	1419		5.20		5.30			$2x10^{-6}$	10.8	
	1423		6.0		6.10			$2x10^{-6}$	11.1	
	1425		7.2		7.40			$2x10^{-6}$	11.5	
	1429		8.34		8.14			$2x10^{-6}$	11.8	
	1432	976	9.30	953	9.03			$2x10^{-6}$	12.1	
	1435							$2x10^{-6}$	12.5	
	1438½		10.70		10.5			$2x10^{-6}$	13.0	
	1441		11.4		11.24			$2x10^{-6}$	13.5	
	1443		12.38		12.18			$2.5x10^{-6}$	14.0	
	1444½		13.10						14.5	
	1446½		13.74		13.7			$7.4x10^{-6}$	15.0	
Braze X	1446½		14.50		14.40			$7.5x10^{-6}$	14.25	
	1447½		14.60		14.50				14.2	
	1448½		14.60		14.50			$7.2x10^{-6}$	14.2	
	1449½		14.64		14.56				14.2	
	1450½	1429	14.68	1427	14.66			$6.4x10^{-6}$	14.2	
X	1451½		14.68	1421	14.58				12	
	1452½								11.5	
	1502									RF OFF

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

1440 - 1450°C
14.815 -



DATE: 10-20-69

PART DESCRIPTION: 4^2 cm

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1613	Room	Top		Bott.			4×10^{-7}	8	RF ON
	1616		0.78		0.64			3.5×10^{-7}	8.5	
	1619		1.36		1.10			5.6×10^{-7}	9.0	
	1622		1.9		1.74			1×10^{-6}	9.5	Coil was lowered
	1625		2.98		2.60			1×10^{-6}	10.0	to between 2-3
	1628		4.14		3.55			1×10^{-6}	10.5	coil from bottom
	1631	599	5.20	537	4.58			1.4×10^{-6}	11.0	of can
	1634	727	6.54	645	5.68			1.7×10^{-8}	11.5	
	1637	829	7.64	768	6.98				11.5	
	1639		8.20		7.70	LOWER	OIL		-	RF OFF
	1643		7.10		6.84			4×10^{-7}	9	RF ON
	1645								10.0	
	1646		7.52		7.3			5.8×10^{-7}	11.0	
	1647		7.98		7.64				11.5	
	1650		9.28		8.94			9.8×10^{-7}	12.0	
	1653		10.30		10.00				13.0	
	1654		11.10		10.80			5×10^{-6}	13.5	
	1655		12.04		11.88			4.8×10^{-6}	14.00	
	1656½		12.94		13.10			8×10^{-6}	14.5	- 15
	1658		14.32		14.18			1.6×10^{-6}	16	
X	1659	1439	14.80	1464	15.10			1.4×10^{-5}	14½	
	1700	1452	14.96	1473	15.20			1×10^{-5}	14	
	1701	1464	15.10	1453	14.97					
	1702	1468	15.14	1454	14.98			9×10^{-6}	13.9	
	1703	1468	15.14	1452	14.96			9×10^{-6}	13.8	
X	1704	1464	15.10	1450	14.94			9×10^{-6}	11.5	
	1714									RF OFF

BRAZING/FIRING SCHEDULE

5 heat shields
coil height 1 turn
below to can (7-3/4")
Replacement for SC-3
flat flange - (no convolute)
1425°C - 1440°C

DATE: October 10, 1969

PART DESCRIPTION: Flange 4^2 Converter

BRAZE TYPE: Seal

WA NO. 4018-001-001

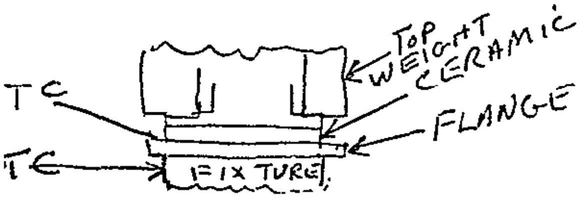
OPERATOR: Gon - Mitch

	TIME	Bottom TEMP.°C No. 1	mV 1	Top TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1314	Room						1.8×10^{-7}	8	RF ON
	1317		0.55		0.74			5.1×10^{-7}	8.5	
	1320		1.15		1.48			6.8×10^{-7}	9.0	
	1323		1.92		2.20			1.4×10^{-7}	9.5	
	1326		2.80		2.98			1.4×10^{-6}	9.8	
	1329		3.74		3.92			1.4×10^{-6}	10.2	
	1332		4.64		4.84			1.4×10^{-6}	10.7	
	1335	629	5.52	664	5.88			1.4×10^{-6}	11.1	
	1338	736	6.64	783	7.14			1.4×10^{-6}	11.5	
	1341	848	7.85	893	8.35			1.4×10^{-6}	11.9	
	1344	959	9.09	1012	9.70			1.4×10^{-6}	12.5	- 13
	1345		9.90		10.50				13.5	-14
	1347		10.80		11.50				14.5	
	1348		12.10		12.60			1.8×10^{-5}	15.0	
	1349		13.04		13.90			1.6×10^{-5}	15.5	- 16
X	1350		14.33		15.10					
	1351	1437	14.70	1515	15.70				15.5	- 15
	1352		15.14		15.70			1.6×10^{-5}	14.1	- 14
	1353		15.14		15.62			1×10^{-5}	13.2	
	1354	1434	14.74	1469	15.16			1×10^{-5}	13	
	1355	1422	14.60	1456	15.00				11.5	
					3.80	Quick	Cool			

FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

14.815 mV = 1440°C
1 coil below Ta can
3 heat shields on top



DATE: 10-14-69

PART DESCRIPTION: 4^2 Convert Flange

BRAZE TYPE: Heat distrib. betw. FLANGE AND FIXTURE

WA NO. 4018

OPERATOR: GON

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0854	Room	Bot Fix		Bottom Flange			$2x10^{-7}$	8	RF ON
	0857		0.48					$8x10^{-7}$	8.5	
	0900		0.98		2.10			$1.2x10^{-6}$	9.0	
	0903		1.7		2.80			$1.4x10^{-6}$	9.5	
	0906		2.42		3.60			$1.6x10^{-6}$	10	
	0909	424	3.48	536	4.58			$1.4x10^{-6}$	10.5	
	0912	519	4.40	618	5.40			$1.3x10^{-6}$	11.0	
	0915	621	5.44	704	6.30			$1.7x10^{-6}$	11.5	
	0918	713	6.40	798	7.30			$1.6x10^{-6}$	12.0	
	0921	802	7.35	880	8.20			$1.3x10^{-6}$	12.5	
	0924		8.85		9.68			$1.6x10^{-6}$	13.0	
	0925		9.38		10.34			$2.6x10^{-6}$	13.5	
	0926		10.00		11.00			$3.5x10^{-6}$	14	- 14.5
	0927		11.00		12.10			$8x10^{-6}$	15	- 15.5
	0928		12.40		13.44				16	
	0929		13.46		14.50			$2.4x10^{-5}$	16	- 16 1/2
50°C	0930	1434	14.74	1484	15.34			$1.7x10^{-5}$	15.7	- 15 - 14.5
	0932		14.94		15.42				14.5	- 14.4
	0933		15.0		15.38				14	
	0934		14.92		15.30			$7.5x10^{-6}$	14	
31°C	0935	1446	14.88	1477	15.26			$7.6x10^{-6}$	14	
	0936		14.87		15.26				13.05	
	0938		14.50		14.84					
	0939	1442	14.48	1442	14.84				12	
	0950									RF OFF

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

Max Temps
1580°C Emitter
775°C Seals
300°C Tee Temp

DATE: 10-27-69

PART DESCRIPTION: Final outgas SC-3

BRAZE TYPE:

WA NO. 4018-001-001

OPERATOR: Pyle

OBS.EMITT TEMP°C	TIME	Seals TEMP.°C No. 1	mV 1	Tee TEMP.°C No. 4	mV 2	Coll TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
0	1045	Room		Room				EXT / INT		
1100	1100	494	20.4		1.4	438	18 mV	$2x10^{-6}$ / 15 μc		
1250	1115		25.00		2.0		22.00	$2x10^{-6}$ / 30 uc		
1375	1120	747	31.10		2.35		27.0	$3x10^{-6}$ / 90 μc		Surface Temp
1420		Seals to bot reducing temp								Bottom of Emit
										1395°C
										Top 1275
									L	Side 1280
									R	Side 1280

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

Max Temps
1580°C emitter
775°C seals 32.27 mV
300°C tee 12.21

DATE: 10-27-69

PART DESCRIPTION: Final outgas SC-3

BRAZE TYPE:

WA NO. 4018-001-001

OPERATOR: Pyle

OBS TEMP EMITT	TIME	Seals TEMP.°C No. 1	mV 1	Tee TEMP.°C No. 4	mV 2	Coil TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
Used short	fil for	gun						EXT / INT		
	1550							1×10^{-6} / 20 μa		Filt bomb ON
1400°C	1605	717°C	29.85	45°C	1.8	638	26.50			
1530°C	1613		32.22		2.5		29.14	2×10^{-6} / 75 μa		
1520°C	1630		32.04		3.43		29.05	1.8×10^{-6} / 75 μa		Tee header on
1530°C	1655	776°C	32.3	222°C	9.00	706°C	29.40	1×10^{-6} / 3.2 μa		
Coming down										
	1612	Power off								
10-28-69										
	0830							1×10^{-6} / 10 μa		Filt bomb ON
1538	0900		32.76		12.24		29.76	1×10^{-6} / 1.0 μa		
1530	0917		33.14		12.20		29.68	1.2×10^{-6}		
1525			32.00		12.22		29.00			
1525	0940		32.56		12.21		29.50	1.2×10^{-6} / 600 μa		
1510	0950		32.31		12.28		29.38	1.3×10^{-6} / 700 μa		
			32.35				29.34			
1528	1010		32.52		12.30		29.40	1.8×10^{-6} / 800 μa		
1510	1025		32.36		12.20		29.28	1.2×10^{-6} / 800 μa		
1500	1055		32.06		11.96		29.60	1×10^{-6} / 700 μa		
1498	1120		32.20		12.12		29.12	9×10^{-7} / 630 μa		
1495	1138		31.84		11.84		28.84	8×10^{-7} / 600 μa		
1495	1150		31.78		11.74		28.86	8×10^{-7} / 600 μa		Coming down for lunch
										Fil end CS on
	1155	Bomb OFF								Bomb off
	1325		19.30		11.04		17.78	10.8 μa		Bomb on
1520°C	1345	780°C	32.48	288°C	11.70	708	29.48	2×10^{-7} / 120 μa		
1520°C	1400		32.44		11.93		29.40	1.8×10^{-7} / 150 μa		
	1415		32.50		12.00		29.48	1.8×10^{-7} / 160 μa		

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

1580°C emitter
775°C seals
300°C tees

DATE: 10-28-69

PART DESCRIPTION: Final Outgas SC-3

BRAZE TYPE:

WA NO. 4018-001-001

OPERATOR:

OBS TEMP	TIME	Seals TEMP.°C No. 1	mV 1	Tee TEMP.°C No. 2	mV 2	Coll TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
1525°C	1430		32.20		12.00		29.20	2.2×10^{-7} / 195 μa		
1525°C	1445		32.29		12.04		29.30	3×10^{-7} / 215 μa		
1530°C	1500		32.32		12.09		29.30	3.2×10^{-7} / 228 μa		
1520°C	1515		32.38		11.22		29.34	2.8×10^{-7} / 200 μa		
1530°C	1530		32.41		11.32		29.38	2.7×10^{-7} / 199 μa		
1525°C	1545		32.48		11.34		29.48	2.6×10^{-7} / 180 μa		
1525°C	1602		32.38		11.25		29.34	2.2×10^{-7} / 162 μa		
1530°C	1615		32.62		11.32		29.40	2.1×10^{-7} / 160 μa		
1530°C	1630		32.65		11.31		29.48	2.0×10^{-7} / 155 μa		
1700	All power off							125 μa		
Cesium										
Drive	1000	Room	1.0					7×10^{-7}		Power On
300°C	1005		6.86					3.8×10^{-7}		
1½ hours	1010		10.50					3×10^{-7}		
Time	1020	300°C	12.21					1.6×10^{-7}		
	1030		12.31					1×10^{-7}		
	1050		12.1					8.8×10^{-8}		
	1130		12.1					6.2×10^{-8}		
End	1150		12.1					5.4×10^{-8}		Power off

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

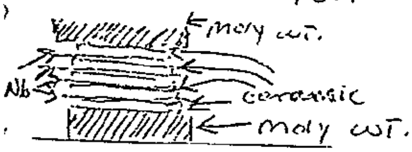
1000°C for 5 min.

DATE: Oct. 1, 1969

PART DESCRIPTION: Convt flanges

18.1 mV

BRAZE TYPE: Nb-Anneal

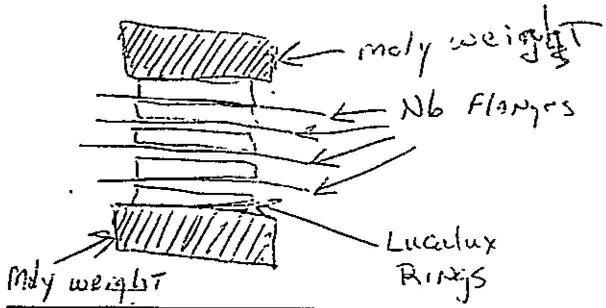


WA NO. 4018-001-001 4 flanges

OPERATOR: Mitchner

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1426	Room						$1.6x10^{-6}$	9	RF ON
	1428		0.48					$0.8x10^{-5}$	10	
	1431	140	1.98					$8x10^{-6}$	11	
	1434	290	4.36					$3.5x10^{-6}$	12	
	1437	680	10.16					$3.2x10^{-6}$	13	
X	1440	1000	18.02					$2x10^{-6}$	12.5	
	1443	1030	18.66					$0.7x10^{-6}$	11.5	
X	1445		18.36					$0.3x10^{-6}$	10	Going down
	1451									RF OFF
	1535		Quick cool @ 400°C							

BRAZING/FIRING SCHEDULE



DATE: 10/10/69

PART DESCRIPTION: Nb Converter Flanges (convoluted)

BRAZE TYPE: Anneal @ $1000^{\circ}C$ for 5 min.

WA NO. 4018-001-001 (18.1 mv)

OPERATOR: Mitchner

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1511	Room						$6x10^{-6}$	9	RF ON
	1513		3.2					$2x10^{-5}$	10	
	1515		7.7					$1.5x10^{-5}$	11	
	1517		11.4					$6.8x10^{-6}$	12	
	1519		15.1					$7.4x10^{-6}$	13	
Braze	1521		18.1					$6x10^{-6}$	12	11 1/2
	1523		18.64					$4.3x10^{-6}$	11½	
	1525		19.0					$4x10^{-6}$	10½	
Out of braze	1526		19.12					$2.5x10^{-6}$	8	
	1531									RF OFF

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

DATE: 8-6-69

PART DESCRIPTION: Re Discs 4 pcs

BRAZE TYPE: 1700°C 15 min Anneal

WA NO.

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1625	Room						$2x10^{-7}$	9	RF ON
	1627								10	
	1629		12.27						11	
	1631		16.48						12	
	1633		19.80					$3.4x10^{-7}$	13	
	1635		23.38					$6.4x10^{-7}$	14	
	1637		25.85					$1.8x10^{-6}$	15	
	1639		28.42					$7x10^{-6}$	16¼	
X	1640		29.50					$8x10^{-6}$	16½	
	1645		29.50					$8x10^{-6}$	16½	
	1650		29.53					$8x10^{-6}$	16½	
X	1655		29.60						14	
	1700									RF OFF

BRAZING/FIRING SCHEDULE

4 turns of heater

DATE: 9/8/69

PART DESCRIPTION: Reservoir and Heater

BRAZE TYPE: T.

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1124	Room						$8x10^{-7}$	9	RF ON
	1126		2.80					$2.2x10^{-5}$	10	
	1128		7.10					$4.4x10^{-6}$	11	
	1130		12.10					$3.8x10^{-6}$	12	
	1132		16.00					$2.1x10^{-6}$	13	
	1134½		20.69					$2.4x10^{-6}$	14	
	1136		23.94					$3.2x10^{-6}$	15	
	1138		26.12					$4.2x10^{-6}$	16	
	1140		27.28					$5.4x10^{-6}$	17	
X	1142		29.00						17	
	1142½		29.10					$4.5x10^{-6}$	17	
	1143		29.10							
X	43½		29.30					$4.8x10^{-6}$	14.5	

BRAZING/FIRING SCHEDULE

4 turns of heater

DATE: Sept. 8, 1969

PART DESCRIPTION: Reservoirs 2 pcs with Heater

BRAZE TYPE: T.

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0931	Room						$7x10^{-7}$	9	RF ON
	0933							$4x10^{-5}$	11	
	0934							$1.5x10^{-5}$	10	
	0936		8.74					$3.6x10^{-6}$	11	
	0938		13.00					$2x10^{-6}$	12	
	0940		17.10					$1.9x10^{-6}$	13	
	0942		21.24					$2.8x10^{-6}$	14	
	0944		23.76					$4x10^{-6}$	15	
	0946		25.18					$6.2x10^{-6}$	16	
	0948		27.20						17	
X	0949		29.00					$1x10^{-5}$	17	
	0950		29.20							
X	0950½		29.20						14.5	
	0955									RF OFF

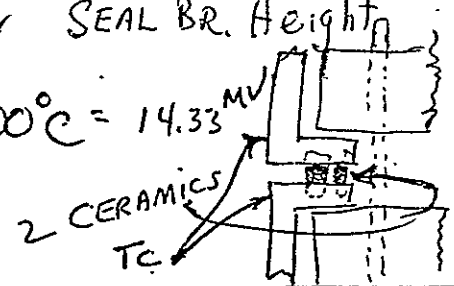
OS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

12 3/4" SEAL BR. Height

1400°C = 14.33 MV



DATE: 9-9-69

PART DESCRIPTION: Gun Holder

BRAZE TYPE: Seal 1400°C

WA NO. 4018-001-001

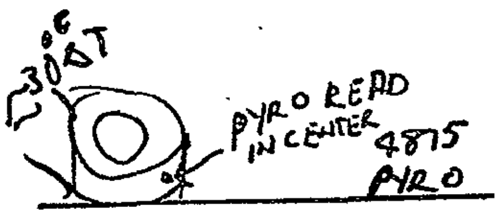
OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0913	Room	Top		Bot.			$8x10^{-7}$	8	RF ON
	0916½							$1.4x10^{-6}$	8.5	
	0919		2.2		2.15			$1.0x10^{-6}$	9.0	
	0922½		3.54		3.63			$1.2x10^{-6}$	9.5	
	0925½		4.66		5.08			$1.4x10^{-6}$	10.0	
	0928½		5.80		6.15			$2x10^{-6}$	10.5	
	0931½		6.80		7.34			$3x10^{-6}$	11.0	
	0935		8.50		8.90			$3x10^{-6}$	11.5	
	0938		10.20		10.56			$2x10^{-6}$	12	
	0939		10.48		10.88			$2x10^{-6}$	12.5	
	0940		11.26		11.84			$2.6x10^{-6}$	13	
	0941		12.08		12.50			$3.5x10^{-6}$	13.5	
	0942		12.76		13.32			$4.8x10^{-6}$	14.0	
	0943		13.60		14.02				14.5	
X	0944	1400	14.33		14.80			$8x10^{-6}$	14.5	
	0945		14.35		14.92			$6.2x10^{-6}$	14.0	
	0946	1400	14.33		14.76			$4.6x10^{-6}$	13.8	
	0947		14.30		14.76			$4.5x10^{-6}$	13.8	
	0948		14.30		14.76			$4.5x10^{-6}$	13.8	
X	0949	1397	14.30	1430	14.77				11.5	
	0959½									RF OFF

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

1850°C OBS Surface
for 1 hr.



DATE: 9/15/69

PART DESCRIPTION: SC-3 Emitter

BRAZE TYPE:

WA NO. 4018-001-001

OPERATOR: P. V. Dun

	TIME	4875 Pyro	OC	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
		OBS								
	1530									POWER ON
	1535									Bomb on
	1540	1500°C						$8x10^{-6}$		
	1555	1800°C						$8x10^{-6}$		
Start	1600	1850°C						$7x10^{-6}$		
	1610	1845°C								
	1615	1855°C						$4x10^{-6}$		
	1620	1855°C						$3.8x10^{-6}$		
	1625	1850°C						$2.5x10^{-6}$		
	1635	1845°C						$2x10^{-6}$		
	1640	1845°C								
	1645	1850°C						$1.8x10^{-6}$		
	1650	1860°C						$1.6x10^{-6}$		
	1655	1857°C						$1.4x10^{-6}$		
Stop	1700	1850°C						$1.4x10^{-6}$		
	1701	All Power Off								

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS, INC. SC-3 DATA SHEET NUMBER ______

A XEROX COMPANY PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Nb SPECIFICATION ______
THICKNESS 0.020 P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

WELDED TO

MATERIAL Nb SPECIFICATION ______
THICKNESS 0.020 P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

FILLER METAL

MATERIAL ______ P.O. NO. ______ FORM ______ CERTS YES ______ NO ______

TYPE OF WELD JOINT #1 Circular Bott #2 Rotary Pierce PENETRATION REQUIRED #1 .020 #2 .020
REQUESTOR OR CUSTOMER P. Horo #3 Circular Pierce W.A. NO. 4018-001-001
OPERATOR J. Frey DATE 10/29/69
JOB DESCRIPTION Cylindrical Converter Assy. (4 cm)

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

				Flange to Cell	Flange to Emitter Lead Strad			
OPTIMUM WELD SCHEDULE		*		*	*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	1	1	1			
RUN NUMBER		1	2	3	2 rerun			
DISTANCE TO WORK (Inches)		7"	7"	7"	7"			
FILAMENT CURRENT (Amps)		1.75	1.75	1.75	1.75			
ACCELERATING VOLTAGE (kV)		1.20	1.50	1.50	1.50			
BEAM CURRENT (mA)		3.0	2.5	3.7	3.7			
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.008	min	min	min			
	VIEWER (Increments)	5						
BEAM FOCUS (Dial Setting)		511	558	553	553			
D.C. DEFLECTION	YES	√	√	√	√			
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		10	25	17	23			
SPEED INDICATOR (Dial Setting)		60	130	95	120			
TIMER (Seconds)		--	23	3.7	2.6			
SLOPE CONTROL (%)	RISE							
	FALL	60%	60%	60%	60%			
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		$5x10^{-5}$	$8x10^{-5}$	$6x10^{-5}$	$7x10^{-5}$			

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER ____

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL TA SPECIFICATION ____
THICKNESS 0.015 P.O. NO. ____ FORM Tube
DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

WELDED TO

MATERIAL TA SPECIFICATION ____
THICKNESS 0.015 P.O. NO. ____ FORM Tube
DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

FILLER METAL

MATERIAL ____ P.O. NO. ____ FORM ____ CERTS YES ____ NO ____

TYPE OF WELD JOINT Fillet PENETRATION REQUIRED 0.010
REQUESTOR OR CUSTOMER Hammerdinger W.A. NO. 4018-001-001
OPERATOR J. Frey DATE 10/29/69
JOB DESCRIPTION Join Tube to Spherical Converter

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE								
Q.A. APPROVAL								
SAMPLE NUMBER		1						
RUN NUMBER		1						
DISTANCE TO WORK (Inches)		7"						
FILAMENT CURRENT (Amps)		1.80						
ACCELERATING VOLTAGE (kV)		110						
BEAM CURRENT (mA)		2.0						
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015						
	VIEWER (Increments)	10						
BEAM FOCUS (Dial Setting)		485						
D.C. DEFLECTION	YES	√						
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		40						
SPEED INDICATOR (Dial Setting)		200						
TIMER (Seconds)		1.4						
SLOPE CONTROL (%)	RISE							
	FALL	60%						
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)								

ELECTRO-OPTICAL SYSTEMS, INC.

