

MINISTRY OF AVIATION - R.R.E.

CV3521

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| Specification M.O.A./CV3521 Issue 2 Reprint A dated 6.7.1960 To be read in conjunction with K1001 and with MIL -E- 1/137B dated 11.10.56. | <div style="text-align: center;"><u>SECURITY</u></div> <div style="display: flex; justify-content: space-between;"> <u>Specification</u> <u>Valve</u> </div> <div style="display: flex; justify-content: space-between;"> Unclassified Unclassified </div> |
| TYPE OF VALVE - Hydrogen Thyatron PROTOTYPE - January, 5949 JAN | <div style="text-align: center;"><u>MARKING</u></div> See K1001/4 Additional Markings Serial No. See also note BB. |
| RATING as on Pages 1 of MIL-E-1/137B See also Notes AA - BB. | <div style="text-align: center;"><u>CONNECTIONS AND DIMENSIONS</u></div> As on Pages 1 & 4 of MIL-E-1/173B. See also note BB. |
| TESTS as on Pages 1, and 2 of MIL-E-1/137B See also Notes AA - GG | |

—————> Indicates a Change

NOTES

- AA The manufacturer, at his discretion may supply thyratrons with or without gas reservoir.
- BB Thyratrons supplied without gas reservoir shall have the words "No Reservoir" indelibly marked on the base. For these valves MIL-E-1/137B shall be considered amended by deletion of all ratings and tests connected with reservoir capsule parameters. In addition there shall be no internal connection to pin 4.
- CC For Type Approval, the Manufacturer shall make four valves available and carry out all the tests (except life) on these valves. In addition both life tests shall have been carried out on at least one valve. The manufacturer shall send to the Approving Authority detailed results of these tests. The approving authority shall be enabled to repeat any of these tests, using the same valves either at the manufacturers test rig, or at any other as required by the approving authority.
- Valves delivered shall be similar to the Type Approval samples.
- DD Delete note 20. Also on Note 7 correct "1800V" to 18,000V"
- EE Add to Carton Drop:- To meet the requirements of K1005.
- FF Copies of "Inspection Instructions for Electron Tubes" (ASESA) as called up in MIL-E-1 can be obtained from the Secretary T.L.5(b), The Ministry of Aviation, Castlewood House, 77-91 New Oxford Street, London, W.C.1.
- GG On Page 2 at Life Test (1) and at life Test (2) delete "Group C" and replace by "Group D" in each case. Where production is less than 100 per month only one life test is required in any one month and this should be performed under Life Test (1) and Life Test (2) conditions alternately.

CV3521

MIL-E-1/137B
11 October 1956
Superseding
MIL-E-1/137A
16 July 1954

INDIVIDUAL MILITARY SPECIFICATION SHEET

ELECTRON TUBE, THYRATRON, WITH HYDROGEN RESERVOIR

JAN-5949



This specification sheet forms a part of the latest issue of Military Specification MIL-E-1.

| | | | | | | | | | |
|-----------------|------------------------|-----------|----------|-----------|------------------------|-----|----------------------------------|--------|-----|
| <u>Ratings:</u> | Ef | epy | epx | Ebb | egy | egx | Ec | ib | Tb |
| Absolute | Vac | kv | kv | kVdc | v | v | Vdc | a | Adc |
| Maximum: | 6.3 2 5% | 25.0 | 25.0 | --- | --- | 450 | --- | 500 | 0.5 |
| | | (Note 17) | (Note 1) | | | | | | |
| Minimum: | --- | 10.0 | 5% epy | 5.0 | Note 2 | --- | --- | --- | --- |
| Test Cond.: | 6.3 | 25.0 | --- | --- | 450 | --- | 0 | --- | --- |
| | | | | | <u>dik</u> | | | | |
| <u>Ratings:</u> | epy x prr x ib | tk | TA | dt | Reservoir (Ef) | prp | Cooling | Alt. | |
| Absolute | --- | sec | °C | a/us | Vac | pps | --- | ft. | |
| Maximum: | 6.25 x 10 ⁹ | --- | 75 | 2500 | 5.5 (Note 3) | --- | (Note 5) | 10,000 | |
| Minimum: | --- | 900 | -55 | --- | 3.0 | --- | --- | --- | |
| Test Cond.: | --- | 900 | --- | --- | (Note 4) | 500 | --- | --- | |
| **Base: | Per Outline, A5-19 | | | | Mounting Position: Any | | | | |
| **Dimensions: | Per Outline | | | | **Cap: Per Outline | | | | |
| **Pin No.: | 1 | 2 | 3 | 4 | 5 | Cap | **Cathode: Unipotential, tied to | | |
| Element: | capsule h | k | g | capsule h | p | | midpoint of heater | | |
| | | | | | | | **Envelope: Per Outline | | |

