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# Variable capacitors of assessed quality: Generic data and methods of test

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Spécification des condensateurs variables de qualité assurée:  
Données génériques et méthodes d'essai

Spezifikation für veränderliche Kondensatoren bestätigter Güte  
Generische Daten und Prüfverfahren

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### FOREWORD

This revision of BS 9090, which has been prepared under the authority of the Electronic Components Standards Committee, is the generic specification for variable capacitors in the system of standards for electronic components of assessed quality.



Amendment Slip No. 1  
published and effective from 31 January 1980  
to BS 9090 : 1977

Variable capacitors of assessed quality:  
Generic data and methods of test

#### Revised text

AMD 3133  
January 1980

CONTENTS LIST. Add at the end of the title of appendix B  
'(full assessment level)'.

AMD 3133  
January 1980

#### 1.1.10 SUPPLEMENTARY PROCEDURE FOR QUALIFICATION APPROVAL

Delete the existing text and substitute the following:

'1.1.10.1 Information concerning the standard qualification approval procedure is given in 2.3 of BS 9000: Part 1.

1.1.10.2 Where the procedure referred to in 1.1.10.1 is not appropriate, and where permitted by the section specification, the following procedure may be applied. This procedure is appropriate for the qualification of components of high cost, produced in small numbers. It is applicable to inspection lots of 280 or less.

(1) Samples may be drawn from one inspection lot.

This lot must be of sufficient size to provide components for all tests, including any possible requirements for a second sample of the double sampling scheme.

(2) The double sampling procedure given in 2.5.1.2(4)(i) of BS 9000: Part 1 may be used. However, the minimum sample size for any subgroup shall be 5, or 6 if the sample is divided'.

AMD 3133  
January 1980

#### 1.1.14 PROCEDURE TO BE FOLLOWED IN THE EVENT OF FAILURE AT GROUP C OR D INSPECTION

Before the existing text insert the subclause heading.

'1.1.14.1 *Full assessment only*.

After existing text of 1.1.14 insert the following:

'1.1.14.2 *Basic assessment only*. For group D, subgroups D3 and D7, a climatic test using procedure 3 of test 2/ABDM of BS 2011 shall be conducted in subgroup B2'.



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AMD 3133  
January 1980

### 2.3.2 ATTRIBUTES INFORMATION

Before the existing text insert the subclause heading.

'2.3.2.1 *Full assessment*

After the existing text of 2.3.2 insert the following:

'2.3.2.2 *Basic assessment*. Attributes information shall be given for subgroups A2, A3, B2, B3, C1, D1, D2, D3, D4, D6, D7 and D8'.

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AMD 3133  
January 1980

### 2.3.3 MEASUREMENTS INFORMATION

Before the existing text insert the subclause heading.

'2.3.3.1 *Full assessment*

After the existing text of 2.3.3 insert the following:

'2.3.3.2 *Basic assessment*. Measurements information shall be given for the endurance tests in subgroups D5(a) and D5(b)'.

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AMD 3133  
January 1980

### APPENDIX B

Delete the existing title and insert the following title:

'APPENDIX B. EXAMPLE OF A TYPICAL CERTIFIED TEST RECORD (FULL ASSESSMENT LEVEL)'

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Amendment No. 2  
published and effective from 31 October 1983  
to BS 9090 : 1977

Variable capacitors of assessed quality:  
Generic data and methods of test

## Revised text

AMD 4409  
October 1983

### FOREWORD

At the end of the foreword, insert the following.

'This standard contains several references to clauses in BS 9000 : Part 1 : 1971, now superseded. A cross reference table between these references and the appropriate clause in the most recent edition of BS 9000 : Part 1 is included in the latter.'

AMD 4409  
October 1983

### CLAUSE 1.1.1 SCOPE

In paragraph 1, in line 3, delete '(or BS 9001)'.

AMD 4409  
October 1983

### CLAUSE 1.1.2 RELATED DOCUMENTS

Delete the reference to BS 1991.

Insert the following new reference below the existing reference to BS 4727.

'BS 5775 (ISO 31) Specification for quantities, units and symbols'

In the reference to BS 6001, delete '(BS 9001 has the same technical content.)'

AMD 4409  
October 1983

### CLAUSE 1.1.4 LETTER SYMBOLS, SIGNS AND ABBREVIATIONS

In line 2, delete 'BS 1991' and substitute 'BS 5775'.

