

EIMAC Division of Varian  
San Carlos, California

TEST SPECIFICATION

8 October, 1968

ELECTRON TUBE, TRANSMITTING TETRODE,  
EXTERNAL ANODE, FORCED-AIR COOLED ‡

TYPE Y-477 ‡

ABSOLUTE MAXIMUM RATINGS:

| Parameter:          | Ef     | Eb   | Ec1  | Ec2 | Ib   | Pg1 | Pg2  | Pp   | Anode<br>Core &<br>Seal T | tk  | Cooling | Altitude |
|---------------------|--------|------|------|-----|------|-----|------|------|---------------------------|-----|---------|----------|
| Units:              | V      | Vdc  | Vdc  | Vdc | mAdc | W   | W    | W    | °C                        | sec |         | Ft       |
|                     | Note 1 |      |      |     |      |     |      |      |                           |     | Note 2  | Note 3   |
| Class B<br>or AB rf | 6.0±5% | 3200 | -250 | 400 | 900  | 1.0 | 12.0 | 1500 | 250                       | 180 | ---     | 10,000   |
| Test Cond:          | 6.0    | 2000 | Adj. | 300 | 250  | --- | ---  | ---  | ---                       | 300 | Note 4  | ---      |

Finishes: See Note 5

METHOD OR PAR. references: MIL-E-1F & MIL-STD-1311

Envelope: Ceramic & Metal

Marking - Tube and Shipping Container: See Note 7

Installation of anode heat exchanger & special test procedure: See Note 6

| METHOD<br>OR PAR.  | REQUIREMENT OR TEST                        | CONDITIONS  | AQL% | INSP.<br>LEVEL | SYMB. | LIMITS |       | UNITS |
|--|--|---|------|----------------|-------|--------|-------|-------|
|  |  |   |      |                |       | Min    | Max   |       |
| <u>General</u>   |  |   |      |                |       |        |       |       |
| 4.8.5  | Holding Period                             |   | ---  | ---            | t:    | 72     | ---   | ---   |
| ---  | Cathode                                    | Oxide-coated<br>unipotential  | ---  | ---            | ---   | ---    | ---   | ---   |
| <u>Quality Conformance<br/>Inspection - Part 1<br/>(Production) Note 8</u> |  |   |      |                |       |        |       |       |
| D-30(a),<br>40, 60   | Visual & Mechanical<br>Inspection Criteria |   | ---  | ---            | ---   | ---    | ---   | ---   |
| 1301   | Heater Current                             |   | 0.65 | II             | If:   | 9.0    | 11.0  | A     |
| 1261   | Grid Voltage                               |   | 0.65 | II             | Ec1:  | -50.0  | -64.0 | Vdc   |
| 1256   | Screen Grid Current                        |   | 0.65 | II             | Ic2:  | 0      | -10.0 | mAdc  |
| ---  | Primary Control Grid<br>Emission           | Ec1/Pg1 = 1.0 watt;<br>p = g2 = k = 0 Vdc;<br>Eavg(Reverse) = 25 V;<br>t = 60; See Note 9 | 0.65 | II             | Isg1: | ---    | -10   | µAdc  |

