

European Commission for Electrotechnical Standardization (CENELEC)
Cenelec Electronic Components Committee

CECC



Système Harmonisé d' Assurance de la Qualité
des Composants Electroniques

**SPECIFICATION GNERIQUE :
TUBES A CHARGE D'ESPACE
CONTROLEE**

Harmonized System of Quality Assessment for
Electronic Components

**GENERIC SPECIFICATION :
SPACE-CHARGE
CONTROLLED TUBES**

Harmonisiertes Gütebestätigungssystem für
Bauelemente der Elektronik

**FACHGRUNDSPEZIFIKATION :
RAUMLADUNGSGESTEUERTE
RÖHREN**

CECC 45000

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FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

This document has been formally approved by the CECC, and has been prepared for those member countries taking part in the System who wish to issue national harmonized specifications for space-charge controlled tubes. It should be read in conjunction with document CECC 00 100: Basic Rules (1974).

At the date of printing of this document the member countries of the CECC are Belgium, Denmark, Germany, France, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland and the United Kingdom, and copies of it can be obtained from the National Committees of the CENELEC in these countries.

PREFACE

This specification was prepared by CECC Working Group 14: "Space-charge controlled tubes".

In accordance with the requirements of document CECC 00 100 it is based, wherever possible, on the Recommendations of the International Electrotechnical Commission and in particular on IEC Publication 151: Measurement of the electrical properties of electronic tubes and valves.

The text of this specification was circulated to the CECC for voting in document CECC(Secretariat)274 in June 1974 and was formally approved by the CECC for printing as a CECC specification on 12 February 1975.

This specification will be supplemented by blank detail specifications specific to each sub-family of space-charge controlled tubes.

SECTION 1 - SCOPE

This document applies to space-charge controlled tubes such as industrial heating tubes, small power transmitting tubes, disk seal tubes, etc.

SECTION 2 - GENERAL2.1 Order of precedence

Where any discrepancies occur for any reason, documents shall rank in the following order of authority:

- 1) the detail specification
- 2) the generic specification
- 3) Document CECC 00 100 or any other international (e.g. IEC) documents to which reference is made.

The same order of precedence shall apply to equivalent national documents.

2.2 Related documents

ISO 1000	1973	Rules for the use of units of the International system of units and selection of the decimal multiples and sub-multiples of the SI units
IEC 27		Letter symbols to be used in electrical technology
-1	1971	General
IEC 50	1974	International electrotechnical vocabulary
IEC 50(Chapter 531)	1974	Electronic tubes
IEC 67	-	Dimensions of electronic tubes and valves
IEC 68	-	Basic environmental testing procedures for electronic components and electronic equipment (see CECC 00 006)
IEC 100	1962	Methods for the measurement of direct inter-electrode capacitances of electronic tubes and valves
	Amendment No.1 1969	
IEC 117	-	Recommended graphical symbols
IEC 134	1961	Rating systems for electronic tubes and valves and analogous semiconductor devices
IEC 151		Measurements of electrical properties of electronic tubes and valves
-0	1966	Precaution relating to methods of measurement of electronic tubes and valves
-1	1963	Measurement of electrode current
-2	1963	Measurement of heater or filament current
-11	1966	Methods of measurement of radio-frequency output power
-12	1966	Methods of measuring electrode resistance transconductance, amplification factor, conversion resistance and conversion transconductance
-13	1966	Methods of measurement of emission current from hot cathodes for high-vacuum electronic tubes and valves
-15	1967	Methods of measurement of spurious and unwanted electrode currents

IEC 235		Measurement of the electrical properties of microwave tubes
-1	1972	Terminology
-2	1972	General measurements
-3	1972	Disk seal tubes
IEC 410	1973	Sampling plans and procedures for inspection by attributes (see CECC 00 007)
CECC 00 100	1974	Basic Rules
CECC 00 006	1973	Basic Specification for IEC 68: Basic environmental testing procedures
CECC 00 007	1973	Basic Specification for IEC 410: Sampling plans and procedures for inspection by attributes

2.3 Units, symbols and terminology

Units, graphical symbols, letter symbols and terminology shall, whenever possible, be taken from the following documents:-

ISO 1000		Rules for the use of units of the International system of units and selection of the decimal multiples and sub-multiples of the SI units
IEC 27		Letter symbols to be used in electrical technology
IEC 50		International electrotechnical vocabulary
IEC 117		Recommended graphical symbols
IEC 235-1	1972	Measurement of the electrical properties of microwave tubes and valves: Terminology

Any other units, symbols, and terminology peculiar to one of the components covered by this specification, shall be taken from the relevant IEC or ISO documents or derived in accordance with the principles of the documents listed above and clearly described.

