

ELECTRONIC VALVE SPECIFICATION

SPECIFICATION CV 4014

ISSUE 4 DATED 5th NOVEMBER, 1956.

AMENDMENT No.3.

GROUP F.

Intermittent Life      Test Point (1000hrs)

Delete all reference to Heater Current Test

Add at the end of this Group (after Anode Current) the following:--

| K1001<br>Ref. | Test                    | Test Conditions  | AQL<br>% | INSP.<br>LEVEL | Symbol      | LIMITS         |             |             |             |             |             |                |
|---------------|-------------------------|--|----------|----------------|-------------|----------------|-------------|-------------|-------------|-------------|-------------|----------------|
|               |                         |  |          |                |             | MIN            | LAL         | BOGEY       | UAL         | MAX         | AID         | UNITS          |
|               | ELECTRODE<br>INSULATION | Vh = 6.3V Note 6<br>Vg1 = all = -100V<br>Vg2 = all = -300V<br>Va = all = -300V | 6.5      |                | R<br>R<br>R | 30<br>30<br>30 | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | MΩ<br>MΩ<br>MΩ |

MINISTRY OF SUPPLY - D.L.R.D. /R.A.E.

|   |  |
|---|--|
| Specification MOS(A)/CV4014<br>Issue 4 Dated 5.11.56<br>To be read in conjunction with E.S.448, B.S.1409 and K.1001 | <b>SECURITY</b>  |
|   | Specification      Valve<br>UNCLASSIFIED      UNCLASSIFIED |

—————> Indicates a change

|   |   |  |
|---|---|--|
| <b>TYPE OF VALVE</b> - Reliable H.F. Pentode<br><b>CATHODE</b> - Indirectly heated<br><b>ENVELOPE</b> - Glass<br><b>PROTOTYPE</b> - CV138<br><b>R.A.E.T.M.A. DESIGNATION</b> - 6064 | <b>MARKING</b><br>See K1001/4<br>Additional Marking:-<br>6064 |  |
|   | <b>BASE</b><br>E.S.448/57G                                    |  |
| <b>RATING</b><br>(All limiting values are absolute)   | Note  | <b>CONNECTIONS</b>   |
|   |   | Pin      Electrode   |
| Heater Voltage (V) 6.3  | B   | 1      Grid      g1  |
| Heater Current (A) 0.3  |   | 2      Cathode      k                                      |
| Max. Heater - Cathode Voltage (V) ± 150   |   | 3      Heater      h                                       |
| Max. Anode Voltage (Va = 3.0) (V) 300   |   | 4      Heater      h                                       |
| Max. Anode Voltage (Ia = 0) (V) 550   |   | 5      Anode      a  |
| Max. Anode Dissipation (W) 3.0  |   | 6      Supp. Sh.      g3 + s                               |
| Max. Screen Voltage (Vg2 = 0.9) (V) 300   |   | 7      Screen      g2                                      |
| Max. Screen Voltage (Ig2 = 0) (V) 450   |   |  |
| Max. Screen Dissipation (W) 0.9   |   | <b>DIMENSIONS</b><br>See E.S.448/57G/2.1<br>Size Ref. No.2 |
| Max. Grid 1 - Cathode Resistance (MΩ) 0.5   | A   | Dimension (mm)      Min.      Max.                         |
| Max. Bulb Temperature (°C) 200  | B   | A seated height      -      47.5                           |
| Max. Shock (short duration) (g) 500   |   | C diameter      16.0      19.0                             |
| Max. Acceleration (continuous operation) (g) 2.5  |   | D overall length      -      54.5                          |
| <b>Typical Operating Conditions</b>   |   | <b>MOUNTING POSITION</b><br>ANY                            |
| Measured at Va = Vg2 = 250V; Vg1 = -2V; Vg3 = 0   |   |  |
| Anode Current (mA) 10   |   |  |
| Screen Current (mA) 2.5   |   |  |
| Mutual Conductance (mA/V) 7.6   |   |  |
| Inner Amplification Factor (μA1, g2) 75   |   |  |
| <b>CAPACITANCES (pF)</b>  |   |  |
| C in (nom.) 7.6   | C   |  |
| C out (nom.) 3.25   | C   |  |
| Ca, g1 (max.) .01   | C   |  |

**NOTES**

- A. For cathode bias. Max. value for fixed bias operation = 100 MΩ.
- B. **Caution to Electronic Equipment Design Engineers:** The life expectancy may be reduced if conditions other than those specified for life tests are imposed on the valve, and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardised if heater voltage ratings are exceeded; life and reliability performance are directly related to the degree that regulation of the heater voltage is maintained at its centre-rated value.
- C. Measured with a close fitting metal screen.