A XEROX COMPANY

DATA SHEET NUMBER ____

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Arc Cast Mo and Nb SPECIFICATION ____

THICKNESS ____ P.O. NO. ____ FORM ____

DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

WELDED TO

MATERIAL Arc Cast Mo and Nb SPECIFICATION ____

THICKNESS ____ P.O. NO. ____ FORM ____

DRAWING OR SKETCH NO. ____ CERTS YES ____ NO ____

FILLER METAL

MATERIAL ____ P.O. NO. ____ FORM ____ CERTS YES ____ NO ____

TYPE OF WELD JOINT ____ PENETRATION REQUIRED 0.005 - 0.010

REQUESTOR OR CUSTOMER Hora W.A. NO. ____

OPERATOR J. Frey DATE 10/30/69

JOB DESCRIPTION Seal 1/8" hole with plug inserted

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE					*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	2	2	3	4	5 & 6	
RUN NUMBER		1	1	2	1	1	1	
DISTANCE TO WORK (Inches)		7"	7"	7"	7"	7"	7"	
FILAMENT CURRENT (Amps)		1.65	1.65	1.65	1.65	1.65	1.80	
ACCELERATING VOLTAGE (KV)		110	110	110	110	110	110	
BEAM CURRENT (mA)		3.0	4.0	4.0	4.0	4.0	5.2	
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015	0.010	0.015	0.015	0.015	min	
	VIEWER (Increments)	10	7	10	10	10	6	
BEAM FOCUS (Dial Setting)		489	484	493	493	493	483	
D.C. DEFLECTION	YES						/	
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.			40	40	40	40	40	
SPEED INDICATOR (Dial Setting)			200	200	200	200	200	
TIMER (Seconds)			1.4	1.4	1.4	1.4	1.4	
SLOPE CONTROL (%)	RISE							
	FALL		60%	60%	60%	60%	60%	
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		10^{-4}					10^{-8}	

CONVERTER NO. SC 3b SHEET 1 OF 16

DATE		11/4	11/4	11/5	11/5	11/5	11/5	11/5
TIME		1630	1655	1600	1635	1645	1700	1707
PRESSURE								
10^{-6} TORR			8				8	
V_b		on	99.9			431	482	601
I_b			.0404	off		.259	.294	.361
V_f			11.2			12.1	12.0	12
I_f			14.7	on		15.33	15.3	15.2
T_r	°C							
	°C							
T_c	°C							
	°C		314		305	434	502	550
COL. HTR.	V							
	I							
T_s	°C		327.5		341	485	548	608
	°C		332		340.5	486	549.6	610
T_{res}	°C							
	°C		292		133.5	274	289	336
RES. HTR.	V							
	I							
T_e	°C		~950		930	1108	1198	1308
	°K							
T_{1s}	°C		347.5		372	532	597	657
OUTPUT								
VOLTS			.817		.375	1.304	.176	.182
AMPS			O.C.		O.C.	O.C.	.1	14.8
WATTS							.02	2.69
PHOTO #								

CONVERTER NO. SC 3b SHEET 2 OF 16

DATE		11/5	11/5	11/6	11/6	11/6	11/6	11/6
TIME		1725	1730	0900	1015	1030	1430	1510
PRESSURE								
10^{-6} TORR			going	.08				
			down			DH	DH	
V_b		672			628	OFF	ON	697
I_b		.415			.427			.462
V_f		12.1		ON	12.4			
I_f		15.3			15.4			
T_r	°C							
	°C							
T_c	°C							
	°C	645			625			719.5
COL. HTR.	V							
	I							
T_s	°C	672.5			656			695
	°C	675			658			684
T_{res}	°C							
	°C	358			328		—	353
RES. HTR.	V							
	I							
T_e	°C	1430			1450			1502
	°K							
T_{1s}	°C	720.6			707.5			740.5
OUTPUT								
VOLTS		.2			.320			.413
AMPS		20.00			20.00			26
WATTS		4.0			6.4			10.74
PHOTO #								

CONVERTER NO. SC 3b SHEET 3 OF 16

DATE		11/6	11/6	11/6	11/7	11/7	11/7	11/7
TIME			1725	1730	1020	1035	1120	1135
PRESSURE								
10^{-6} TORR				going				
				down				
V_b		690	691				610	
I_b		.488	.488		Off	ON	.443	
V_f							13.5	
I_f					ON	ON	16.3	
T_r	°C							
	°C							
T_c	°C							
	°C	690	687		330		634	648.5
COL. HTR.	V							
	I						Off	
T_s	°C	703	702.5		375		662	675
	°C	691	690.5		361		650	662
T_{res}	°C							
	°C	348	349		140		331	333
RES. HTR.	V						1.5	
	I						7.5	
T_e	°C	1480	1492				1435	1430
	°K							
T_{1s}	°C	747.6	747.6		398.4		707	717
OUTPUT								
VOLTS		.280	.326		.456		.409	.410
AMPS		39.6	36.88		O.C.		25.06	25.00
WATTS		11.09	12.02				10.25	10.25
PHOTO #			1					2

CONVERTER NO. SC 3b SHEET 4 OF 16

DATE		11/7	11/7	11/7	11/7	11/7	11/7	11/7
TIME		1155	1329	1420	1440	1455		1535
PRESSURE								
10^{-6} TORR								
V_b		610	609	585	570	582	590	
I_b		.444	.441	.418	.405	.416	.425	
V_f		13.5	13.5	13.4				
I_f		16.3	16.3	16.2				
T_r	°C							
	°C							
T_c	°C	666						
	°C	667	655.5	603.5	663	600	612	656
COL. HTR.	V							
	I			off		off	off	
T_s	°C	689.4	690	630.5	696	649	651.6	696
	°C	677	678	636	683.5	634	63.8	683.5
T_{res}	°C	336						
	°C	338	337	324.5	323	325	328	327.5
RES. HTR.	V							
	I							
T_e	°C	1402	1402	1400	1400	1400	1400	1401
	°K							
T_{1s}	°C	729	729	694.4	731	692	694.6	730.4
OUTPUT								
VOLTS		.397	.395	.399	.600	.600	.500	.500
AMPS		26.20	25.74	10.75	8.5	10.0	16.52	15.24
WATTS		10.40	10.17	6.44	5.10	6.0	8.26	7.62
PHOTO #		3				4	5	

CONVERTER NO. SC 3b SHEET 5 OF 16

DATE		11/7	11/7	11/7	11/7	11/7	11/7	11/7
TIME		1542	1555	1610	1649	1710	1725	1729
PRESSURE							~~Coming~~	
10^{-6} TORR			2					~~On~~
							~~down~~	
V_b		594	605	618	583	547		~~OFF~~
I_b		.427	.438	.450	.387	.381		
V_f				13.3	13.3			
I_f				16.1	16.1			
T_r	°C							
	°C							
T_c	°C							
	°C	681	630	651	601.4	591.5		
COL. HTR.	V			~~OFF~~				
	I	10.0						
T_s	°C	701.5	661	670	631	626		
	°C	690	649	660	619	613		
T_{res}	°C							
	°C	333.5	338	340	323	321		
RES. HTR.	V							
	I							
T_e	°C	1400	1402	1400	1300	1300		
	°K							
T_{1s}	°C	736	704	713	669.5	665		
OUTPUT								
VOLTS		.397	.399	.250	.251	.300		
AMPS		22.66	24.16	34.76	26.6	22		
WATTS		9.00	9.64	8.69	6.68	6.6		
PHOTO #					6	7		

CONVERTER NO. SC 3b SHEET 6 OF 16

DATE		11/11	11/11	11/11	11/11	11/11	11/11	11/11
TIME		0900	1000				1130	
PRESSURE								
10^{-6} TORR		POWER ON						
V_b			630	63.0	610		609	
I_b			.429	.428	.413		.413	
V_f								
I_f								
T_r	°C							
	°C							
T_c	°C							
	°C		626.5	626.5	626	670	597.4	574
COL. HTR.	V							
	I							
T_s	°C		654	654	649.4	686	645	633
	°C			645.5	643.4	682	633	620
T_{res}	°C							
	°C		336	333	290	289	325	295
RES. HTR.	V							
	I							
T_e	°C		1402	1399	1400	1412	1402	1400
	°K							
T_{1s}	°C		697.5	697.5	694	724	688	677.5
OUTPUT					SWEEP	SWEEP		
VOLTS			.399	.401	.160	.033	.600	
AMPS			24.22	23.78	30.66	28.0	11.16	
WATTS			9.66	9.54	4.91	.92	6.70	
PHOTO #				8	9	10	11	

CONVERTER NO. SC 36 SHEET 7 OF 16

DATE		11/11	11/11	11/11	11/11	11/11	11/11	11/11
TIME		1130	1320		1351		1455	1505
PRESSURE								
10^{-6} TORR					.15			
V_b		588	577	570	563	536	612	670
I_b		.396	.384	.380	.376	.354	.333	.462
V_f					12.4			
I_f					13.6			
T_r	°C							
	°C							
T_c	°C							
	°C	573	601	658	679	626	603	695
COL. HTR.	V		Off					
	I			10.0				
T_s	°C	632.6	625.5	670	687	658	646	720
	°C	619.5	615.5	661	678	647	634	711
T_{res}	°C							
	°C	292	326	323	323	307	290.5	340
RES. HTR.	V							
	I							
T_e	°C	1400	1300	1300	1300	1300	1300	1500
	°K							
T_{1s}	°C	677.5	663	699	713	688	677	759
OUTPUT								
VOLTS		.799	.200	.200	.199	.400	.600	.600
AMPS		2.5	28.8	28.82	27.8	11.06	.60	17.58
WATTS		2.0	5.76	5.76	5.53	4.42	.36	10.55
PHOTO #		12			13	14		15

CONVERTER NO. SC 3b SHEET 8 OF 16

DATE		11/11	11/11	11/11	11/11	11/11	11/11	11/11
TIME		1525					1630	
PRESSURE								
10^{-6} TORR								
V_b		647		678	694	715	800	800
I_b		.445		.468	.478	.491	.604	.619
V_f								
I_f								
T_r	°C							
	°C							
T_c	°C						593.5	
	°C	675.6	619	643	668	696	693.5	710
COL. HTR.	V	~~On~~	~~Off~~			~~Off~~		
	I							
T_s	°C	719.6	673	681	691	704	761	776
	°C	703	660	670	682	697	749	762.5
T_{res}	°C						244.5	
	°C	317.5	326	341	341.5	355	277	277
RES. HTR.	V							
	I							
T_e	°C	1500	1500	1500	1501	1500	1865	1900
	°K							
T_{1s}	°C	753	719	728	737	747.4	822	836
OUTPUT								
VOLTS		.800	.801	.600	.400	.200	1.815	1.79
AMPS		6.2	7.86	19.32	30.5	46.50		
WATTS		4.96	6.30	11.59	12.2	9.32		
PHOTO #			16A/16B	17	18	19		

CONVERTER NO. SC 36 SHEET 9 OF 16

DATE		11/11	11/11	11/11	11/11	11/12	11/12	11/12
TIME		1635		1720	1730	0855	0903	0915
PRESSURE								
10^{-6} TORR					all power off	.05	.06	.1
V_b		801	697					800
I_b		.620	.488			off	ON	.617
V_f								13.8
I_f						ON	ON	15.6
T_r	°C							
	°C							
T_c	°C							
	°C	715	604	623.5				693.5
COL. HTR.	V							
	I							
T_s	°C	780	697	660				768
	°C	766	688	630				757
T_{res}	°C							
	°C	279.4	329	314.5				230.5
RES. HTR.	V							
	I							
T_e	°C	1900	1518	1498		~~<1000~~	<1000	1890
	°K							
T_{1s}	°C	840	742	701				830
OUTPUT								
VOLTS		1.78	.600	.500			.286	1.500
AMPS			29.54	23.22			O.C.	O.C.
WATTS			17.72	12.61				
PHOTO #			20	21				

SC 3b

11/12 0915

It was found that taking converter emitter temperature above 1700°C improved the apparent emitter work function thus increasing the emitter current by approximately two. This can be seen by comparing the two pictures 16 B and 20. These pictures have comparable reservoir and emitter temperatures.

CONVERTER NO. SC 36 SHEET 10 OF 16

DATE		11/12	11/12	11/12	11/12	11/12	11/12	11/12
TIME		0925	0935	0945	1006		1120	1140
PRESSURE								
10^{-6} TORR		.1						
V_b		805			629	652	666	609
I_b		.616			.442	.460	.472	.424
V_f		12.8			12.6	12.6	12.6	12.6
I_f		15.6			13.5	13.5	13.5	15.5
T_r	°C							
	°C							
T_c	°C							
	°C	709			630	654	674	607
COL. HTR.	V				Off	Off		Off
	I							
T_s	°C	777	778	784	665	678	689	655
	°C	765			657	672	683	645
T_{res}	°C							
	°C	267			318	321	326	301
RES. HTR.	V							2 watts
	I							
T_e	°C	1890	1875	1900	1418	1403	1401	1401
	°K							
T_{1s}	°C	835			707	719	729	720
OUTPUT								
VOLTS		1.734			.499	.400	.299	.600
AMPS		O.C.			27.76	39	49	16.5
WATTS					13.85	15.6	14.65	9.9
PHOTO #					22A/22B	23		24

CONVERTER NO. SC 3b SHEET 11 OF 16

DATE		11/12	11/12	11/12	11/12	11/12	11/12	11/12
TIME		1300	1315		1319	1329		1345
PRESSURE								
10^{-6} TORR		.08	.08					
V_b		586	572	571	570	628	630	655
I_b		.405	.392	.391	.391	.442	.443	.465
V_f		12.5	12.5	12.5	12.5	12.5	12.5	12.5
I_f		15.5	15.5	15.5	15.5	15.5	15.5	15.5
T_r	°C							
	°C							
T_c	°C							
	°C	595	608	607.5	608	631	623	625
COL. HTR.	V				3.67			
	I				7.5			OFF
T_s	°C	650	662	663	616	688.5	683	
	°C	640	651.4	651	653.5	676	669	670
T_{res}	°C							
	°C	288	280	280	277.5	281	280	302
RES. HTR.	V				5 watts			→ 2 watts
	I							
T_e	°C	1402	1400	1401	1401	1500	1500	1501
	°K							
T_{1s}	°C	690	700	700	701	730.6	726.5	723.6
OUTPUT								
VOLTS		.700	.800	1.00	1.2	1.201	.999	.800
AMPS		6.99	2.10	1.50	1.0	2.22	3.10	12.72
WATTS		4.86	1.68	1.50	1.20	2.66	3.10	10.18
PHOTO #								

CONVERTER NO. SC 3b SHEET 12 OF 16

DATE		11/12	11/12	11/12	11/12	11/12	11/12	11/12
TIME		1352	1415		1435			1535
PRESSURE								
10^{-6} TORR								
V_b		691	714	732	599	600	595	549
I_b		.494	.513	.525	.412	.415	.409	.371
V_f		12.5	12.5	12.5	12.5	12.5	12.5	12.5
I_f		13.5	13.5	13.5	13.5	13.5	13.5	13.5
T_r	°C							
	°C							
T_c	°C							
	°C	667	698	717	652	631	665.6	575
COL.	V							Off
HTR.	I							
T_s	°C	699	715	726	667.5	650	679	620
	°C	692	709	722	661	644	675	610
T_{res}	°C							
	°C	326	336	345	316	316	314	293
RES.	V							
HTR.	I							
T_e	°C	1500	1500	1500	1300	1300	1300	130
	°K							
T_{ls}	°C	743	757	768	698	685	709	656.6
OUTPUT								
VOLTS		.601	.400	.300	.199	.200	.196	.400
AMPS		31.00	48.2	59.0	42.36	42.5	41.32	15.65
WATTS		18.63	19.28	17.7	8.43	8.50	8.10	6.26
PHOTO #		25	26	27	28			29

CONVERTER NO. SC 3b SHEET 13 OF 16

DATE		11/12	11/12	11/12	11/12	11/12	11/12	11/12
TIME		1345		1635	------			
PRESSURE								
10^{-6} TORR								
V_b		546	540	506	517		506	507
I_b		.368	.364	.333	.344		.335	.335
V_f		12.5	12.5					
I_f		15.5	15.5					
T_r	°C							
	°C							
T_c	°C							
	°C	619	642	618	600	604	601	603
COL. HTR.	V							
	I							
T_s	°C	659	673	659.5	646.6	649	649	651
	°C	645.5	664	648.5	636	634	639	639.5
T_{res}	°C							
	°C	296	302.6	284	281	279	279	277
RES. HTR.	V							
	I							
T_e	°C	1301	1305	1300	1300	1300	1300	1300
	°K							
T_{ls}	°C	684.5	701	687	677.5	679	679	680
OUTPUT								
VOLTS		.400	.400	.300	.301	.600	.800	1.000
AMPS		15.8	13.70	2.7	4.6	.8	.64	.50
WATTS		6.32	5.48	1.35	2.30	.48	.512	.50
PHOTO #								

CONVERTER NO. SC 3b SHEET 14 OF 16

DATE		11/12	11/12	11/17	11/17	11/17	11/17	11/17
TIME		1705	1715		1043	1108	1152	1334
PRESSURE			Pwr	Acc.				
10^{-6} TORR				Test	.06	.08	.09	
			Off					Pwr
V_b		638			Pwr		672	Off
I_b		.446			On		.469	
V_f							12.5	
I_f							15.4	
T_r	°C							
	°C							
T_c	°C							
	°C	634.5				633.5	675	
COL. HTR.	V							
	I							
T_s	°C	669				669	690.5	
	°C	660.5				660	684	
T_{res}	°C							
	°C	316				318.5	326	
RES. HTR.	V							
	I							
T_e	°C	1400				1401	1401	
	°K							
T_{1s}	°C	708.4				706	727	
OUTPUT								
VOLTS		.502				.497	.300	
AMPS		27.76				26.76	47.7	
WATTS		13.94				13.30	14.31	
PHOTO #								

CONVERTER NO. SC 3b SHEET 15 OF 16

DATE		11/18	11/18	11/18	11/18	11/18	11/18	11/18
TIME			0949	1020	1044	1055		1119
PRESSURE		Res Test						
10^{-6} TORR								
V_b		584	607	547	653	695	544	613
I_b		.400	.414	.364	.459	.490		.435
V_f								12.5
I_f								15.6
T_r	°C							
	°C							
T_c	°C							
	°C	589.4	631.5	607	627.5	666.3	724	611
COL. HTR.	V							
	I							
T_s	°C	646	652.5	646	681	700.5	734.5	666
	°C	633	645	635	670	692	729	655
T_{res}	°C							
	°C	288	311.5	288	307	326.4	343	303
RES. HTR.	V							
	I							
T_e	°C	1401	1298	1301	1501	1502	1501	1450
	°K							
T_{Js}	°C	684	685	675	723	741.6	778	709.5
OUTPUT								
VOLTS		.699	.200	.399	.800	.800	.300	.700
AMPS		6.4	43.0	15.6	11.3	29.9	57.2	11.5
WATTS		4.47	8.6	6.22	9.04	23.92	17.16	8.05
PHOTO #								

CONVERTER NO. SC 3b SHEET 16 OF 16

DATE		11/18	11/18	11/18				
TIME			1135	1150				
PRESSURE								
10^{-6} TORR			going					
			down	All				
V_b								
I_b				off				
V_f								
I_f								
					ACCEPTED			
T_r	°C							
	°C							
T_c	°C							
	°C	656.4						
COL. HTR.	V							
	I							
T_s	°C	689						
	°C	680						
T_{res}	°C							
	°C	323.5						
RES. HTR.	V							
	I							
T_e	°C	1450						
	°K							
T_{1s}	°C	730						
OUTPUT								
VOLTS		.500						
AMPS		32.3						
WATTS		16.15						
PHOTO #								

The bright spot on photo marks the zero axis for each data point.

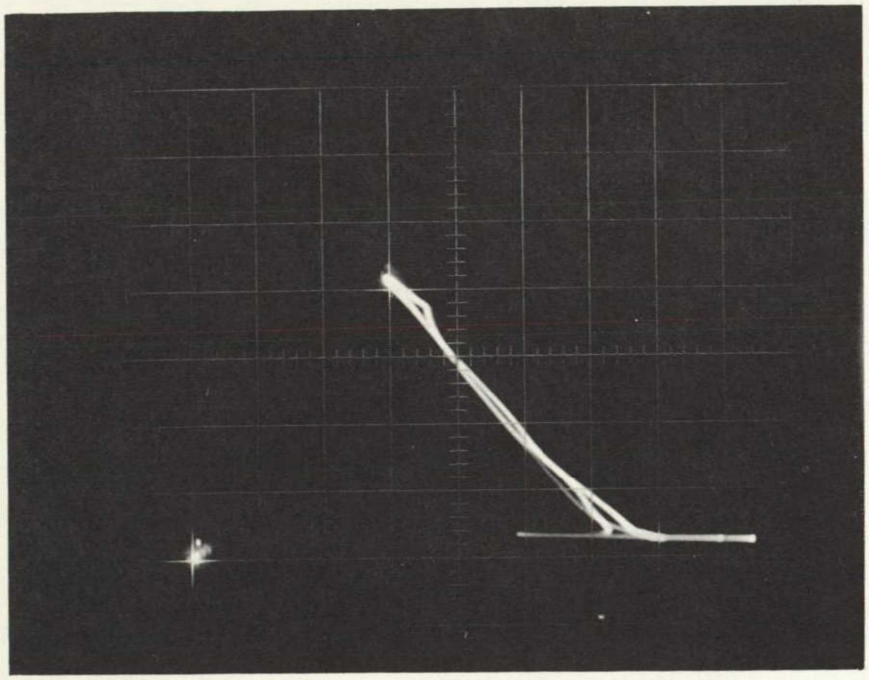


Photo No. SC-3-1

T_E = 1492°C
T_{COLL} = 687°C
T_{CS} = 349°C
X axis = 0.1V/div.
Y axis = 10A/div.