2.4 Marking

The detail specification shall indicate the identification criteria and other information to be shown on the component and/or on the packing. Any identification code used shall be described in full or reference shall be made to the appropriate document.

Use of potentially hazardous materials in the construction of the tube shall be indicated in accordance with the national safety requirements.

SECTION 3 - QUALITY ASSESSMENT PROCEDURES

3.1 Primary stage of manufacture

The primary stage of manufacture of a space-charge controlled tube is the process of joining together of all piece parts and of sealing, pumping and ageing.

Subcontracting of this stage is prohibited.

3.2 Structural similarity

When simultaneous or successive production is proceeding on several types of tubes having common features, those common features may be sampled from the complete range of types instead of from each lot of each type.

Admissible common features and associated tests include the following:-

- envelope assembly dimensions (IEC 67) - Climatic (IEC 68)
- base dimensions (IEC 67) - Climatic (IEC 68)
- terminations IEC 68, Test U
- filament current and voltage (stated)

3.3 Qualification approval procedure

The national detail specification shall prescribe whether Procedure 1 or 2 as given below, is to be followed, together with the necessary details:-

Procedure 1 A single schedule which gives the groups of tests and sample size together with the permissible number of defectives, or

Procedure 2 The use of quality conformance inspection whereby three consecutive lots are subjected to lot-by-lot inspection and one lot (drawn from the three) subjected to periodic inspection.

In 1, each group shall contain five specimens unless otherwise prescribed in the detail specification.

In 2, samples shall be taken from the lots in accordance with IEC 410. Normal inspection shall be used but, where the sample size would give acceptance on zero defectives, additional specimens shall be taken to meet the sample size required to give acceptance on one defective.

3.4 Resubmission of rejected lots

Lots rejected in the quality conformance inspection may be resubmitted after reworking and/or retesting by the manufacturer and after eliminating the non-conforming items.

3.5 Delayed delivery

Each tube held for a period exceeding twelve months following quality conformance inspection shall be reexamined before delivery if prescribed by the detail specification. The detail specification shall prescribe the test requirements.

SECTION 4 - TEST AND MEASUREMENT METHODS

This section contains the test methods which shall be included in each harmonized national specification system. Not all the tests are applicable to all detail specifications. The blank detail specification shall prescribe which of the tests are applicable to a particular family of tubes. Additional test methods included in harmonized national detail specifications shall be clearly indicated as non-harmonized.

4.1 General

The test and measurement methods given in the generic specification are intended to unify test and measurement procedures. They are not necessarily the only methods which can be used. However, the manufacturer shall satisfy the National Supervising Inspectorate that any alternative methods, which may be used, will give results equivalent to those obtained by the method specified.

4.2 Standard conditions for testing

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 68-1.

4.3 Visual examination

Unless otherwise specified, visual examination shall be performed under normal factory lighting conditions and without visual aids. Visual examination shall be carried out for good appearance and workmanship and shall include the following items where applicable:

- quality of seals
- base alignment
- straightness of pins
- freedom from loose elements
- clarity, correctness and position of marking
- finish

4.4 Dimensions

Dimensions and outline drawing, if possible in accordance with IEC 67.

4.5 Electrical measurement methods

The following properties shall be measured in accordance with the IEC Publication clause specified, as prescribed by the detail specification.

- 4.5.1 Filament or heater current or voltage (IEC 151-2)
- 4.5.2 Negative control grid current at stated anode voltage, control grid voltage (or anode current) and screen grid voltage (IEC 151-15, clause 4)
- 4.5.3 Control grid voltage at stated anode voltage, screen grid voltage or anode current (IEC 151-1)
- 4.5.4 Anode current at stated anode voltage, control grid voltage (or cathode resistor) and screen grid voltage (IEC 151-1)
- 4.5.5 Screen grid current at stated anode voltage, control grid voltage (or cathode resistor) and screen grid voltage (IEC 151-1)
- 4.5.6 Screen grid current at stated anode voltage, screen grid voltage and anode current (IEC 151-1)
- 4.5.7 Pulse emission or current saturation (IEC 151-13, clause 4.2)
- 4.5.8 Control grid emission (IEC 151-15, clause 5.2.1)
- 4.5.9 Screen grid emission (IEC 151-15, clause 5.2.2)