To be performed in addition to those applicable in K1001

Tests shall be performed in the specified order unless otherwise agreed with the Inspecting Authority

| Test Conditions - unless otherwise specified |                                |  |        |                      |             |                   |             |             |             |                       |                |       |
|--|--------------------------------|--|--------|----------------------|-------------|-------------------|-------------|-------------|-------------|-----------------------|----------------|-------|
|  | Vh(V)                          | Va(V)  | Vg1(V) | Vg2(V)               | Vg3(V)      | Rk(Ohms)          | Cx(μF)      |             |             |                       |                |       |
|  | 6.3                            | 250  | 0      | 250                  | 0           | 160               | 1000        |             |             |                       |                |       |
| K1001 Ref.                                   | Test                           | Test Conditions  | AQL %  | Insp. Level          | Symbol      | Limits            |             |             |             |                       |                | Units |
|  |                                |  |        |                      |             | Min.              | LAL         | Bogey       | UAL         | Max.                  | ALD            |       |
| 7.1  | Glass Strain                   | No Voltages  | 6.5    | I                    |             |                   |             |             |             |                       |                |       |
|  | <u>GROUP A</u>                 |  |        |                      |             |                   |             |             |             |                       |                |       |
|  | Electrode Insulation           | Vh = 6.3V Note 6<br>Vg1-all = -100V<br>Vg2-all = -300V<br>Va-all = -300V |        | 100%<br>100%<br>100% | R<br>R<br>R | 100<br>100<br>100 | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | -<br>-<br>-           | MΩ<br>MΩ<br>MΩ |       |
|  | Reverse Grid Current           | Rg1 = 500k max.  |        | 100%                 | Ig1         | -                 | -           | -           | -           | 0.5                   | μA             |       |
|  | <u>GROUP B</u>                 |  |        |                      |             |                   |             |             |             |                       |                |       |
|  |                                | Combined AQL   | 1.0    | II                   |             |                   |             |             |             |                       |                |       |
|  | Heater Current                 |  | 0.65   | II                   | Ih          | 275               | -           | -           | -           | 325                   | -              | mA    |
|  | Heater-Cathode Leakage Current | Vhk = ±100V Note 5<br>Vhk = -100V<br>Cathode Positive                    | 0.65   | II                   | Ihk         | -                 | -           | -           | -           | 10                    | -              | μA    |
|  | Anode Current                  |  | 0.65   | II                   | Ia          | 7.5               | -           | -           | -           | 12.2                  | -              | mA    |
|  | Screen Current                 |  | 0.65   | II                   | Ig2         | 1.8               | -           | -           | -           | 3.4                   | -              | mA    |
|  | Mutual Conductance             |  | 0.65   | II                   | gm          | 6.0               | -           | -           | -           | 9.25                  | -              | mA/V  |
|  |                                |  |        |                      |             |                   | 6.81        | 7.62        | 8.43        | 1.8                   |                | mA/V  |
|  | <u>GROUP C</u>                 |  |        |                      |             |                   |             |             |             |                       |                |       |
|  |                                | Combined AQL   | 6.5    | I                    |             |                   |             |             |             |                       |                |       |
|  | Anode Current                  | Vg1 = -5V  | 2.5    | I                    | Ia          | -                 | -           | -           | -           | 100                   | -              | μA    |
|  | Reverse Grid Current           | Vg1 = -50V   | 2.5    | I                    | Ig1         | -                 | -           | -           | -           | 1.0                   | -              | μA    |
|  | Change of Mutual Conductance   | Vh = 5.7V<br>Notes 1 and 4   | 2.5    | I                    | gm          | -                 | -           | -           | -           | 15                    | -              | %     |
|  | Reverse Grid Current           | Vh = 6.9V, Rk = 250Ω<br>Va = Vg2 = 300V<br>Note 2                        | 2.5    | I                    | Ig1         | -                 | -           | -           | -           | 1.0                   | -              | μA    |
| 11.1   | Vibration Noise                | RL = 2K Va(b) = 250V<br>Vg1 = -2V<br>Rk = 0                              | 2.5    | I                    | Va AC       | -                 | -           | -           | -           | 15<br>75<br>mV<br>RMS | -              | mVrms |