For miscellaneous requirements see paragraph 3.3, Inspection Instructions for Electron Tubes

| <u>Ref.</u> | <u>Test</u> | <u>Conditions</u> | <u>Min.</u> | <u>Max.</u> |
|-------------|---------------------------|--|-------------|-------------|
| | Qualification Approval: | Required for JAN Marking | | |
| 4. | Holding Period: | t=96 hrs. | | |
| 4.9.18.1.6 | Carton Drop: | (1); Package Group 4; Carton Size F | | |
| 4.10.8 | Cathode Heater Current: | | If: 15.0 | 22.0 Aac |
| 4.10.8 | Reservoir Heater Current: | Eres=4.5Vac | Ires: 2.0 | 5.0 Aac |
| --- | Instantaneous Starting: | epy=18.0kv(min); Notes 6 and 7 | --- | --- |
| 4.10.17.2 | DC Anode Voltage: | Notes 6 and 8 | Ebb: --- | 4000 Vdc |
| --- | Operation (1): | epy=27.5kv; prr=450 pps; t=30 minutes; Notes 6, 9 and 18 | egy: --- | 450 volts |
| --- | Reservoir Voltage (1): | Operation(1); Note 19 | Eres: 3.0 | 5.5 Vac |
| --- | *Anode Delay Time: | Operation(1); Note 10; t=120 | tad: --- | 1.0 us |
| --- | *Anode Delay Time Drift: | Anode Delay Time; Note 11 | Δ tad: --- | 0.25 us |
| --- | *Time Jitter: | epy=8.0kv; Notes 6 and 12 | tj: --- | 0.01 us |