‡ w/special heat exchanger on anode

‡ Y-477 is a special-anode version  
of the 8660/4CX1500B

| METHOD<br>OR PAR.   | REQUIREMENT OR TEST   | CONDITIONS   | AQL% | INSP.<br>LEVEL | SYMBOL       | LIMITS |      | UNITS           |     |
|---|---|--|------|----------------|--------------|--------|------|-----------------|-----|
|   |   |  |      |                |              | Min    | Max  |                 |     |
| <u>Quality Conformance</u><br><u>Inspection - Part 1</u><br><u>(Production) Note 8</u><br><u>Cont'd</u> |   |  |      |                |              |        |      |                 |     |
| ---   | Primary Screen Grid<br>Emission                               | $E_{c2}/P_{g2} = 12$ watts;<br>$p = g1 = k = 0$ Vdc;<br>$E_{avg}(\text{reverse}) \pm 50$ V;<br>$t = 60$ ; See Note 9   | 0.65 | II             | $I_{sg2}$ :  | ---    | -25  | $\mu\text{Adc}$ |     |
| ---   | † Ion Current   | $E_b = -67.5$ Vdc;<br>$E_{c2} = 300$ Vdc;<br>$E_{c1}/I_{c2} = 20$ mAdc;<br>See Note 10   | 0.65 | II             | $I_z$ :      | ---    | 10   | $\mu\text{Adc}$ |     |
| 1236  | Power Output  | Class AB amplifier;<br>$F = 1$ MHz minimum;<br>$E_b = 3000$ Vdc;<br>$E_{c2} = 400$ Vdc maximum;<br>$E_{c1}/I_{b0} = 250$ mAdc;<br>$E_{g1}/I_b = 900$ mAdc;<br>$I_{c1} = 2.0$ mAdc maximum;<br>$I_{c2} = 30$ mAdc maximum;<br>$R_L = 2200 \pm 200$ ohms | 0.65 | II             | $P_o$ :      | 1350   | ---  | W<br>(useful)   |     |
| ---   | Insulation<br>Resistance                                      | No voltages except<br>between test points.<br>$g1$ to $k$<br>( $g1$ neg.) $E = 50$ Vdc<br>$g1$ to $g2$ $E = 50$ Vdc<br>( $g1$ neg.)<br><br>anode to heat exchanger;<br>(anode pos.) $E = 500$ Vdc  | 0.65 | II             |              | $R$ :  | 50   | ---             | Meg |
|   |   |  |      |                |              | $R$ :  | 50   | ---             | Meg |
|   |   |  |      |                |              | $R$ :  | 50   | ---             | Meg |
| <u>Quality Conformance</u><br><u>Inspection - Part 2</u><br><u>(Design) - Note 11</u>                   |   |  |      |                |              |        |      |                 |     |
| D-20(b)   | Dimensions  | Per EIMAC Drwg. No.<br>Y-477-60, Change B  | 6.5  | S3             |              | ---    | ---  | ---             |     |
| 1331  | Direct Interelectrode<br>Capacitance<br>(gnd.cath.connection) |  | 6.5  | S3             | $C_{in}$ :   | 75.0   | 88.0 | pF              |     |
|   |   |  |      |                | $C_{gp}$ :   | ---    | 0.03 | pF              |     |
|   |   |  |      |                | $C_{out}$ :  | ---    | 15.0 | pF              |     |
|   |   | (anode to heat exchanger)  |      |                | $C_{a/hs}$ : | ---    | 20.0 | pF              |     |
| 1372  | Current Division  | $E_b = 500$ Vdc;<br>$E_{c2} = 325$ Vdc;<br>$E_{c1} = -200$ Vdc;<br>$egk/ib = 3.0$ a;<br>See Note 12  | 6.5  | S3             | $egk$ :      | ---    | +16  | v               |     |
|   |   |  |      |                | $ic1$ :      | ---    | 30   | ma              |     |
|   |   |  |      |                | $ic2$ :      | ---    | 300  | ma              |     |

| METHOD<br>OR PAR.  | REQUIREMENT OR TEST                           | CONDITIONS   | AQL% | INSP.<br>LEVEL | SYMBOL  | LIMITS |     | UNITS    |
|--|---|--|------|----------------|---------|--------|-----|----------|
|  |   |  |      |                |         | Min    | Max |          |
| <u>Quality Conformance</u><br><u>Inspection - Part 2</u><br><u>(Design) - Note 11</u><br><u>Cont'd</u> |   |  |      |                |         |        |     |          |
| ---  | High-voltage Breakdown                        | Anode to heat exchanger;<br>E = 13.0 kv peak 60 Hz;<br>No other voltages;<br>Press. = 760 mmHg;<br>Temp. = 25 ± 5 °C;<br>See Note 13   | 6.5  | S3             | ---     | ---    | --- | ---      |
| ---  | High-voltage Breakdown<br>and point           | Insulation Resistance,<br>anode to heat exchanger<br>anode pos. E = 500 Vdc  | ---  | ---            | R:      | 50     | --- | Meg      |
| <u>Quality Conformance</u><br><u>Inspection - Part 3</u><br><u>(Periodic) Note 14</u>                  |   |  |      |                |         |        |     |          |
| 2204   | Linear Amplifier Power<br>Output & Distortion | Class AB rf amplifier;<br>Eb = 2900 Vdc;<br>Ec2 = 225 Vdc;<br>Ec1/Ib0 = 300 mAdc;<br>Eg1/Ib = 700 mAdc;<br>RL = 2200 ± 100 ohms;<br>Loaded Q(plate) = 10 to 15;<br>Rg = 1000 ohms max; | ---  | ---            | 3rd IM: | -35    | --- | db       |
|  |   |  |      |                | 5th IM: | -40    | --- | db       |
|  |   |  |      |                | Po:     | 1000   | --- | W        |
|  |   |  |      |                | 1-tone  |        |     | (useful) |

