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2005-03

Waveguide type dielectric resonators –

Part 4:
Sectional specification

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

WAVEGUIDE TYPE DIELECTRIC RESONATORS –

Part 4: Sectional specification

FOREWORD

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International Standard IEC 61338-4 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

The text of this standard is based on the following documents:

FDIS	Report on voting
49/702/FDIS	49/716/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 61338 consists of the following parts, under the general title: *Waveguide type dielectric resonators:*

Part 1: Generic specification

Part 1-3: General information and test conditions – Measurement method of complex relative permittivity for dielectric resonator materials at microwave frequency

Part 2: Guidelines for oscillator and filter applications

Part 4: Sectional specification (this publication)

Part 4-1: Blank detail specification

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

WAVEGUIDE TYPE DIELECTRIC RESONATORS –

Part 4: Sectional specification

1 General

1.1 Scope

This sectional specification applies to waveguide type dielectric resonators as custom built products or as standard catalogue items whose quality is assessed on the basis of capability approval.

It prescribes the preferred ratings and characteristics with the appropriate tests and measuring methods contained in IEC 61338-1, and gives the general performance requirements to be used in detail specifications for waveguide type dielectric resonators.

The concept of preferred values is in general directly applicable to standard catalogue items but does not necessarily apply to custom built products.

1.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61338-1, *Waveguide type dielectric resonators – Part 1: Generic specification*

QC 001002-3*, IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: Approval procedures*

QC 001005, *Register of Firms, Products and Services approved under the IECQ System, including ISO 9000*

2 Preferred ratings and guidance on detail specifications

2.1 Preferred ratings and characteristics

The values given in detail specifications shall preferably be selected from those stated in 2.3 of IEC 61338-1.

2.2 Information to be prescribed in detail specifications
(for both custom built and standard catalogue items)

Guidance on the preparation of detail specifications is given in the blank detail specification.

Each detail specification shall state all the tests and measurements required for inspection. For standard catalogue items this shall, as a minimum, include the relevant tests given in the blank detail specification, with methods and severities.

The following information shall be given in each detail specification.

2.2.1 Outline drawing and dimensions

The detail specification shall include a dimensional drawing of the waveguide type dielectric resonator and/or reference to an appropriate international standard, to permit easy recognition and to provide information for dimensioning and gauging procedures.

The dimensions shall include the overall dimensions of the body of the component and the size and spacing of the terminations. All dimensions shall be stated in millimetres.

2.2.2 Marking

The detail specification shall prescribe the content of the marking on the waveguide type dielectric resonator primary package in accordance with 2.4 of IEC 61338-1.

2.2.3 Ordering information

The detail specification shall prescribe that the following information is required when ordering a waveguide type dielectric resonator.

a) Quantity

b) Detail specification number, issue number and date

and where applicable

c) Nominal frequency in MHz or GHz

d) Full description of any additional requirements to identify the waveguide type dielectric resonator.

2.2.4 Additional information (not for inspection purposes)

The detail specification may include information which is not normally required to be verified by the inspection procedure, such as circuit diagrams, curves, drawings and notes needed for clarification.

3 Capability approval

3.1 Eligibility for capability approval

Prior to making an application for capability approval a manufacturer shall first obtain manufacturer's inspection approval in accordance with QC 001002-3.

The primary stage of manufacture shall be as defined in 3.2 of IEC 61338-1.

3.2 Structural similarity

Structural similarity is not applicable to capability approval. However, it is applicable to released lots as defined in 3.14.1 of this specification.

3.3 Procedures for capability approval

3.3.1 General

Capability approval in waveguide type dielectric resonator technology covers:

– the complete design, material preparation and manufacturing techniques, including control procedures and tests;

– the performance limits claimed for the processes and products, that is those specified for the Capability Qualifying Components (CQCs);

– the range of mechanical structures for which approval is granted.

3.3.2 Application for capability approval

In order to obtain capability approval the manufacturer shall apply the rules of procedure given clause 4 of QC 001002-3.

