5G. ACCEPTANCE TESTS FOR GAS FILLED VOLTAGE STABILISERS AND REFERENCE TUBES

This section covers the requirements to be met by Gas Filled Voltage Stabilisers and Reference Tubes supplied for Services use. The tests contained in this section shall apply when specified in the Test Specification.

The load resistor will be specified on the Individual Test Specification.

5.G.1. STRIKING TESTS

Two methods are described but these are not to be used as alternatives unless permitted by the Test Specification.

The ripple content of the supply shall not exceed 0.25% for either method.

Unless otherwise specified, measurements are to be made with normal room illumination (5 to 50 lumen per square foot natural or artificial).

5.G.1.1. Striking Time

Following the specified inoperative period the specified direct voltage shall be applied between the anode and cathode in such a manner that this value is never exceeded. The device shall strike within the specified time measured from the initiation of the voltage. Unless otherwise specified, the time taken for the applied direct voltage to reach the specified maximum, shall not exceed 10% of the specified striking time.

5.G.1.2. Striking Voltage

Following the specified inoperative period a direct voltage shall be applied between anode and cathode. This shall be increased linearly, commencing at the specified maintaining voltage, at a rate not exceeding 25 volts per second until conduction occurs.

5.G.2. DARK STRIKING VOLTAGE

The valve shall be held inoperative in total darkness for at least 24 hours or a minimum period specified on the individual Test Specification. On conclusion of this period and before exposure to light, the specified striking test shall be applied.

5.G.3 MAINTAINING VOLTAGE

The voltage drop between anode and cathode shall be measured at the specified anode current. If a period of conduction is required prior to the measurement of the maintaining voltage this will be stated in the test specification.

5.G.4. REGULATION

This is to be derived by determining the difference between the maintaining voltages at the specified currents.

5.G.5. NEGATIVE IMPEDANCE

When required by the individual Test Specification the valve characteristics shall be examined for negative impedance. A suitable test method is described in the Appendix to Section 5G.

5.G.6. NOISE AND OSCILLATION

The valve shall be operated from a low impedance well filtered, adjustable d.c. supply, the output capacitance of which shall be at least 16 uF. The impedance of the power supply shall not be more than 1/5 of the impedance of the specified load resistor. The current through the valve shall be varied at a specified rate between the specified current values. Either direction of sweep may be used unless otherwise specified.

The anode of the valve shall be coupled by an 0.1 uF capacitor to a voltage amplifier with an input impedance of 100 K ohms. The frequency response of the amplifier shall be flat to within ± 0.5 dB of the response at 400 c/s over the frequency range from 50 c/s to 25 kc/s, not more than 3 dB down at 25 c/s and 100 kc/s, the fall off thereafter being 6 dB per octave.

The noise output of the valve under test which may be displayed on a cathode ray tube will be specified and shall be measured as a peak to peak voltage.

A voltage that exceeds the specified noise limit but which persists for less than a specified current range within the total current sweep shall be considered as a voltage jump.

Other indicating devices of a less subjective and more automatic nature may be used provided that the response can be shown to be in substantial agreement with that given by the Cathode Ray Tube display.

This measurement shall not include voltage jumps.

5.G.7. VOLTAGE JUMPS OR DISCONTINUITY

Using the equipment specified in 5.G.6. the current through the valve shall be varied at a specified rate between the specified values. The maximum amplitude of a voltage jump shall be measured as a peak voltage. The method of sweep i.e. one direction or both, shall be specified.

5.G.8. MICROPHONIC NOISE

With the current through the valve fixed at a specified value and using the equipment described in 5.G.6. the valve shall be tapped by an approved mechanical device, the direction and number of taps to be detailed in the individual Test Specification. Limits for Microphonic noise shall be specified as millivolts peak to peak.

5.G.9. RESONANCE SEARCH

Using the equipment described in 5.G.6 with the valve current fixed at a specified value the valve shall be mounted in an approved holder (see Drawing No.4 Appendix X) and vibrated as specified in Section 11.2. The limits of noise output shall be measured in millivolts peak to peak.

5.G.10. TEMPERATURE COEFFICIENT

Unless otherwise specified in the individual Test Specification the valve current shall be set at the specified value with the envelope immersed in a bath of high thermal capacity at a temperature of 25 ± 5°C and allowed to stabilise for three minutes. The Maintaining Voltage shall be recorded.

The valve envelope shall then be immersed in a bath of high thermal capacity for a specified period at temperature T1. and the Maintaining Voltage recorded at the end of this time.

The valve envelope shall then be re-immersed for a specified time in the bath at 25 ± 5°C and the Maintaining Voltage recorded.

The valve envelope shall then be immersed in a bath of high thermal capacity for a specified period at temperature T2 and the Maintaining Voltage recorded at the end of this time.

The temperature coefficient shall be computed in milli-volts per degree centigrade from the recorded changes of Maintaining Voltage from 25 ± 5°C to T1 and T2.

This test shall not be done more than once on any individual valve.

When the valve envelope is immersed in a bath of high thermal capacity maintained at the required temperature, the temperature of this bath measured close to the valve shall be considered to be temperature of the envelope.

