MILITARY SPECIFICATION SHEET

# ELECTRON TUBE, TRAVELING WAVE

## TYPE 8878

This specification is approved for use by the Engineering and Technical Support Division (AFLC/LOIE), Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

The complete requirements for procuring the electron tube described herein shall consist of this document and the latest issue of Specification MIL-E-1.

DESCRIPTION: O-Type, medium power, integral periodic permanent magnet, convection-cooled.

ABSOLUTE RATINGS:

| Parameter: | $E_f$ | $I_f$ | $E_c$ | $I_c$ | $E_w$ | $I_w$ | Pin |
|---|---|---|---|---|---|---|---|
| Unit: | F | A | Vdc | mAdc | Vdc | mAdc | W |
| Maximum: | 7.0 | 0.5 | 100 | .05 | 350 | 5 | 10 |
| Minimum: | 6.0 | 0.0 | -1000 | 0 | 0 | 0 | 0 |

PHYSICAL CHARACTERISTICS:

Dimensions: See outline drawing
Weight: 4.5 pounds approximately
Mounting Position: Any
Cathode: Unipotential, grounded cathode operation

| Test Frequencies Tolerance ±0.1% |
|---|
| $F_1$ = 490 MHz |
| $F_2$ = 750 MHz |
| $F_3$ = 1010 MHz |

TEST CONDITIONS: See Note 12

| Parameters: | $E_f$ | $I_f$ | $E_c$ | $I_c$ | $E_w$ | $I_w$ | $I_k$ | $T_k$ |
|---|---|---|---|---|---|---|---|---|
| Unit: | V | A | V | mAdc | Vdc | mAdc | mAdc | sec |
| Test 1: | 6.3 ± 5% | Set up from data on tube label and individual test data sheet, See Note 1 | | | | | | 120 |
| Test 2: | 0 | -- | 0 | ---- | 0 | ---- | ---- | --- |

GENERAL:

First Article Inspection - Required (See Note 13)

8878

FSC 5960

| METHOD | REQUIREMENT OR TEST | TEST | CONDITIONS | SYMBOL | LIMITS MIN | LIMITS MAX | UNIT |
|---|---|---|---|---|---|---|---|
| | First Article Inspection | | See Note 13 | --- | --- | --- | --- |
| 1011 | Humidity | - | See Notes 3 and 10 | --- | --- | --- | --- |
| 1006 | Salt spray | 1,2 | See Notes 6 and 10 | --- | --- | --- | --- |
| ---- | Vibration | 1 | MIL-STD-202, Method 204 See Note 10 | --- | --- | --- | --- |
| 1042 | Shock | - | 15G, 11 ms See Note 10 | --- | --- | --- | --- |
| | Quality conformance inspection, part 1 | | | | | | |
| 1301 | Heater current | - | $E_f$ = 6.3 V | $I_f$ | --- | .5 | A |
| ---- | Helix voltage | 1 | | Ew | 250 | 350 | V |
| 4250 | Small signal gain | 1 | $F = F_1-F_3$ $P_i$ = -40 dbm | Gss | 41 | --- | db |
| 4253 | Gain variation | 1 | $F = F_1-F_3$ $P_i$ = -40 dbm | ΔGss | --- | 5 | db |
| 4253 | Gain variation (fine gain) | | $F = F_1-F_3$ $P_i$ = -40 dbm See Note 4 | ΔGss | --- | ±1.5 | db |
| ---- | Gain slope, small signal | 1 | $F = F_1-F_3$ $P_i$ = -40 dbm See Note 4 | $\frac{\Delta Gss}{\Delta F}$ | --- | .1 | $\frac{db}{MHz}$ |
| 4260 | Noise figure | 1 | $F = F_1-F_3$ | NF | --- | 20 | db |
| ---- | Gain control element | 1 | $F = F_2$ $P_i$ =0 dbm See Note 5 | ΔGss | 60 | --- | db |
| 4251 | Output power | 1 | $F = F_1-F_3$ | Po | 10 | --- | dbm |
| 4256 | Input and output match (hot) | 1 | $F_1$ to $F_3$ continuously variable frequency | VSWR | --- | 1.7:1 | --- |
| | Quality conformance inspection, part | | | | | | |
| D-30(b) | Dimensions | - | See Figure 1 | --- | --- | --- | --- |
| ---- | Magnetic field | 2 | See Note 7 | H | --- | 5 | Gauss |
| ---- | Temperature | 1 | See Notes 2 and 10 | --- | --- | --- | --- |
| ---- | Altitude | 1 | See Notes 9 and 10 | --- | --- | --- | ---- |
| ---- | Temperature altitude | - | See Notes 8 and 10 | --- | --- | --- | --- |

