

BS 148:2009



BSI Standards Publication

Reclaimed mineral insulating oil for transformers and switchgear – Specification

bsi.

...making excellence a habit.
AVA Documents™
Document Sharing Hub

Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© BSI 2009

ISBN 978 0 580 59225 6

ICS 29.040.10

The following BSI references relate to the work on this standard:

Committee reference GEL/10

Draft for comment 08/30167496 DC

Publication history

First published April 1923

First revision May 1927

Second revision April 1933

Third revision January 1951

Fourth revision April 1959

Fifth revision December 1972

Sixth revision September 1984

Seventh revision October 1997

Eighth revision July 1998

Ninth (latest) revision February 2009

Amendments issued since publication

Date	Text affected
------	---------------

Contents

Foreword *ii*

1	Scope	1
2	Normative references	1
3	Terms and definitions	2
4	Identification and delivery	3
5	Sampling	3
6	Properties of the oils	3
7	Test methods	4

Annexes

Annex A (normative) Analysis method for determination of passivators in mineral oils by high performance liquid chromatography (HPLC) **8**

Bibliography **16**

List of figures

Figure A.1 – UV spectra of TTAA and BTA **13**

List of tables

Table 1 – Uninhibited mineral insulating oils	6
Table 2 – Inhibited mineral insulating oils	7
Table A.1 – Examples of separation condition	12
Table A.2 – Repeatability	15
Table A.3 – Reproducibility	15

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 16, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 28 February 2009. It was prepared by Technical Committee GEL/10, *Fluids for electrotechnical applications*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 148:1998, which is withdrawn.

BS 148:1998 was the specification for unused and reclaimed mineral insulating oil for transformers and switchgear. The specification for unused mineral insulating oil is now covered in BS EN 60296. Due to the continued market requirement for reclaimed oil to an agreed specification, BS 148 is now dedicated to reclaimed mineral insulating oil only.

Information about this document

The limits given in this standard are based on BS EN 60296. For ease of cross-reference, the clause numbering of this standard follows that of BS EN 60296 as far as possible. This standard differs from BS EN 60296 in specifying limits for total furans. The increasing use of total furfural/furans measurements as an in-service diagnostic tool has brought about the necessity to impose limits on reclaimed oil, which is continued in this edition.

This standard acknowledges UK practice whereby the limiting values for reclaimed mineral insulating oils are based on those for unused mineral insulating oils for transformers and switchgear while having due regard for the variability of used oil feedstock from which reclaimed oil will be produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies requirements for reclaimed oxidation inhibited and uninhibited mineral insulating oils, as delivered, for use in transformers, switchgear and similar electrical equipment in which oil is required as an insulant or for heat transfer.

Oils with and without additives are within the scope of this standard. This standard does not differentiate between the methods used to reclaim used mineral insulating oil; thus it is also applicable to oils having undergone a re-refining process.

This standard does not apply to mineral insulating oils used as impregnates in cables or capacitors, or to hydrocarbon insulating liquids obtained by synthesis.

NOTE 1 Oils conforming to the requirements of this standard, and containing no additives, are considered to be compatible with one another and can be mixed in any proportion. This does not necessarily apply to oils containing additives, and where the user wishes to mix such oils a check should be made to ensure that the mixture conforms to the requirements of this standard.

NOTE 2 Reclaimed mineral insulating oil is produced by the processing, to a greater or lesser extent, of service degraded used mineral insulating oil. Such oil will have been originally supplied in compliance with either BS 148:1998 (or earlier editions) or BS EN 60296. Due to the variability of service conditions and the changes in original specification since the first edition of BS 148, reclaimers may reserve the right to reject used oil if it is considered unsuitable as a feedstock to produce a reclaimed oil in accordance with this specification.

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.

BS 2000-15, *Methods of test for petroleum and its products – Part 15: Petroleum products – Determination of pour point*

BS 5263, *Method for sampling liquid dielectrics*

BS 5984, *Method for detection and determination of specified anti-oxidant additives in insulating oils*

BS EN 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method*

BS EN 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity*

BS EN 60814, *Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration*

BS EN 61125, *Unused hydrocarbon-based insulating liquids – Test methods for evaluating the oxidation stability*

BS EN 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds*

BS EN 61619, *Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography*

BS EN 62021-1, *Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration*

BS EN 62021-2, *Insulating liquids – Determination of acidity – Part 2: Colourimetric titration*

BS EN 62535, *Method for detection of potentially corrosive sulfur in used and unused mineral insulating oils¹⁾*

BS EN ISO 2719, *Determination of flash point – Pensky-Martens closed cup method*

BS EN ISO 3104, *Methods of test for petroleum and its products – Part 71: Section 1: Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

BS EN ISO 3675, *Methods of test for petroleum and its products – BS 2000-160: Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method*

IEC 60475, *Method for sampling liquid dielectrics*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

- 3.1 additive**
substance deliberately added to an insulating liquid in small proportion in order to improve certain characteristics
- 3.2 anti-oxidant**
additive incorporated in an insulating liquid to reduce or delay its degradation by oxidation
- 3.3 inhibited oil**
mineral insulating oil which contains an anti-oxidant
- 3.4 passivator**
additive incorporated in an insulating liquid to reduce the chemical reactivity of metallic surfaces within oil-filled equipment
- 3.5 passivated oil**
mineral insulating oil which contains a passivator
- 3.6 pour point depressant**
additive that enables the pour point of a mineral insulating oil to be lowered
- 3.7 reclaimed oil**
mineral insulating oil used in electrical equipment which has been subjected to chemical and/or physical processing to eliminate soluble and insoluble contaminants
- 3.8 reconditioned oil**
mineral insulating oil used in electrical equipment which has been subjected to physical processing to remove contaminants

¹⁾ In preparation.

3.9 re-refined oil

mineral insulating oil used in electrical equipment which has been subjected to extensive chemical and/or physical processing, similar to that used for the initial production of such oils, to eliminate soluble and insoluble contaminants

3.10 uninhibited oil

mineral insulating oil containing no added anti-oxidant but which may contain other additives

3.11 unused oil

mineral insulating oil which has not been used in, or been in contact with, electrical equipment or other equipment not required for manufacture, storage or transport

4 Identification and delivery

4.1 Road or rail tank wagons and drums used for the delivery of oil shall be specially cleaned for this purpose.

4.2 Oil drums and containers of oil samples shipped by the oil supplier shall carry at least the following markings:

- a) supplier's designation;
- b) number and date of this British Standard, i.e. BS 148:2009 ²⁾.

4.3 Each oil delivery shall be covered by a document from the supplier stating at least the following:

- a) supplier's designation;
- b) function and generic nature of any additive present;
- c) that the oil conforms to BS 148:2009.

4.4 Health and safety information, in line with current legislation, shall be available to the purchaser.

5 Sampling

Sampling shall be carried out in accordance with BS 5263.

NOTE As a general rule, oil samples should be taken where the oil is presumed to be more contaminated, e.g. at the lowest point of the container; however, contaminants at the surface or in the body of the oil should not be overlooked.

6 Properties of the oils

Uninhibited and inhibited oils shall be in accordance with the limiting values specified in Table 1 and Table 2, respectively, when tested in accordance with Clause 7.

²⁾ Marking BS 148:2009 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity, which might also be desirable.