In an application for capability approval the manufacturer shall define the boundaries of the capability for which approval is sought in accordance with 3.5.

3.3.3 Granting of capability approval

Capability approval shall be granted when the manufacturer has:

– prepared a capability manual describing the capability for which he wishes to be approved, to the satisfaction of the NSI;
– agreed with the NSI the range of CQCs, as defined in clause 4 of QC 001002-3, to be used for the assessment of capability;
– successfully demonstrated that he can design and manufacture components which satisfy the requirements of this sectional specification, within the limits of his capability;
– prepared a capability approval test report to the satisfaction of the NSI.

3.4 Description of capability

The manufacturer shall prepare a manual describing his capability (see clause 4 of QC 001002-3), in relation to the technologies involved.

The manual shall be approved by the NSI who shall ensure that it is a true and a complete record of procedures carried out by the manufacturer during the design, production, testing, inspection and release of his products. The manual is a document that shall be treated as 'commercial in confidence'.

The manual shall include the following as a minimum:

– a general introduction and description of the technologies involved;
– aspects of customer liaison including provision of design rules (if appropriate) and assistance to customers in the formulation of their requirements;
– a detailed description of the design rules to be used;
– the procedure for checking that the design rules are complied with for waveguide type dielectric resonators manufactured to a detail specification;
– a list of all materials used, with references to the corresponding purchasing specifications and goods inward inspection;
– a flow chart for the total process showing quality control points and permitted rework loops and containing references to all process and quality control procedures;
– a declaration of processes for which approval has been sought in accordance with 3.5.1;
– a declaration of boundaries for which approval has been sought in accordance with 3.5.2;
– a list of CQCs used to assess the capability, with a general description of each, supported by a detailed table showing where the declared boundaries of capability are demonstrated by a particular CQC design;
– a detail specification for each CQC. These shall be produced to the satisfaction of the NSI (see Annexes B and C).

3.5 Capability Qualifying Components (CQCs)

The manufacturer shall agree with the NSI the range of capability qualifying components, selected in accordance with the general plan (see 3.11.2) specified in the capability manual.

The CQCs shall comply with the following requirements:

a) the range of CQCs used shall cover all the processes, component types and limits of the declared capability;
b) the CQCs shall be one of the following:
   – waveguide type dielectric resonators in production;
   – test pieces designed for assessment of a process or range of processes;
   – a combination of both of these.

When CQCs are designed and produced solely for capability approval, the manufacturer shall satisfy the NSI that the same design rules, materials and manufacturing processes will be applied to released products.

The CQC specifications may refer to internal control documentation which specifies production testing and recording in order to demonstrate control and maintenance of processes and boundaries including the use of SPC procedures where appropriate.

3.5.1 Process

The CQC specifications shall include the following processes to be assessed. This list is not exclusive:

– sintering see 3.11.3.1
– deposition of electrodes (when applicable) see 3.11.3.2

3.5.2 Boundaries

CQCs shall demonstrate a set of boundaries which shall include the following:

– Temperature range see 3.11.4.2
– Ageing limits (when claimed) see 3.11.4.4
– Climatic category see 3.11.4.2
– Mechanical test severities see 3.11.4.5

This list is not exclusive. Where additional boundaries are claimed these shall be covered by one or more CQCs.

3.6 Inspection requirements for CQCs

The inspection requirements shall be contained in the CQC detail specifications together with environmental tests, measurements, severities and end point limits, where appropriate (see 3.11). Where possible the tests applied to CQCs shall be selected from Clause 4 of IEC 61338-1.

For capability approval and the subsequent maintenance of that approval, the inspection requirements shall ensure that processes and design features meet the declared capability.

3.7 Programme for capability approval

The manufacturer shall prepare a programme for the assessment of the declared capability to the satisfaction of the NSI. This programme shall be designed so that each declared boundary condition is verified by the appropriate CQC.

The programme shall contain the following:

– a bar chart or other means of showing the proposed timetable for the approval exercise;

– details of all the CQCs to be used with references to their detail specifications;
– a chart showing the features to be demonstrated by each CQC.

