

Specification for

Gas-filled microwave switching tubes of assessed quality: Generic data and methods of test

UDC 621.372.837.2:621.387.362

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- Electronic Components Industry Federation*
- Electronic Engineering Association
- Institution of Electronic and Radio Engineers*
- Ministry of Defence*
- National Supervising Inspectorate*
- Post Office
- Society of British Aerospace Companies Limited*
- Telecommunication Engineering and Manufacturing Association (TEMA)
- Trades Union Congress

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Scientific Instrument Manufacturers' Association
- United Kingdom Atomic Energy Authority

This British Standard, having been prepared under the direction of the Electronic Components Standards Committee, was published under the authority of the Executive Board on 31 May 1978

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First published December 1970
First revision May 1978

The following BSI references relate to the work on this standard:
Committee reference ECL/5
Draft for comment 72/29217/DC

ISBN 0 580 10248 3

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Foreword

This British Standard, which supersedes BS 9040:1970, has been prepared under the direction of the Electronic Components Standards Committee and is the generic specification for gas-filled microwave switching tubes in the system of standards for electronic parts of assessed quality.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 67 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General matters

1.1 Scope

This British Standard forms part of the system of common standard specifications for electronic parts of assessed quality and should be read in conjunction with the standards in the series BS 9000 to BS 9009 inclusive.

It applies to t.r. tubes, t.r. limiters, a.t.r. tubes, pre-t.r. tubes, and passive protection tubes as defined in 1.3 and gives the terms, definitions, symbols, test methods and other material necessary to implement fully the detail specifications for these tubes. The material herein shall be applicable only when called up by the detail specification, except for 1.6 to 1.18 inclusive which are mandatory requirements.

1.2 Related documents

BS 448, *Dimensions of electronic tubes and valves.*

BS 1991, *Letter symbols, signs and abbreviations.*

BS 2011, *Basic environmental testing procedures.*

BS 3939, *Graphical symbols for electrical power, telecommunications and electronics diagrams.*

BS 3966, *Microwave measuring instruments.*

BS 4727, *Glossary of electrotechnical, power, telecommunications, electronics, lighting and colour terms — Part 1: Terms common to power, telecommunications and electronics.*

BS 6001, *Sampling procedures and tables for inspection by attributes.*

BS 9000, *General requirements for electronic components of assessed quality — Part 1: General description and basic rules.*

BS 9240, *Flanges, fastenings and accessories of assessed quality for waveguide tubing and components: generic data and methods of test.*

PD 9002, *BS 9000 Component selection guide — Part 1: Qualified products list — Part 2: Miscellaneous.*

IEC 134, *Rating systems for electronic tubes and valves and analogous semiconductor devices.*

1.3 Terminology

For the purposes of this British Standard the following terms and definitions, in addition to those from BS 4727, apply.

1.3.1

t.r. tube

a gas-filled transmission line cavity which acts as a short-circuit when ionized but transmits low power signals from the aerial to the receiver when not ionized

1.3.2

t.r. limiter

a device incorporating a t.r. tube and a semiconductor limiting diode the purpose of which is to reduce the amplitude of the leakage which would have passed through the t.r. tube if used alone

1.3.3

a.t.r. tube

a gas-filled transmission line cavity which acts as a short-circuit when ionized but is an open-circuit when un-ionized. It is used in a t.r. switch for directing the energy received from the aerial to the receiver to an extent independent of the transmitter impedance

1.3.4

pre-t.r. tube

a gas-filled microwave switch tube used in duplexing systems to reduce the incident power on a t.r. tube

1.3.5

passive protection tube

a gas-filled microwave switch tube used in front of a mixer or detector diode to prevent r.f. electrical overload

1.3.6

primer ignition

the process of creating local ionization by means of an applied d.c. or pulsed voltage for the purpose of increasing the electron density in the breakdown gap of the tube in order to facilitate the ionization of the tube on the application of high r.f. power

1.3.7

primer ignition period

the period of time taken for the completion of primer ignition after the application of primer voltage

1.3.8

primer current

the current which flows when a voltage is applied to the primer terminal

1.3.9

primer interaction

the change in insertion loss resulting from energizing the primer

1.3.10

primer voltage drop

the voltage drop between the body of the tube and the primer terminal when primer current flows

