BRITISH STANDARD

BS EN
50015:1998

Electrical apparatus for potentially explosive atmospheres — Oil immersion “o”

The European Standard EN 50015:1988 has the status of a British Standard

ICS 29.260.20

National foreword

This British Standard is the English language version of EN 50015:1998. This standard supersedes BS EN 50015:1994 which remains current.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for explosive atmospheres, to Subcommittee GEL/31/17, Pressurization and other techniques, 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 subcommittee can be obtained on request to its secretary.

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 5 and a back cover.

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EUROPEAN STANDARD

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Descriptors: Electrical apparatus, potentially explosive atmosphere, explosive atmosphere, explosion proofing, specific requirement, oil immersion "o"

English version

Electrical apparatus for potentially explosive atmospheres — Oil immersion "o"

Matériel électrique pour atmosphères explosibles — Immersion dans l'huile "o"

Elektrische Betriebsmittel für explosionsgefährdete Bereiche Ölkapselung "o"

This European Standard was approved by CENELEC on 1998-08-01.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 31, Electrical apparatus for explosive atmospheres — General Requirements.

It consists of the text of EN 50015:1994 and a draft amendment to this second edition which was submitted to the unique acceptance procedure and received a positive vote. The second edition and the amendment have been combined to form an "editorial" third edition which was approved by CENELEC on 1998-08-01.

This European Standard was prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and supports the essential health and safety requirements of EC Directive 94/9/EC.

This European Standard is to be read in conjunction with EN 50014:1997 Electrical apparatus for potentially explosive atmospheres — General requirements, and with the European Standards for the specific types of protection listed in the scope of EN 50014:1997. This European Standard should not be considered in conjunction with any editions of these standards and their amendments published before 1997.

The following dates were fixed:

— latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-06-01

— latest date by which the national standards conflicting with the EN have to be withdrawn (dow) —

Contents

1 Scope

1.1 This European Standard specifies the requirements for the construction and testing of oil-immersed electrical apparatus, oil-immersed parts of electrical apparatus and Ex components in the type of protection "o", intended for use in potentially explosive atmospheres of gas, vapour and mist.

Potentially explosive atmospheres include the presence of combustible dusts.

This European Standard covers Category 2G and Category M2 only.

1.2 This European Standard supplements EN 50014, in so far that it applies to oil-immersed electrical apparatus.

1.3 This European Standard is applicable to electrical apparatus and parts of electrical apparatus which are not ignition capable in normal operation. Conformity of the electrical apparatus shall be assessed against IEC 60079-15 except for those parts designed to conform to EN 50020.

NOTE This European Standard assumes that the electrical apparatus immersed in the protective liquid is fixed in its operating position in accordance with the installation instructions.

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 50014, *Electrical apparatus for potentially explosive atmospheres — General requirements.*

EN 50019, *Electrical apparatus for potentially explosive atmospheres — Increased safety "e".*

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i".*

EN 60156, *Method for the determination of the electric strength of insulating oils.*
(IEC 60156:1995)

EN 60529:1991, *Degree of protection provided by enclosures (IP code).*
(IEC 60529:1989)

HD 565 S1:1993, *Specifications for silicone liquids for electrical purposes.*
(IEC 60836:1988)

IEC 60079-15:1987, *Electrical apparatus for explosive gas atmospheres — Part 15: Electrical apparatus with type of protection "n".*

IEC 60247:1978, *Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids.*

IEC 60296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

IEC 60588-2:1978, *Askarels for transformers and capacitors — Part 2: Test methods.*

ISO 2719:1988, *Petroleum products and lubricants — Determination of Flash Point Pensky-Martens closed cup method.*

ISO 3016:1974, *Petroleum Oils — Determination of pour point.*

ISO 3104:1976, *Petroleum Products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity.*

3 Definitions and symbols

The following definitions in EN 50014:1997 apply to this standard: **3.27**, **3.29**, **3.31**.

The following definitions specific to the type of protection oil immersion "o" are applicable in this European Standard. They supplement the definitions which are given in EN 50014.