- 4.5.10 Mutual conductance and amplification factor at stated electrode voltages and/or currents (IEC 151-12 sections 6 and 7)
- 4.5.11 Intermodulation under stated conditions of operation (see Appendix)
- 4.5.12 Gain under stated conditions of operation (IEC 235-2, clause 14 and 235-3, clause 2.5)
- 4.5.13 Insulation of electrodes (IEC 151-15, clause 8.2.2)
- 4.5.14 Capacitances (IEC 100)
- 4.5.15 Radio frequency power output under stated conditions of operation (IEC 151-11)

4.6 Environmental tests

- 4.6.1 Robustness of terminations (IEC 68-2-21, Test U)
- 4.6.2 Shock (IEC 68-2-27, Test Ea)
- 4.6.3 Bump (IEC 68-2-29, Test Eb)
- 4.6.4 Vibration (IEC 68-2-6, Test Fc)
- 4.6.5 Climatic test-damp heat (IEC 68-2-3, Test Ca)

4.7 Endurance tests

In accordance with the test conditions stated in the national detail specification.

4.8 Additional test and measurement methods

Additional tests and measurements shall be made in accordance with IEC 151 and 235 or any other harmonized test or measurement methods. Failing this, reference may be made to a test or a measurement method described in a harmonized national system. If such methods are used they shall be fully described in the detail specification.

Appendix to CECC 45 000INTERMODULATIONGeneral methods

The amplifying device shall be operated under stated conditions. Stated carriers shall be then applied simultaneously. The output spectrum shall be studied and each intermodulation product within the stated bandwidth, or the intermodulation product greater than a stated power, measured. For each intermodulation product the result shall be expressed in decibels relative to a stated power level.

Precautions

To avoid distortions by intermodulation in the generators, the combination of the carriers is achieved by hybrids and isolators or attenuators, as shown in Figure 1. Intermodulation products of the input shall be at least 10 dB lower in amplitude than the smallest intermodulation product to be measured.

Harmonic outputs will in general be present and shall not be ignored. Their magnitude may be highly dependent on the associated circuit. It may be necessary to use low pass filters to remove them.

1. Two frequency (tone) method (s.s.b.)

The amplifying electronic device shall be operated under stated conditions. Two carriers of equal power of frequencies f_1 and f_2 shall be used at the input. If non-linearity exists in the device, intermodulation products occur at the output with frequencies $pf_1 \pm qf_2$.^{*} The difference in level, expressed in decibels, between the intermodulation product with the highest level and the lower of the carrier levels is the intermodulation ratio. An example is given in Figure 2.

Note 1 : The greatest intermodulation product does not necessarily occur at the highest peak envelope power level.

Note 2 : If the intermodulation products at opposite sides of the two tones are different in amplitude, the higher value shall be taken. This gives the lowest intermodulation ratio.

2. Three frequency (tone) method (t.v.)

The amplifying electronic device shall be operated under stated conditions. Three frequencies f_a , f_b , f_c shall be used. The power level, the frequency spacings of the three frequencies, and the reference level shall be stated. The largest intermodulation product f_1 , within a stated band shall be measured with reference to the stated reference level (peak synchronisation level) and expressed in dB/dB. (See Figure 3).

* p and q are positive integers, zero included.

