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Sealing test for pressurized waveguide tibing and assemblies

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SEALING TEST FOR PRESSURIZED WAVEGUIDE TUBING AND ASSEMBLIES

Essai d'étanchéité applicable aux guides d'ondes soumis à la pression et à leurs dispositifs d'assemblage

Dichtheitsprüfung für druckdichte Hohlleiterrohre und -Anordnungen

BODY OF THE HD

The Harmonization Document consists of:

- IEC 261 (1989) ed 2; IEC/SC 46B, not appended

This Harmonization Document was approved by CENELEC on 1990-06-01.

The English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text. The German translation is not yet available.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level by or before 1990-12-15

to publish their new harmonized national standard by or before 1991-06-15

to withdraw all conflicting national standards by or before 1991-06-15.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Essai d'étanchéité applicable aux guides d'ondes soumis à la pression et à leurs dispositifs d'assemblage

Sealing test for pressurized waveguide tubing and assemblies

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEALING TEST FOR PRESSURIZED WAVEGUIDE TUBING AND ASSEMBLIES

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 46B: Waveguides and their accessories, of IEC Technical Committee No. 46: Cables, wires, and waveguides for telecommunication equipment.

This second edition of IEC Publication 261 replaces the first edition issued in 1968.

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

Six Months' Rule	Report on Voting
46B(CO)104	46B(CO)107

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

The following IEC publications are quoted in this standard:

Publications Nos. 68-1 (1988): Environmental testing, Part 1: General and Guidance.
68-2-17 (1978): Part 2: Tests — Test Q: Sealing.

SEALING TEST FOR PRESSURIZED WAVEGUIDE TUBING AND ASSEMBLIES

1. Scope

This standard specifies uniform measuring methods for sealing tests for pressurized waveguide components and assemblies. These measuring methods are carried out with regard to quantity and quality.

2. Unit of pressure

The following SI unit of pressure is used in this standard: pascal (Pa).

Notes 1. — 1 bar = 10^5 Pa.

2. — For ease in mathematical calculations it is recommended that the SI unit kilopascal (kPa) be used.

3. — [1 psi lbf/in^2] = 6.895×10^3 Pa.

3. Test method A: Pressure drop during elapsed time (quantity test)

The leak rate and the rate of pressure loss from a sealed assembly are determined by measuring the change in the internal pressure during a test time interval.

Cautionary note. — Safety precautions shall be taken when using test methods that require a positive pressure for testing components.

3.1 *Definitions of terms and symbols*

Leak rate

The quantity of a dry gas at a given temperature that flows through a leak per unit of time and for a known difference of pressure across the leak (see IEC Publication 68-2-17).

Unit

The basic SI unit for leak rate is "pascal cubic metre per second (Pa · m^3/s)". The derived unit "Pa · cm^3/s" is used in this standard:

$$1 \text{ Pa} \times \text{m}^3/\text{s} = 10^6 \text{ Pa} \times \text{cm}^3/\text{s}$$
$$= 10 \text{ bar} \times \text{cm}^3/\text{s}.$$

Note. — During the test period, the pressure inside the component may decrease and the ambient pressure outside the waveguide may fluctuate. In all of these tests, any error due to variations in the pressure differential arising from the above effects during the testing period has been neglected.

Gauge pressure

The pressure as shown by a pressure gauge, that is the amount by which the pressure exceeds atmospheric pressure.

Standard atmospheric conditions

A temperature of 293 K (that corresponds to 20 °C), and a pressure of 101.3 kPa. (These conditions are described in IEC Publication 68-1.)

Symbols

P_0 = standard pressure (101.3 kPa)
P_1 = initial atmospheric pressure
P_2 = final atmospheric pressure
P_{e1} = initial gauge pressure
P_{e2} = final gauge pressure
$P_{1.0}$ = initial absolute pressure within the assembly, corrected to standard temperature of 293 K
$P_{2.0}$ = final absolute pressure within the assembly, corrected to standard temperature of 293 K
$P_{1.2}$ = pressure drop during test time interval, corrected to standard temperature of 293 K
T_1 = initial waveguide gas temperature (K)
T_2 = final waveguide gas temperature (K)
V = combined volume of the assembly and the pressure-measuring apparatus
LR_c = leak rate, corrected to standard temperature
t = testing time interval.

3.2 *Test procedure*

a) Pressurize the assembly with air to the specified gauge pressure and disconnect the source of air.

b) Allow sufficient time for the internal pressure to become stable and then record the gauge pressure P_{e1}, the ambient pressure P_1 and the waveguide gas temperature T_1.

c) At the end of the test time interval, record the gauge pressure P_{e2}, the ambient pressure P_2 and the waveguide gas temperature T_2.

d) Convert P_{e1} and P_{e2} to the corresponding absolute values according to the formulae:

$$P_{1.0} = (P_1 + P_{e1}) \frac{293}{T_1}$$

and

$$P_{2.0} = (P_2 + P_{e2}) \frac{293}{T_2}$$

e) Calculate the temperature-corrected pressure drop $P_{1.2}$ during the test time interval from the relation:

$$P_{1.2} = P_{1.0} - P_{2.0}$$

f) To convert pressure loss to volume of leak, use the formula:

$$LR_c = \frac{P_{1.2} \times V}{t} \quad (10^5 \text{ Pa} \times \text{dm}^3 \times \text{h}^{-1} \text{ or } 10^5 \text{ Pa} \times \text{cm}^3 \times \text{s}^{-1})$$

Example: The combined volume of a waveguide assembly and its pressure-measuring apparatus is 8.195 dm³. It is pressurized with air and the initial gauge reading is 3.44 10^5 Pa. This reading is taken when the atmospheric pressure is 93 kPa and the temperature of the waveguide is 293 K. After 24 h, the gauge pressure has dropped to 3.29 10^5 Pa, the atmospheric pressure is 96 kPa and the temperature of the waveguide is 298 K. Calculate the leak rate in 10^5 Pa × dm³/h.

$$P_{1.0} = \frac{(3.44 \times 10^5 \text{ Pa} + 0.93 \times 10^5 \text{ Pa}) \times 293 \text{ K}}{293 \text{ K}} = 4.37 \times 10^5 \text{ Pa}$$

$$P_{2.0} = \frac{(3.29 \times 10^5 \text{ Pa} + 0.96 \times 10^5 \text{ Pa}) \times 293 \text{ K}}{298 \text{ K}} = 4.18 \times 10^5 \text{ Pa}$$

$$P_{1.2} = 4.37 \times 10^5 \text{ Pa} - 4.18 \times 10^5 \text{ Pa} = 0.19 \times 10^5 \text{ Pa}$$

$$LR_c = \frac{8.195 \text{ dm}^3 \times 0.19 \times 10^5 \text{ Pa}}{24 \text{ h}} = 6.49 \times 10^{-2} \times 10^5 \text{ Pa} \times \text{dm}^3/\text{h}$$