3.1 oil immersion "o"

type of protection in which the electrical apparatus or parts of the electrical apparatus are immersed in a protective liquid in such a way that an explosive atmosphere which may be above the liquid or outside the enclosure cannot be ignited

3.2 protective liquid

mineral oil conforming to IEC 60296 or an alternative liquid meeting the requirements of **4.1**

3.3 sealed apparatus

apparatus designed and constructed in such a manner as to prevent ingress of an external atmosphere during the expansion and contraction of the internally contained liquid during normal operation

3.4 non-sealed apparatus

apparatus designed and constructed in such a manner as to allow the ingress and egress of an external atmosphere during the expansion and contraction of the internally contained fluid during normal operation

3.5 maximum permissible protective liquid level

maximum level the protective liquid can attain in normal service, taking into account the effects of expansion from the worst case filling condition specified by the manufacturer to the condition of full load at maximum ambient temperature for which the apparatus is designed

3.6 minimum permissible protective liquid level

minimum level the protective liquid can attain in normal service taking into account the effects of contraction from the worst case filling condition to the condition of de-energization at minimum ambient temperature

4 Constructional requirements

4.1 Protective liquid other than mineral oil conforming to IEC 60296 shall comply with the following specific requirements.

a) The protective liquid shall have a fire point of 300 °C (minimum) as determined by the test method indicated in HD 565 S1 (IEC 60836).

b) The protective liquid shall have a flash point (closed) of 200 °C (minimum) determined in accordance with ISO 2719.

c) The protective liquid shall have a kinematic viscosity of 100 cSt (maximum) at 25 °C determined in accordance with ISO 3104.

d) The protective liquid shall have an electrical breakdown strength of 27 kV (minimum) determined in accordance with EN 60156.

In the case of silicone liquids HD 565 S1 (IEC 60836) shall be used.

e) The protective liquid shall have a volume resistivity at 25 °C of 10^{14} ohm.cm (minimum) determined in accordance with IEC 60247.

f) The pour point shall be −30 °C (maximum) determined in accordance with ISO 3016.

g) The acidity (neutralization value) shall be 0,03 mg KOH/g (maximum) determined in accordance with IEC 60588-2.

NOTE The reference to IEC 60588-2 identifies a test method only; it does not allow the use of substances prohibited by legislation.

h) The protective liquid shall have no adverse effect on the properties of materials with which it is in contact.

The manufacturer shall provide data to confirm conformity to the above.

4.2 For Group I apparatus, mineral oils are not acceptable.

4.3 The apparatus shall be constructed so that deterioration of the protective liquid by dust or humidity from the exterior is prevented by the following means.

4.3.1 Apparatus which is sealed shall be provided with a pressure relief device. This device shall be set and sealed by the manufacturer of the liquid filled apparatus to operate at least at 1,1 times the pressure above the liquid level at the maximum permissible protective liquid level.

4.3.2 Apparatus which is not sealed shall be constructed so that gas or vapour which may evolve from the protective liquid in normal service can readily escape. A breathing device complete with suitable drying agent shall be provided. The manufacturer shall specify the maintenance requirements for the drying agent. The testing station is not required to verify the suitability of the drying agent nor its maintenance.

4.3.3 The apparatus shall have a degree of protection of at least IP66 as given in EN 60529 with no ingress of water.

The outlet of the breathing device for non-sealed apparatus and the outlet of the pressure relief device for sealed apparatus shall have a degree of protection of at least IP23 as given in EN 60529.

4.4 Means shall be provided to guard against accidental loosening of external and internal fasteners, as well as of devices to indicate the liquid level, plugs and other parts for filling or draining the liquid.

Examples of means to guard against accidental loosening are:

— cementing of threads;

— locking washers;

— wiring of bolt heads.

A warning label is not considered sufficient.

4.5 A protective liquid level indicating device(s) complying with the requirements of **4.5.1** to **4.5.3** shall be provided so that the liquid level of each separate liquid filled compartment can be easily checked in service.

4.5.1 The maximum and the minimum protective liquid levels permissible in normal service shall be clearly marked, taking into account the effects of expansion and contraction resulting from operational temperature changes over the full ambient temperature range specified by the manufacturer.

4.5.2 The protective liquid level indicating device shall be so marked to indicate the levels to which the electrical apparatus shall be filled under the filling temperature conditions specified by the manufacturer. Alternatively an adjacent label shall be provided which fully specifies the filling conditions.

4.5.3 The construction shall be such that, unless the manufacturer can demonstrate that in normal service leakage from the indicating device will not occur, the minimum possible filling level of the protective liquid cannot fall beneath the level necessary to comply with **4.7** taking into account the effects of expansion and contraction resulting from operational temperature changes over the full ambient temperature range specified by the manufacturer.