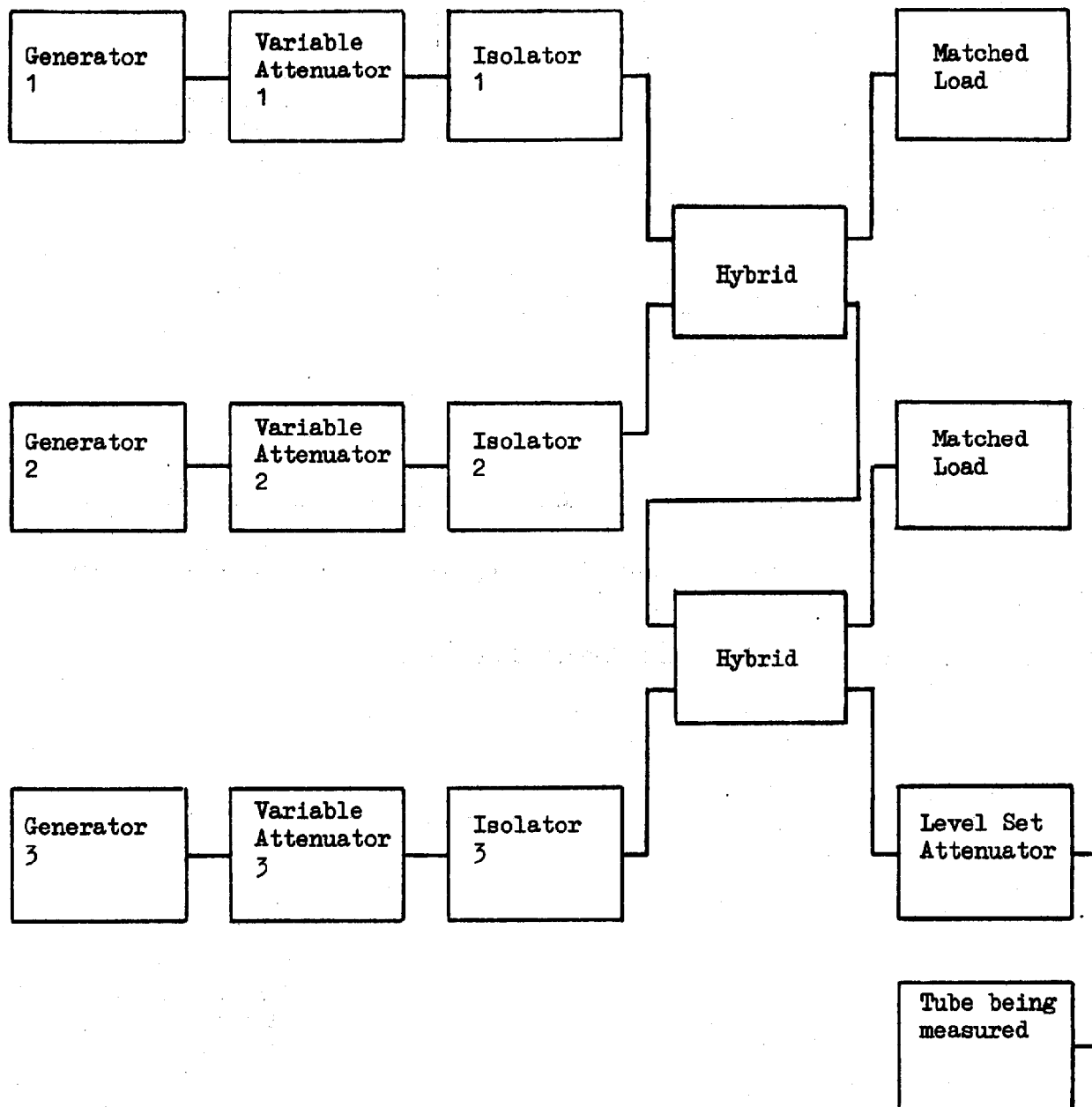


Figure 1:- Arrangement to avoid distortion of driving signals by generator intermodulation