3.8 Capability approval report

The report shall contain the following information;

– the issue number and date of the capability approval manual;
– a programme for capability approval in accordance with 3.7;
– the test results obtained during the performance of the programme;
– the test methods used.

The report shall be signed by the Chief Inspector as a true statement of the results obtained and submitted to the NSI for approval.

3.9 Abstract of description of capability

The abstract, is intended for formal publication in QC 001005 when capability approval is granted by the National Certified Body (NCO) on the recommendation of the NSI.

It shall include a concise description of the manufacturer's capability and give sufficient information on the technologies, methods of construction, packaging and range of products for which the manufacture has been approved. The layout shall conform to Annex A of this specification indicating the boundary conditions for which approval has been granted.

3.10 Modifications likely to affect the capability approval

Any modification likely to affect the capability approval shall satisfy the requirements of Clause 4 of QC 001002-3.

3.11 Initial capability approval

The test plans given below are to be applied to appropriately selected groups of CQCs.

The test plans are in categories as follows:

a) Process CQCs
b) Boundary CQCs

The tests referred to in each test plan are defined in Table 1. These tests have been grouped to prove particular design areas covering materials, processes, resonator performance and durability.

The tests in each group shall be carried out in the given order.

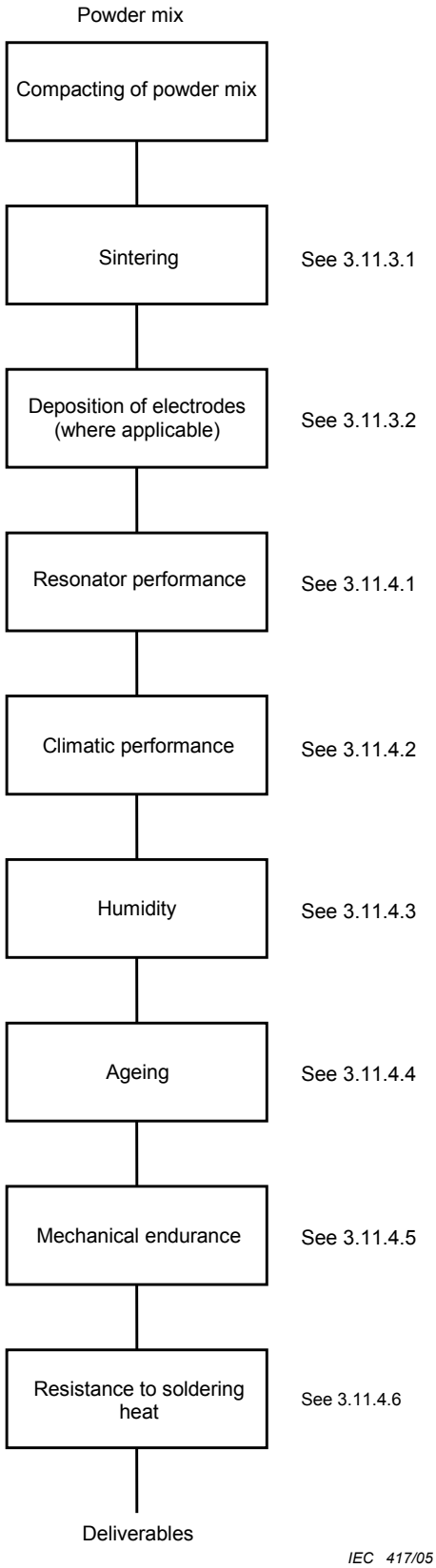
The approval is granted when the selected range of CQCs has collectively satisfied the assessment requirements of the CQC detail specifications with no non-conformances allowed.

A CQC is counted as a non-conforming CQC if it has not satisfied the whole or part of the tests of a group.

3.11.1 Procedure in the event of CQC failures

In the event of the failure of specimens to meet the test requirements, the manufacturer shall apply the procedures given in Clause 4 of QC 001002-3.