1.3.11

primer noise temperature

increase in noise temperature at the output terminal due to an energized primer

1.3.12

firing

the ionization of the gas within the tube which occurs due to r.f. energy

1.3.13

firing period

the period of time taken for the tube to fire after the application of the r.f. energy

1.3.14

firing power

the minimum incident r.f. power that causes the tube to fire

1.3.15

cold or unprimed insertion loss

the loss of power at low level, due to the insertion of the tube in a transmission line, with the primer unenergized

1.3.16

primed or total insertion loss

the loss of power at low level, due to the insertion of the tube in a transmission with the primer energized

1.3.17

arc loss

the loss of transmitted high power after the reference short circuit has been replaced by the tube

1.3.18

low-power leakage

the maximum power leakage, through the tube, which occurs when the incident power on the tube is gradually increased from a level below to a level above the firing power

1.3.19

total leakage power

the power transmitted through the tube averaged over the period of the incident r.f. pulse

1.3.20**spike leakage energy**

the initial transient pulse of energy which is transmitted through the tube prior to its firing

1.3.21**flat leakage power**

the leakage power through the tube during the period when the tube is fully fired

1.3.22**amplitude recovery period**

that period of time between the instant at which the r.f. ionizing pulse ceases and that instant at which the low-power attenuation caused by the tube is 3 dB below fully recovered value

1.3.23**phase recovery period**

the period of time between the instant at which the r.f. ionizing pulse ceases and that instant at which the phase shift of the low power signal reduces to a specified value

1.3.24**electrical length**

the equivalent length of a specified transmission line that produces the same phase shift as the tube

1.3.25**short-circuit position**

the position, relative to a specified reference plane on the tube, at which an effective short-circuit occurs when the tube is fired

1.3.26**reference frequency**

the r.f. frequency at which measurements are made

1.4 Letter symbols, signs and abbreviations

For the purposes of this British Standard, the following letter symbols apply.

b	normalized susceptance
D	duty factor
d_{sc}	short circuit position
f_o	frequency of resonance
f_r	reference frequency
g	normalized conductance
I_{pr}	primer current
L	insertion loss cold
L_{pr}	insertion loss primed
L_a	arc loss
L_l	attenuation
L_r	rejection loss
$L_{\Delta f}$	amplitude tracking
$L_{\Delta T}$	amplitude tracking with temperature
N	noise
P	ambient pressure
P_{av}	mean power
P_f	firing power
P_{fl}	flat leakage power
P_{lp}	low power leakage
P_p	pulse power

P_{tot}	total leakage power
Q_L	loaded Q
R_{pr}	primer resistor
r	voltage standing wave ratio
r_o	voltage standing wave ratio at f_o
t_f	firing period
t_i	primer ignition period
t_p	t_f pulse duration
t_{pl}	duration of leakage pulse
t_r	amplitude recovery period
$t_{\phi r}$	phase recovery period
T_{op}	operating temperature range
T_{pt}	primer noise temperature
T_{stg}	storage temperature range
W_s	spike leakage energy
W_{sp}	spike leakage amplitude
V_{pr}	primer voltage
ϕ	phase
$\phi_{\Delta f}$	phase tracking
$\phi_{\Delta T}$	phase tracking with temperature
θ	electrical length

1.5 Graphical symbols

For the purposes of this British Standard graphical symbols shall be in accordance with BS 3939 (IEC 117).

1.6 Marking of the tube and packing

The following symbols or codes shall be clearly and durably marked on the tube in the following order of preference as space permits. All symbols and codes except terminal marking and operating conditions shall also appear on the primary pack, e.g. carton, box, plastics envelope etc., used as initial protection or wrapping for delivery.

- a) Manufacturer’s part designation number and special marking relating to hazard and special operating conditions.
- b) Manufacturer’s factory identification code.
- c) Date code.
- d) BS number of the detail specification.

1.7 Eligibility for qualification approval

The first stage of processing in accordance with 2.3.2 3) of BS 9000-1 is

- a) construction of the frequency determining elements and the joining together of all piece parts;
- b) the use of the procedure specified in 2.3.2 3) ii) of BS 9000-1 is excluded.