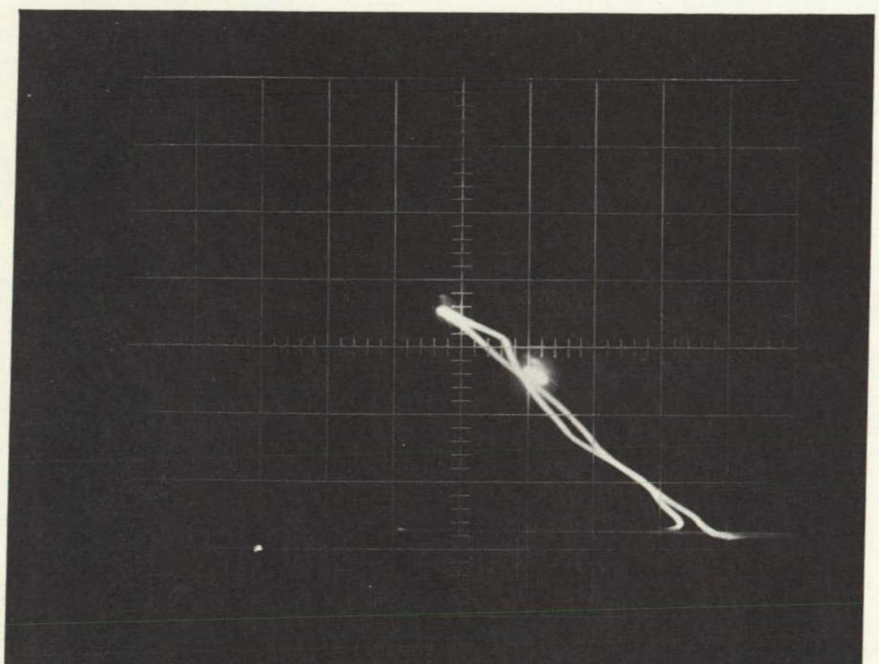


Photo No. SC-3-2

T_E = 1430°C
T_{COLL} = 648.5°C
T_{CS} = 333°C

X axis = 0.1V/div.
Y axis = 10A/div.

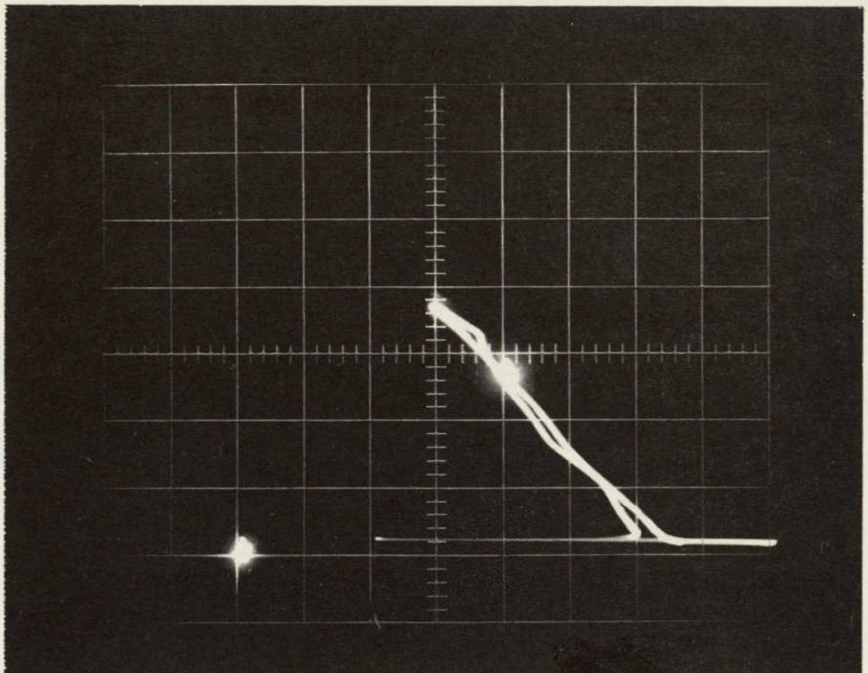


Photo No. SC-3-3

T_E = 1402°C
T_{COLL} = 667°C
T_{CS} = 338°C
X axis = 0.1V/div.
Y axis = 10A/div.

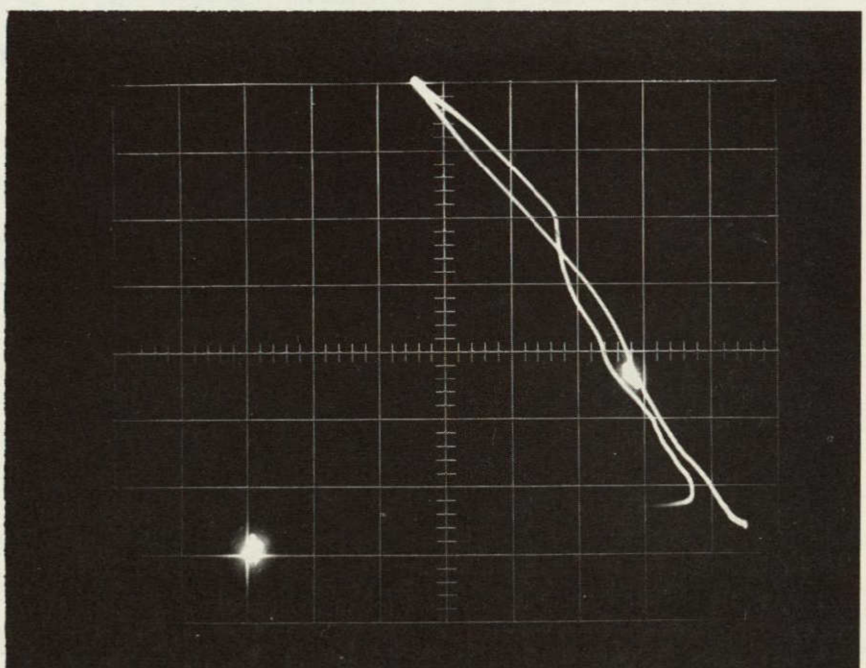


Photo No. SC-3-4

T_E = 1400°C
T_{COLL} = 600°C
T_{CS} = 325°C

X axis = 0.1V/div.
Y axis = 4A/div.

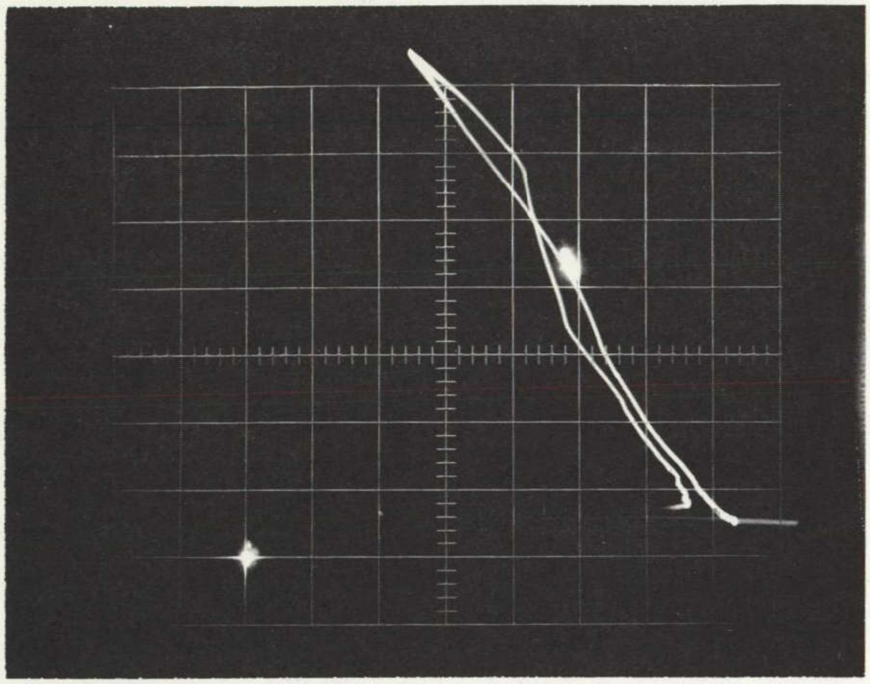


Photo No. SC-3-5

T_E = 1400°C

T_{COLL} = 612°C

T_{CS} = 328°C

X axis = 0.1V/div.

Y axis = 4A/div.

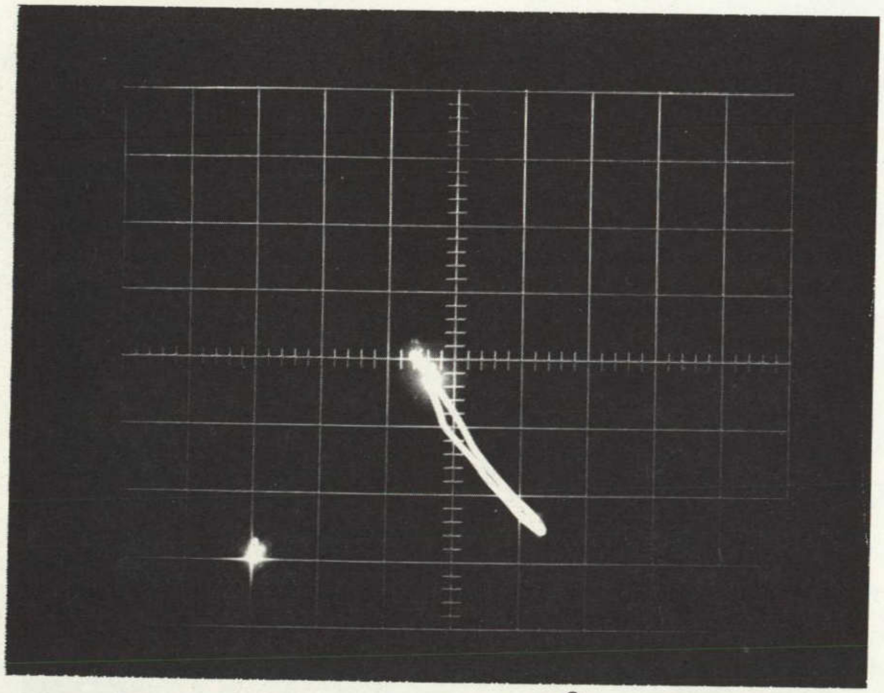


Photo No. SC-3-6

T_E = 1300°C

T_{COLL} = 601°C

T_{CS} = 323°C

X axis = 0.1V/div.

Y axis = 10A/div.

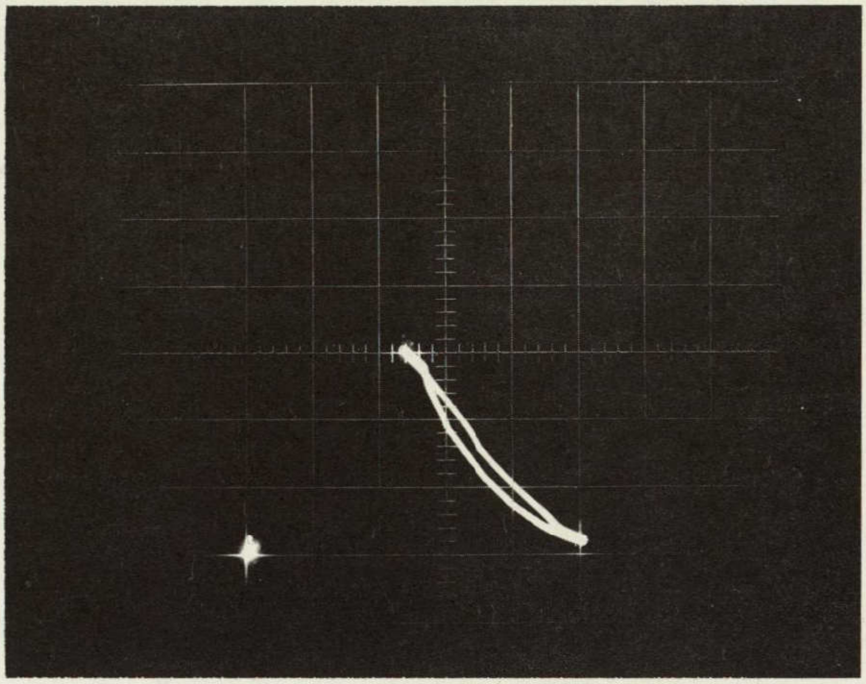


Photo No. SC-3-7

T_E = 1300°C
T_{COLL} = 592°C
T_{CS} = 321°C
X axis = 0.1V/div.
Y axis = 10A/div.

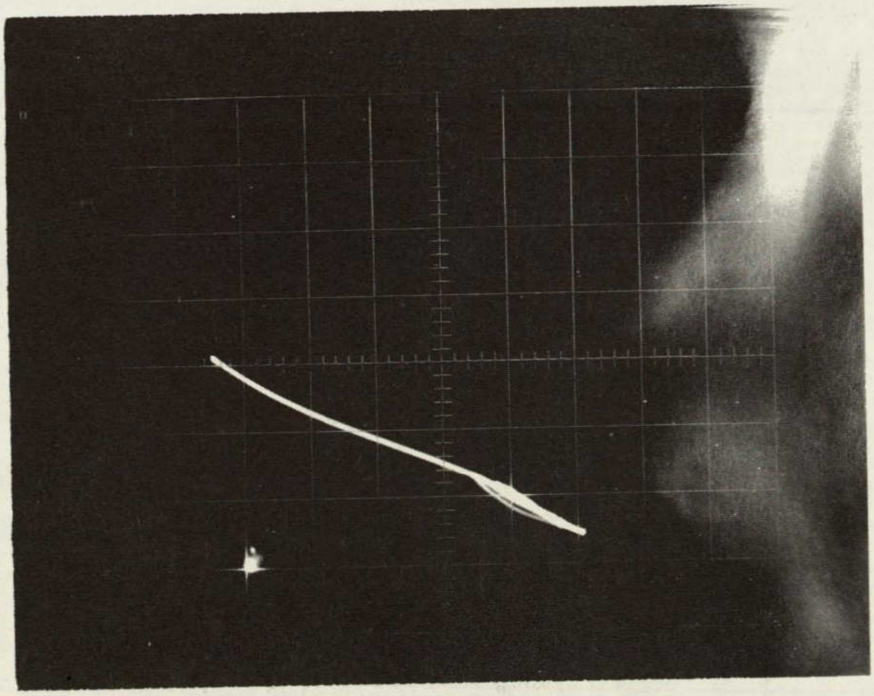


Photo No. SC-3-8

T_E = 1399°C
T_{COLL} = 627°C
T_{CS} = 333°C
X axis = 0.1V/div.
Y axis = 20A/div.

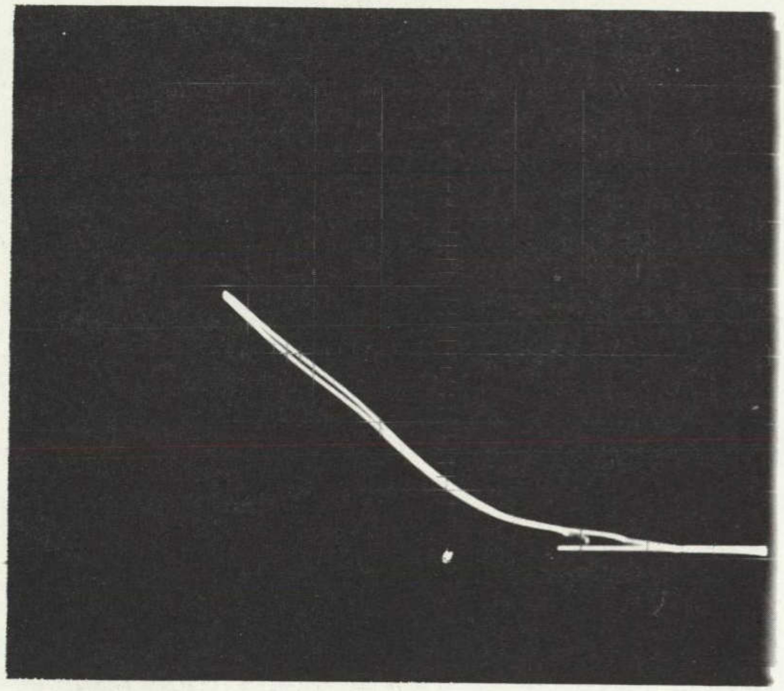


Photo No. SC-3-9

$T_E = 1400^{\circ}C$
$T_{COLL} = 626^{\circ}C$
$T_{CS} = 290^{\circ}C$
X axis = 0.2V/div.
Y axis = 20A/div.

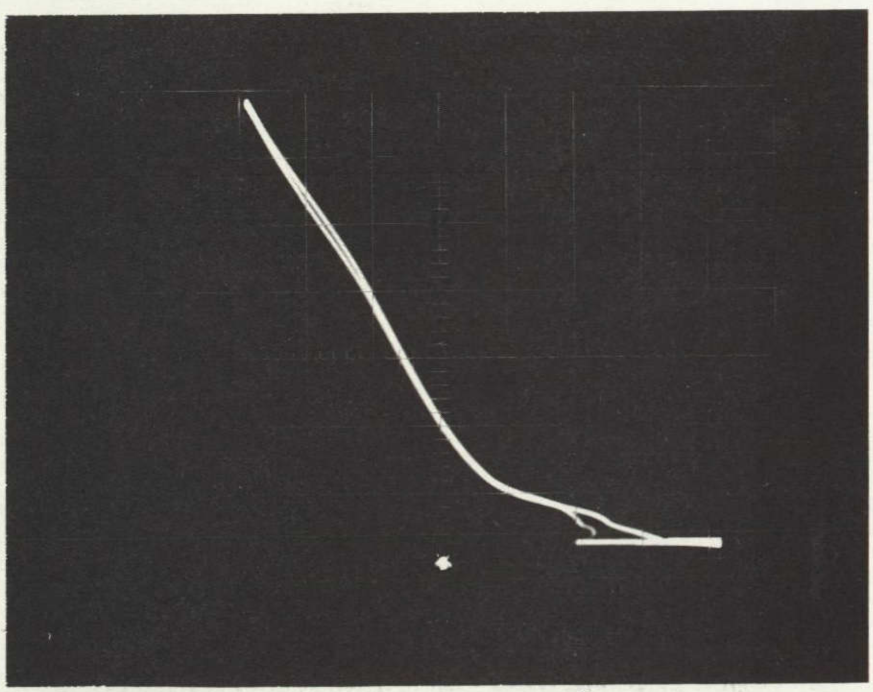


Photo No. SC-3-10

$T_E = 1412^{\circ}C$
$T_{COLL} = 670^{\circ}C$
$T_{CS} = 290^{\circ}C$

X axis = 0.2V/div.
Y axis = 10A/div.

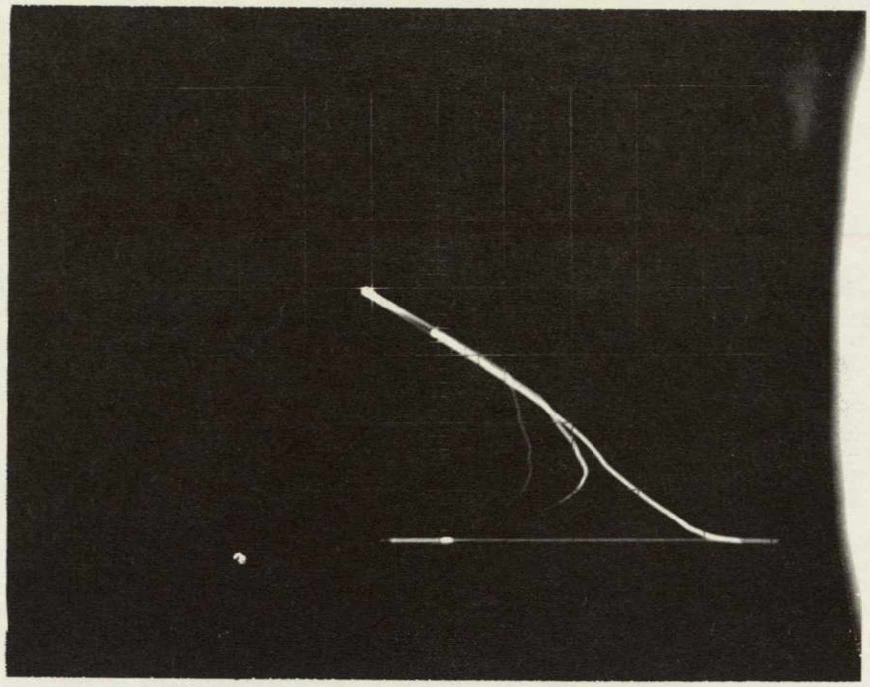


Photo No. SC-3-11

T_E = 1402°C
T_{COLL} = 598°C
T_{CS} = 325°C
X axis = 0.1V/div.
Y axis = 10A/div.