NOTES

1. Heater voltage should be maintained as close to nominal as possible, and should be measured directly at the tube base or socket with an accurate meter.
2. Bias and anode voltage may be applied simultaneously with heater voltage. Screen-grid voltage and rf drive should be applied only after the cathode has heater for 180 seconds minimum. Stable operation is achieved in 500 seconds maximum.
3. In all cases of operation, forced-air cooling is required and the maximum seal and anode core temperature rating must not be exceeded. For the base, 0.6 lbs/minute of air at 100°C maximum should be directed through the socket in a base-to-anode direction. For the anode, sufficient air must be directed through the heat exchanger fins in an outside-diameter to inside-diameter direction such that for any given combination of anode dissipation, cooling air temperature, and altitude, the temperature at the base of the heat exchanger fins does not exceed 100°C. Cooling air must be applied before or simultaneously with the application of electrode voltages, including heater, and may be removed simultaneously with them. Where long life and consistent performance are factors, cooling in excess of minimum requirements is normally beneficial.
4. During all electrical tests involving application of heater voltage, forced-air cooling may be used, and a special cooling adaptor may be used on the anode in place of the special heat exchanger assembly.
5. Plating shall be in accordance with the requirements of MIL-F-14072. Mounting surface contact areas shall be nickel plated, finish number M 313.
6. All electrical testing may be performed with a special adaptor on the anode to allow for forced-air cooling. After the installation of the special heat exchanger assembly on the anode and the completion of any other mechanical processing, the tube shall be held for the specified holding period at which time compliance with the Ion Current test shall be demonstrated.
7. If specified in the contract or order, each tube shall be marked with the customer's identification number, to consist of his CODE IDENTIFICATION number followed by his part number, in addition to any other marking and/or identification. Also, if specified in the contract or order, each shipping container, in addition to EIMAC identification and any other marking, shall be marked with the lot number or date code, and the customer's purchase order number.
8. These tests shall be carried out as standard production tests. Sampling per MIL-STD-105 may be used. The AQL for the combined defectives for attributes, excluding mechanical, shall be one percent. A tube having one or more defects shall be counted as one defective.
9. By means of the circuit shown in Figure 1 and a 60-cycle source, the grid shall be heated during the positive half cycle and the primary emission measured during the negative half cycle. The input voltage shall be varied to obtain the average inverse voltage, and the resistor R shall be varied to obtain the forward power and maintained for the specified time. The primary grid emission at this time shall not be greater than the limit specified. All unused tube elements shall be grounded. The wattmeter shall be capable of reading over the range from dc to at least 600 Hz. Circuit components shall be selected consistent with good engineering practice. Loading of the transformer is permissible.

(Cont'd)

9. (Cont'd)

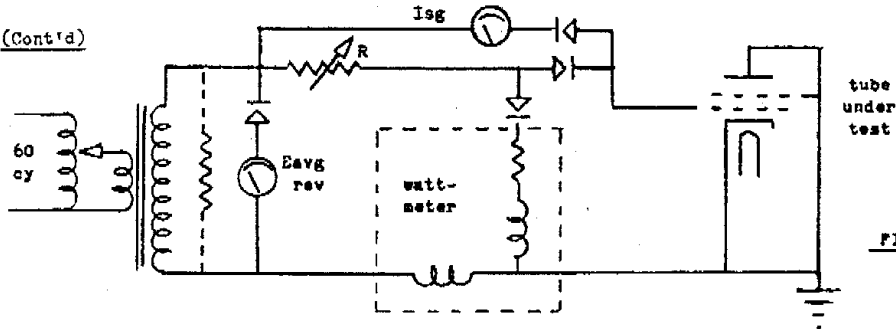
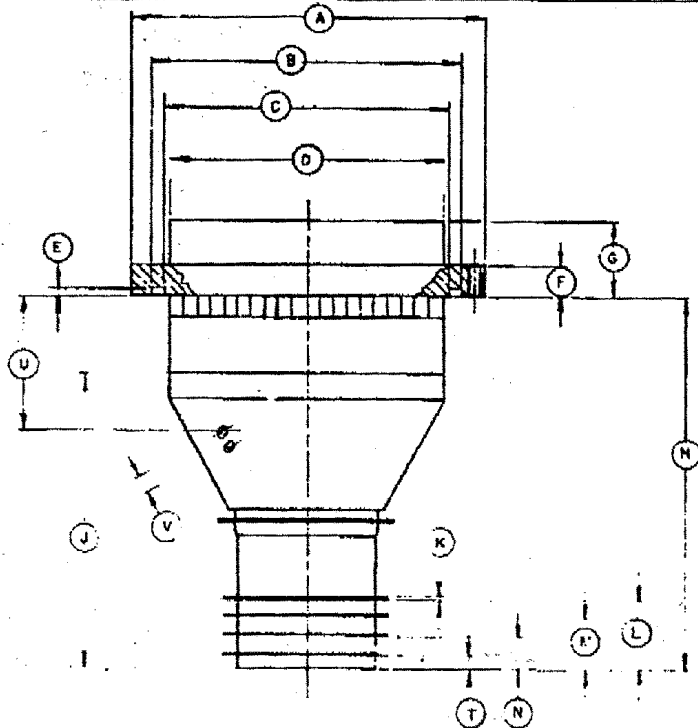