1.8 Structurally similar tubes

When simultaneous or successive production is proceeding on several types of tube having common features, those common features may be sampled from the complete range of types instead of from each lot of each type. Some examples of admissible common features and associated tests are:

Common method of mounting	{ Visual inspection Terminal inspection Dimensions Temperature cycling and moisture resistance and/or fixed lug torque
---------------------------	--

Common processing and assembly techniques {
 Endurance tests
 Leakage tests
 Recovery period
 Arc loss
 Primer tests

Claims for structural similarity shall be made in accordance with the requirements of **2.4.6** of BS 9000-1.

1.9 Delayed delivery

Tubes held by the manufacturer for a period exceeding one year following acceptance inspection shall be re-inspected before release for all subgroup A2 requirements.

Group	Lot size	Sample size	Accept	Reject	2nd sample	Total sample	Accept	Reject
A and B	2 to 7	100 %, See note	0	1				
	8 to 280	6	0	2	2	8	1	2
C and D	Any	2	0	2	2	4	1	2
NOTE Qualification approval is dependent on at least six samples being tested.								

1.10 Supplementary procedure for qualification approval

The above table supersedes the sample size requirements of **2.3.1** of BS 9000-1, for production lot sizes below 280 specimens. The samples may be drawn from one production lot. When using the table a second sample, as shown, shall be taken when the quantity of defectives exceeds the acceptance quantity but is less than the reject quantity.

Where production rates are 12 tubes per month or less, permission to release prior to approval may be granted on successful completion of the specified tests on two specimens for groups A and B and one specimen for groups C and D.

On receipt of such permission the manufacturer may commence to release components meeting the specification.

Qualification approval will be granted when the number of specimens quoted in the above table have satisfied the specified requirements, provided that during this period no inspection lots have been rejected.

Permission to release tubes will be withdrawn

- in the event of the rejection of an inspection lot prior to the granting of qualification approval;
- in the event of qualification approval not being granted within 18 months of the date of permission to release.

When permission to release is granted, the specification number will be shown in Part 4 of PD 9002 but there will be no entry in Part 1 of PD 9002 until qualification approval is granted.

All release documentation including the certificate of conformity shall be prominently marked "This tube is released in advance of qualification approval" and the reference of the document granting permission to release shall be quoted.

Defective tubes may be used for those tests where the validity of the result is not affected by the particular defect(s).

Results obtained on development samples which have been produced using substantially final production techniques and tested by approved methods may be included in the test report to cover part of the requirements for qualification approval with the agreement of the NSI.

1.11 Certified test records

See **2.8** and Appendix C of BS 9000-1.

1.12 Standard ratings and characteristics

Not applicable.

1.13 Unchecked parameters

Not applicable.

1.14 Procedure to be followed in the event of failures at group C or D inspection

The procedures of 2.6.4.1 and 2.6.4.2 of BS 9000-1 shall apply.

1.15 Ordering information

Ordering information will be found in the appropriate detail specification.

1.16 Release prior to completion of group B tests

Not applicable.

1.17 Inspection procedures for low rates of production

Where the production rates are low, with the result that lots are acceptable on zero rejects, 2.5.1.2 of BS 9000-1 allows a larger sample to be taken with consequent lot acceptance on one reject. Alternatively, the manufacturer may elect to perform tests on a 100 % basis.

This clause is applicable to group A tests.

In the case of group B, environmental and short term life tests, where the sample size exceeds 10 % of the batch size, the lot shall be assessed on a cumulative basis over a period of thirteen weeks. The original inspection level and AQL values shall be maintained against the new accumulated lot size.

When this procedure is adopted, tubes may be released week by week provided that a minimum of one-thirteenth of the total sample size, appropriate to the accumulated 13 week period, satisfies the specified requirements.

The above principle may also apply where the manufacturer elects to test a greater number of specimens in relation to the accumulated sample size, at less frequent intervals over specified requirements.

1.18 Continuous production

For the purposes of this British Standard, continuous production is defined as in 2.5.1.1 5) of BS 9000-1 except that in subclause (iii) the period shall be increased from one month to six months.

Section 2. Test procedures

2.1 Test and measurement conditions

All tests shall be carried out under the standard atmospheric conditions for testing as specified in 5.3 of BS 2011-1.1:1977 unless otherwise stated.