This is not the temperature which the envelope would assume in air at 25°C and the results obtained must be interpreted accordingly.

5.G.11. LIFE TEST

Life test shall be done under specified conditions of envelope temperature, anode current and, when necessary, illumination.

5.G.12. SHELF LIFE TEST

The Striking and Maintaining Voltage shall be recorded and the valves stored for a specified period. The Striking and Maintaining Voltage shall again be measured at the end of this period.

Unless specified otherwise this test will be applied only for Type Approval purposes.

5.G.13. LEAKAGE CURRENT

With an ambient illumination of 5 to 50 lumen per square foot a specified voltage shall be applied to the valve in series with a specified resistor and the current through the valve/resistor combination measured.

APPENDIX TO SECTION 5G

THE MEASUREMENT OF NEGATIVE IMPEDANCE IN GAS-FILLED STABILISER VALVES

The presence of negative impedance or regulation in a stabiliser can be detected by plotting a static characteristic. A close approximation to this can be achieved conveniently be means of the basic circuit of Fig.1 enabling a dynamic characteristic to be displayed on a cathode ray tube.

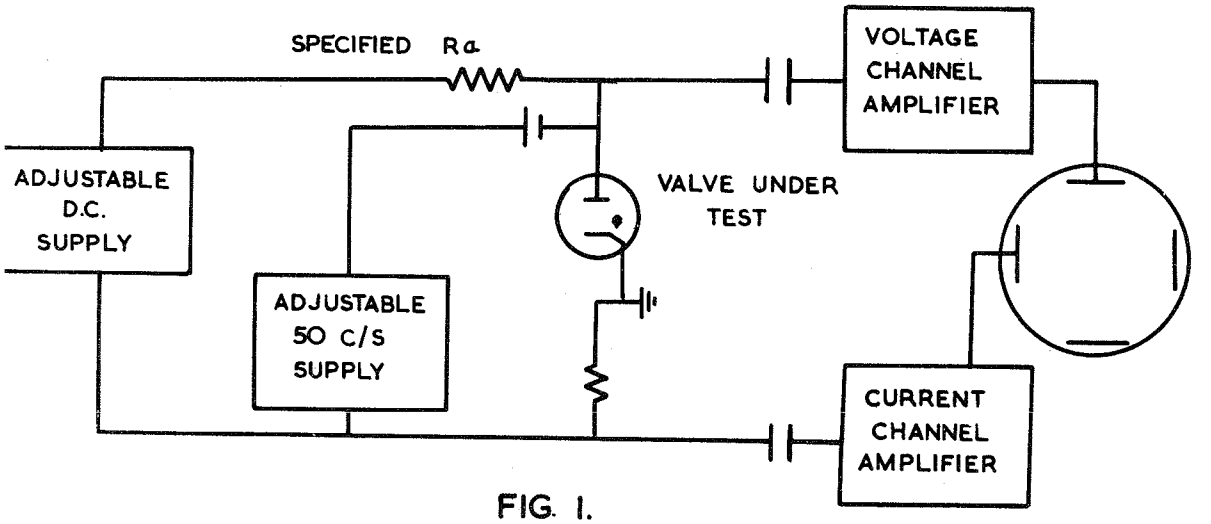

FIG. 1.

Prior to testing a valve in the above circuit, a resistor, of equivalent incremental resistance is substituted for the valve under test. The phase relationship of the amplifiers is then adjusted so that when a.c. is passed through the resistor a straight line is displayed on the cathode ray tube.

With the valve under test in the circuit and the a.c. supply disconnected the anode current of the stabiliser is set to the mid-point of its specified d.c. operating range. The 50 c/s sine wave voltage is then superimposed and adjusted to vary the stabiliser current between the limits of its current range. The voltages developed across the stabiliser and current monitoring resistor are then displayed on the C.R.T. as an Ia/Va curve.

The basic shape of any characteristic will be that of an ellipse the major axis of which represents the impedance of the stabiliser (Fig.2).

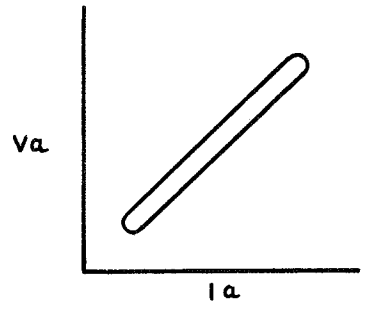

FIG. 2.

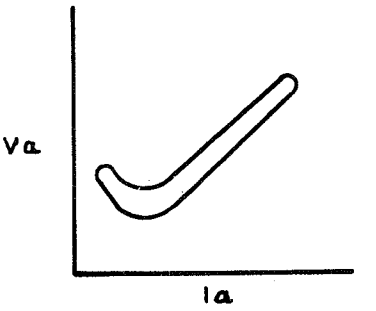

FIG. 3.

Negative impedance is indicated by a slope in the opposite direction Figure 3 shows a combination of negative and positive impedance. Voltage jumps of appreciable amplitude will appear as regions of high negative impedance.

Oscillations of appreciable amplitude can be detected, and the current range over which they occur can be noted. Regulation can be assessed by direct measurement of the display.

To facilitate correlation the frequency of the a.c. supply must be 50 c/s.