AMD 4409  
October 1983

### CLAUSE 1.1.7 ELIGIBILITY FOR QUALIFICATION APPROVAL

Delete the existing text entirely and substitute the following:

'For styles 1, 2, 3 and 5, the primary stage of processing in accordance with 2.3.2(3) of BS 9000 : Part 1 is the manufacture of the stator(s) and the corresponding rotors(s). For style 4, the primary stage is the manufacture of the electrode and the dielectric layers.'



BRITISH STANDARD SPECIFICATION FOR  
VARIABLE CAPACITORS OF ASSESSED QUALITY:  
GENERIC DATA AND METHODS OF TEST

1. PRINCIPLES AND MANDATORY PROCEDURES

1.1 GENERAL MATTERS

1.1.1 SCOPE

This British Standard forms part of the system for electronic components of assessed quality (the BS 9000 system) and should be read in conjunction with the standards in the series BS 9000, BS 6001 (or BS 9001), PD 9002, etc. It applies to variable capacitors as defined in 1.1.3 and gives the terms, definitions, symbols, test methods and other material necessary to implement fully the detail specifications for these components.

The rules for the preparation of these detail specifications are given in section two of this standard and in BS 9091 et seq. for the various types of variable capacitor.

1.1.2 RELATED DOCUMENTS

- BS 1852 (IEC 62) Marking codes for resistors and capacitors
- BS 1991 Letter symbols, signs and abbreviations
- BS 2011 (IEC 68) Methods for the environmental testing of electronic components and electronic equipment
- BS 2045 (ISO/R 3) Preferred numbers
- BS 2488 (IEC 63) Schedule of preferred numbers for the resistance of resistors and the capacitance of capacitors for telecommunication equipment
- BS 2564 Control chart technique when manufacturing to a specification, with special reference to articles machined to dimensional tolerances'
- BS 3939 (IEC 117) Graphical symbols for electrical power, telecommunications and electronics diagrams
- BS 4000 (ISO/R 101) Sizes of papers and boards
- BS 4727 (IEC 50) Glossary of electrotechnical, power, telecommunications, electronics, lighting and colour terms
- BS 6000 Guide to the use of BS 6001. Sampling procedures and tables for inspection by attributes
- BS 6001 Sampling procedures and tables for inspection by attributes. (BS 9001 has the same technical content.)
- BS 9000 General requirements for electronic components of assessed quality
- BS 9093 N001 Detail specification for variable capacitor type C (preset) air dielectric, vane type without locking device nut sealed

### 1.1.3 TERMINOLOGY

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

- (1) *Variable capacitor*. A capacitor which is designed to enable the capacitance to be varied continuously over its complete range.
- (2) *Differential capacitor*. Comprises two isolated stators which function with one rotor, arranged so that as the capacitance between the rotor and one stator increases, the capacitance between the rotor and the other stator decreases but the sum of the two capacitance values remains substantially constant for all settings.
- (3) *Split stator capacitor*. Comprises two isolated stators which function in series with a common rotor.
- (4) *Section*. A stator and its corresponding rotor.
- (5) *Multi-section capacitor*. A capacitor which has several sections, the capacitance values of which are varied simultaneously by a common actuating device.
- (6) *Reference section*. That section to which other sections can be matched.
- (7) *Matching section*. A section matched to a reference section.
- (8) *Assessment level*. Variable capacitors are divided into assessment levels according to use (see 1.3(10) of BS 9000: Part 1).
- (9) *Type (function)*. Capacitors of one type comprise those having similar design features exclusive of mounting accessories and falling within a manufacturer's usual range of capacitance, voltage, etc. for such design.

NOTE. The segregation of capacitors into types is determined by the function and is governed by the ability of the capacitor to withstand various severities of mechanical endurance.

- (a) *Type A*. Tuner capacitor. A variable capacitor which is intended to be operated frequently throughout its life. When used for tuning purposes, this variable capacitor may be provided with a control spindle to which a knob or drive may be fitted.
  - (b) *Type B*. Trimmer capacitor. A variable capacitor used for trimming or for other similar purposes where considerably fewer operations are required than for type A.
  - (c) *Type C*. Preset capacitor. A variable capacitor used specifically as preset capacitor where a comparatively small number of movements are required during its life.
- (10) *Style*. Products of the same type (function) having similar means of varying the capacitance.
- (a) *Style 1*. Concentric. An air dielectric capacitor of which the capacitance can be varied by the axial movement of a rotor in a stator.
  - (b) *Style 2*. Vane. A capacitor of which the capacitance can be varied by rotating the rotor vanes between the stator vanes.
  - (c) *Style 3*. Tubular. A capacitor of which the capacitance can be varied by the axial movement of an electrode within a tube.