The limits quoted in detail specifications are absolute. The test limits used for quality conformance inspection shall be inset from the absolute limits by the amount necessary to allow for measurement uncertainty. Difficulties may be encountered in assessing measurement uncertainties in the test methods marked with an asterisk in 2.4.15. In such cases, at the manufacturer's discretion, the tube shall meet the limits given in the detail specification when the measurement is carried out using identified test equipment and monitoring procedures approved by the NSI.

2.2 Visual inspection

Unless otherwise specified, visual inspection shall be performed under normal factory lighting conditions and without visual aids.

Visual inspection for good appearance and workmanship shall include the following.

- a) Shape.
- b) Quality of seals.
- c) Alignment of connectors.
- d) Straightness of pins or leads, etc.
- e) Freedom from loose particles.

- f) Clarity of marking.
- g) Correctness of marking.
- h) Location of marking.
- i) Finish.
- j) Materials (the materials and finish for external parts shall be seen to conform with the requirements of the detail specification and/or the quality of the qualification approval samples.)

2.3 Dimensioning and gauging procedures

Dimensional and gauging tests shall be made in accordance with the inspection drawing included in a detail specification and as listed in the appropriate subclause below.

The dimensions which shall be checked as part of the groups B, C and D in section requirements are indicated.

Group B

Waveguide fixing. (Couplings complying with the requirements of BS 9240).

Maximum height.

Minimum and maximum length.

Maximum width.

Fixing centres.

Primer terminal.

In addition, for plug-in devices, those dimensions which are necessary to ensure correct fitting into a standard mount or gauge.

Group C

Less important dimensions.

Group D

Remaining dimensions on inspection drawing.

2.4 Electrical test procedures

2.4.1 Alternative methods of test. See 2.4.2 of BS 9000-1.

2.4.2 Measuring equipment. All microwave components used in the measuring equipment shall be verified to ensure satisfactory operation over the required frequency range. This should preferably be carried out using swept frequency techniques. Measuring instruments shall comply with the requirements of BS 3966 and waveguide couplings with the requirements of BS 9240.

The time constants or pulse response characteristics of any indicating circuits shall not affect the validity of the measurement results.

Care shall be taken to ensure that any stray electro-magnetic fields do not affect the measurement results.

When measurements are carried out on balanced duplexer systems, it is necessary to ensure that each 3 dB hybrid coupler has a v.s.w.r. of less than 1.1 : 1 looking into any port with the other three ports terminated in matched loads, splits the power evenly within ± 0.25 dB, and has a directivity of not less than 25 dB.

2.4.3 Temperature conditions. It is necessary to maintain steady conditions for a sufficient time to ensure that all parts of the tube have reached their equilibrium temperature.

2.4.4 Forced cooling. Where forced cooling is required the following items shall be checked.

- a) Type of coolant.
- b) Method of application.
- c) Rate of flow, or pressure difference between inlet and outlet at specified ambient conditions.
- d) Limits of inlet temperature.
- e) Maximum permitted body temperature of the tube at a specified point.

2.4.5 Pressurizing. Where pressurizing is required the following items shall be checked before and during operation of the tube.

- a) The system shall be clean and free from condensation and be capable of adequate sealing to maintain gas purity.
- b) The minimum or maximum limits of gas pressure to which the microwave components can be subjected without damage or mechanical distortion shall be observed.

2.4.6 Reference point. The polarity of all voltages applied to the terminals are specified relative to the body of the tube.

2.4.7 D.C. supply for tubes with primers. The d.c. primer supply voltage shall be $1 \text{ kV} \pm 50 \text{ V}$. The regulation of the voltage source over the current range from zero to the operating current shall be better than 1 %. The superimposed ripple component of the supply voltage shall be less than 10 V peak-to-peak. Unless otherwise stated these conditions shall apply for all electrical tests.

The primer voltage shall be applied through a total series resistance of $5.6 \text{ M}\Omega \pm 5 \%$ for the main primer and a total of $12.4 \text{ M}\Omega \pm 5 \%$ for the auxiliary primer. Not less than $0.5 \text{ M}\Omega$ of the total resistance shall be connected directly to the primer terminal(s) of the tube. Primer resistors which are built into the tube shall be considered as part of the total resistance and specified in the detail specification.