| K001 Ref.                      | Test                           | Test Conditions   | AQL %      | Inspection Level | Symbol                  | Limits           |             |             |             |                    |             | Units                      |
|--------------------------------|--------------------------------|---|------------|------------------|-------------------------|------------------|-------------|-------------|-------------|--------------------|-------------|----------------------------|
|                                |                                |   |            |                  |                         | Min.             | LAL         | Boggy       | UAL         | Max.               | ALD         |                            |
| 7.2                            | <u>GROUP D</u>                 |   |            |                  |                         |                  |             |             |             |                    |             |                            |
|                                | Base Strain                    | No voltages   | 6.5        | IA               |                         |                  |             |             |             |                    |             |                            |
|                                | Capacitances                   | Measured on 1 Mc/s bridge with valve mounted in a fully shielded socket. Valve screened           | 6.5        | IC               | C in<br>C out<br>Ca.61  | 6.5<br>2.75<br>- | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | 8.7<br>3.75<br>.01 | -<br>-<br>- | PF<br>PF<br>PF             |
|                                | g3 Negative Cut off voltage    | Vg1 = 3.5V<br>Ia = 50 μA  | 6.5        | IA               | -Vg3                    | 70               | -           | -           | -           | 120                | -           | V                          |
|                                | Inser Amplification Factor     | Max. grid swing IV  | 6.5        | IA               | μ 8162                  | 60               | -           | 75          | -           | 89                 | -           |                            |
| 11.2                           | <u>GROUP E</u>                 |   |            |                  |                         |                  |             |             |             |                    |             |                            |
|                                | Resonance Search               | RL = 2k Va(b)-250V<br>Frequency:-<br>(1) 25 - 200 c/s<br>(2) 200 - 500 c/s<br>(3) 300 - 2,500 c/s | 2.5        | IC               | Va AC<br>Va AC<br>Va AC | -<br>-<br>-      | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | 20<br>100<br>500   | -<br>-<br>- | MF rms<br>MF rms<br>MF rms |
|                                | 11.3 Fatigue                   | Vh = 6.9V Note 3  |            | IA               |                         |                  |             |             |             |                    |             |                            |
|                                | <u>POST FATIGUE TESTS</u>      |   |            |                  |                         |                  |             |             |             |                    |             |                            |
|                                | Heater-Cathode Leakage Current | Combined AQL<br>Vhk = ±100V   | 4.0<br>2.5 |                  | Ihk                     | -                | -           | -           | -           | 20                 | -           | μA                         |
|                                | Reverse Grid Current           | Rg1 = 500k Ω max.   | 2.5        |                  | Ig1                     | -                | -           | -           | -           | 1.0                | -           | μA                         |
|                                | Mutual Conductance             |   | 2.5        |                  | gm                      | 5.5              | -           | -           | -           | 9.25               | -           | mA/V                       |
|                                | 11.1 Vibration Noise           | As in Group C   | 2.5        |                  | Va AC                   | -                | -           | -           | -           | 25                 | -           | MF rms                     |
|                                | 11.4 Shock                     | Hammer Angle = 30°<br>No voltages   |            | IA               |                         |                  |             |             |             |                    |             |                            |
|                                | <u>POST SHOCK TESTS</u>        |   |            |                  |                         |                  |             |             |             |                    |             |                            |
| Heater-Cathode Leakage Current | Combined AQL<br>Vhk ± 100V     | 4.0<br>2.5  |            | Ihk              | -                       | -                | -           | -           | 20          | -                  | μA          |                            |
| Reverse Grid Current           | Rg1 = 500k Ω max.              | 2.5   |            | Ig1              | -                       | -                | -           | -           | 1.0         | -                  | μA          |                            |
| Mutual Conductance             |                                | 2.5   |            | gm               | 5.5                     | -                | -           | -           | 9.25        | -                  | mA/V        |                            |
| 11.1 Vibration Noise           | As in Group C                  | 2.5   |            | Va AC            | -                       | -                | -           | -           | 25          | -                  | MF rms      |                            |