(d) *Style 4. Compression.* A capacitor of which the capacitance can be varied by compressing a stack of electrode and dielectric layers.

(e) *Style 5. Disc.* A solid dielectric capacitor of which the capacitance can be varied by rotating a metal or metallized disc.

(11) *Descriptive code.* The description of the type (function), dielectric, style and assessment level of a capacitor may be in the form of a four character code as follows.

|                  |   |   |   |                                                                                                                                                    |
|------------------|---|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Descriptive code | C | 2 | 3 | 2                                                                                                                                                  |
| Type (function)  |   |   |   | A. Tuner<br>B. Trimmer<br>C. Preset                                                                                                                |
|                  | C |   |   |                                                                                                                                                    |
| Dielectric       |   | 2 |   | { 1. Air<br>2. Solid                                                                                                                               |
| Style            |   |   | 3 | { 1. Concentric<br>2. Vane<br>3. Tubular<br>4. Compression<br>5. Disc                                                                              |
| Assessment level |   |   | 2 | { 1. Full assessment plus additional requirements<br>2. Full assessment<br>3. Basic assessment plus additional requirements<br>4. Basic assessment |

#### Example

For a preset capacitor, solid dielectric, tubular style at full assessment level the descriptive code is C 232.

(12) *Pattern.* A pattern is a variation within a style and usually describes a variable capacitor of unique design.

(13) *Maximum capacitance.* The maximum value which can be obtained with the actuating device adjusted in the manner specified in the detail specification.

(14) *Minimum capacitance.* The minimum value which can be obtained with the actuating device adjusted in the manner specified in the detail specification.

(15) *Capacitance swing.* The difference between the maximum and minimum capacitance values.

(16) *Capacitance law.* The relationship between capacitance and the position of the actuating device.

(17) *Total angle of rotation.* The angle (or number of turns) through which the rotor moves between the end stops. If there are no end stops, then the total angle of rotation is the effective angle of rotation.

(18) *Effective angle of rotation.* The angle (or number of turns) through which the rotor moves between the positions of maximum and minimum capacitance.

(19) *Nominal angle of rotation.* The angle of the rotor used for determining the measuring points when capacitance law measurements are made.

(20) *Backlash*. The difference in capacitance (expressed as a ratio) obtained at a prescribed measuring angle when the actuating device is moved to approach this measuring angle from a clockwise and then from an anti-clockwise direction.

(21) *Capacitance drift after adjustment*. The change in capacitance (expressed as a ratio) obtained in a stated time after the actuating device has been rotated at a specified speed to a stated capacitance.

(22) *Apparent power*. The maximum V A rating at which the capacitor can be used in relation to temperature rise, in terms of frequency, current and voltage.

(23) *Lower category temperature*. The lowest ambient temperature for which the capacitor has been designed to operate continuously.

(24) *Upper category temperature*. The highest ambient temperature for which the capacitor has been designed to operate continuously.

(25) *Category temperature range*. The range of ambient temperatures for which the capacitor is designed for continuous operation.

(26) *Nominal capacitance*. The values which are indicated upon the capacitor or the package. These will be defined in the detail specification and will comprise one or more of the following.

Capacitance swing (nominal)

Maximum capacitance (nominal)

Minimum capacitance (nominal)

(27) *Rated voltage*. The maximum peak voltage which may be applied continuously to the terminals of a capacitor at any temperature in the category temperature range.

(28) *Rotor contact resistance*. The resistance between the rotor contact terminal and the rotor shaft.

#### 1.1.4 LETTER SYMBOLS, SIGNS AND ABBREVIATIONS

For the purposes of this British Standard the abbreviations and letter symbols given in BS 1991 apply.

#### 1.1.5 GRAPHICAL SYMBOLS

For the purposes of this British Standard the graphical symbols given in BS 3939 (IEC 117) apply.

#### 1.1.6 MARKING OF THE COMPONENT AND THE PACKAGE

Each capacitor shall be marked with as many of the following items, in the order given below, as is practicable.

(1) Nominal capacitance.

(2) Date code and lot identification.

(3) Manufacturer's name or trade mark.

(4) Number of the detail specification and pattern number.

(5) Any additional marking required by the detail specification.

All the information listed above shall be marked on the package of the capacitors.