2.4.8 Holding period prior to ignition test(s). Tubes shall be stored in darkness and free from ionizing radiations for a period of not less than 24 h before any measurement of primer ignition is performed.

2.4.9 High power measurements. The high power r.f. load shall have a v.s.w.r. not exceeding 1.1 : 1 over the required frequency band. Tubes having structural symmetry about the axis of insertion shall be tested in such a manner as to ensure compliance with the specified limits for all mounting positions of the tube.

2.4.10 Low power measurements. The incident power on the tube under test shall be less than that value which results in a change in the values of the parameters being measured. Tubes having structural symmetry about the axis of insertion shall be tested in such a manner as to ensure compliance with the specified limits for all mounting positions of the tube.

2.4.11 Resonance tuning

2.4.11.1 T.R. tubes. Where possible, tuning to the resonance frequency of a t.r. tube shall be indicated by the minimum value of v.s.w.r. In those cases where the v.s.w.r. method is not convenient, the resonance frequency shall be indicated by the maximum in the transmitted power.

2.4.11.2 A.T.R. tubes. Where possible, tuning to the resonance frequency of an a.t.r. tube shall be indicated by the maximum value of v.s.w.r. Where this method is not convenient, the resonance frequency shall be indicated by the minimum in the transmitted power.

2.4.12 Test condition tolerances. For general measurements, the allowable tolerances are as follows.

- a) *Resonance frequency*
 - $\pm 1 \%$ for high power measurements.
 - $\pm 0.1 \%$ for low power measurements.
- b) *P.R.F.* $\pm 10 \%$.
- c) *Duty factor.* $\pm 10 \%$.

NOTE Measurements on tubes of high Q value require substantially tighter tolerances as specified in the detail specification.

2.4.13 V.S.W.R. Voltage standing wave ratios are expressed as a value greater than unity.

2.4.14 Tube under test. In the absence of any indication to the contrary the term "tube under test" includes the mount.

In the case of balanced duplexer tests the tube under test includes a 3 dB hybrid coupler (as defined in 2.4.2) in front of and behind the tube under test.

Tests shall be carried out with ports indicated X in the following table coupled into the test circuit specified in the test method. Ports marked Y shall have matched terminations.

Test methods	Port 1 aerial	Port 2 transmitter	Port 3 receiver	Port 4 terminated
1006, 1007, 1012, 1020, 1027	X	Y	X	Y
1013, 1014, 1015, 1031	Y	X	X	Y
1008	Y	X	Y	X
1011	X	X	Y	Y

2.4.15 Index of test methods. For convenience of identification in detail specifications the following numbering system for test methods has been used. The methods are described in this standard after 2.7.4.

Index of test methods

Title	Method
Primer ignition period	1001
Primer oscillations	1002
Primer current	1003
Primer noise temperature	1004 ^a
Primer voltage drop	1005
Insertion loss	1006 ^a
V.S.W.R. at low power	1007 ^a
V.S.W.R. at high power	1008 ^a
Loaded Q (t.r. tubes)	1009 ^a
Loaded Q (a.t.r. tubes)	1010 ^a
Arc loss	1011 ^a
Low power leakage	1012 ^a
Total leakage power	1013 ^a
Spike leakage energy	1014 ^a
Flat leakage power	1015 ^a
Amplitude recovery period	1016 ^a
Short-circuit position	1019 ^a
Firing power	1020 ^a
Tuning range	1021
Resonance of pre-tuned tube	1022
Electrical length (phase shift)	1024 ^a
Normalized conductance	1025 ^a
Normalized susceptance	1026 ^a
Firing period	1027
Phase recovery period	1028 ^a
Phase ripple	1029 ^a
Phase tracking	1030 ^a
Maximum peak leakage power	1031 ^a

^a See 2.1

2.5 Mechanical test procedures

Not applicable.

2.6 Environmental test procedures

2.6.1 Increased air pressure. The areas of the tube exposed to waveguide pressurization shall be subjected to an increase of pressure of 300 kN/m² and maintained at this condition for at least 1 min. The pressure shall be achieved within 1 min.