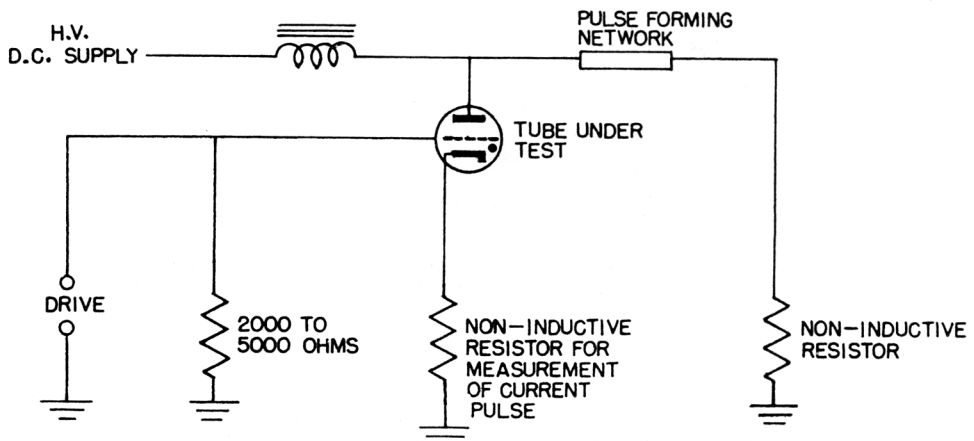
JAN-5949

CV3521

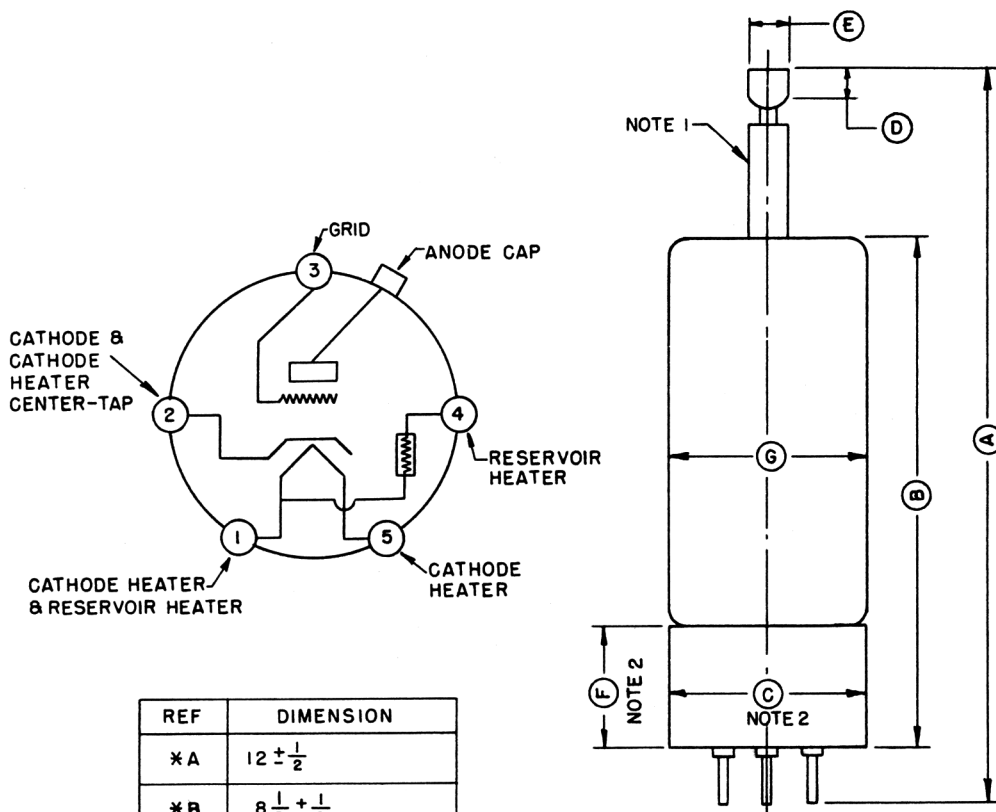
| <u>Ref.</u> | <u>Test</u> | <u>Conditions</u> | <u>Min.</u> | <u>Max.</u> |
|-------------|---|--|---------------------------------|------------------------------|
| --- | Operation(2): | Notes 13 and 18; t=20 minutes; Prr=1200pps; epy=20kv | egy: --- | 450 v |
| --- | Reservoir Voltage(2): | Operation(2); Note 18 | Eres: 3.0 | 5.5 Vac |
| --- | **Operation(3): | TA=75°C; t=5 hrs; Notes 6 & 18 | egy: --- | 450 v |
| --- | Emission: | ib=500a; tp=5.0us \pm 10%; pr=60pps \pm 10%; tr=0.5us max; Note 14 | egk: --- | 250 v |
| 4.11 | Life Test(1): | Group C; Notes 6 & 15 | t: 500 | --- hrs. |
| 4.11 | Life Test(2): | Group C; Operation (2); Notes 15 and 16 | t: 500 | --- hrs. |
| 4.11.4 | Life Test End Points (1) and (2): | Operation (1); except Note 18 DC Anode Voltage Time Jitter | egy: --- Ebb: --- tj: --- | 500 v 4500 Vdc 0.02 us |
| Note 1: | The peak inverse voltage, exclusive of a spike of .05us (max) duration, shall not exceed 5kv during the first 25us following the anode pulse. | | | |
| Note 2: | The Driver pulse, measured at tube socket with thyatron grid disconnected; epy=550 volts (min), 1000volts (max), rate of rise 1800 volts/us, tp=2.0us(min), impedance of driver circuit 50 to 200 ohms. | | | |
| Note 3: | The optimum reservoir voltage for operation in accordance with Operation(1) conditions is inscribed on the base of the tube and must be held to within \pm 5%. Applications involving other operating conditions will necessitate the redetermination of the optimum reservoir voltage. | | | |
| Note 4: | Adjust reservoir voltage to value indicated on tube within \pm 5%. | | | |
| Note 5: | Cooling of the anode lead is permissible, but there shall be no air blast directly on the bulb. | | | |
| Note 6: | The tube shall be tested in the test circuit shown in the attached drawing. Tests performed at repetition rates less than the resonant repetition rate shall be made with a hold-off diode in the charging circuit. The circuit constants shall be chosen so that at epy=25.0kv under resonant charging conditions, dik/dt=2500a/us (min); ib=500a (min); tp=2.0 \pm 0.2us; pr=500pps (min). | | | |
| Warning: | These conditions are specified only for the purpose of determining circuit constants. The actual operating voltage and repetition rates for each test is specified in the conventional manner under the particular conditions or under the general test conditions, as the case may be. | | | |
| | The grid pulse characteristics shall be tp=2.0us (max); tr=0.25us(min); Internal impedance of driver=300 ohms (min). | | | |
| Note 7: | This shall be the first test after the holding period. The tube shall operate satisfactorily on push-button starting within 3 attempts when the anode voltage (epy) is applied to the tube under test in such a manner as to rise from 0 to 18,000v within 0.03 sec. (the filter in the rectifier shall be designed so that the epy reaches at least 9000v within 0.015 sec). The intervals between successive attempts to instantaneously start the tube shall not be less than 10 seconds nor more than 30 seconds. Any tube failing to start within 3 attempts will be considered a failure. | | | |
| Note 8: | This test shall be performed within 60 seconds after Operation (1) test. | | | |