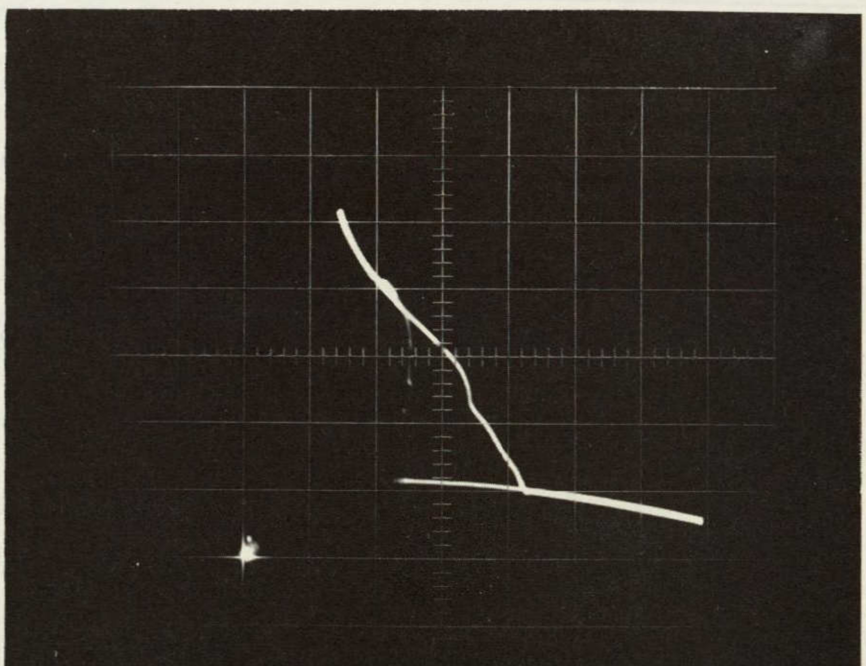


Photo No. SC-3-12

T_E = 1400°C
T_{COLL} = 573°C
T_{CS} = 292°C
X axis = 0.2V/div.
Y axis = 2A/div.

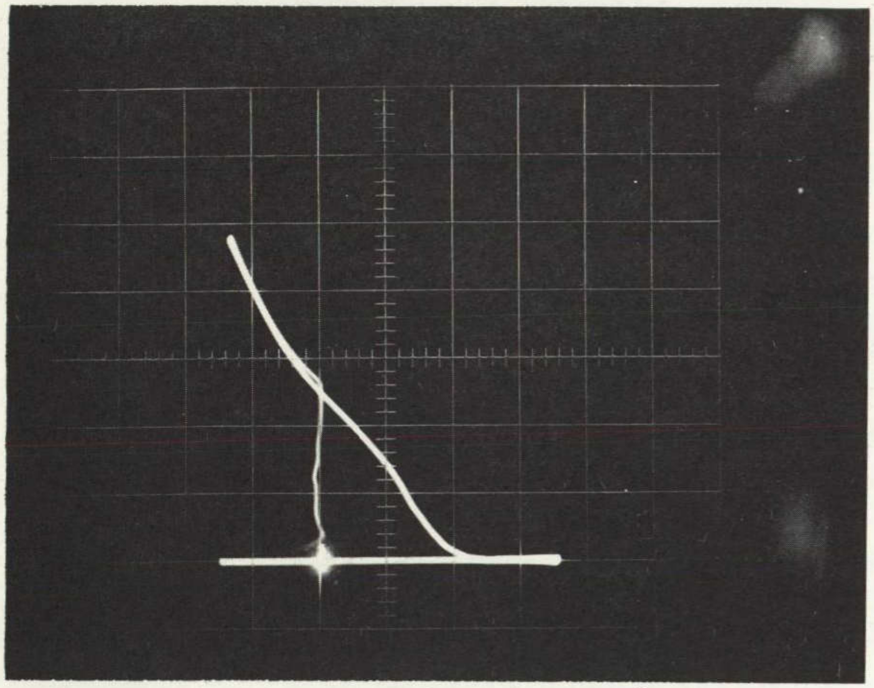


Photo No. SC-3-13

$T_E = 1300^{\circ}C$

$T_{COLL} = 679^{\circ}C$

$T_{CS} = 323^{\circ}C$

X axis = 0.2V/div.

Y axis = 20A/div.

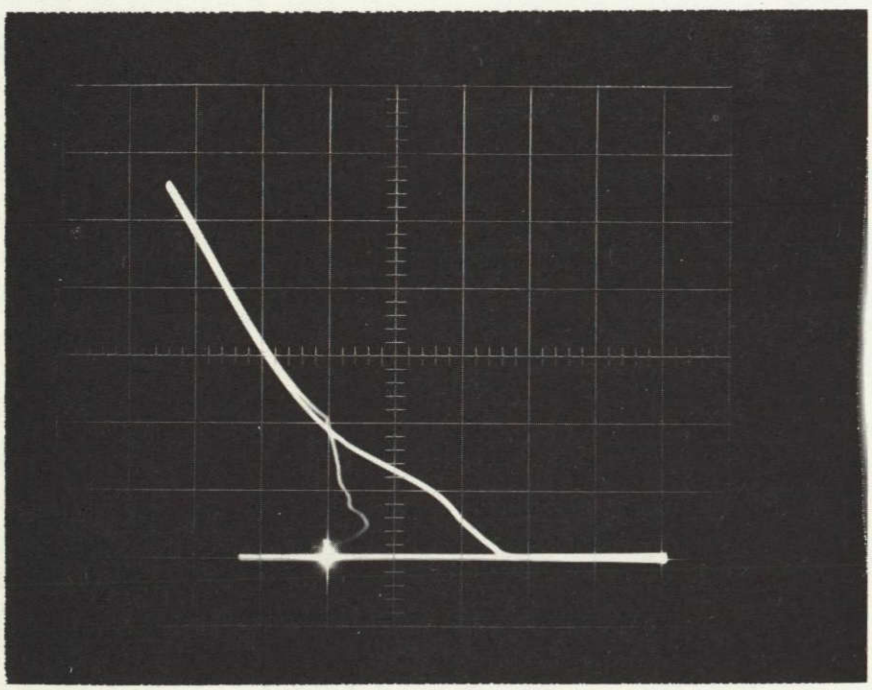


Photo SC-3-14

$T_E = 1300^{\circ}C$

$T_{COLL} = 626^{\circ}C$

$T_{CS} = 307^{\circ}C$

X axis = 0.2V/div.

Y axis = 20A/div.

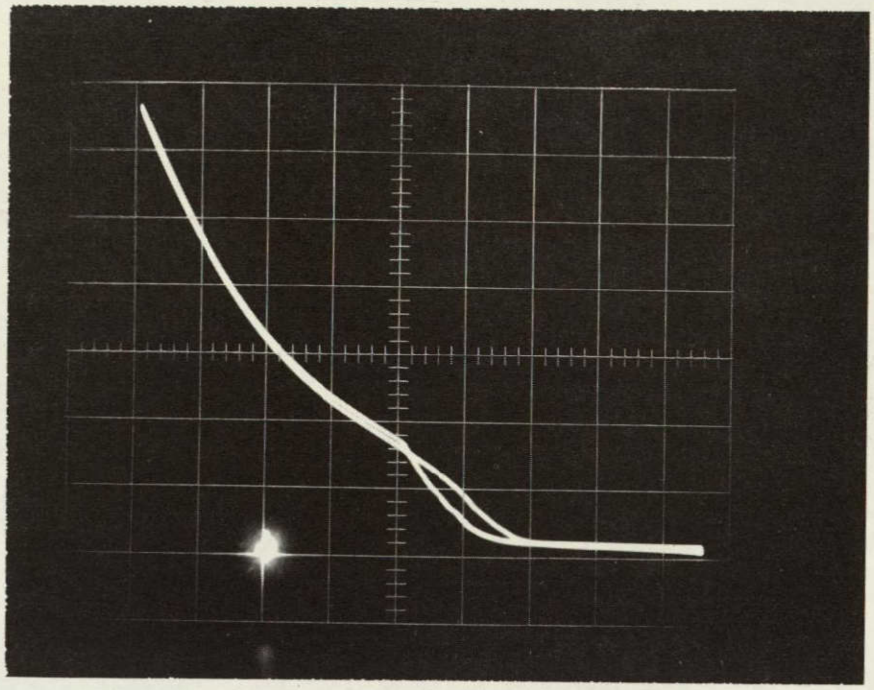


Photo No. SC-3-15

T_E = 1500°C

T_{COLL} = 695°C

T_{CS} = 340°C

X axis = 0.2V/div.

Y axis = 20A/div.

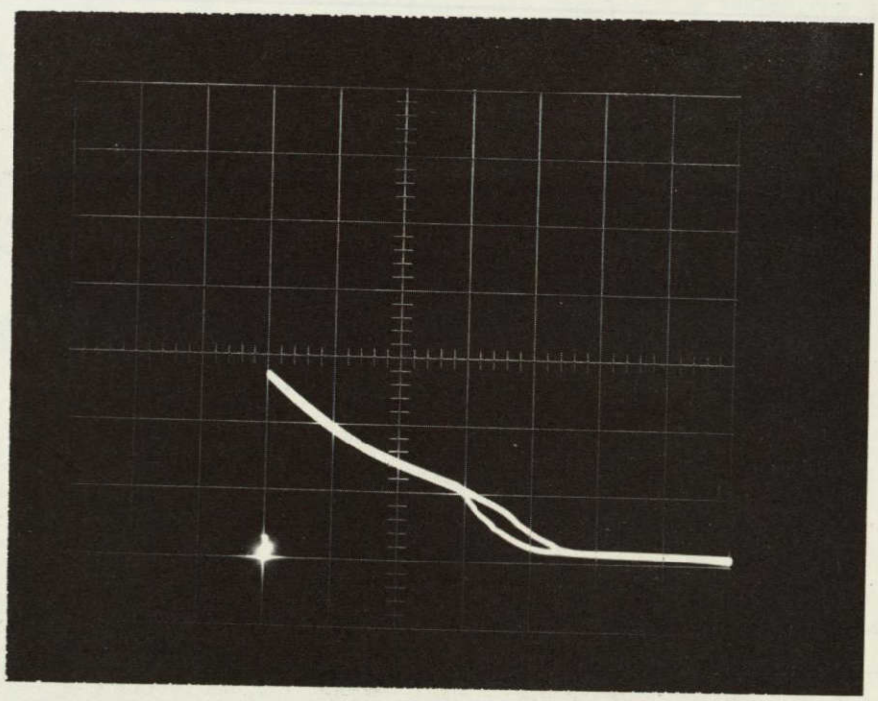


Photo No. SC-3-16A

T_E = 1500°C

T_{COLL} = 619°C

T_{CS} = 317.5°C

X axis = 0.2V/div.

Y axis = 20A/div.

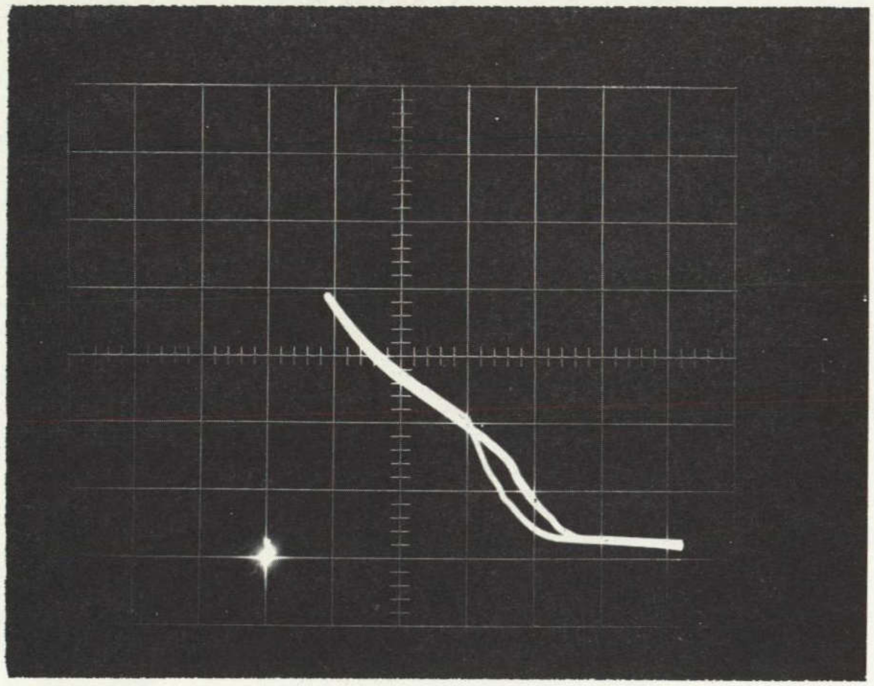


Photo No. SC-3-16B

$T_E = 1500^{\circ}C$

$T_{COLL} = 619^{\circ}C$

$T_{CS} = 317.5^{\circ}C$

X axis = 0.2V/div.

Y axis = 10A/div.

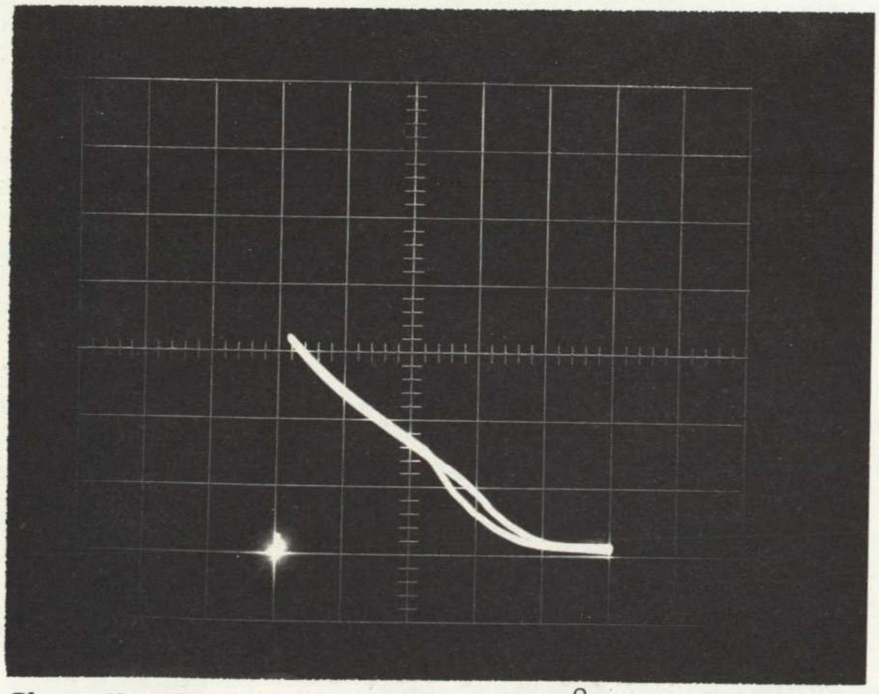


Photo No. SC-3-17

$T_E = 1500^{\circ}C$

$T_{COLL} = 643^{\circ}C$

$T_{CS} = 341^{\circ}C$

X axis = 0.2V/div.

Y axis = 20A/div.

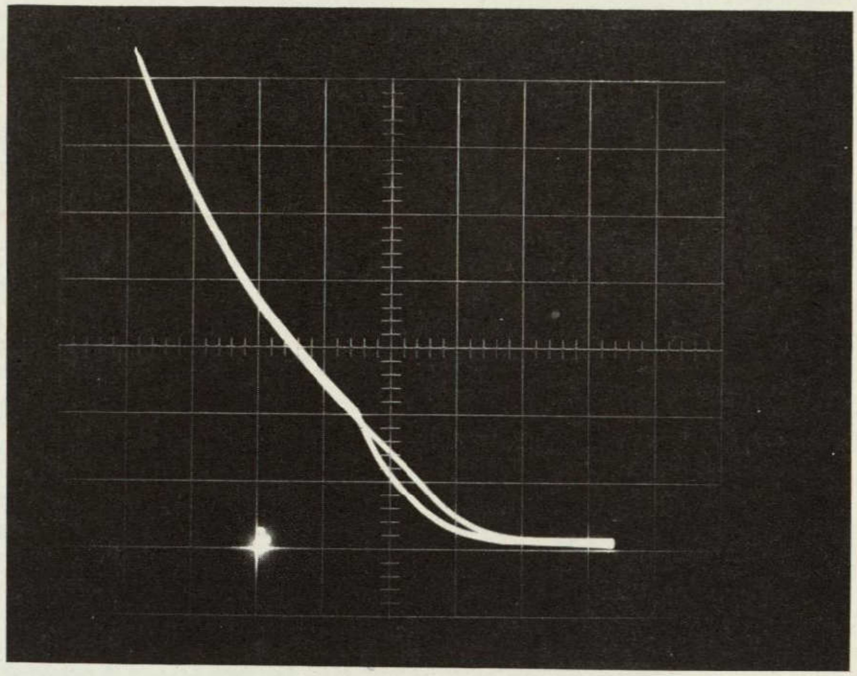


Photo No. SC-3-18

T_E = 1501°C
T_{COLL} = 668°C
T_{CS} = 341.5°C
X axis = 0.2V/div.
Y axis = 20A/div.

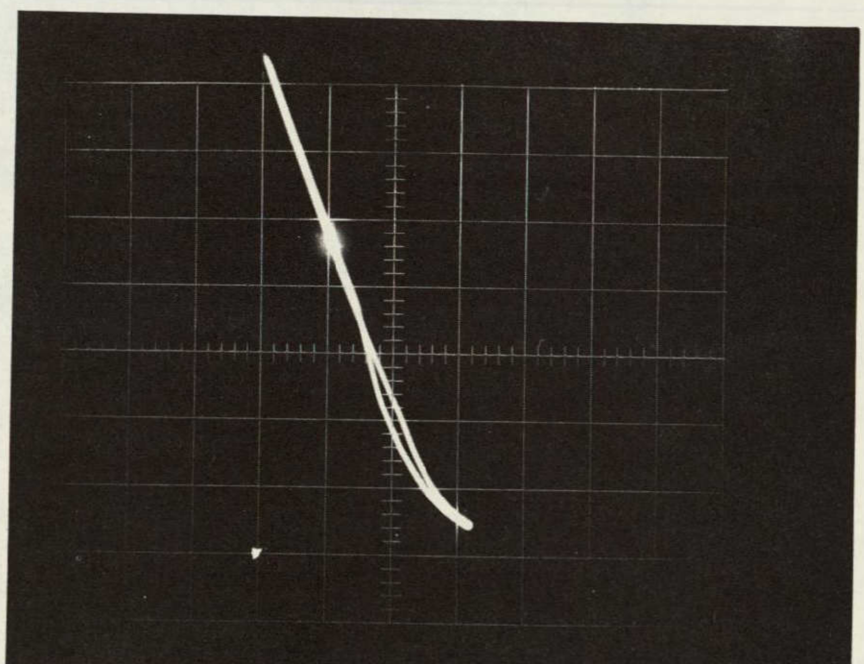


Photo No. SC-3-19

T_E = 1500°C
T_{COLL} = 696°C
T_{CS} = 355°C

X axis = 0.2V/div.
Y axis = 10A/div.

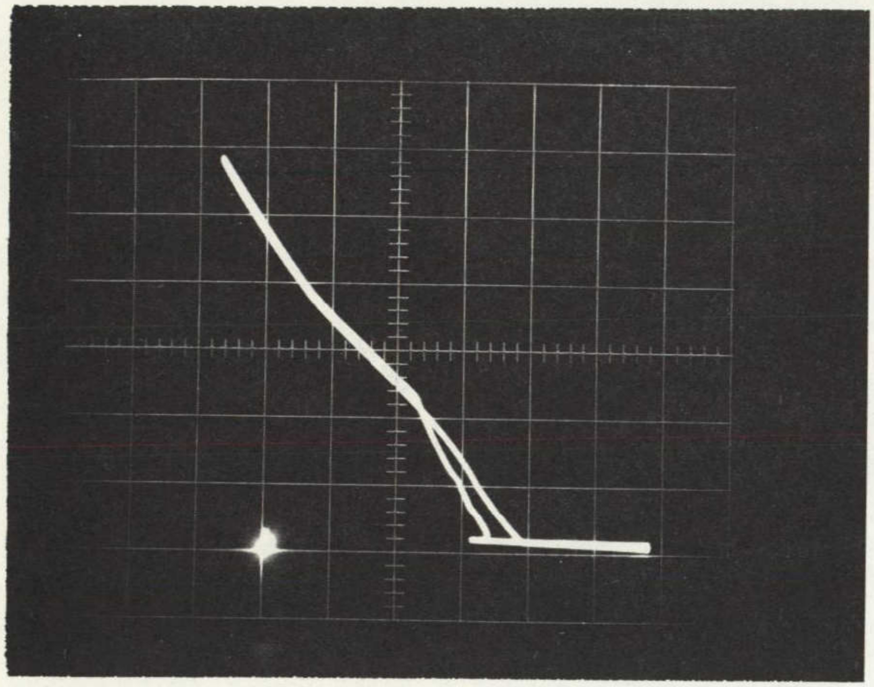


Photo No. SC-3-20

T_E = 1518°C
T_{COLL} = 604°C
T_{CS} = 329°C
X axis = 0.2V/div.
Y axis = 20A/div.

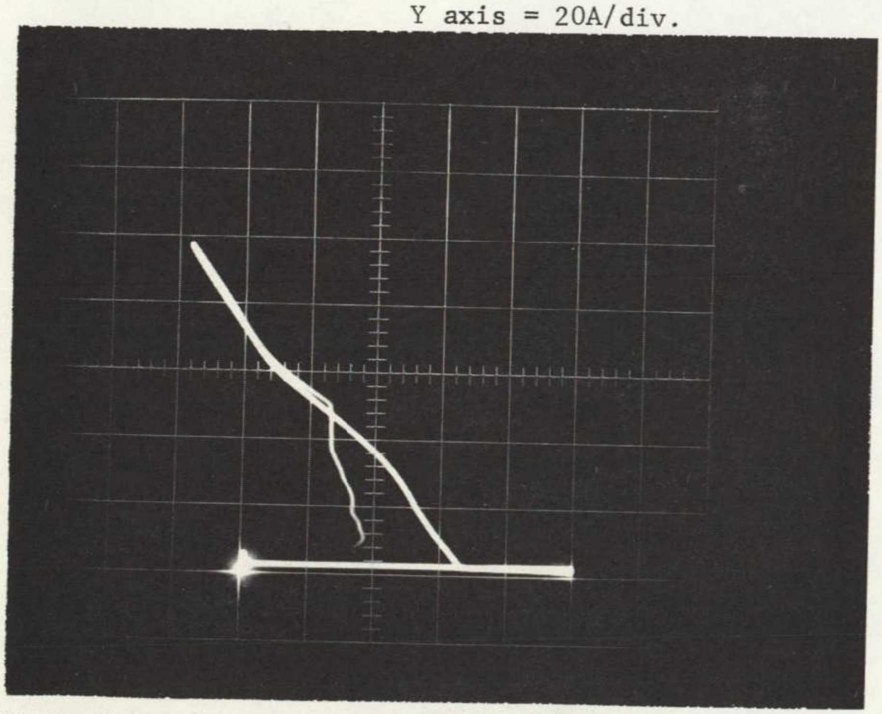


Photo No. SC-3-21

T_E = 1448°C
T_{COLL} = 624°C
T_{CS} = 314°C

X axis = 0.2V/div.
Y axis = 20A/div.