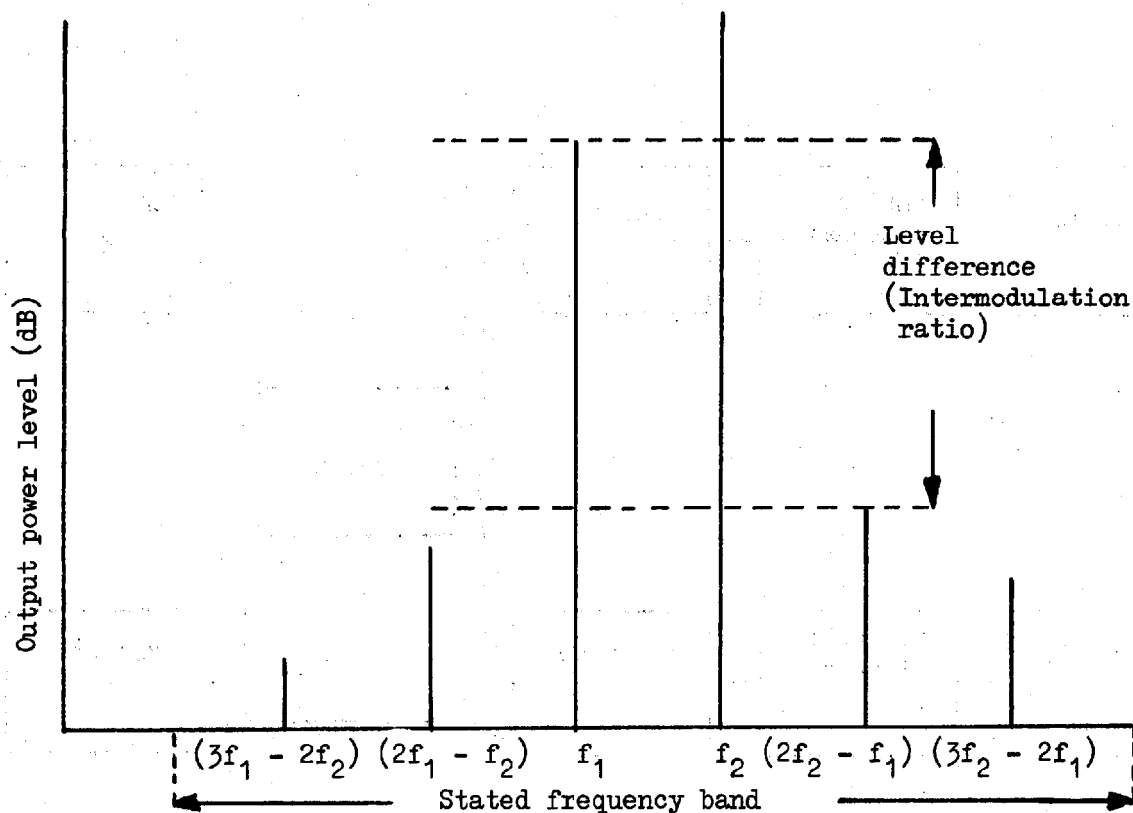


Figure 2:- Intermodulation : Two-frequency method

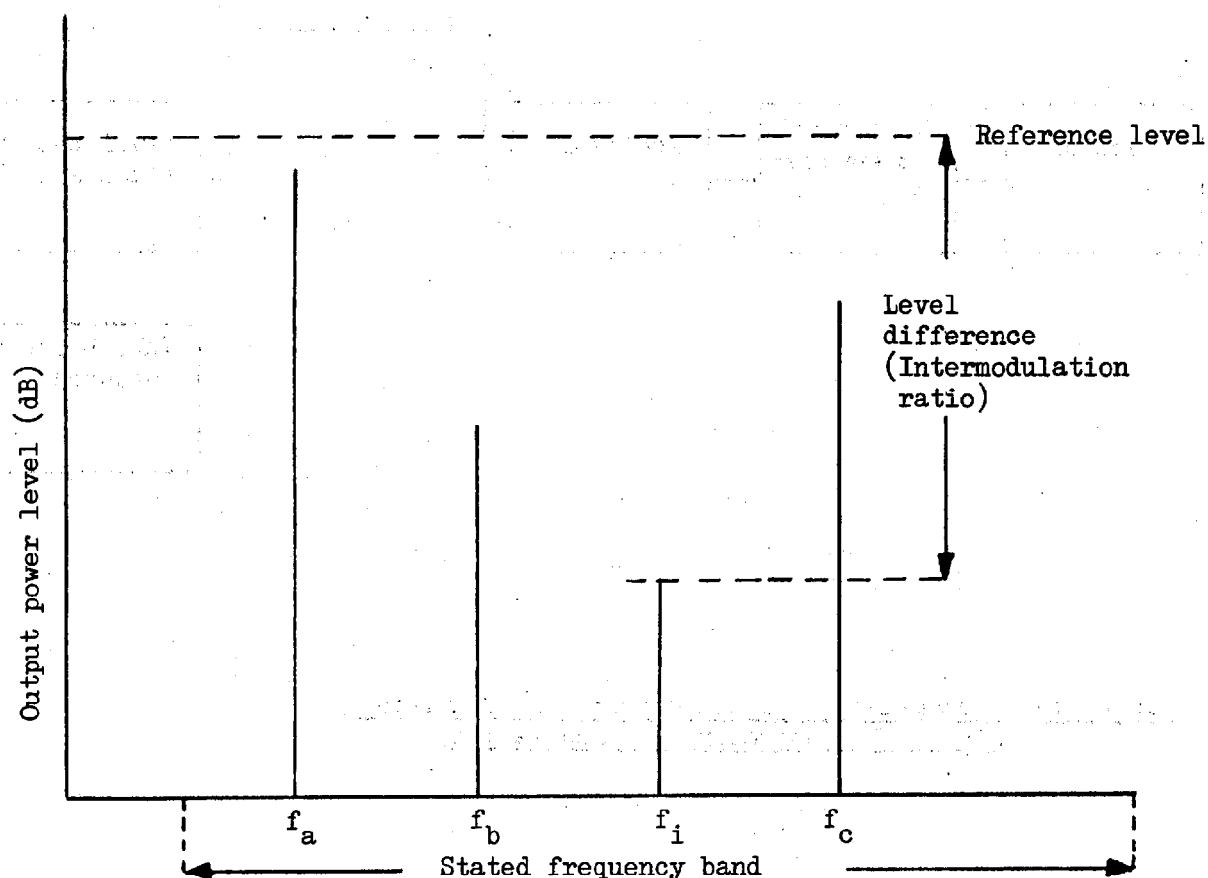


Figure 3:- Intermodulation : Three-frequency method