3.11.2 General plan for the selection of CQCs



NOTE Some operations may be performed in a different order from that shown.

Figure 1 – Selection of CQCs

3.11.3 Process CQC test plans

Representative types shall be selected for each material type and each type of resonator. Eight specimens for each shall be prepared and subjected to the following test groups.

3.11.3.1 Sintering

The purpose of this test is to demonstrate by inspection the quality of the compacting and sintering process that the fired part dimensions and temperature coefficient are within the design limits.

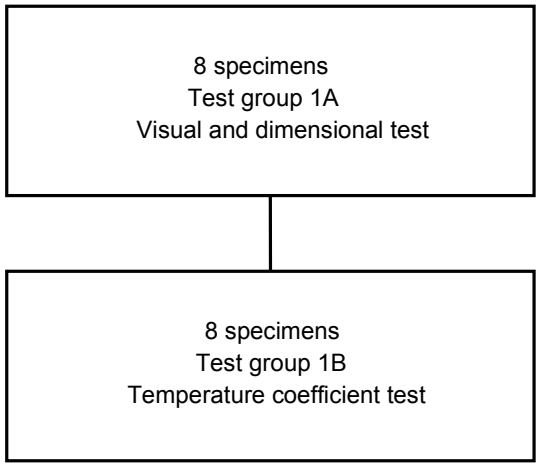


Figure 2 – Test plan for sintering process CQCs

3.11.3.2 Deposition of electrode material

The purpose of this test is to demonstrate the quality of the deposition of the electrode process by inspection of the metallization, its thickness and adhesion

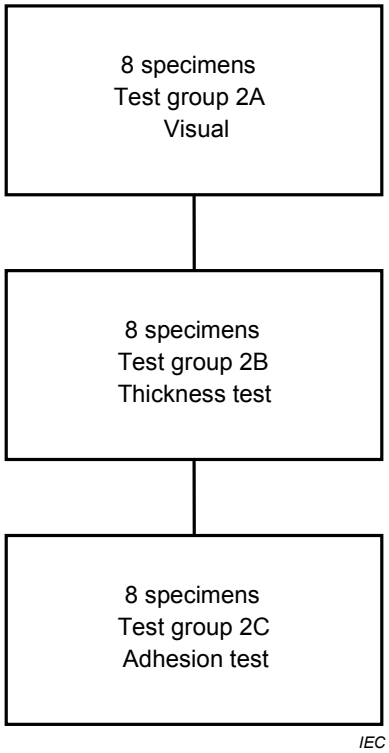


Figure 3 – Test plan for deposition of electrode material CQCs

3.11.4 Boundary CQC test plans for dielectric resonator design and performance

The purpose of these tests is to validate the design for the waveguide type dielectric resonator (representative types) with respect to its specified performance in accordance with IEC 61338-1 and customer requirements.

3.11.4.1 Resonator performance

A batch of 60 specimens shall be subject to the test plan shown in Figure 4 for initial testing. Then test group 3 shall be split into 5 different test groups containing 12 specimens each.

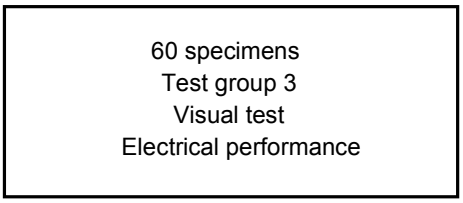


Figure 4 – Test plan for resonator performance CQCs

3.11.4.2 Climatic performance

The purpose of these tests is to demonstrate the climatic performance of the dielectric resonator. 12 specimens shall be subjected to the test plan shown in Figure 5.