FIGURE 1

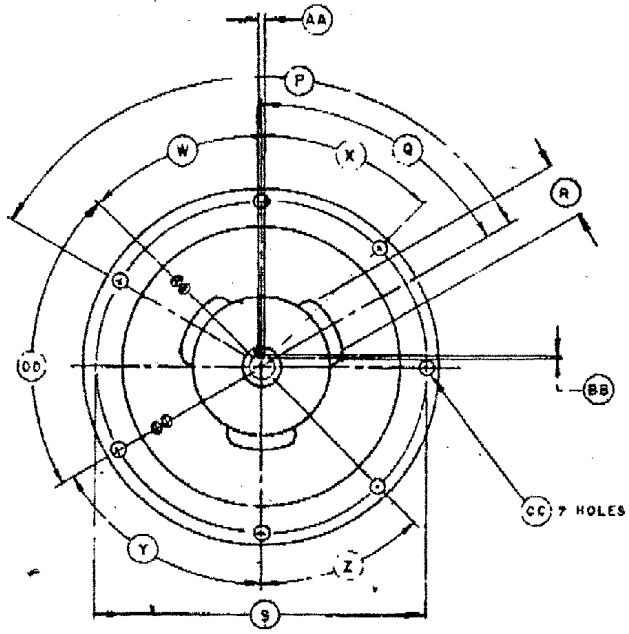
10. This test shall be performed after the holding period. The tube shall be connected as an ion gage with the specified potentials applied, and the highest initial reading shall be taken as the test value. Ion current is read with a microammeter in series with the negative anode lead. Except for  $E_f$ , all voltages shall be applied simultaneously, with an automatic regulator controlling  $I_{c2}$  to the specified value.
11. Sampling shall be in accordance with MIL-STD-105.
12. The symbol  $e_{gk}$  represents the instantaneous value of voltage between the control grid and the cathode.
13. There shall be no indication of arcing during a test period of 60 seconds duration.
14. Periodic tests shall be performed every 3 months. Sample size and failure allowance are shown. The testing shall be considered as non-destructive except in case of failure. In case of a sample failure, that test shall become Quality Conformance Inspection part 2 (Design), AQL 6.5%, Inspection Level S3 for three consecutive successful submissions, at which time the test may revert to the quarterly basis.

|               | Sample | Allowable<br>Failures |
|---------------|--------|-----------------------|
| IM Distortion | 10     | 1                     |



DIMENSIONS IN INCHES  
DIMENSIONAL DATA

| REF. | MIN.     | MAX.     | NOM. |
|------|----------|----------|------|
| A    | 4.870    | 4.880    |      |
| B    | 4.245    | 4.255    |      |
| C    | 3.870    | 3.880    |      |
| D    | 3.735    | 3.765    |      |
| E    | .120     | .130     |      |
| F    | .307     | .317     |      |
| G    | .924     | .969     |      |
| H    | 5.165    | 5.194    |      |
| J    | .4       | 4-1/4    |      |
| K    | .020     | .030     |      |
| L    | .965     | .988     |      |
| M    | .690     | .710     |      |
| N    | .415     | .435     |      |
| P    | 115°     | 125°     |      |
| Q    | 55°      | 65°      |      |
| R    | .700     | .800     |      |
| S    | 4.495    | 4.505    |      |
| T    | .140     | .165     |      |
| U    | 1-3/4    | 2        |      |
| V    | 19/64    | 21/64    |      |
| W    | 40°      | 50°      |      |
| X    | 44°      | 46°      |      |
| Y    | 59°      | 61°      |      |
| Z    | 44°      | 46°      |      |
| AA   | .040     | .070     |      |
| BB   | .022     | .048     |      |
| CC   | 210 DIA. | 220 DIA. |      |
| DD   | 70°      | 80°      |      |



|   |   |          |                 |
|---|---|----------|-----------------|
| NO.   | DESCRIPTION OF CHANGE   | BY       | DATE            |
| — EST                                       |   | N.C.N.   | 10-6-67         |
| A   | NOM. DIM'S. (DEC. & FRACTIONS) TO MIN. MAX. ABCDEFCS/CC ADDED           | N.C.N.   | 10-26-67 J.R.J. |
| B   | WAS: E(113-121), G(943-963), H(5180-5194), C(169-175 DIA.), ADDED (DD). | N.C.N.   | 2-26-68 C.R.    |
| EITEL-MCCULLOUGH INC.<br>SAN CARLOS, CALIF. |   |          |                 |
| CODE IDENT. NO.                             |   | PART NO. |                 |
| 08594                                       |   | Y-477-60 |                 |
| <b>ELECTRON TUBE</b>                        |   |          |                 |
| DRAWN: DLT                                  |   |          | NO. Y-477-60    |
| SCALE: NONE                                 |   |          | CHANGE 8        |