#### 1.1.7 ELIGIBILITY FOR QUALIFICATION APPROVAL

The primary stage of processing in accordance with 2.3.2.(3) of BS 9000: Part 1 is the manufacture of the stator(s) and its corresponding rotor(s). This stage and, where applicable, the assembly of piece parts and/or sub-assemblies onto the capacitor base or chassis shall be under the direct surveillance of the manufacturer's chief inspector.

#### 1.1.8 STRUCTURALLY SIMILAR COMPONENTS

This term covers a range of capacitors produced by using sensibly similar processes, methods of construction and materials. They may be of different physical sizes and electrical ratings but they usually conform to the same descriptive code as defined in 1.1.3(11).

#### 1.1.9 DELAYED DELIVERY

Variable capacitors held by the manufacturer or stockist for a period exceeding two years following acceptance inspection shall, before release, be re-examined for compliance with the group A tests of the relevant detail specification.

#### 1.1.10 SUPPLEMENTARY PROCEDURE FOR QUALIFICATION APPROVAL

Not applicable. (Information concerning the standard qualification approval procedure is given in 2.3 of BS 9000: Part 1.)

#### 1.1.11 CERTIFIED TEST RECORDS

Certified test records shall be prepared by the manufacturers, as specified in 2.8 of BS 9000: Part 1 for variable capacitors at the full and full plus additional assessment levels. They are not required for those at the basic and basic plus additional assessment levels.

Certified test records shall be printed on international size A4 paper that complies with the requirements of BS 4000 in the layout shown in appendix B.

Where the detail specification requires that attributes information shall be recorded, the following procedures shall be used.

(1) Where a subgroup comprises a single conditioning test, the total number of rejected capacitors shall be recorded without reference to the parameter for which the rejection was made.

(2) Where a subgroup comprises a number of conditioning tests, the detail specification shall state whether the results shall be recorded for the individual conditioning tests or for a number of them as a group. For the purposes of this specification the climatic sequence shall be deemed to form a single conditioning test.

The relevant detail specification shall state which tests are to be reported on the certified test record as measurements information. It shall also state whether results may be aggregated, e.g. by ranges of rated capacitance, etc.

As a minimum requirement, the results of all endurance tests shall be presented as measurements information.

#### 1.1.12 STANDARD RATINGS AND CHARACTERISTICS

Preferred ratings and characteristics are given below.

(1) *Capacitance*. Values of nominal capacitance shall be prescribed in the detail specification. These should, where possible, be selected from one of the series of BS 2488.

(2) *Tolerances*. Tolerances should, where possible, be selected from the list in BS 1852.

(3) *Rated voltages*. These should conform to the R5 series given in BS 2045. Where intermediate values are required, these shall be chosen from the R10 series.

#### 1.1.13 UNCHECKED PARAMETERS

Detail specifications prepared in accordance with this specification do not necessarily give information on the operation of capacitors under special conditions, e.g. under pulse conditions. Unchecked parameters are not used for inspection purposes and consistent performance under such conditions cannot be relied upon.

Where a requirement exists for operation under conditions not covered by this specification, it shall be given in a detail specification prepared by a manufacturer. The test method shall be fully described and appropriate limits, acceptable quality levels and inspection levels specified.

#### 1.1.14 PROCEDURE TO BE FOLLOWED IN THE EVENT OF FAILURE AT GROUP C OR D INSPECTION

For group C, subgroups C1 and C2 and group D, the procedure given in 2.6.4.1 and 2.6.4.2 of BS 9000: Part 1 shall be applied.

For group C, subgroup C3, a climatic test using procedure 3 of test Z/ABDM of BS 2011: Part 2.1: 1977 shall be conducted in subgroup B2.

#### 1.1.15 ORDERING INFORMATION

The ordering information shall be specified in the detail specification and shall include the number of the detail specification.

#### 1.1.16 RELEASE BEFORE COMPLETION OF GROUP B INSPECTION

When the conditions of BS 6001 for reduced inspection have been satisfied for all group B tests the manufacturer is permitted to release components before the completion of such tests.

### 1.2 TEST PROCEDURES

This clause comprises a schedule of tests, but these tests are not necessarily applicable in all cases. Test and inspection schedules, giving the tests, the conditions of test and the requirements appropriate to the particular type and style of variable capacitor, appear in the detail specifications.

#### 1.2.1 MEASUREMENT CONDITIONS

Unless otherwise specified all tests shall be carried out under the standard atmospheric conditions for testing as specified in BS 2011.

Before the measurements are made, the capacitors shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature. The recovery period called for after conditioning is normally sufficient for this purpose.