| METHOD | REQUIREMENT OR TEST | TEST | CONDITIONS | SYMBOL | LIMITS MIN | LIMITS MAX | |
|---|---|---|---|---|---|---|---|
| | Quality conformance inspection, part 3 | | | | | | |
| ---- | Life test | - | Group D | t | 1000 | --- | hrs |
| ---- | Life test end points: | | | | | | |
| 4251 | Output power | 1 | $F = F_1 - F_3$ | Po | 10 | --- | dbm |
| 4250 | Small signal gain | 1 | $F = F_1 - F_3$<br>$P_i = -40$ dbm | Gss | 41 | --- | db |

NOTES:

1. A copy of the critical performance characteristics including operating voltages shall be shipped with each tube. The operating voltages shall also be clearly indicated on the tube label and on a small decal at the collector end of each tube. Each tube delivered on the contract shall operate optimally under a single combination of discreet voltages which shall fall within the ranges shown under Absolute Ratings herein. All operating requirements of this specification sheet shall be met under these specific voltages.

2. The tube under test shall perform as specified herein with relative humidity uncontrolled at ambient temperatures from -51°C to 65°C.

3. The tube under test shall perform as specified herein at relative humidity varying from 5 to 100 percent, including condensation at any temperature up to 50 °C (122°F).

4. Fluctuation in gain versus frequency shall not exceed ±1.5 db with a maximum slope of .1 db per MHz.

5. The TWT shall contain a voltage controlled element which shall have the capability of continuously controlling the small signal gain by a range of at least 60 db. The grid voltage necessary for normal TWT operation shall be between 0 and 100 volts with respect to cathode in order to reduce small signal gain by 60 db from its normal operating values. It shall not be necessary to apply grid voltages more negative than -10 volts.

6. The tube under test shall withstand, in both the operating and nonoperating condition, exposure to salt-sea atmosphere.

7. The magnetic field shall not exceed 5 Gauss at a distance of 1 inch from the tube helix. The field may be 5 Gauss one (1) inch from case at the cathode end of the tube and extending toward the collector 1.5 inches.

8. The tube under test shall operate at an environmental temperature not less than 10°C or greater than 15°C at a simulated altitude of 60,000 feet. From a predetermined hot spot measurement test at room ambient conditions. The hottest spot on the tube shall not exceed 213°C during the temperature altitude test.

9. The tube shall be operated at least four hours at 60,000 feet altitude condition conditions at maximum rated helix voltage. No arcing shall occur.

10. During (or after) performance of the specified test the tube shall satisfy the requirements of Methods 4250, 4251, and 4260 as specified herein.

NOTES: Continued

11. The sample size (n) for Quality conformance inspection, part 2 shall be determined according to the following criteria.

| Lot size (N) | Sample size (n) | Acceptance number (C) |
|---|---|---|
| Under 10 | 0 | |
| 10 to 20 | $n_1 = 1$ | $C_1 = 0$ |
| | $n_2 = 2$ | $C_2 = 1$ |
| 21 up | $n_1 = 2$ | $C_1 = 0$ |
| | $n_2 = 4$ | $C_2 = 1$ |

12. The tube under test shall be operated with the cathode at ground potential.

13. First article sample inspection shall conform to the requirements of appendix F of MIL-E-1 and shall consist of performing all tests specified on this tube specification sheet. In addition, first article sample approval shall include satisfactory demonstration of the tube-to-system compatibility. Invitation for bids should provide that the Preparing Activity reserves the right to waive the requirements for first article samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