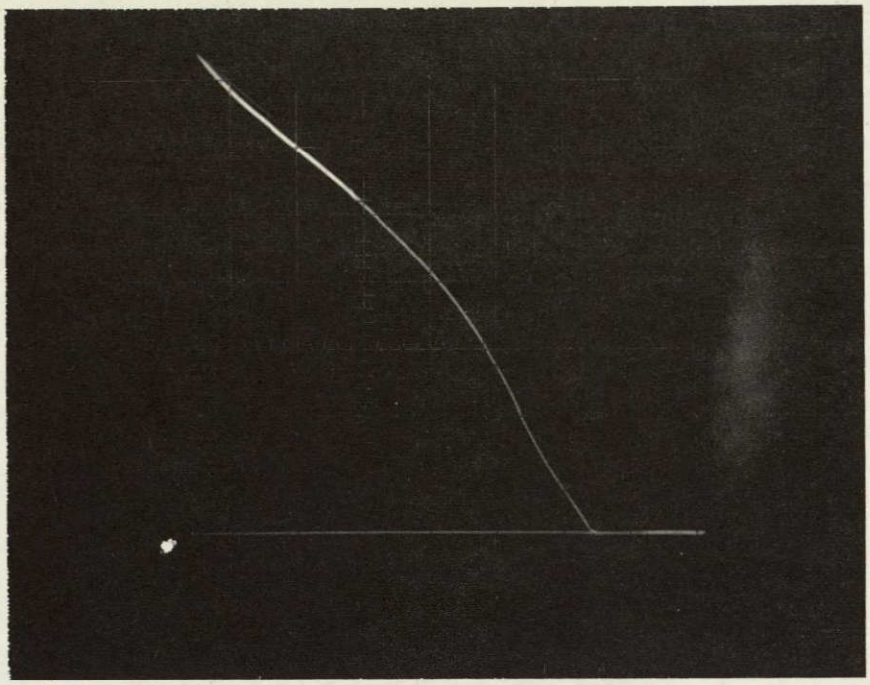


Photo No. SC-3-22A

T_E = 1418°C

T_{COLL} = 603°C

T_{CS} = 318°C

X axis = 0.1V/div.

Y axis = 10A/div.

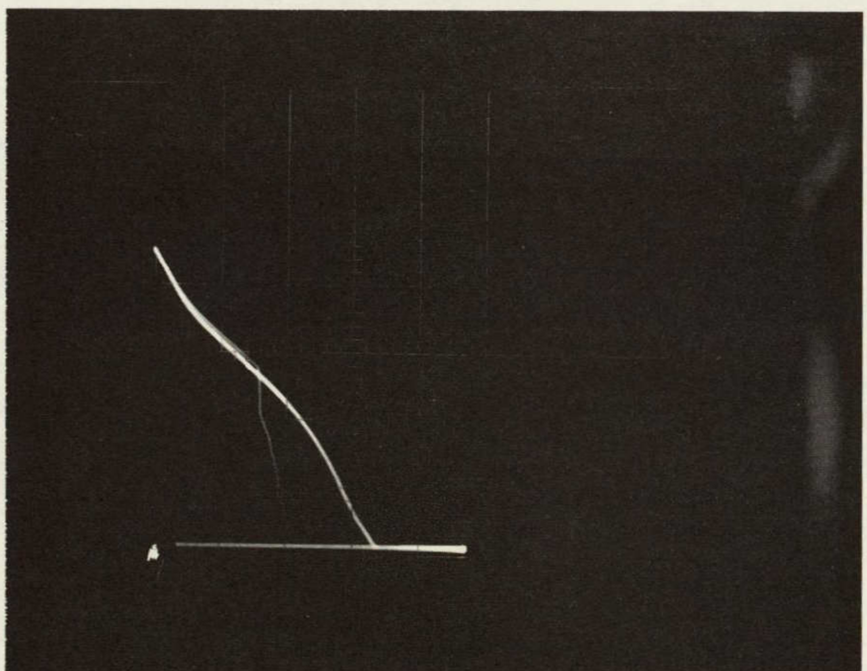


Photo SC-3-22B

T_E = 1418°C

T_{COLL} = 603°C

T_{CS} = 318°C

X axis = 0.2V/div.

Y axis = 20A/div.

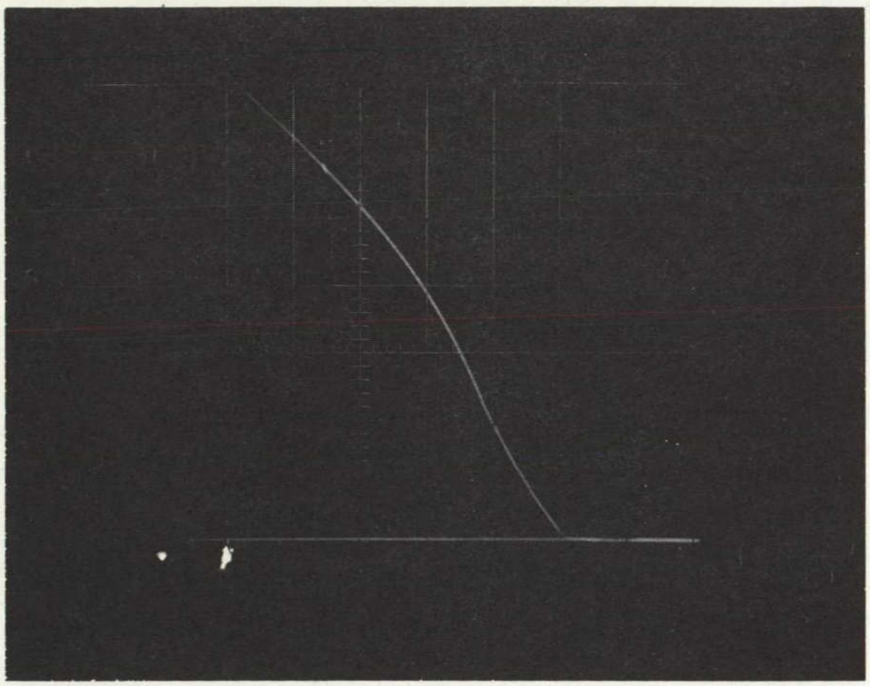


Photo No. SC-3-23

T_E = 1403°C

T_{COLL} = 654°C

T_{CS} = 321°C

X axis = 0.1V/div.

Y axis = 10A/div.

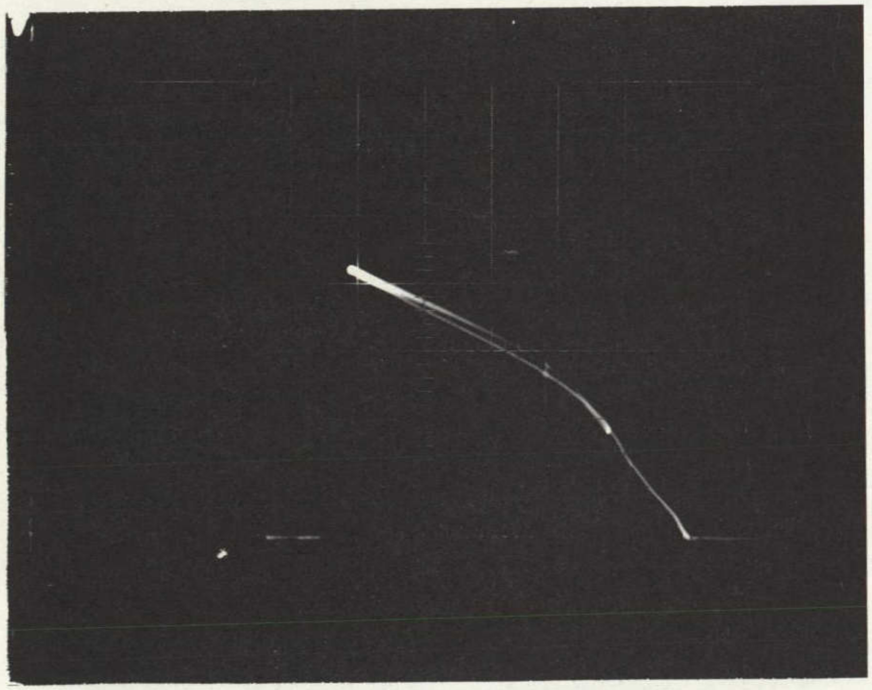


Photo No. SC-3-24

T_E = 1401°C

T_{COLL} = 607°C

T_{CS} = 301°C

X axis = 0.1V/div

Y axis = 10A/div.

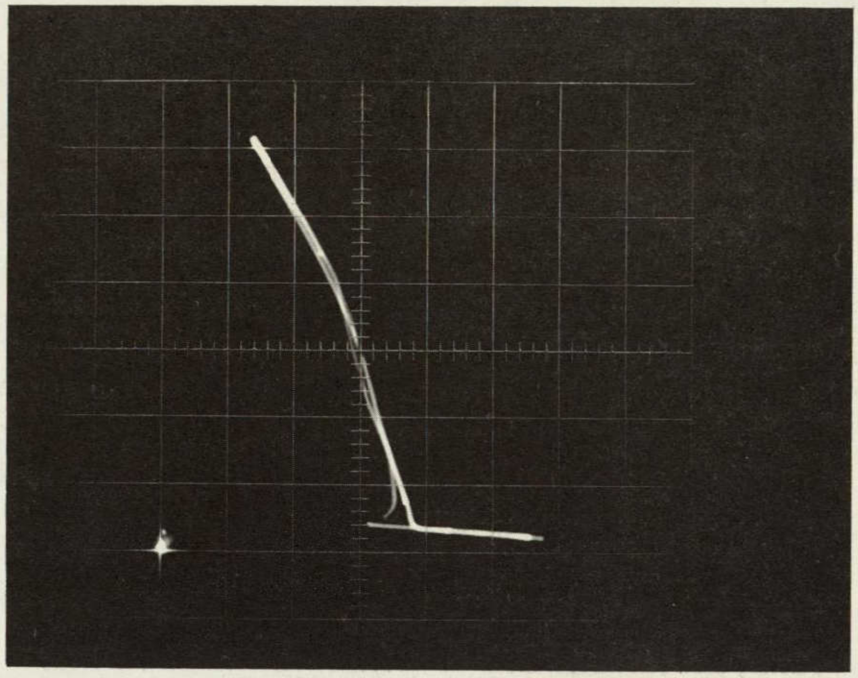


Photo No. SC-3-25

$T_E = 1500^\circ C$

$T_{COLL} = 667^\circ C$

$T_{CS} = 326^\circ C$

X axis = 0.2V/div.

Y axis = 10A/div.

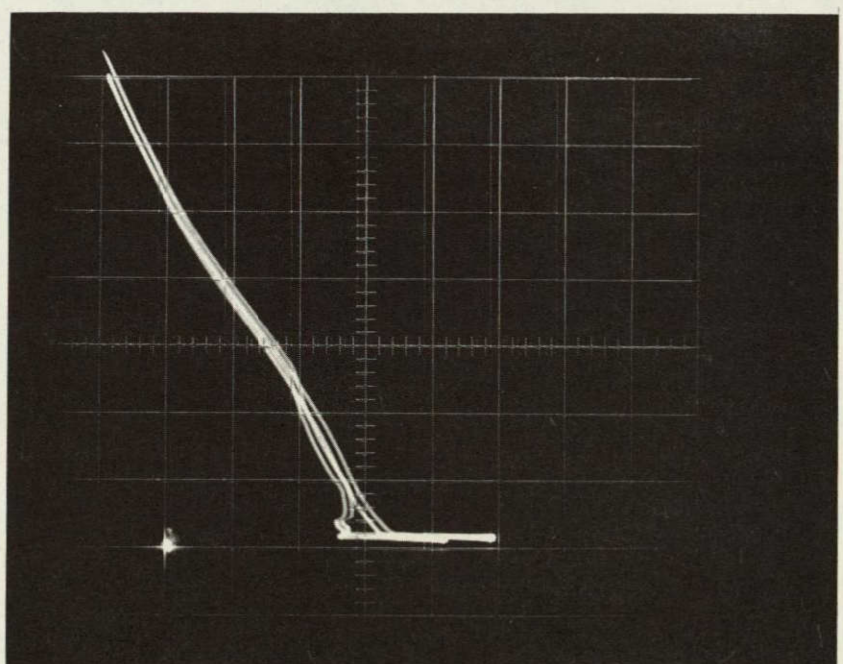


Photo No. SC-3-26

$T_E = 1500^\circ C$

$T_{COLL} = 698^\circ C$

$T_{CS} = 336^\circ C$

X axis = 0.2V/div.

Y axis = 20A/div.

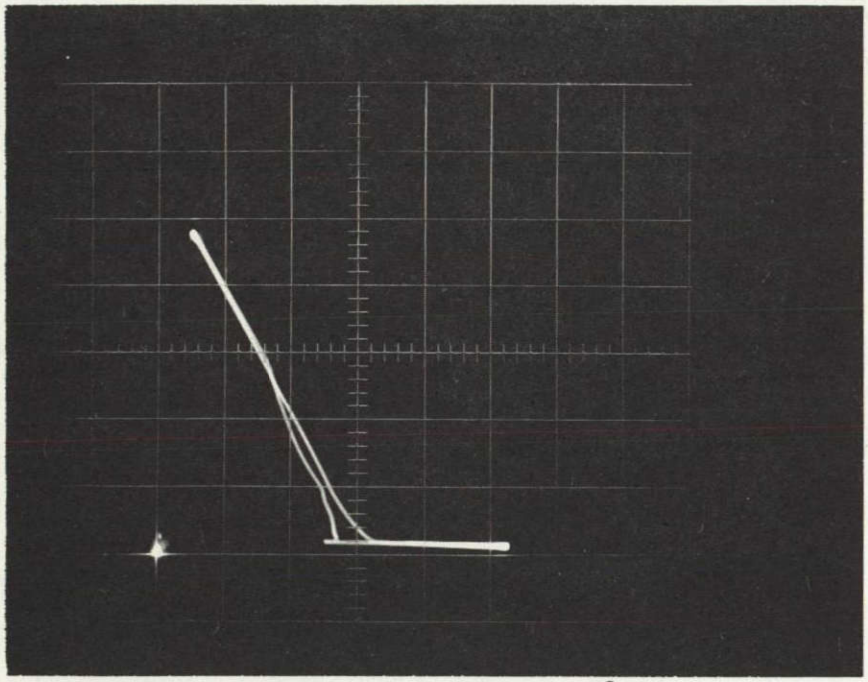


Photo No. SC-3-27

$T_E = 1500^{\circ}C$
$T_{COLL} = 717^{\circ}C$
$T_{CS} = 345^{\circ}C$
X axis = 0.2V/div.
Y axis = 20A/div.

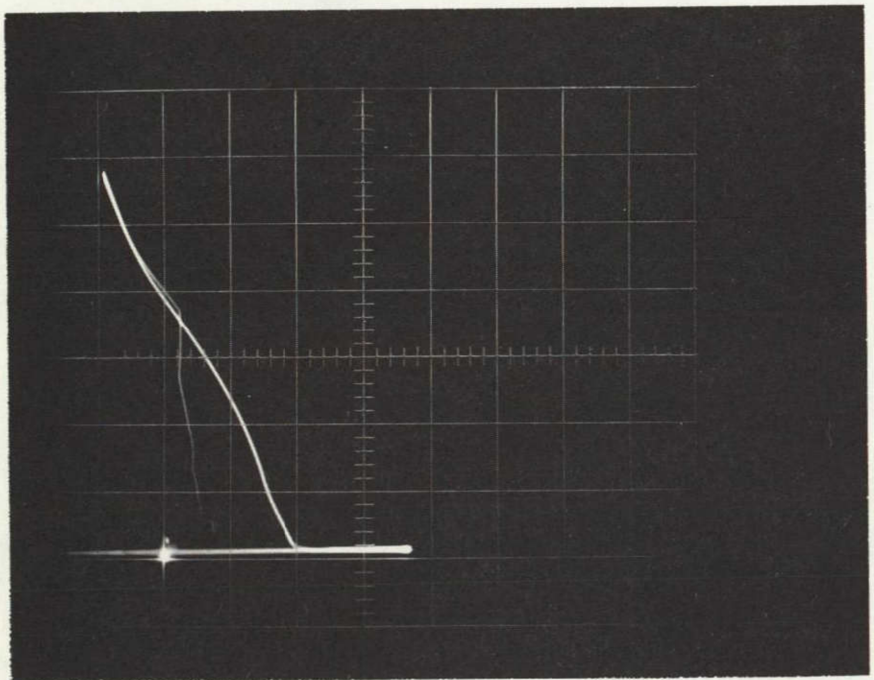


Photo No. SC-3-28

$T_E = 1300^{\circ}C$
$T_{COLL} = 652^{\circ}C$
$T_{CS} = 316^{\circ}C$
X axis = 0.2V/div.
Y axis = 20A/div.

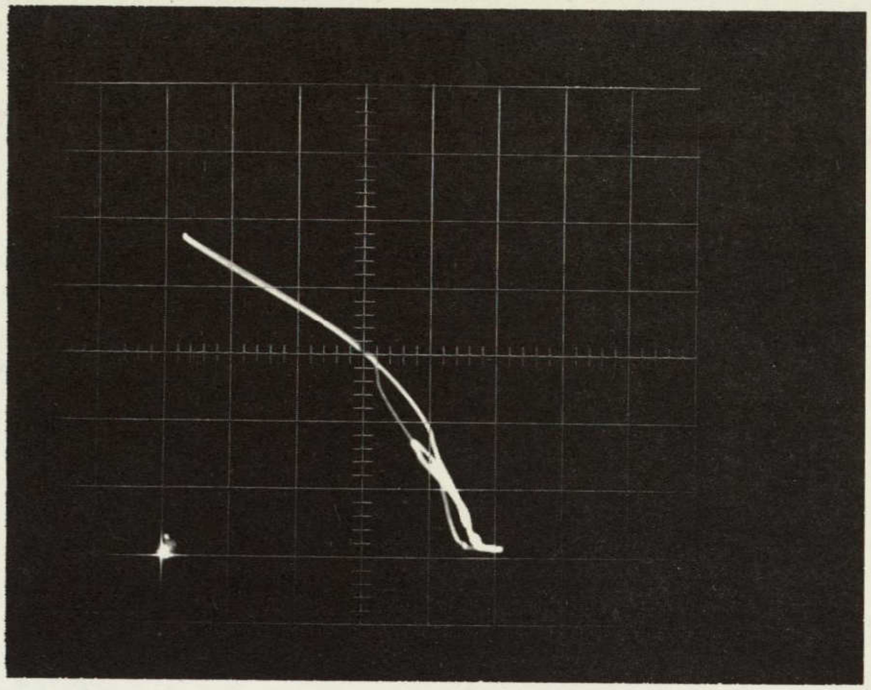


Photo No. SC-3-29

$T_E = 1300^\circ C$

$T_{COLL} = 575^\circ C$

$T_{CS} = 293^\circ C$

X axis = 0.1V/div.

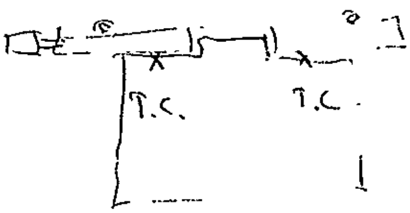
Y axis = 10A/div.

PRECEDING PAGE BLANK NOT FILMED

APPENDIX 5

CONVERTER SC-4

BRAZING/FIRING SCHEDULE



29.0 - 29.3   1.5 min

DATE: 12/16/68

PART DESCRIPTION: 4 cm^2 Collector (heater wire & res. adap.)

BRAZE TYPE: Ti

WA NO.

OPERATOR: PJ

	TIME	TEMP.°C No. 1	mV 1 outside	TEMP.°C No. 2	mV 2 inside	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
		1441	0.44		0.41			1.5×10^{-6}	8	
		1445	3.4		1.6			2.3×10^{-5}	9	
		1448	9.0		5.5			8.4×10^{-5}	8	
		1454	10.0		6.6			8.4×10^{-5}	9	
		1459	12.5		9.1			5.7×10^{-5}	10	
		1502	15.2		12.3			2.8×10^{-5}	11	
		1505	18.1		16.3			1.8×10^{-5}	12	
		1509	22.5		21.6			8.0×10^{-6}	13	
		1512	25.7		25.4			1.1×10^{-5}	14	
		1514	27.3		27.3			1.6×10^{-5}	14-1/2	
		1516	28.3		28.4			3.2×10^{-5}	15	
		1517	29.0		29.1			5.0×10^{-5}	15-1/2	
		1518^{30}	29.5		29.7			3.0×10^{-5}	15-1/2	- 19
		1524								off

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

DATE: 12/17/68

PART DESCRIPTION: 4 cm^2 (rebraze) Heater Wire/Res. Adap.

BRAZE TYPE: T_i Conv

WA NO.

