

Non-destructive testing — Leak testing — Pressure change method

The European Standard EN 13184:2001, with the incorporation of amendment A1:2003 has the status of a British Standard

ICS 19.100

National foreword

This British Standard is the official English language version of EN 13184:2001, including amendment A1:2003. Together with BS EN 13185:2001 it supersedes BS 3636:1963 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/46, Non-destructive testing, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 May 2001

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English version

Non-destructive testing — Leak testing — Pressure change method

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(inclut l'amendement A1:2003)

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This European Standard was approved by CEN on 18 January 2001, and amendment A1 was approved by CEN on 20 November 2003.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 138, Non-destructive testing, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2001, and conflicting national standards shall be withdrawn at the latest by September 2001.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Annex A is normative, the annexes B and C are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document EN 13184:2001/A1:2003 has been prepared by Technical Committee CEN/TC 138 “Non-destructive testing”, the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 13184:2001 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This document describes the techniques for the determination of the leakage rates across the boundary of an isolated object, subjected to a pressure difference. The techniques are based on the evaluation of the change of the mass of gas within the test object. The ideal gas equation states the relationship between mass, pressure, temperature, volume of the gas contained in the internal free volume of the object. In some circumstances one or more variables may be considered constant and so the mass change can, for example, be assessed by monitoring the pressure or pressure-temperature changes within the test object.

The volume change of the object (due to pressure and temperature changes during the test) should be taken into account. In most industrial applications, however, this change is so small that it can be neglected. Therefore the main part of this standard considers the volume as a constant during the test.

The deformability of the object under test is normally to be considered in drafting of the test specification and, if test precision can be affected by a volume change, alternative formulae or some techniques of keeping the pressure constant (flow measurement) can be used.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 473, *Qualification and certification of NDT personnel — General principles*.

EN 1330-8, *Non-destructive testing — Terminology — Part 8: Terms used in leak tightness testing*.

EN 1779, *Non-destructive testing — Leak testing — Criteria for method and technique selection*.

EN 13185:2001, *Non-destructive testing — Leak testing — Tracer gas method*.

prEN 13625:2001, *Non-destructive testing — Leak test — Guide to the selection of instrumentation for the measurement of gas leakage*.

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions given in EN 1330-8 and the following apply.

3.1

differential pressure gauge

instrument measuring the difference between two pressures

4 Personnel qualification

It is assumed that leak tightness testing is performed by qualified and capable personnel. In order to prove this qualification, it is recommended to certify the personnel according to EN 473 or equivalent.

NOTE For pressure equipment see directive 97/23/EC (Annex I, paragraph 3.1.3): "For pressure equipment in categories III and IV, the personnel must be approved by a third party organization recognized by a Member State".

5 General Requirements

5.1 Safety

The design of the object under test shall be checked to ensure its integrity under the pressure differential, at the temperature of the test, having regard for the effects of the temperature increases due to ambient changes, solar heating, etc. Specific devices to prevent excessive pressure gradients may have to be provided in accordance with local safety regulations to assure that the design limits cannot be exceeded.

5.2 Feasibility

The leakage rate determines the change in the total pressure that takes place over a given period of time. Because of this, the resolution of gauges should be such that the pressure change can be determined accurately. The instrument sensitivity is related to the final reading: this sensitivity should be at minimum five to ten times higher than the pressure to be expected.

The instrument resolution has to be defined within the acceptance criteria.

5.3 Test instruments

5.3.1 Types of gauges — see prEN 13625:2001

- Vacuum gauges suitable for the test pressure range.
- Pressure gauges: Absolute or differential pressure gauges may be used. When differential pressure gauges are used, reference pressure variations shall be monitored and taken into account.
- Thermometers: Resistance thermometers are generally used for temperature measurements, but other devices may be employed.
- Hygrometer: For the measurements of the humidity or the dew point of test gas, capacitive or resistive type instruments may be used.
- Flowmeters may be of mass or volumetric types, with an integrator device.

All instruments shall have ranges, resolution, accuracy, and repeatability compatible with the acceptance criteria.

5.3.2 Location

For pressure measurement either single or a small number of sensors are normally used.

NOTE Sensors should be placed in the most appropriate position in the test object.

With large vessels or complex systems, the temperature and dew point at several positions shall be monitored since these can vary across a system, particularly if there are thermally isolated, occluded or dead volumes. Such variation shall be taken into account in the calculations.

Dials and indicating/recording devices shall be readily accessible to the operator.

In long-term tests, an appropriate number of sensors shall be used so that the failure of one or more sensors will not invalidate the test.

5.4 Auxiliary equipment

Auxiliary equipment used in the performance of the test includes:

- compressors or vacuum pump systems;
- pressure regulators, dryers, tight chambers;
- valves, vent lines, safety devices against overpressure or high vacuum.

6 Calibration

All the instruments shall be calibrated against devices that are traceable to national standards.

7 Pressure decay technique — See EN 1779, technique D.1

7.1 Application

This method is applicable to test objects or systems that can withstand an internal overpressure without deformation or significant variation of the volume. The internal free volume shall be known, unless the leakage rate is specified as a rate of pressure fall within the pressure involved.

If the test is carried out under conditions different from those characteristics of normal operation (different operating fluids, different pressure), this shall be taken into account in the test procedures and in the test acceptance limits.

7.2 Working principle

The object under test is subjected to a positive differential pressure (either by pressurization or by placing it in a vacuum chamber). The pressure source is then isolated and, after a suitable temperature stabilization time, the pressure and the temperature reading (dew point readings if required) are recorded at regular intervals.

Two techniques may be used.

7.2.1 Absolute technique

The indicated pressure is the absolute pressure.

7.2.2 Reference vessel technique

The pressure within the test object is compared to the pressure inside a reference object. The latter may be a sealed volume located within the test object, of such a geometry that it can assume the temperature of the atmosphere of the object. The reference volume shall have a pressure slightly lower than the object and shall be tested for tightness before and after the test; its temperature shall also be recorded.

7.3 Free volume measurement

The internal free volume of the object shall be accurately assessed if the leakage rate is to be stated as a mass flow.

Volume can be estimated, for example, from several measurements of a significant pressure fall over a short given time caused by a measured leakage rate through a valve. The volume can be estimated from the average value of the pressure drop and the total gas lost.