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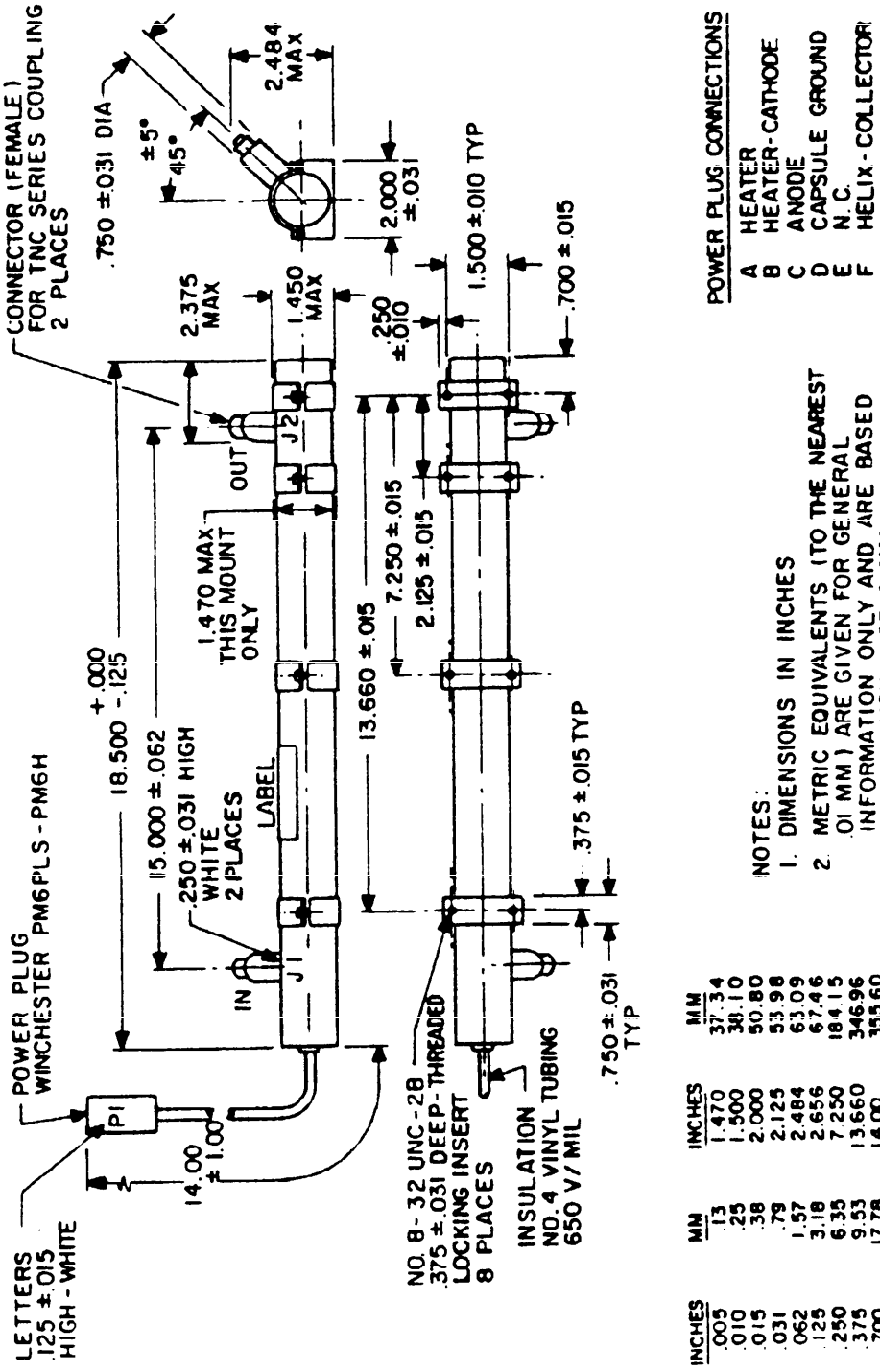


| INCHES | MM |
|---|---|
| .005 | .13 |
| .010 | .25 |
| .015 | .38 |
| .031 | .79 |
| .062 | 1.57 |
| .125 | 3.18 |
| .250 | 6.35 |
| .375 | 9.53 |
| .700 | 17.78 |
| .750 | 19.05 |
| 1.00 | 25.40 |
| 1.450 | 36.83 |

| INCHES | MM |
|---|---|
| 1.470 | 37.34 |
| 1.500 | 38.10 |
| 2.000 | 50.80 |
| 2.125 | 53.98 |
| 2.484 | 63.09 |
| 2.656 | 67.46 |
| 7.250 | 184.15 |
| 13.660 | 346.96 |
| 14.00 | 355.60 |
| 15.000 | 381.00 |
| 18.500 | 469.90 |

NOTES:
1. DIMENSIONS IN INCHES
2. METRIC EQUIVALENTS (TO THE NEAREST .01 MM) ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 MM

POWER PLUG CONNECTIONS

| | |
|---|---|
| A | HEATER |
| B | HEATER-CATHODE |
| C | ANODE |
| D | CAPSULE GROUND |
| E | N.C. |
| F | HELIX-COLLECTOR |

FIGURE 1 Outline drawing for tube Type 8878

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MIL-E-1/1692A (USAF) Electron Tube, Traveling Wave, Type 8878

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

FSC 5960

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