OPERATOR: PJ

29.0 - 29.7 1.5 min

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1514							1.0×10^{-6}	8	on
	1517		2.5		1.4			8.6×10^{-6}	9	
	1520		7.0		4.3			1.2×10^{-5}	10	
	1523		12.4		9.3			5.6×10^{-6}	11	
	1526		16.9		14.8			4.0×10^{-6}	12	
	1529		21.1		18.8			5.4×10^{-6}	13	
	1532		25.0		29.3			1.0×10^{-5}	14	
	1534		27.3		27.0			1.2×10^{-5}	14-1/2	
	1536		28.2		28.1			1.3×10^{-5}	15	
	1537		29.1		29.0			1.1×10^{-5}	15+	
	1538½		29.7		29.7			1.0×10^{-5}	15+	
	1544									off

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

2 shims on top
can 3" x 9"
Tap 6 - grid 71
coil height 8-5/16

DATE: 12/16/69

PART DESCRIPTION: 4 cm^2 Conv. Seal with 2^2 Ceramic

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1624	Room	Bot.		Top			5×10^{-7}	12	
	1626							4.4×10^{-7}	14	
	1628		0.65		0.65			3×10^{-7}	16	
	1631		0.95		1.06			5×10^{-7}	18	
	1634		1.50		1.68			6×10^{-7}	20	
	1637		1.98		2.25			1.4×10^{-6}	22	
	1640		3.02		3.20			1.8×10^{-6}	24	
	1643		4.18		4.46			1.6×10^{-6}	26	
	1646	642	5.65	670	5.94			1.8×10^{-6}	28	
	1649		7.82	861	7.99			2.0×10^{-6}	30	
	1652		10.10		10.00				32	
	1653		10.90		10.80			2×10^{-6}	34	
	1654		12.18		12.02			1×10^{-5}	34	
	1655		12.68		12.78			1.2×10^{-5}	36	
	1656		13.44		13.58			1.8×10^{-5}	38	
	1657	1405	14.40		14.40				36	
X	1657½		14.65		14.68			2.4×10^{-5}	34	
	1658½		14.78		14.84			1.6×10^{-5}	33.5 -	33
	1659½		14.84		14.86			1.2×10^{-5}	33	
	1701½		14.70		14.74			1.2×10^{-5}	33	
X	1702½		14.72		14.74				28	24
	1717									RF off

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

2 shims on top
3" x 9" can
coil set 8 5/16"

Tap 6 - GR 71

DATE: 12/17/69

PART DESCRIPTION: 4 cm^2 Conv. Seal with 2^2 cm Ceramics

BRAZE TYPE: Seal

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1448	Room	Bot.	Room	Top			2×10^{-7}	12	RF on
	1451							2×10^{-7}	14	
	1453		0.66		0.66			3×10^{-7}	16	
	1456		1.10		1.20			4×10^{-7}	18	
	1459		1.66		1.80			4.8×10^{-7}	20	
	1502		2.24		2.58			8×10^{-7}	22	
	1505		3.00		3.40			1.4×10^{-6}	24	
	1508		3.80		4.28			1.4×10^{-6}	26	
	1511		5.20		5.70			1.6×10^{-6}	28	
	1514		6.60		7.06			1.5×10^{-6}	30	
	1517		8.54		8.80			1.5×10^{-6}	32	
	1518½		9.80		10.00			2.2×10^{-6}	34	
	1520		11.00		11.30			4×10^{-6}	35	
	1521		11.92		12.1			7×10^{-6}	36 - 37	
	1522		12.80		13.06				38	
X	1524		14.40		14.48			1×10^{-5}	36	
	1525		14.70		14.80			1.1×10^{-5}	35 - 36	
	1526		14.69		14.82			1.1×10^{-5}	36 - 35	
	1527		14.80		14.88			1.1×10^{-5}	35	
	1528		14.78		14.88			7.2×10^{-6}	35	
X	1529½		14.84		14.88			6.8×10^{-6}	28	24
	1545									RF off

OS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

SC 4

BRAZING/FIRING SCHEDULE

1st anneal after
1st form by cliff
$1700^{o}C$ for 15 min

$1700^{o}C = 29.528$ mV

DATE: 12/17/69

PART DESCRIPTION: Re Lead Strap (4 pcs.)

BRAZE TYPE: Anneal @ $1500^{o}C$ - 15 min

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1018	Room						1.4×10^{-6}	9	RF on
	1020		1.50					5×10^{-6}	10	
	1022		7.14					1.4×10^{-6}	11	
	1024		11.14					1×10^{-6}	12	
	1026		18.91					6×10^{-7}	13	
	1028		23.90					1.1×10^{-6}	14	
	1030		25.69					1.4×10^{-6}	15	
	1032		27.10					2.2×10^{-6}	16	
	1034		28.50					4×10^{-6}	17	
X	1035	1700^{o}	29.53					7×10^{-6}	17	
	1037		29.59					6.2×10^{-6}	16.9	
	1039		29.54					5.7×10^{-6}	16.9	
	1044		29.54					4.9×10^{-6}	16.9	
	1047		29.54					4.7×10^{-6}	16.9	
X	1050		29.54					4.3×10^{-6}	14	
	1055		29.54							RF off

EOS FORM NO. 806 (7/67)

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

2nd Anneal after
2nd forming by Cliff
No more than 1700°C for 15 min.

DATE: 12/19/69

PART DESCRIPTION: RE Lead Straps 4 pcs.

BRAZE TYPE: Anneal @ 1500°C to 1700°C

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP. °C No. 1	mV 1	TEMP. °C No. 2	mV 2	TEMP. °C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1338	Room						1.4×10^{-6}	9	3×10^{-6}
	1341							2×10^{-6}	10	
	1343								11	
	1345		14.40					1.4×10^{-6}	12	
	1347		18.80					1.2×10^{-6}	13	
	1349		23.14					1.4×10^{-6}	14	
	1351		25.65					1.7×10^{-6}	15	
X	1353		27.20					3.1×10^{-6}	16	
	1354		28.40					6×10^{-6}	16	
	1355		28.60					5.6×10^{-6}	16.5	
	1356		29.00					7.4×10^{-6}	16.5	
	1400		29.22					5.7×10^{-6}	16.5	
	1403		29.30					5×10^{-6}	16.5	
	1407		29.30						14	
	1415									RF off

SC 4

BRAZING/FIRING SCHEDULE

DATE: 12/22/69

PART DESCRIPTION: 4^2 cm Heat Choke Lead Strap Assembly

BRAZE TYPE: T. SC4-3

WA NO. 4018-001-001

Station #2

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1447	Room						6×10^{-7}	9	RF on
	1449							2×10^{-6}	10	
	1451		2.78					1.6×10^{-6}	11	
	1453		5.58					1.6×10^{-6}	12	
	1455		9.74					2×10^{-6}	13	
	1457		14.91					2×10^{-6}	14	
	1459		19.50					2×10^{-6}	15	
	1501		23.90					2.2×10^{-6}	16	
	1504		27.45					4×10^{-6}	17	
	1506		28.45					5.6×10^{-6}	17.5	
X	1506¼		29.00					7×10^{-6}	17.5	
	1507¼		29.30							
X	1507-3/4		29.50					7×10^{-6}	14	
	1515									RF off

BRAZING/FIRING SCHEDULE

Re heat choke to Nb

DATE: 12/23/69

PART DESCRIPTION: 4 cm^2 Lead Strap Assembly SC4-4

BRAZE TYPE: T.

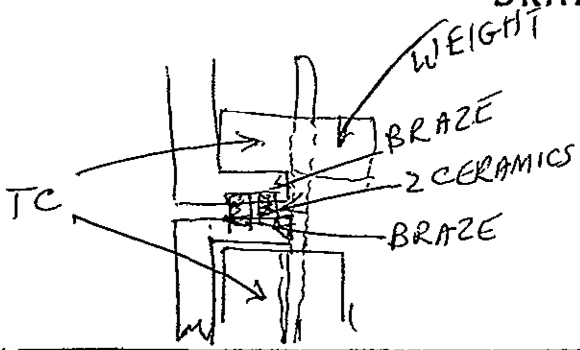
WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	0947	Room						8×10^{-7}	9	RF on
	0949								10	
	0951		2.84					8×10^{-7}	11	
	0953		4.80					8×10^{-7}	12	
	0955		8.66					8×10^{-7}	13	
	0957		13.45					1.6×10^{-6}	14	
	0959		18.78					1.4×10^{-6}	15	
	1001		23.30					1.5×10^{-6}	16	
	1004		27.15					2.4×10^{-6}	17	
	1006		28.55					5×10^{-6}	17.5	- 17.7
X	1007¼		29.00					5.9×10^{-6}	17.7	
	1008¼		29.20					6.3×10^{-6}	17.8	
X	1008-3/4		29.44					6.3×10^{-6}	14.5	
	1015									RF off

OS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE



DATE: 1/9/70

PART DESCRIPTION: Gun Holder

BRAZE TYPE: Seal @ 1400^{o}C

WA NO. 4018-001-001

OPERATOR: Gon

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1605	Room						1×10^{-7}	12	RF on
	1608		0.98		0.35			4×10^{-7}	14	
	1611		1.78		0.60			3.6×10^{-7}	16	
	1614		2.35		1.00			4.8×10^{-7}	18	
	1617		3.06		1.58			1×10^{-6}	20	
	1621		3.92		2.22			1.5×10^{-6}	22	
	1625		5.20		3.25			2×10^{-6}	24	
	1628		6.20		4.30			2×10^{-6}	26	
	1630			OFF		READ J COIL				
	1631			ON				1×10^{-6}	20	
	1633		6.18		5.60			1×10^{-6}	22	
	1636		6.80		6.30			1×10^{-6}	24	
	1639		7.46		7.00			1×10^{-6}	26	
	1642		8.40		7.68			1×10^{-6}	28	
	1645		9.42		9.00			1×10^{-6}	30	
	1646		10.30		9.60			2×10^{-6}	32	
	1647		11.40		10.6			4×10^{-6}	34	
	1648		12.3		11.62				36	
	1649		13.74		12.80			1×10^{-5}	38 - 39	
X	1650		14.62		14.00			1.6×10^{-5}	39	
	1651		14.82		14.33			1.6×10^{-5}	38 - 36	
	1652		14.54		14.62			1×10^{-5}	35 -	
	1653		14.30		14.50			1×10^{-5}	37 - 36	
	1654		14.54		14.54			1×10^{-5}	36 -	
X	1655		14.54		14.60			1×10^{-5}	28	

ELECTRO-OPTICAL SYSTEMS

BRAZING/FIRING SCHEDULE

1 hr @ 2100°C true or
1850°C surface observed

DATE: 1/7/70

PART DESCRIPTION: Rhenium Cylindrical Emitter for SC-4

~~BRAZE TYPE~~: Vac firing and set tol.

WA NO. 4018-001-001

OPERATOR: RWH

	TIME	Surface Temp. TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
1100			Filament on							
	1142	1355						1×10^{-6}		
	1145	1440						1×10^{-6}		
	1149	1550						1.5×10^{-6}		
	1153	1600		Coming down for lunch leaving						
				filament on						
	1306			Bomb on						
	1310	1685						1×10^{-6}		
	1311	1780						1.5×10^{-6}		
	1314	1850						2×10^{-6}		
	1315	1920						3×10^{-6}		
	1318	1950						3.5×10^{-6}		
	1320	1890						3.5×10^{-6}		
	1353	1881						1.8×10^{-6}		
	1400	1885						1.5×10^{-6}		
	1415	1885						1.5×10^{-6}		
	1418	1960						1.5×10^{-6}	Coming down	

EOS FORM NO. 806 (7/67)

BRAZING/FIRING SCHEDULE

750°C - 775°C max seal
temp. 31.23 mV

DATE: 1/19/70

PART DESCRIPTION: SC-4 4^2 cm Converter

BRAZE TYPE: Final Outgas

WA NO.

OPERATOR: Pyle & Mitchner

TIME	EMITT. TEMP.	TEMP.°C No. 1	mV 1	TEMP.°C No. 3	mV 3	TEMP.°C No. 4	mV 4	EXT. / INT.	DIAL No.	REMARKS
	OBS.	COLL		SEAL		TEE		7.4×10^{-7} / 18 μA		
1545										Fil. on
1620										Bomb on
1640	1100°C	463	19.10	505	20.85	42	1.7	4×10^{-6} / 250 μA		
1700	1570°C		27.95		31.00		2.58	4×10^{-6} / 200 μA		
1715	1640°C	697	29.00	747	31.10	74	3.00	3×10^{-6} / 200 μA		Coming down
1725	Power off									
1-20-70										
0850										Power on
0915	1700°C		30.40		32.20		2.85			Tee heater on
0935	1700°C	737	30.68	775	32.28	286	11.63	1.8×10^{-6} / 600 μA		
1000	1700°C		31.05		32.54	282	11.48			
1030	1700°C		30.70		32.20		11.30	8×10^{-7} / 1 MA		
1100	1700°C		30.71		31.66		11.60	7×10^{-7} / 1 MA		
1130	1700°C		30.90		31.90	276	11.24	6×10^{-7} / 850 μA		
1200	1690°C	736	30.66	758	31.57	276	11.23	5×10^{-7} / 650 μA		
1230	1690°C	737	30.70	758	31.59	277	11.28	4.5×10^{-7} / 550 μA		
1300	1690		30.60		31.54		11.29	4×10^{-7} / 410 μA		

BRAZING/FIRING SCHEDULE

750°C - 775°C max seal temp. 31.23 mV

DATE: 1/19/70

PART DESCRIPTION: SC-4 4^2 cm Converter

BRAZE TYPE: Final Outgas

WA NO.

OPERATOR: Pyle & Mitchner

TIME	EMITT. TEMP.	TEMP. °C No. 1	mV 1	TEMP. °C No. 3	mV 3	TEMP. °C No. 4	mV4	EXT / INT.	DIAL No.	REMARKS
1330	1685		30.57		31.56		11.30	3.9×10^{-7}		
								360 μA		
1400	1695	742	30.91	767	31.94	280	11.38	3.6×10^{-7}		
								325 μA		
1430	1695		30.88		31.92		11.37	3.5×10^{-7} / 290		
1500	1685		30.86		31.82		11.34	3.4×10^{-7} / 265		
1530	1690		30.88		31.86		11.40	3.4×10^{-7}		
								248		About 10°C to 15°C drop thru jar
1630	1685		31.04		32.06		11.44	3.4×10^{-7}		
								228		
Coming down slowly					770					off

BRAZING/FIRING SCHEDULE

DATE: 1/21/70

PART DESCRIPTION: Cs Loading SC 4

BRAZE TYPE:

WA NO.

OPERATOR: Pyle

	TIME	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
	1305									heater on
	1315	275°C	11.18					1×10^{-7}		
	1334	277°C	11.25							
	1404	279°C	11.34							
	1425	289	11.77					3×10^{-8}		
	1445	278	11.31					3×10^{-8}		
	1445			Power off						

BRAZING/FIRING SCHEDULE

750°C
775°C max seal
Temp (31.23 mV)

DATE: 1/21/70

PART DESCRIPTION: SC-4 4 cm^2 Converter

BRAZE TYPE: Final Outgas

WA NO.

OPERATOR: EJR and Pyle

TIME	OBSERVED TEMP	TEMP.°C No. 1	mV 1	TEMP.°C No. 2	mV 2	TEMP.°C No. 3	mV 3	PRESSURE (mmHg)	DIAL No.	REMARKS
0830		Coll		Seal		Tee		7 µA	Fil. on	
									Bomber on	
									Tee on	
0850		Room		Room		Room		1.2×10^7		
								7 µA		
0900	1500		21.36		23.1		5.86	3.5×10^7		
								7.5 µA		
0915	1680	760	31.65	785	32.7	293	11.93	3.6×10^7		
								12.5 µA		
0935			Down slowly and							off

ELECTRO-OPTICAL SYSTEMS, INC.

A XEROX COMPANY

DATA SHEET NUMBER ______

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL TA SPECIFICATION ______

THICKNESS 0.015 P.O. NO. ______ FORM Tube

DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

WELDED TO

MATERIAL TA SPECIFICATION ______

THICKNESS 0.015 P.O. NO. ______ FORM Tube

DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

FILLER METAL

MATERIAL ______ P.O. NO. ______ FORM ______ CERTS YES ______ NO ______

TYPE OF WELD JOINT Fillet PENETRATION REQUIRED 0.010

REQUESTOR OR CUSTOMER Hora W.A. NO. 4018-001-001

OPERATOR J. Frey DATE 1/21/70

JOB DESCRIPTION Join tube to spherical converter

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE								
Q.A. APPROVAL								
SAMPLE NUMBER		1						
RUN NUMBER		1						
DISTANCE TO WORK (Inches)		7						
FILAMENT CURRENT (Amps)		1.80						
ACCELERATING VOLTAGE (kV)		110						
BEAM CURRENT (mA)		2.0						
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015						
	VIEWER (Increments)	10						
BEAM FOCUS (Dial Setting)		485						
D.C. DEFLECTION	YES	✓						
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		40						
SPEED INDICATOR (Dial Setting)		200						
TIMER (Seconds)		1.4						
SLOPE CONTROL (%)	RISE	60%						
	FALL							
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)								

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER ______

PAGE ______ OF ______

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Arc Cast Mo & Nb SPECIFICATION ______
THICKNESS ______ P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

WELDED TO

MATERIAL Arc Cast Mo & Nb SPECIFICATION ______
THICKNESS ______ P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

FILLER METAL

MATERIAL ______ P.O. NO. ______ FORM ______ CERTS YES ______ NO ______

TYPE OF WELD JOINT ______ PENETRATION REQUIRED 0.005 - 0.010
REQUESTOR OR CUSTOMER Hora W.A. NO. ______
OPERATOR J. Frey DATE 1/21/70
JOB DESCRIPTION Seal 1/8" hole with plug inserted

NOTES

1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

OPTIMUM WELD SCHEDULE					*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	2	2	3	4	5 & 6	
RUN NUMBER		1	1	2	1	1	1	
DISTANCE TO WORK (Inches)		7"	7"	7"	7"	7"	7"	
FILAMENT CURRENT (Amps)		1.65	1.65	1.65	1.65	1.65	1.80	
ACCELERATING VOLTAGE (kV)		110	110	110	110	110	110	
BEAM CURRENT (mA)		3.0	4.0	4.0	4.0	4.0	5.2	
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.015	0.010	0.015	0.015	0.015	min	
	VIEWER (Increments)	10	7	10	10	10	6	
BEAM FOCUS (Dial Setting)		489	484	493	493	493	483	
D.C. DEFLECTION	YES						✓	
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.			40	40	40	40	40	
SPEED INDICATOR (Dial Setting)			200	200	200	200	200	
TIMER (Seconds)			1.4	1.4	1.4	1.4	1.4	
SLOPE CONTROL (%)	RISE		60%	60%	60%	60%	60%	
	FALL							
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		10^{-4}					10^{-8}	

ELECTRO-OPTICAL SYSTEMS, INC.
A XEROX COMPANY

DATA SHEET NUMBER ______

PAGE ____ OF ____

ELECTRON BEAM WELD SCHEDULE DEVELOPMENT DATA

MATERIAL Nb SPECIFICATION ______
THICKNESS 0.020 P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

WELDED TO

MATERIAL Nb SPECIFICATION ______
THICKNESS 0.020 P.O. NO. ______ FORM ______
DRAWING OR SKETCH NO. ______ CERTS YES ______ NO ______

FILLER METAL

MATERIAL ______ P.O. NO. ______ FORM ______ CERTS YES ______ NO ______

TYPE OF WELD JOINT #1 circular bott, #2 rotary pierce, #3 circular pierce PENETRATION REQUIRED #1 .020, #2 .020
REQUESTOR OR CUSTOMER P. Hora W.A. NO. 4018-001-001
OPERATOR J. Frey DATE 2/3/68
JOB DESCRIPTION Cylindrical converter assembly (4 cm)

NOTES
1. SHOP TRAVELER, MANUFACTURING ORDER OR GENERAL WORK REQUEST AND DRAWINGS, SKETCHES OR WRITTEN INSTRUCTIONS MUST ACCOMPANY ALL JOBS.
2. RECORD ALL WELDING DATA ON THIS SHEET - RECORD OTHER PERTINENT INFORMATION FOR EACH SAMPLE AND EACH RUN ON EOS FORM 6302A.
3. ASTERISK (*) SHALL DENOTE OPTIMUM WELD SCHEDULE FOR THIS APPLICATION AND SHALL BE APPROVED BY Q.A. IF REQUIRED.

				Flange to Coil	Flange to Emitter Lead Strap			
OPTIMUM WELD SCHEDULE		*		*	*			
Q.A. APPROVAL								
SAMPLE NUMBER		1	1	1	1			
RUN NUMBER		1	2	3	2 rerun			
DISTANCE TO WORK (Inches)		7"	7"	7"	7"			
FILAMENT CURRENT (Amps)		1.75	1.75	1.75	1.75			
ACCELERATING VOLTAGE (kV)		120	150	150	150			
BEAM CURRENT (mA)		3.0	2.5	3.7	3.7			
BEAM SPOT DIAMETER	ACTUAL (10^{-3} Inches)	0.008	min	min	min			
	VIEWER (Increments)	5						
BEAM FOCUS (Dial Setting)		511	558	553	553			
D.C. DEFLECTION	YES							
	NO							
A.C. DEFLECTION (Inches, ℄ To ℄)	X							
	Y							
CIRCLE GENERATION	YES							
	NO							
CIRCLE O.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
CIRCLE I.D.	ACTUAL (10^{-3} Inches)							
	VIEWER (Increments)							
LINEAR SPEED OR R.P.M.		10	25	17	23			
SPEED INDICATOR (Dial Setting)		60	130	95	120			
TIMER (Seconds)		-	2.3	3.7	2.6			
SLOPE CONTROL (%)	RISE							
	FALL	60%	60%	60%	60%			
PULSER SETTINGS	WIDTH (Milli Sec.)							
	FREQUENCY (CPS)							
VACUUM (mm of Hg)		$5x10^{-5}$	$8x10^{-5}$	$6x10^{-5}$	$7x10^{-5}$			

EOS FORM NO. 6301 (REV. 11/67)

CONVERTER NO. SC 4 SHEET 1 OF 15

DATE	1/26	1/26	1/26	1/26	1/26	1/26	1/26
TIME	0840	0932	0952	1010	1020	1035	1048
PRESSURE	2 MA	9 MA	12 MA		16 MA	11 MA	11 MA
10^{-6} TORR							
V_b	Off			On	180	230	315
I_b					.100	.140	.200
V_f	On	11	12		12.6	12.6	12.6
I_f		13	13.5		13.5	13.5	15.5
T_r °C		166	236		276	301	321
T_r °C							
T_c °C		198	282		332	364	391
T_c °C		202	288		338	369	396
COL. HTR. V							
COL. HTR. I							
T_s °C		215	305		359	392	424
T_s °C							
T_{res} °C		88	117		136	142	147
T_{res} °C		83	110		127	133	138
RES. HTR. V							
RES. HTR. I							
T_e °C							
T_e °K							
T_{1s} °C							
OUTPUT							
VOLTS					.095	.24	.405
AMPS					O.C.	O.C.	O.C.
WATTS							
PHOTO #							

154

CONVERTER NO. SC 4 SHEET 2 OF 15

DATE		1/26	1/26	1/26	1/26	1/26	1/26	
TIME		1100	1127	1146	1259	1332	1422	
PRESSURE		16 MA	9 MA	7 MA	2.9 MA	12 MA		
10^{-6} TORR								
V_b		380	410	410	410	700		
I_b		.260	.300	.300	.300	.460		
V_f		12.6	12.4	12.4	12.4			
I_f		15.5	15.5	15.5	15.5			
T_r	°C	366	413	416.6	417.5	616	625.5	
	°C							
T_c	°C	448	502	506	506.5	679	~~697.5~~	688.5
	°C	453	507	511	512	721	~~648.5~~	714.5
COL. HTR.	V				ON			
	I							
T_s	°C	482	537	540.5	541	690	697.5	
	°C							
T_{res}	°C	160	191	194	195	274.5	253	
	°C	149	179	181	181.5	334	306.5	
RES. HTR.	V							
	I							
T_e	°C	1038	1120	1124	1122	1377	1400	
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.73	1.146	1.146	1.154	.229	.399	
AMPS		O.C.	.90	1.84	1.8	36.2	35.76	
WATTS			1.03	2.11	2.08	8.29	14.27	
PHOTO #								