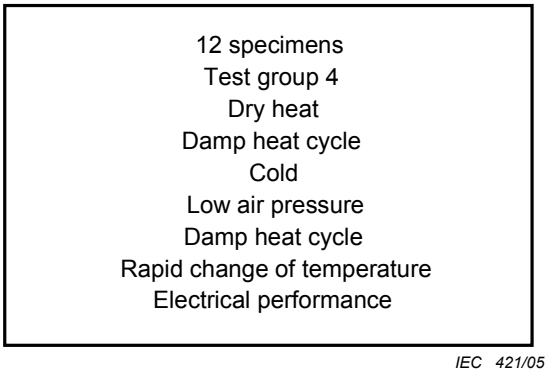


Figure 5 – Test plan for climatic performance CQCs

3.11.4.3 Humidity

The purpose of the test is to demonstrate the resistance of dielectric resonators against heat and humidity. 12 specimens shall be subjected to the test plan shown in Figure 6.

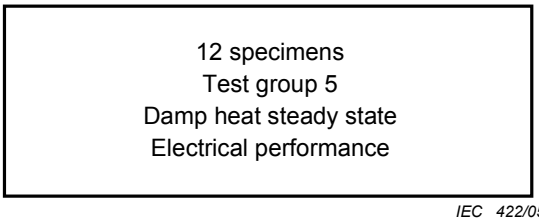


Figure 6 – Test plan for humidity CQCs

3.11.4.4 Ageing

The purpose of these tests is to demonstrate the ageing of the dielectric resonators. 12 specimens shall be subjected to the test plan shown in Figure 7.

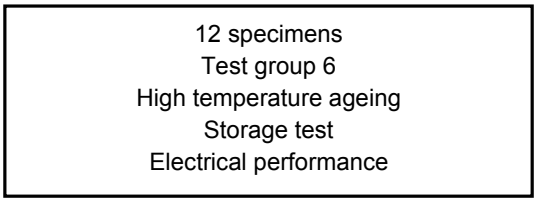


Figure 7 – Test plan for ageing CQCs

3.11.4.5 Mechanical endurance

The purpose of these tests is to demonstrate the ability of the dielectric resonator to withstand mechanical load. 12 specimens shall be subject to the test plan shown in Figure 8.

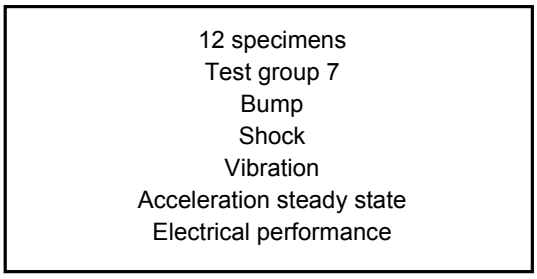


Figure 8 – Test plan for mechanical endurance CQCs

3.11.4.6 Resistance to soldering heat

The purpose of this test is to demonstrate the ability of the dielectric resonators to withstand the soldering process. 12 specimens shall be subjected to the test plan shown in Figure 9.

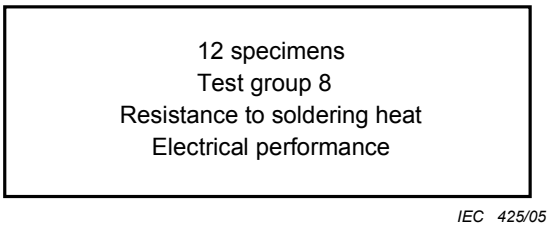


Figure 9 – Test plan for resistance to soldering heat CQCs

3.12 Maintenance of capability approval

The periodicity of testing for the maintenance of capability approval shall be as defined in Table 1 ensuring that all processes and claimed boundaries are verified at intervals except where SPC is used for control.

The manufacturer shall satisfy the NSI that the range of CQCs remains representative of the products released and in accordance with 3.5 of this specification.

CQCs taken from, or representative of current production shall be identified prior to testing.

The manufacturer shall have maintained production, so that

– the process specified in the capability manual, including any additions/deletions agreed with the NSI since initial approval remain unchanged, in accordance with Clause 4 of QC 001002-3;
– there has been no change in the place of manufacture, and final test;
– there has been no break exceeding 6 months in the manufacturer's production under capability approval.