The following tests from BS 2011-2.1:1977 shall be performed as required by the detail specification.

2.6.2 Test Ca: Damp heat, steady state. Duration: 21 days.

The marking shall remain legible.

2.6.3 Test Da: Accelerated damp heat. The periodic variation of 2 °C to 3 °C four times per hour is omitted. The number of cycles of conditioning shall be two. Standard drying conditions shall apply.

2.6.4 Test Ea: Shock. The acceleration and duration of the shock pulse shall be 147 m/s², 3 ms.

Tubes having structural symmetry about one of the three axes shall be subjected to three successive shocks in each sense along the axes of symmetry and to three shocks in each sense along an axis perpendicular to it. (Total number of shocks: 12.)

2.6.5 Test Eb: Bump.

Number of bumps: 1 000 ± 10

Peak acceleration: 245 m/s²

Duration: 6 ms.

Tubes having structural symmetry about one of the three axes shall be subjected to 1 000 successive bumps in each sense along the axes of symmetry and 1 000 bumps in each sense perpendicular to it. (Total number of bumps: 4 000 ± 40.)

2.6.6 Test Fc: Vibration (sinusoidal). Procedure B4 frequency range and acceleration are as follows.

Frequency: 55 Hz to 2 000 Hz.

Acceleration: 49 m/s².

The tube shall be mounted as specified and vibrated through the specified frequency range at the specified acceleration. Duration shall be 90 min in each of three mutually perpendicular axes.

Tubes having structural symmetry about one of the three axes shall be subjected to 90 min vibration in each of the two directions instead of three. (Total duration: 3 h.)

2.6.7 Test N: Change of temperature. Rapid change of temperature, two-chamber method (Test Na).

$T_{\text{max.}}$: 100 ± 3 °C, $T_{\text{min.}}$: 5 ± 3 °C. Duration at each temperature extreme shall be as given in the following table.

Mass of tube	Minimum period
kg	h
0.15 and less	0.5
Above 0.15 to 1.5 inclusive	1.0
Above 1.5 to 15.0 inclusive	2.0

It is permissible to use one chamber provided that the change in temperature can be achieved within 3 min.

2.6.8 Test M: Low air pressure. When the pressure has been reduced to 30 kN/m² the primer shall be energized and there shall be no external arcing at the primer terminal. It is only necessary to reduce the pressure surrounding the primer insulator.

2.6.9 Test U: Robustness of terminations and integral mounting devices

Purpose. To assess the ability of terminations to withstand the mechanical strains likely to be applied during normal assembly of the tube into equipment.

Preferred values. Torque (Test Ud).

The value of torque shall be as follows.

Top caps less than 15 mm diameter: 0.2 N m

Top caps greater than 15 mm diameter: 0.4 N m

Threaded terminal less than 5 mm diameter: 0.2 N m

Threaded terminal greater than 5 mm diameter: 0.4 N m

Wire wrap terminals less than 2 mm diameter: 0.2 N m
 Diagonal: 0.2 N m

Tensile (Test U_{a1})

Preferred values of loading mass are $\frac{1}{4}$ kg and $\frac{1}{2}$ kg.

2.7 Endurance test procedures

2.7.1 Non-operating endurance (holding). Before electrical acceptance tests are performed a period of at least 168 h shall have elapsed since the completion of those manufacturing operations which determine the tube performance. However, operations which do not influence tube performance, such as labelling etc., may be performed during this period.

2.7.2 Non-operating endurance (storage). The tubes shall initially be tested to the requirements of the detail specification. They shall then be stored, either without a container or in an open container, in such a way that they are exposed to standard testing conditions (see 5.3 of BS 2011-1.1:1977) but protected from direct sunlight.

Unless otherwise specified, the period of storage shall be 12 months. Tubes shall be removed for testing at intervals of 3, 6, 9 and 12 months.

2.7.3 Operating endurance test. Tubes shall be connected in a transmission system and operated under the specified conditions for the required number of hours.

The frequency of the r.f. power shall be within the range of propagation of the fundamental mode of the waveguide used.

It is permissible to connect tubes in either series or shunt multiple mounts provided that the final tube has a power incident upon it of not less than that specified.