CONVERTER NO. SC 4 SHEET 3 OF 15

DATE		1/26	1/26	1/26	1/26	1/26	1/26	1/26
TIME		1437	1440	1506	1517	1530	1540	1548
PRESSURE								
10^{-6} TORR			.8	.8	.85	.8	.8	.8
V_b			700	700	702	700	700	700
I_b			.495	.499	.499	.499	.499	.500
V_f			12.3	12.3	12.3	12.3	12.3	
I_f			15.4	15.4	15.4	15.4	15.4	
T_r	°C	623	625	630	626	629	629	631
	°C							
T_c	°C	688	688	699.5	693	699.5	701	705
	°C	704.5	718	738	731	738	737	742
COL. HTR.	V							
	I							
T_s	°C	696	697	704.4	698	702.5	703	704.4
	°C							
T_{res}	°C	242.5	254.5	249.6	249	250	248	252
	°C	294	309.9	302.5	301.5	303	301	306
RES. HTR.	V							
	I							
T_e	°C	1400	1399	1400	1400	1400	1399	1401
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.399	.398	.395	.400	.397	.400	.400
AMPS		33.82	34.23	37.95	36.22	37.43	36.86	37.90
WATTS		13.49	13.62	14.99	14.49	14.86	14.74	15.16
PHOTO #								

CONVERTER NO. SC 4 SHEET 4 OF 15

DATE		1/26	1/26	1/26	1/26	1/26	1/27	1/27
TIME		1604		1702	1717	1722	0833	0932
PRESSURE								
10^{-6} TORR		.8		.7				
V_b		700	700	678	680			
I_b		.300	.500	.475	.480		ON	
V_f				12.3				
I_f				15.4			ON	
T_r	°C	631	644	625	621	619		622
	°C							
T_c	°C	702.5	713	675.4	674	674		673
	°C	742	755	700.5	698	695		697
COL.	V		max					
HTR.	I		10.5					
T_s	°C	704	726	708	701.5	699		701.5
	°C							
T_{res}	°C	256	258.6	249	243	238.5		236
	°C	310	313	301	294.5	289		286.5
RES.	V							
HTR.	I							
T_e	°C	1400	1399	1401	1400	1400		1398
	°K							
T_{ls}	°C							
OUTPUT								
VOLTS		.400	.4	.495	.494	.502		.500
AMPS		37.42	33.2	19.2	22.22	21.6		20.58
WATTS		14.97	13.28	9.30	10.98	10.84		10.29
PHOTO #								

CONVERTER NO. SC 4

DATE		1/27	1/27	1/27	1/27	1/27	1/27	1/27
TIME			0959	1019	1040	1048		
PRESSURE			2MA	2MA	2MA	2MA		
10^{-6} TORR								
V_b			650	650				
I_b			.495	.495				
V_f			12.5	12.5				
I_f			13.5	13.5				
T_r	°C	619.5	639	669	637.4	637.4	675	600
	°C							
T_c	°C	671	691	694	688	684	745	660
	°C	692	720	721	713	714	796	678
COL. HTR.	V							~~900~~
	I							
T_s	°C	701	727	728.5	624	723	768	677
	°C							
T_{res}	°C	231	244	239	234	251.5	194	240
	°C	280	295	290	283.5	305	235	291.5
RES. HTR.	V							
	I							
T_e	°C		1400	1400	1400	1402	1895	
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.490	.500	.501	.500	.497	1.44	.499
AMPS		18.28	18.7	18.52	16.68	15.4	.14	22.28
WATTS		8.96	9.35	9.28	8.34	7.65	.20	11.12
PHOTO #								

CONVERTER NO. SC 4 SHEET 6 OF 15

DATE		1/27	1/27	1/27	1/27	1/27	1/27	1/27
TIME			1130	1150	1507	1616	1637	1651
PRESSURE							4 MA	3.3 MA
10^{-6} TORR				Δ# / Off	Δ# / ON			
V_b		659	560			645	644	644
I_b		.500	.500			.465	.460	.460
V_f			12.5			12.5	12.5	12.5
I_f			15.5	[illegible]		15.5	15.5	15.5
T_r	°C	601	598			601.4	613	611.5
	°C							
T_c	°C	660	660			658	672.5	670
	°C	680	673			678	691.5	687.5
COL. HTR.	V							
	I							
T_s	°C	677	674			672	689	688.5
	°C							
T_{res}	°C	244.5	233			239	238	232.5
	°C	297	283			290	289	282
RES. HTR.	V							
	I							
T_e	°C	1401	1400			1400	1400	1400
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.500	.499			.499	.500	.500
AMPS		21.06	20.20			18.72	18.6	16.54
WATTS		10.53	10.08			9.34	9.30	8.27
PHOTO #								

CONVERTER NO. SC 4 SHEET 7 OF 15

DATE		1/27	1/27	1/27	1/27	1/27	1/27	1/28
TIME		1659	1704	1714	1720	1723	1735	1022
PRESSURE		3.2 MA	3 MA	3 MA				1.2 MA
10^{-6} TORR							~~P11~~	
V_b		642		642			~~976~~	680
I_b		.458		.458				.485
V_f		12.5		12.5				12.4
I_f		15.5		15.5				15.2
T_r	°C	613.5	613.5	613	614			617
	°C							
T_c	°C	670	670	670	671			676
	°C	691	691	690	691			698.5
COL. HTR.	V							
	I							
T_s	°C	690	690.5	689	690			687
	°C							
T_{res}	°C	244	242	238	237			245
	°C	296	293.5	288	263.5			296.5
RES. HTR.	V							
	I							
T_e	°C		1400	1399	1400	1880		1414
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.500	.500	.500	.500			.492
AMPS		15.76	15.96	16.62	16.92			24.06
WATTS		7.88	7.98	8.31	8.46			11.84
PHOTO #								

CONVERTER NO. SC 4 SHEET 8 OF 15

DATE		1/28	1/28	1/28	1/28	1/28	1/28	1/28
TIME		1030	1031	1046	1051	1105	1134	1142
PRESSURE		1.2 MA	1.2 MA	1.3 MA	1.3 MA	1.3 MA	1.3 MA	1.2 MA
10^{-6} TORR								
V_b		680	680	680	680	675	665	660
I_b		.480	.480	.485	.485	.465	.455	.455
V_f		12.4	12.4	12.4	12.4	12.9	12.9	12.9
I_f		15.2	15.2	15.2	15.2	15.2	15.2	15.2
T_r	°C	615	615	623	621	614	601.4	602
	°C							
T_c	°C	674	674	687	683	666	651	652
	°C	695	695.2	707	702.5	687	670.6	670.8
COL. HTR.	V							
	I							
T_s	°C	685.4	674	694	691.5	690	674.5	675.4
	°C							
T_{res}	°C	243	242.5	243	243	235	234	231
	°C	294.6	294.2	294.6	294.6	284.5	283.8	280
RES. HTR.	V							
	I							
T_e	°C	1401	1403	1403	1406	1412	1408	1410
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.470	.472	.462	.500	.597	.587	.586
AMPS		24.2	24.22	28.26	24.74	12.32	8.7	8.96
WATTS		11.37	11.43	13.06	12.37	7.36	5.11	5.25
PHOTO #								1

CONVERTER NO. SC 4 SHEET 9 OF 15

DATE		1/28	1/28	1/28	1/28	1/28	1/28	1/28
TIME		1145	1156	1328	1330	1340		1411
PRESSURE		1.2 MA	1.4 MA	1.8 MA	1.8 MA	1.8 MA		1.8 MA
10^{-6} TORR								
V_b		660	695	705	705	750		618
I_b		.455	.490	.510	.510	.530		.448
V_f		12.4	12.4	12.4	12.4	12.4		12.4
I_f		13.2	13.2	13.2	13.2	13.2		13.2
T_r	°C	605	629	650	652	663	621.5	621
	°C							
T_c	°C	654	695	711	712.5	732	668	666
	°C	674.5	719.8	745	749.8	773	686	685
COL.	V					OFF		ON
HTR.	I							FULL
T_s	°C	680.4	698	726.5	729.5	734	710.5	711
	°C							
T_{res}	°C	231	252	251.5	256.5	311	227	215
	°C	279.6	303.8	305	311	318.8	275	260.5
RES.	V							
HTR.	I							
T_e	°C	1409	1395	1400	1400	1401	1400	1402
	°K							
T_{1s}	°C							
OUTPUT							.797	
VOLTS		.586	.392	.398	.401	.296	~~.80~~	1.0
AMPS		8.9	35.36	35.64	36.18	51.27	2.22	1.7
WATTS		5.22	13.86	14.18	14.51	15.18	1.77	1.7
PHOTO #		2	3		4			

CONVERTER NO. SC 4 SHEET 10 OF 15

DATE		1/28	1/28	1/28	1/28	1/28	1/28	1/28
TIME		1419	1452	1459	1531	1627	1639	1718
PRESSURE		1.7 MA	1.8 MA	1.8 MA	1.5 MA	1.3 MA	1.3 MA	1.2 MA
10^{-6} TORR								
V_b		618			690		695	
I_b		.445			.529		.510	
V_f		12.4			12.5	12.5	12.5	
I_f		13.2			13.4	13.4	13.4	
T_r	°C	618	687	654	619	608.5	606	624.6
	°C							
T_c	°C	662	757	712	671	637	654	683
	°C	680	835	749.5	695	676.5	673	718
COL. HTR.	V							
	I		off		off	off		
T_s	°C	708	762	729	690.5	680.4	678	690
	°C							
T_{res}	°C	206.5	269.4	262	245	227	226.5	249
	°C	250	326.5	318	296.5	275	274	624.6
RES. HTR.	V							
	I							
T_e	°C	1400	1498	1502	1500	1501	1500	1301
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		1.200	.402	.600	.800	1.016	1.200	.211
AMPS		.91	50.30	28.32	8.48	3.44	2.4	43.34
WATTS		1.09	20.22	16.99	6.78	3.46	2.88	9.14
PHOTO #			5	6	7	8	9	

CONVERTER NO. SC 4 SHEET 11 OF 15

DATE		1/28	1/29	1/29	1/29	1/29		1/30
TIME		1720	0939	1035	1105	1115		1401
PRESSURE			1MA					
10^{-6} TORR								
		going						
V_b								.640
I_b		Down	~~on~~					.475
V_f			on					12.3
I_f								15.4
T_r	°C			622	622	620.4		620.4
	°C							
T_c	°C			583	584	586		697.5
	°C			716	715	711		720.5
COL. HTR.	V							
	I							
T_s	°C			687	687	687		684.5
	°C							720.5
T_{res}	°C			249.4	246	241		248.5
	°C			303	298.5	292.5		301
RES. HTR.	V							
	I							
T_e	°C			1300	1300	1301		1302
	°K					(40° ΔT)		
T_{1s}	°C							
OUTPUT								
VOLTS				.209	.207	.206		.208
AMPS				43	42.36	40.90		42.95
WATTS				8.99	8.81	8.43		8.93
PHOTO #								

Conv. down over lunch the reactor from to shift #7 T.C.
the lower reach

CONVERTER NO. SC 4 SHEET 12 OF 15

DATE		1/30	1/30	1/30	1/30	1/30	1/30	1/30
TIME		1511	1520	1536	1541	1549	1628	1647
PRESSURE		1.2 MA	1.2 MA	1.2 MA	1.1 MA	1.1 MA	1.2 MA	
10^{-6} TORR								
V_b		564	518	518	518	518	584	663
I_b		.408	.400	.398	.398	.398	.430	.505
V_f		12.3	12.3	12.3	12.3	12.3	12.3	12.3
I_f		13.4	13.4	13.4	13.4	13.4	13.4	13.4
T_r	°C	557	554	548	534	532.5	584.5	638
	°C							
T_c	°C	592.5	595	583.5	573.4	573.5	647	722
	°C	603	597.6	593.5	575	573	651.5	744.5
COL. HTR.	V							
	I							
T_s	°C	622	619.5	611	596.5	595	652	714.4
	°C	643.5	631.5	628	613	612	678.5	745
T_{res}	°C	217	205	202	201	177.5	233.4	255
	°C	263	249	245	244	216.5	286	309.6
RES. HTR.	V							
	I							
T_e	°C	1300	1302	1298	1300	1302	1302	1400
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.400	.601	.800	.999	1.2	.306	.400
AMPS		6.32	.48	.84	.66	.46	24.92	33.60
WATTS		2.53	.29	.67	.66	.55	7.63	13.44
PHOTO #								

CONVERTER NO. SC 4 SHEET 13 OF 15

DATE		2/2	2/2	2/2	2/2	2/3	2/3	2/3
TIME		1045				920	946	1020
PRESSURE								
10^{-6} TORR							.4	Acc
								Test
V_b				640				
I_b		ON		.495		ON		
V_f				12.3				
I_f		ON		15.2		ON		
T_r	°C		625	611	615		635	
	°C							
T_c	°C		586	682.5	671.5		602	
	°C		709	667	689		721	
COL. HTR.	V						OFF	
	I							
T_s	°C		701.5	691	695		710	
	°C		735.6	722	726		745	
T_{res}	°C		246	235	239		251.5	
	°C		299.5	285	290		305.5	
RES. HTR.	V							
	I							
T_e	°C		1400	1402	1401		1400	
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS			.401	.498	.499		.401	
AMPS			36.08	21.34	22.28		38.08	
WATTS			14.47	10.63	11.12		15.27	
PHOTO #								

CONVERTER NO. SC 4 SHEET 14 OF 15

DATE		2/3	2/3	2/3	2/3	2/3	2/3	2/3
TIME		1021	1044	1056	1111	1117	1137	1138
PRESSURE		1.4 MA	1.3 MA	1.3 MA	1.3 MA	1.3 MA	1.3 MA	1.3 MA
10^{-6} TORR								
V_b		675	640	605	632	645	705	730
I_b		.520	.500	.478	.500	.505	.540	.562
V_f		12.4	12.4	12.4	12.4	12.4	12.4	12.4
I_f		13.5	13.5	13.5	13.5	13.5	13.5	13.5
T_r	°C	635	621.5	614	635	608	649	659
	°C							
T_c	°C	702	673	661.5	683	661	713	721
	°C	722	695	679	704	674	739	750
COL. HTR.	V						~~Off~~	~~Off~~
	I							
T_s	°C	709.5	699	696	723	681.5	726	738
	°C	745	731	726	754	704	761.5	769.5
T_{res}	°C	251	236	231	233	229.5	258	263.5
	°C	304	286	280	282	278	312	319.5
RES. HTR.	V							
	I							
T_e	°C	1400	1389	1389	1440	1440	1440	1489
	°K							
T_{ls}	°C							
OUTPUT								
VOLTS		.399	.495	.594	.695	.697	.499	.598
AMPS		37.76	22.48	9.92	8.3	11.22	35.54	31.2
WATTS		15.07	11.13	5.89	5.77	7.82	17.73	18.66
PHOTO #								

CONVERTER NO. SC 4 SHEET 15 OF 15

DATE		2/3	2/3	2/3	2/3	2/3		
TIME		1147	1158	1328	1338	1355		
PRESSURE		1.3 MA	1.3 MA	1.2 MA	1.2 MA			
10^{-6} TORR								
						All		
V_b		780	672	555	630	off		
I_b		.588	.525	.430	.485			
V_f		12.4	12.4	12.4	12.4		ACC OPT. 50	
I_f		15.5	15.3	15.3	15.3			
T_r	°C	685.5	622	562	631			
	°C							
T_c	°C	759	674	605	692			
	°C	829	691.5	616	716.5			
COL. HTR.	V							
	I	~~off~~	~~off~~					
T_s	°C	765	697.5	629	702.5			
	°C	806	720.5	656	735			
T_{res}	°C	269	245	217	247.5			
	°C	326	296	264	300			
RES. HTR.	V							
	I							
T_e	°C	1488	1491	1392	1288			
	°K							
T_{1s}	°C							
OUTPUT								
VOLTS		.402	.789	.399	.210			
AMPS		52.86	8.62	11.14	43.46			
WATTS		21.25	6.80	4.44	9.13			
PHOTO #								

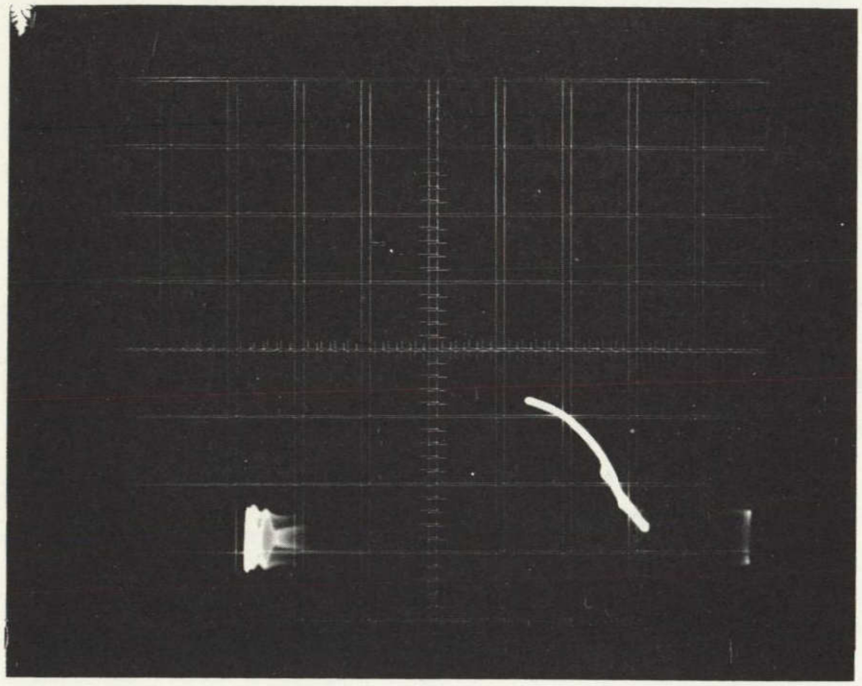


Photo No. SC-4-1

T_E = 1410°C
T_{COLL} = 671°C
T_{CS} = 280°C
X axis = 0.1V/div.
Y axis = 10A/div.

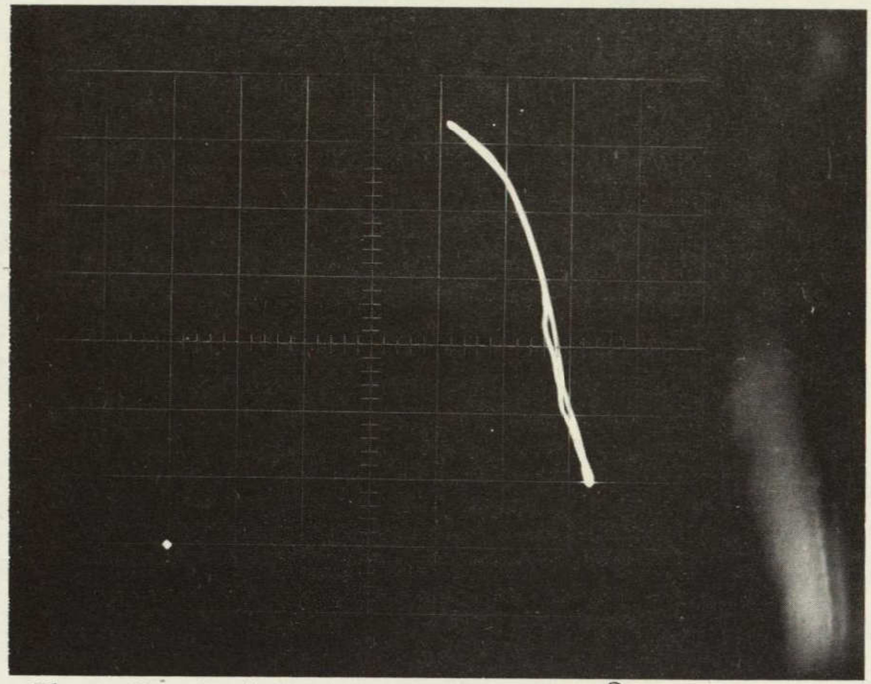


Photo No. SC-4-2

$T_E = 1409^{o}C$

$T_{COLL} = 675^{o}C$

$T_{CS} = 280^{o}C$

X axis = 0.1V/div.

Y axis = 4A/div.

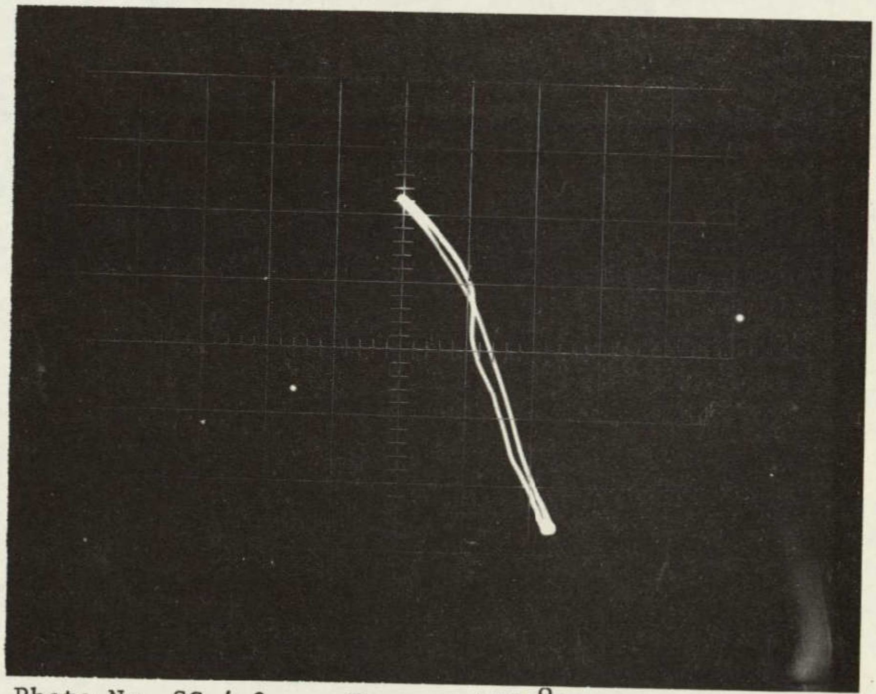


Photo No. SC-4-3

$T_E = 1395^{o}C$

$T_{COLL} = 720^{o}C$

$T_{CS} = 300^{o}C$

X axis = 0.1V/div.