4.5.4 The manufacturer shall provide data to show that transparent parts will retain their mechanical and optical properties when in contact with the protective liquid.

4.5.5 For non-sealed apparatus, a dipstick may be used, provided that in normal operation the dipstick is secured in its measurement position and that the requirements of **4.3** with regard to ingress protection are maintained. An adjacent label shall be provided, requiring the dipstick to be replaced after use.

4.6 The lower of the two temperatures specified in **4.6.1** and **4.6.2** shall not be exceeded.

4.6.1 The temperature at the free surface of the protective liquid shall not exceed a value equal to 25 K less than the stated minimum flash point (closed) for the protective liquid used.

4.6.2 The temperature at the free surface of the protective liquid or at any point on the surface of the electrical apparatus to which a potentially explosive atmosphere has access shall not exceed the limit specified in EN 50014, for the specified temperature class.

4.7 With the exception of conductors meeting the clearance and creepage distance requirements of EN 50019, or forming part of a circuit complying with the safety requirements of EN 50020, live parts of electrical apparatus shall be immersed to a depth of not less than 25 mm below the surface of the protective liquid, at the minimum possible liquid level.

Apparatus, components and conductors not complying with the above requirement shall have a type of protection specified in EN 50014, **1.2**.

4.8 Any possibility of the protective liquid being lost by capillary or siphon action shall be prevented.

4.9 Devices for draining the liquid shall be provided with an effective sealing device and shall be secured by fastener (s) that are shrouded or secured against unauthorized removal.

4.10 Covers of sealed enclosures may be continuously welded to the enclosure, or sealed by means of a gasket in which case the cover shall be provided with fasteners that are shrouded or secured against unauthorized removal.

4.11 Non-sealed enclosures shall be provided with an oil expansion facility and be equipped with a protective device which is only resettable manually and which automatically causes interruption of the supply current if there is an internal fault in the liquid-filled enclosure such as would create evolution of gas from the protective liquid.

5 Type tests

5.1 Overpressure test on sealed enclosures

A pressure equal to 1,5 times the pressure relief device setting shall be applied internally with the enclosure filled with the protective liquid to at least the maximum permissible protective liquid level. The period of application of the pressure shall be at least 60 s. The pressure relief device entry shall be sealed for the duration of the test.

The test shall be considered satisfactory if, at the end of the test, the enclosure has suffered neither damage nor permanent distortion which adversely affects its ability to comply with **4.3.3**.

5.2 Reduced pressure test on sealed enclosures

The internal pressure of the enclosure without protective liquid shall be reduced by an amount equivalent to not less than the change in the protective liquid level from at least the maximum permissible level to the minimum permissible level when appropriately corrected for any ambient temperature variations.

At the end of 24 h any increase in pressure shall not exceed 5 %.

5.3 Overpressure test on unsealed enclosures

A pressure equal to 1,5 times atmospheric pressure, with the breather sealed, shall be applied internally with the enclosure filled with liquid to at least maximum protective liquid level. The period of application shall be at least 60 s.

The test shall be considered satisfactory if, at the end of the test, the enclosure has suffered neither damage nor permanent distortion which adversely affects its ability to comply with **4.3.3**.

6 Routine tests

6.1 Each sealed enclosure shall be subjected to both of the following tests in sequence:

a) the overpressure test described in **5.1**. This routine test may be omitted for welded enclosures, if during type testing, the apparatus complies with the acceptance criteria in **5.1** using four times the prescribed pressure (i.e. six times the pressure relief device setting).

b) the test described in **5.2** or an equivalent, accelerated test using a lower pressure proposed by the manufacturer. In the latter case the manufacturer shall prove that his test will achieve the same threshold value of leakage as in the 24 h test.

6.2 Each unsealed enclosure shall be subjected to the test specified in **5.3**. This routine test may be omitted for welded enclosures, if during type test, the apparatus complies with the acceptance criteria in **5.3** using four times the prescribed pressure (i.e. 6 bar).

7 Marking

The marking shall be in accordance with EN 50014:1997 except for **27.2**a) and **27.2**b) and shall include the following additional information:

a) the protective liquid to be used;

b) the pressure relief device setting where appropriate.

NOTE In some countries further information giving for instance the net calorific value and fire point of the protective liquid may be necessary before the equipment can be used.

8 Instructions

Clause **28** of EN 50014 applies.

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