CV3521

- Note 9:** The tube shall operate continuously during this test without evidence of arcbback.
- Note 10:** Anode Delay Time (t_{ad}) - a time interval between the point on the rising portion of the grid pulse which is 26% of the maximum unloaded pulse amplitude and the point where anode conduction takes place.
- Note 11:** During the interval between 2 minutes and 7 minutes of the Anode Delay Time test, the change in anode delay time (Δt_{ad}) relative to the t_{ad} value observed on the Anode Delay Time test shall not exceed the specified value.
- Note 12:** The variation in firing time (t_j) shall be measured at 50% of pulse amplitude and shall not be greater than the amount specified.
- Note 13:** The anode circuit constants shall be so chosen that at resonant charging conditions; $e_{py}=20\text{kV}$; $i_b=200\text{a}(\text{min})$; $dik/dt=2500\text{a}/\text{us}(\text{min})$. Output pulse: $t_p=1.0\text{us}$, 10%; $prr=1200\text{pps}(\text{min})$, $e_{px}=5.0\text{kV}$. Grid pulse same as Note 6. Adjust reservoir voltage to optimum value for these test conditions. The tube shall operate continuously for 20 minutes without evidence of arcbback.
- Note 14:** The positive pulse shall be applied to the grid of the tube. Measure the voltage between grid and cathode not more than 2.5us after the beginning of the current pulse. The average voltage shall not increase after the voltage measurement point. Plate floating.
- Note 15:** Life test shall be operated with the tube in a horizontal position and shall be shut down every ninety-six (96) hours for a sixty (60) minute interval.
- Note 16:** The reservoir voltage shall be adjusted to the value determined under Operation(2).
- Note 17:** Instantaneous starting is not recommended. When it is absolutely necessary, however, the maximum permissible e_{py} is 18.0kV and shall not be attained in less than 0.04 sec.
- Note 18:** There shall be no evidence of anode heating during this test.
- Note 19:** The optimum reservoir voltage determined by the manufacturer under these conditions shall be inscribed permanently on the base of each tube.
- Note 20:** Reference specification shall be of the issue in effect on the date of invitation for bid.



CV352I



| REF | DIMENSION |
|-----|---------------------------------------|
| *A | $12 \pm \frac{1}{2}$ |
| *B | $8 \frac{1}{2} \pm \frac{1}{2}$ |
| *C | $3 \frac{1}{16} \pm \frac{1}{16}$ DIA |
| **D | .500 |
| **E | $.566 \pm .007$ DIA |
| **F | $1 \frac{15}{16}$ |
| *G | $3 \frac{5}{16}$ MAX DIA |

NOTE 1. SERVICEABILITY OF ALTERNATE SEALS WILL BE TESTED ON A QUALIFICATION APPROVAL BASIS.

NOTE 2. METAL SHELL, 5-PIN BASE WITH MICALEX OR EQUIVALENT INSERT. PIN DIMENSIONS AND LOCATION SAME AS A5-19. SHELL DIMENSIONS AS SHOWN.

N O T E

SPECIFICATION MOA/CV3521.
ISSUE 2 REPRINT A

To complete the above
Specification the existing
4 pages of MIL-E-1/137B must
be retained.

TVC Office

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