Y axis = 10A/div.

0

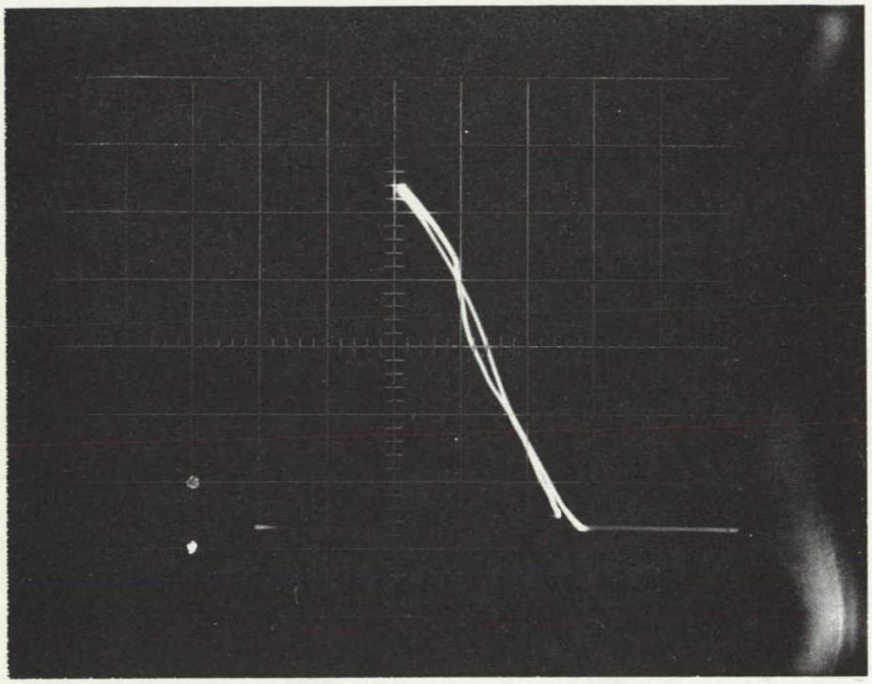


Photo No. SC-4-4

T_E = 1400°C

T_{COLL} = 750°C

T_{CS} = 311°C

X axis = 0.1V/div.

Y axis = 10A/div.

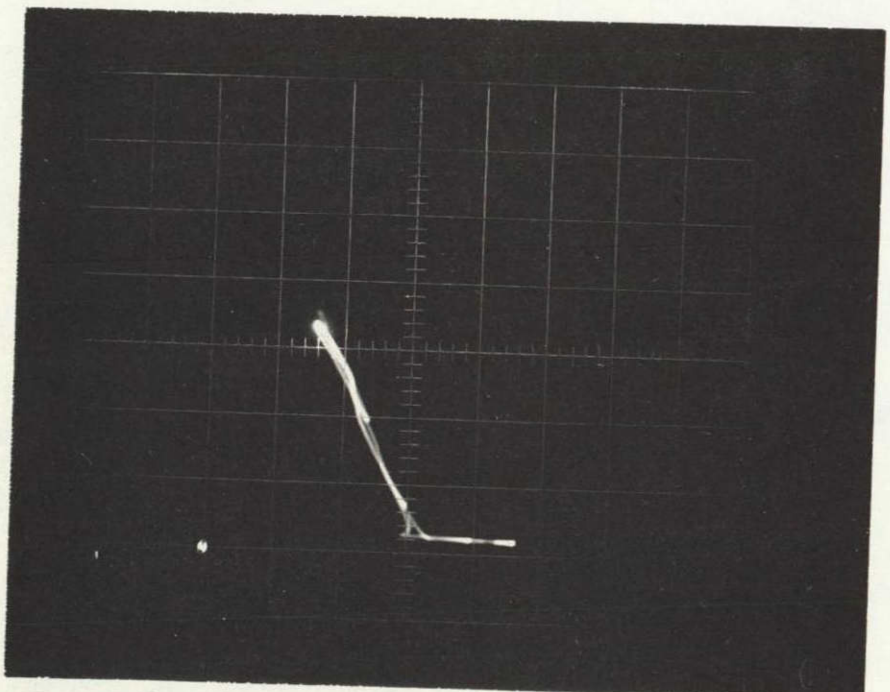


Photo No. SC-4-5

T_E = 1498°C

T_{COLL} = 835°C

T_{CS} = 327°C

X axis = 0.2V/div.

Y axis = 20A/div.

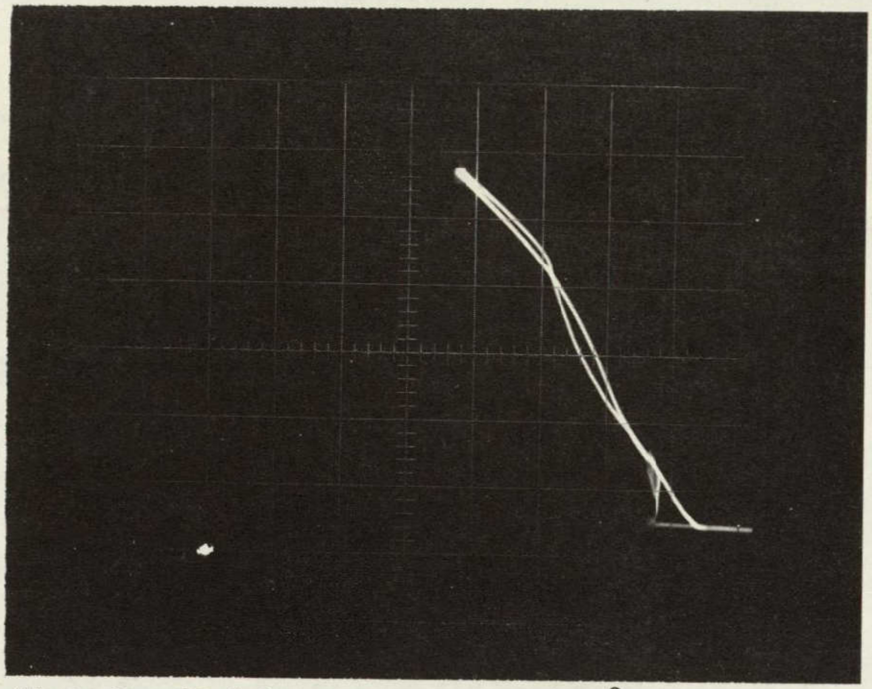


Photo No. SC-4-6

T_E = 1502°C
T_{COLL} = 750°C
T_{CS} = 318°C
X axis = 0.1V/div.
Y axis = 10A/div.

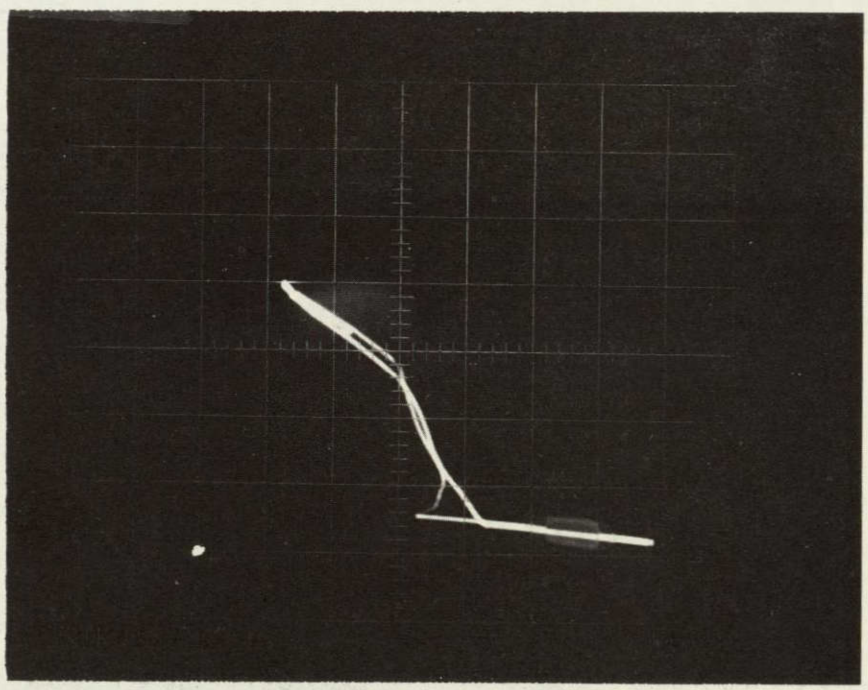


Photo No. SC-4-7

T_E = 1500°C
T_{COLL} = 695°C
T_{CS} = 297°C
X axis = 0.2V/div.
Y axis = 10A/div.

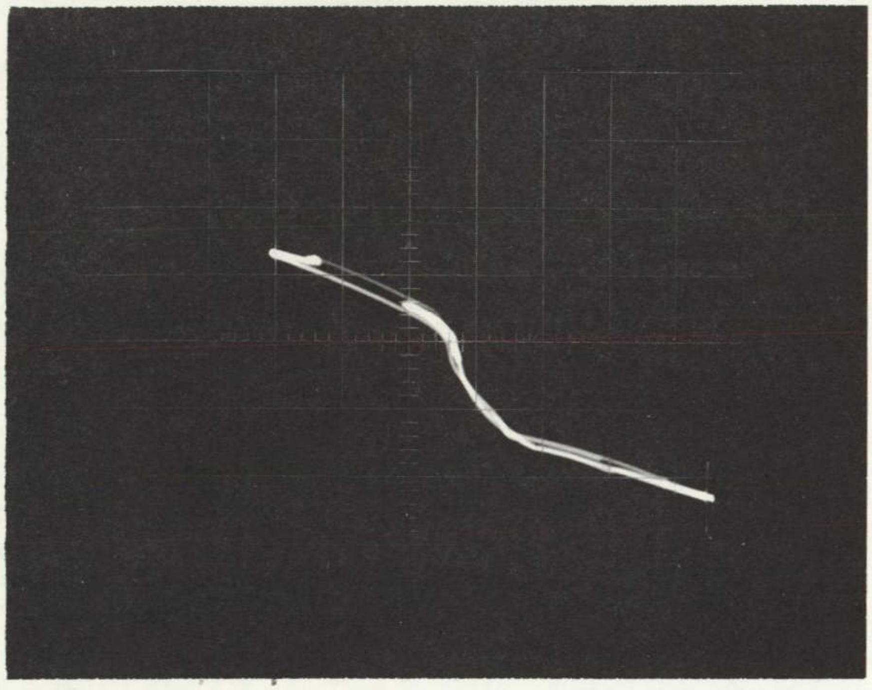


Photo No. SC-4-8

T_E = 1501°C
T_{COLL} = 676°C
T_{CS} = 275°C
X axis = 0.2V/div.
Y axis = 4A/div.

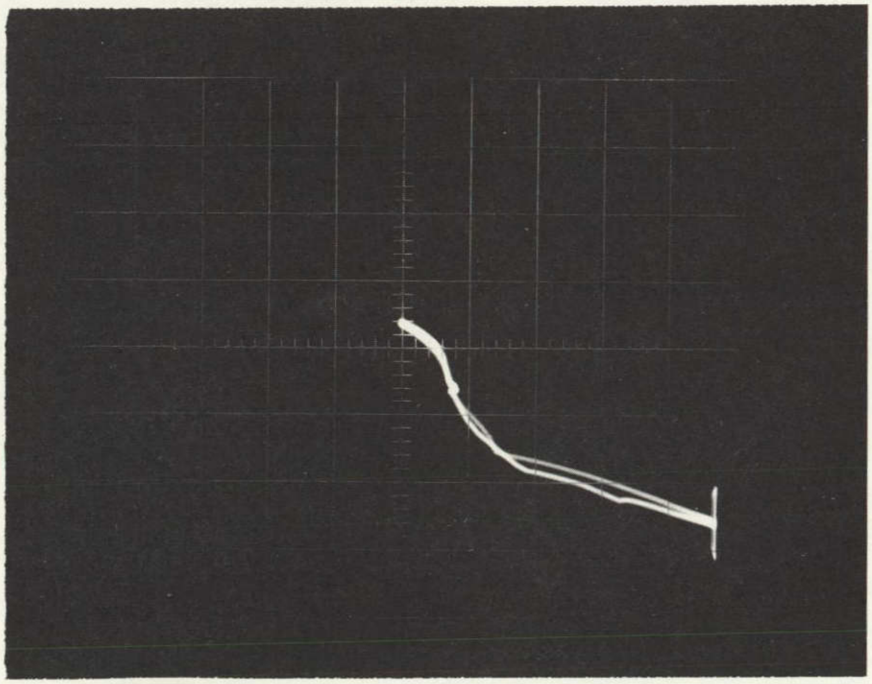


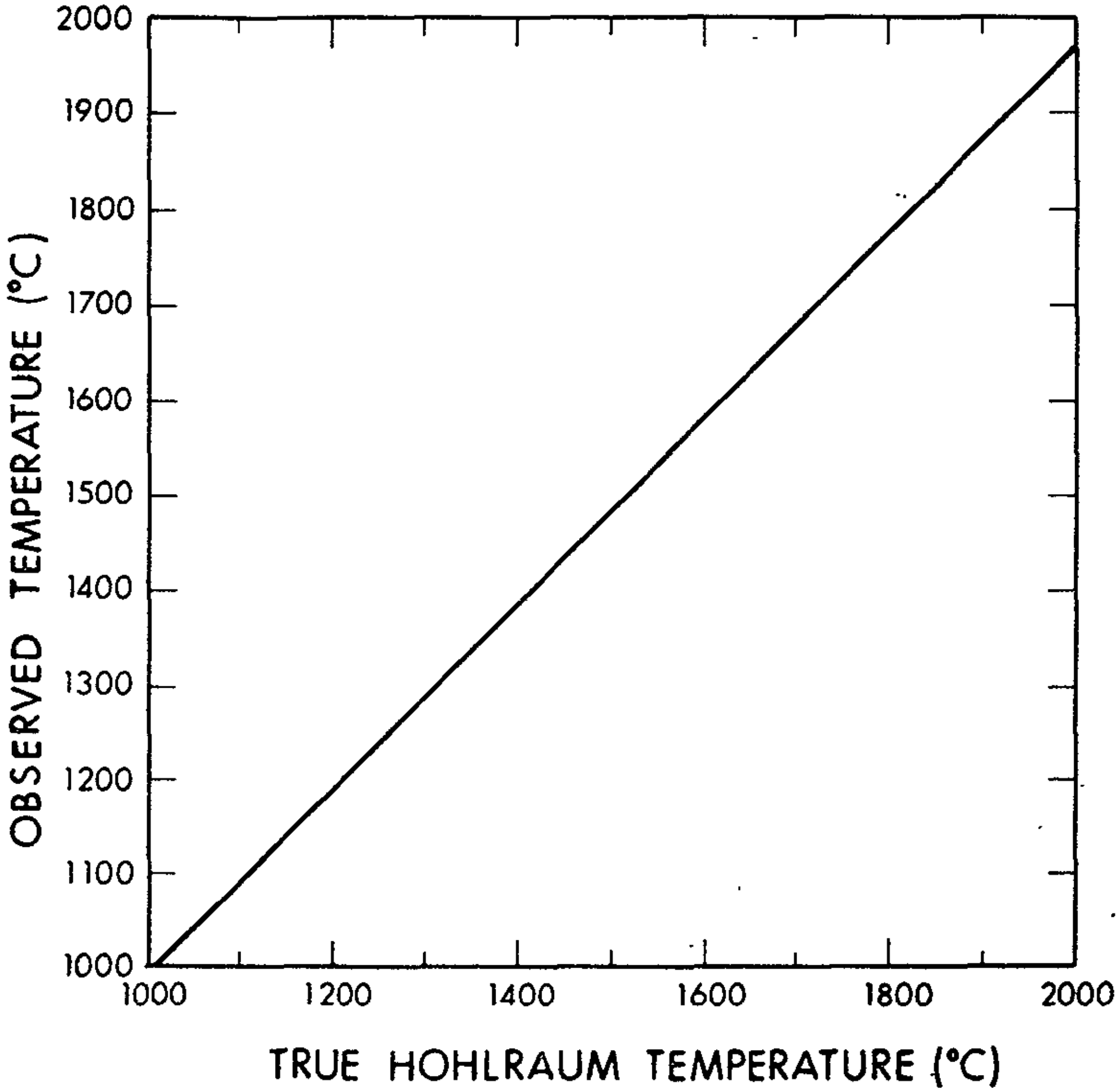
Photo No. SC-4-9

T_E = 1500°C
T_{COLL} = 673°C
T_{CS} = 274°C

X axis = 0.2V/div.
Y axis = 4A/div.

APPENDIX 6

BELL JAR CALIBRATION



Bell Jar Calibration Curve

37656

APPENDIX 7

PYROMETER CALIBRATION

FIRST CAL RUN OF NEW GE LAMP NO. 37 ON REBUILT PYRO

Date	True Temperature	Power V	Power A	Temperature	Operator	Pyrometer Serial Number	Lens	Remarks
3-18-69	1027°C		13.46	1031	PD	M5100	B	New lamp No. 37
				1034	DG			Scale No. 1
	1127°C		14.75	1131	PD			Scale No. 1
				1131	DG			Scale No. 1
	1227°C		16.20	1228	PD			Scale No. 1
				1228	DG			Scale No. 1
	1327°C		17.85	1326	PD			Scale No. 1
				1325	DG			Scale No. 1
				1327	PD			Scale No. 2
				1325	DG			Scale No. 2
	1427°C		19.68	1427	PD			Scale No. 2
				1428	DG			Scale No. 2
	1527°C		21.70	1526	PD			Scale No. 2
				1526	DG			Scale No. 2
	1627°C		23.88	1625	PD			Scale No. 2
				1624	DG			Scale No. 2
	1727°C		26.20	1720	PD			Scale No. 2
				1720	DG			Scale No. 2
	1827°C		28.65	1828	PD			Scale No. 2
				1826	DG			Scale No. 2
	1927°C		31.20	1933	PD			Scale No. 3
				1938	DG			Scale No. 3

FIRST CAL RUN OF NEW GE LAMP NO. 37 ON REBUILT PYRO (contd)

Date	True Temperature	Power V	Power A	Temperature	Operator	Pyrometer Serial Number	Lens	Remarks
3-18-69	1727°C		26.20	1720	PD			Recheck of 1720
	1827°C		28.65	1820	PD			Scale No. 3 of 1827
				1828	PD			Scale No. 2 of 1827
	1027		13.46	1031	PD	M4875	B	New Lamp No. 37
				1032	DG			New Lamp No. 37
	1127		14.75	1128	PD			New Lamp No. 37
				1127	DG			Scale No. 1
	1227		16.20	1222	PD			Scale No. 1
				1222				Scale No. 1
	1327		17.85	1322	PD			Scale No. 1
				1321	PD			Scale No. 1
				1321	PD			Scale No. 2
				1322	PD			Scale No. 2
	1427		19.68	1418	PD			Scale No. 2
				1416	DG			Scale No. 2
	1527		21.70	1515	PD			Scale No. 2
				1518	RH			Scale No. 2
				1517	P.D.(V.D.)			Scale No. 2
	1627		23.88	1618	PD			Scale No. 2
				1619	DG			Scale No. 2

FIRST CAL RUN OF NEW GE LAMP NO. 37 ON REBUILT PYRO (contd)

Date	True Temperature	Power V	Power A	Temperature	Operator	Pyrometer Serial Number	Lens	Remarks
3-18-69	1727		26.20	1720	PD			Scale No. 2
				1718	DG			Scale No. 2
	1827		28.65	1822	PD			Scale No. 2
				1822	DG			Scale No. 2
				1822	PD			Scale No. 3
				1821	DG			Scale No. 3

Form 431-8182 8-59

GENERAL ELECTRIC COMPANY

PRODUCT TESTING
AND
EVALUATION #431
NELA PARK, CLEVELAND, OHIO 44112

CERTIFICATE OF STANDARDIZATION

LAMP ABBREVIATION 30AT24/5
TYPE Ribbon Filament Pyrometer AMPERES 30.0 VOLTS 6.0

ORDERED BY Electro Optical Systems

ORDER NUMBER X-14934-100

LAMP OPERATED BASE DOWN, WITH FILAMENT NEARLY VERTICAL AS POSSIBLE, AND WITH SIDE ON WHICH LAMP NUMBER APPEARS TOWARD OPTICAL PYROMETER. THE TEMPERATURES WERE MEASURED ON THE CENTER OF THE FILAMENT DIRECTLY IN LINE WITH THE SMALL NOTCH FILED IN THE FILAMENT. THE LAMPS WERE ALLOWED TO OPERATE FOR TEN MINUTES AT EACH CURRENT BEFORE READINGS WERE TAKEN.

RELATION BETWEEN CURRENT AND BRIGHTNESS TEMPERATURE

Lamp No.	CURRENT IN AMPERES	TEMPERATURE IN DEGREES Kelvin
431-P-694	11.45	1100
	12.37	1200
	13.46	1300
	14.75	1400
	16.20	1500
	17.85	1600
	19.68	1700
	21.70	1800
	24.88	1900
	26.20	2000
	28.65	2100
	31.20	2200
	33.83	2300

Wavelength 0.665 Microns

These measurements are traceable to the National Bureau of Standards.

THESE TEMPERATURES ARE BASED UPON ASSUMPTION OF WIEN'S EQUATION WITH C_2 TAKEN AS 1.438 CM. DEG. AND UPON THE MELTING POINT OF GOLD TAKEN AS 1336°K. ON THIS SCALE THE MELTING POINT OF PALLADIUM HAS BEEN FOUND TO BE 1825°K. FOR CONVENIENCE IN THE CALIBRATION OF OPTICAL PYROMETERS. A BLACK BODY HELD AT THE MELTING POINT OF PALLADIUM IS USED AS THE POINT OF REFERENCE.

DATE February 20, 1969

IN CHARGE OF TEST Martha Wood

APPROVED BY H. E. Koth

4018-Final

PRECEDING PAGE BLANK NOT FILMED

REFERENCES

1. A. E. Campbell and D. L. Jacobson, Thermionic Research and Development Program Contract NAS7-514, Final pp. 87, 88, Sept 1968.
2. Ibid, p. 121, 123.
3. S. Kitilakis and M. Meeker, "Experimental Determination of the Heat Conduction of Cesium Gas," Advanced Energy Conversion, Vol. 3, pp 59-68.

ELECTRO-OPTICAL SYSTEMS
A XEROX COMPANY
PASADENA, CALIFORNIA 91107 • 213/351-2351