The manufacturer shall maintain a record of the progress of the maintenance of capability programme so that at any time the capability boundaries that have been verified and those awaiting verification in the specified period can be established.

Table 1 – Periodic tests for maintenance of capability approval

CQC test plan and clause number	Test group	Periodicity	Minimum numbers of specimens for each CQC
3.11.3.1 Sintering	1A	12 weeks	8
	1B		
3.11.3.2 Deposition of electrode material	2A	12 weeks	8
	2B		
	2C		
3.11.4.1 Resonator performance	3	2 years	60
3.11.4.2 Climatic performance	4	2 years	12
3.11.4.3 Humidity	5	2 years	12
3.11.4.4 Ageing	6	2 years	12
3.11.4.5 Mechanical endurance	7	2 years	12
3.11.4.6 Resistance to soldering heat	8	2 years	12

3.13 Rework and repair work

3.13.1 Rework

Permitted rework shall be defined in the capability manual and shall be in accordance with 3.11.1 of IEC 61338-1.

3.13.2 Repair work

In accordance with 3.11.2 of IEC 61338-1 repair work is not permitted.

3.14 Quality conformance inspection

3.14.1 General

The manufacturer shall carry out all the tests and inspection requirements specified in the detail specification for the final component before delivery.

Ranges of waveguide type dielectric resonators can be covered by rules of structural similarity as set out below and may be grouped together for the purposes of sampling tests.

A lot shall consist of resonators of the same method of construction, though they may be of different physical sizes, ratings and characteristics.

Variations in the package sealing method may be aggregated for electrical characteristic tests only.

3.14.2 Custom built dielectric resonators

Inspection requirements for custom built dielectric resonators shall be as specified in the Customer Detail Specification (CDS), the content of which shall be by agreement between the manufacturer and his customer in accordance with the blank detail specification.

The manufacturer shall ensure that the requirements of the customer detail specification fall within the range of his capability approval.

3.14.3 Standard catalogue items

A manufacturer wishing to supply dielectric resonators or a range of dielectric resonators covered by his capability approval, as a standard catalogue item, shall produce a detail specification in accordance with the blank detail specification.

The manufacturer shall ensure also that the content of the detail specification complies with 2.2 of this specification.

3.15 Screening procedures

Any screening procedures offered by the manufacture shall be stated in the capability manual.

4 Test and measurement procedures

All test and measurement procedures shall be selected from Clause 4 of IEC 61338-1. If any required test is not included then it shall be defined in the relevant CQC, customer, or catalogue item detail specification.

Annex A
(normative)

Example layout of an abstract of description of capability

Certificate number

Issue

Date

Waveguide type dielectric resonators IEC 61338-1

Manufacturer

Limits of approval

Frequency range
Temperature range
Ageing limits
Climatic category
Mechanical test severities

NOTE The limits above may not all be met concurrently. Refer to manufacturer's data.

Annex B
(normative)

Layout of the front page of a CQC specification for process control

Capability approval No .....

CQC specification No .....

Issue .....

Capability manual reference No .....

Date .....

Process control monitor

Process stage

Purpose of check

Specification reference

Capability feature(s) covered by this specification

1	Drawings	Include outline and layout drawings as appropriate or list here the drawing reference numbers.
2	Verification	Include all tests, measurements or inspection requirements with acceptance criteria necessary to verify the features stated above.

Annex C
(normative)

Layout of the front page of a CQC specification to demonstrate boundary or limit

Capability approval No .....

CQC specification No .....

Issue .....

Capability manual reference No .....

Date .....

Capability qualifying component

Description

Part identity

Manufacturing drawing reference

Capability feature(s) covered by this specification

1	Drawings	Include outline and layout drawings as appropriate or list here the drawing reference numbers.
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standard is incomplete ❑
standard is too academic ❑
standard is too superficial ❑
title is misleading ❑
I made the wrong choice ❑
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quality of writing.....
technical contents.....
logic of arrangement of contents .....
tables, charts, graphs, figures.....
other .....

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English text only ❑
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