| KJ001 Ref. | Test  | Test Conditions  | AQL %          | Insp. Level | Symbol        | Limits         |     |       |     |                |     | Units         |
|------------|---|--|----------------|-------------|---------------|----------------|-----|-------|-----|----------------|-----|---------------|
|            |   |  |                |             |               | Min.           | LAL | Reggy | UAL | Max.           | ALD |               |
| A VI/5     | <u>GROUP F</u><br>Life  | Note 7   |                |             |               |                |     |       |     |                |     |               |
| A VI/5.1   |   | <u>Stability Life (1 hour)</u>   |                |             |               |                |     |       |     |                |     |               |
| A VI/5.3   | Change in Mutual Conductance                                      |  | 1.0            | I           | $\Delta gm$   | -              | -   | -     | -   | 10             | -   | %             |
| A VI/5.6   |   | <u>Intermittent Life</u>   |                |             |               |                |     |       |     |                |     |               |
| A VI/5.6   | <u>Test Point 500 hrs.</u><br>Inoperatives                        | Combined AQL   | 6.5            | IA          |               |                |     |       |     |                |     |               |
|            | <del>Heater Current</del>   |  | <del>2.5</del> |             | <del>Ih</del> | <del>275</del> |     |       |     | <del>325</del> |     | <del>mA</del> |
|            | Heater-Cathode Leakage Current                                    | $V_{hk} = \pm 100V$  | 2.5            |             | Ihk           | -              | -   | -     | -   | 20             | -   | mA            |
|            | Reverse Grid Current  | $R_g1 = 500k \Omega \text{ max.}$  | 2.5            |             | Ig1           | -              | -   | -     | -   | 0.75           | -   | mA            |
|            | Mutual Conductance  |  | 2.5            |             | gm            | 5.2            | -   | -     | -   | 9.25           | -   | mA/V          |
|            | Average Change of Mutual Conductance                              |  |                |             | $\Delta gm$   | -              | -   | -     | -   | 15             | -   | %             |
|            | Anode Current   |  | 4.0            |             | Ia            | 6.8            | -   | -     | -   | 12.2           | -   | mA            |
|            | Electrode Insulation  | $V_h = 6.3V \text{ Note 6}$<br>$V_{g1-all} = -100V$<br>$V_{g2-all} = -300V$<br>$V_a-all = -300V$ | 4.0            |             | R             | 50             | -   | -     | -   | -              | -   | M $\Omega$    |
|            |   |  |                |             | R             | 50             | -   | -     | -   | -              | -   | M $\Omega$    |
|            |   |  |                |             | R             | 50             | -   | -     | -   | -              | -   | M $\Omega$    |
| A VI/5.6   | <u>Test Point 1000 hrs.</u><br>Inoperatives                       | Combined AQL   | 10.0           | IA          |               |                |     |       |     |                |     |               |
|            | Heater Current  |  | 4.0            |             | Ih            | 275            | -   | -     | -   | 325            | -   | mA            |
|            | Heater-Cathode Leakage Current                                    | $V_{hk} = \pm 100V$  | 4.0            |             | Ihk           | -              | -   | -     | -   | 20             | -   | mA            |
|            | Reverse Grid Current  | $R_g1 = 500k \Omega \text{ max.}$  | 4.0            |             | Ig1           | -              | -   | -     | -   | 1.0            | -   | mA            |
|            | Mutual Conductance  |  | 4.0            |             | gm            | 4.9            | -   | -     | -   | 9.25           | -   | mA/V          |
|            | Anode Current   |  | 6.5            |             | Ia            | 5.25           | -   | -     | -   | -              | -   | mA            |
|            | <i>See Amendment, 3.</i>  |  |                |             |               |                |     |       |     |                |     |               |
| A IX/2.4   | <u>GROUP G</u><br>Electrical Re-test after 28 days holding period |  |                | 100%        |               |                |     |       |     |                |     |               |
| A VI/5.6   | Inoperatives  |  | 0.5            |             |               |                |     |       |     |                |     |               |
|            | Reverse Grid Current  | $R_g1 = 500k \Omega \text{ max.}$  | 0.5            |             | Ig1           | -              | -   | -     | -   | 0.75           | -   | mA            |

NOTES

1. The change of mutual conductance is expressed:

$$\frac{gm \text{ at } 6.3V - gm \text{ at } 5.7V}{gm \text{ at } 6.3V} \times 100\%$$

2. Prior to this test the valve shall be preheated for five minutes under the test conditions.  $I_g$  shall not be rising or out of limit after a total of 10 minutes.
3. Valves shall be vibrated in each of the three required planes for not less than 30 hours and not less than 100 hours total. Heater switched 1 minute on 3 minutes off. No other voltages applied. Min. peak acceleration = 5g; frequency = 170  $\pm$  5 c/s.
4. Preheat the valves for five minutes under the test conditions before making the test.
5. Heater positive and negative successively.
6. Heater strapped to cathode and considered as a single electrode.
7.  $R_g$  = 100K  $\Omega$   $\pm$  20%;  $R_k$  = 180  $\Omega$   $\pm$  10%;  $V_{hk}$  = 100V D.C. heater positive  
Or 150V A.C. 50 c/s r.m.s.