Unless otherwise specified, the applied transmitter pulse shall have a nominal duration of 1 μ s and a p.r.f. of 1 000 Hz. Where the calculated duty factor deviates from an average value of 0.001 a direct correction factor shall be applied to the accumulated hours of endurance. The power pulse duration shall be measured at the base line of the total power leakage waveform, as specified in test method 1013.

Tubes undergoing the endurance test shall be measured at the following time intervals.

0 h, 160 h, 500 h, 1 000 h, and thereafter at 1 000 + 48, – 24 h intervals.

The given time intervals (up to 1 000 h) may be extended to allow the manufacturer to perform the required tests during normal factory working hours. At the discretion of the manufacturer, tests may be performed at more frequent intervals.

Tubes which are rejected for mechanical defects, e.g. dimensions, etc., which do not affect the electrical parameters listed under the post conditioning test requirements may be used for endurance tests.

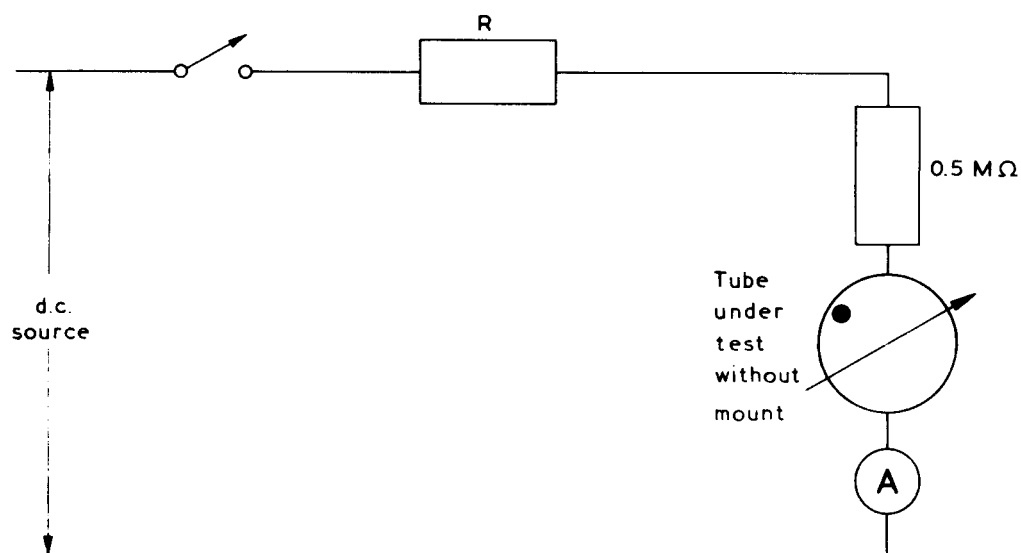
Tubes which are rejected for mechanical defects which affect one or more of the electrical parameters listed under the post conditioning test requirements may also be used for endurance tests but in this case the permitted deviation in the specification limits shall be maintained from the initial measured value of the affected parameter.

2.7.4 Mechanical tuner cycling. The mechanical tuner shall be cycled over the minimum specified tuning range for the specified number of cycles.

After completion of the specified cycling, the tube shall be held in storage for a minimum period of 24 h, after which the tube shall be submitted to the spike leakage energy test (method 1014).

Primer ignition period

Purpose. To ensure satisfactory primer operation after storage in darkness.

Test circuit

Procedure. Not less than 24 h after the tube has been placed in total darkness the specified d.c. voltage shall be applied to the primer terminal.

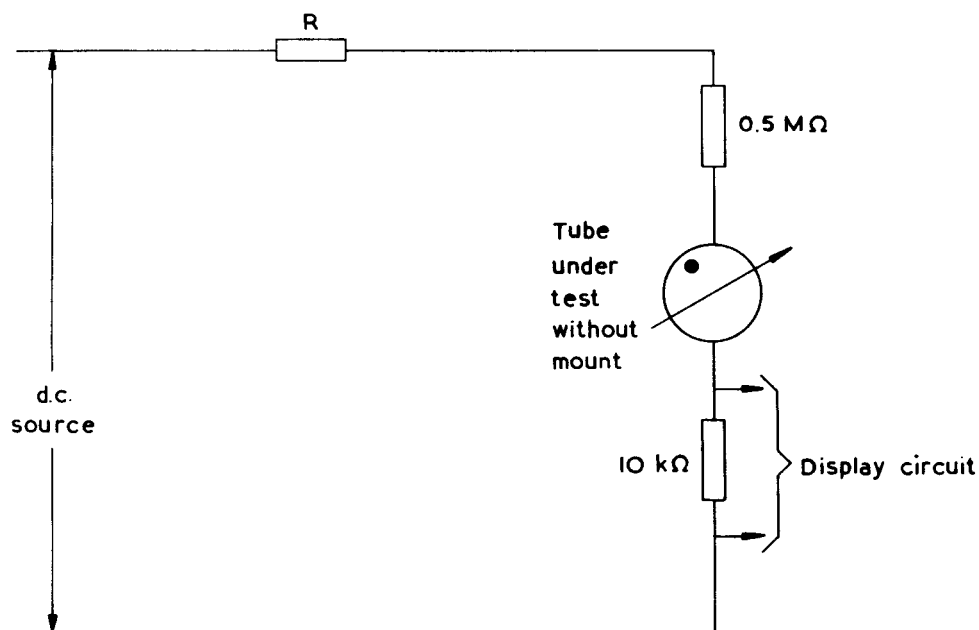
The period of time elapsing after the application of this voltage before the primer ignites shall be measured.

When the tube has more than one primer electrode each primer shall be tested individually after storage in darkness of at least 24 h before the test on each primer.

Condition prescribed in the detail specification

2.4.7 of this standard.

NOTE It is only necessary that the inside of the tube is maintained in darkness.

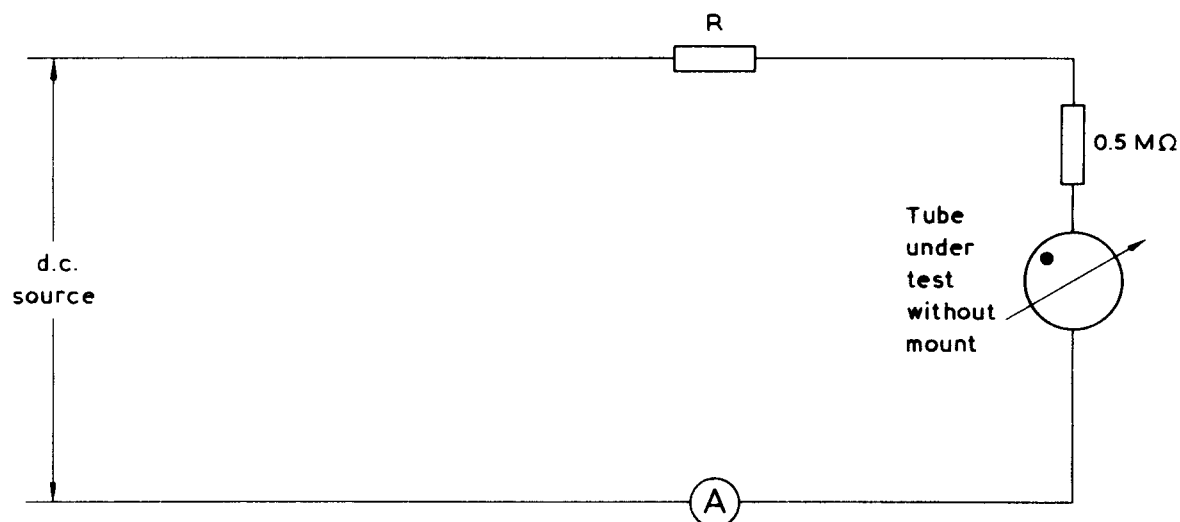
Primer oscillations**Test circuit**

Procedure. With the primer energized the minimum instantaneous value of the current shall be measured.

Precaution. To simulate user conditions (stray capacitance) the tube under test shall be placed on an earthed metal square plate, the side dimension of which shall be approximately ten wave lengths, e.g. 300 mm for X-band.

Condition prescribed in the detail specification

2.4.7 of this standard.

Primer current**Test circuit**

Procedure. With the d.c. voltage applied to the primer terminal via the specified series resistor the resultant current shall be measured.

Condition prescribed in the detail specification

2.4.7 of this standard.

