

Insulating liquids — Methods for counting and sizing particles

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National foreword

This British Standard is the UK implementation of EN 60970:2007, incorporating corrigendum January 2008. It is identical with IEC 60970:2007.

The UK participation in its preparation was entrusted to Technical Committee GEL/10, Fluids for electrotechnical applications.

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

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

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Date	Comments
30 June 2008	Implementation of CENELEC corrigendum January 2008, deletion of Note in Bibliography

English version

**Insulating liquids -
Methods for counting and sizing particles
(IEC 60970:2007)**

Isolants liquides -
Méthodes de détermination du nombre
et de la taille des particules
(CEI 60970:2007)

Isolierflüssigkeiten -
Verfahren zur Bestimmung der Anzahl
und Größen von Teilchen
(IEC 60970:2007)

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CENELEC

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

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Foreword

The text of document 10/695/FDIS, future edition 2 of IEC 60970, prepared by IEC TC 10, Fluids for electrotechnical applications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60970 on 2007-08-01.

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) | 2008-05-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2010-08-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60970:2007 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

The first edition of this standard was published in 1989, and confirmed in 1996. The present edition has been found necessary for consistency with the new ISO 4406:1999, in which calibration procedures for automated particles counters have been changed from ACFTD standard to ISO-MTD standard. Specific procedures for sample preparation are described in more detail when automated particle counters are used. Results and ISO Code reporting are consistent with ISO 4406:1999 standard. Repeatability and reproducibility data are reported.

It has been demonstrated that particle contamination of insulating liquids used in electrical equipment have been responsible for major faults [1]¹. Particle analysis is recommended (as complementary test) by IEC 60422[3] for power transformers with nominal voltage above 170 kV[2].

Particle counting and sizing is usually carried out using automated counters; the calibration standard for these counters was changed in 1999. The ISO reporting code has also been changed from a two-figure to a three-figure code. This code gives information on three classes of cumulative counting: particles/ml with $\varnothing > 4 \mu\text{m}$, particles/ml with $\varnothing > 6 \mu\text{m}$, particles/ml with $\varnothing > 14 \mu\text{m}$. Particle analysis with automated particle counters has been thoroughly investigated to verify factors influencing the results and to optimize the analysis procedure. Reference figures for repeatability and Reproducibility are reported, for particle counting and for ISO Class.

Annex A provides information about sampling with syringes. Annex B reports a reference for ISO MTD calibration procedure.

¹ Figures in square brackets refer to the bibliography.

INSULATING LIQUIDS – METHODS FOR COUNTING AND SIZING PARTICLES

1 Scope

This standard describes the sampling procedures and methods for the determination of particle concentration and size distribution.

Three methods are specified. One uses an automatic particle size analyser, working on the light interruption principle. The other two use an optical microscope, in either the transmitted light or incident light mode, to count particles collected on the surface of a membrane filter. The optical microscope methods are described in ISO 4407.

All three methods are applicable to both used and unused insulating liquids.

Annex A contains an alternative sampling procedure using a syringe and Annex B reports a reference for the calibration of automatic particle counters.

NOTE 1 The methods are not intended to measure particulate matter in liquids containing sludge. While analysing solid content on oils containing sludge refers to method for sediment and sludge determination in IEC 60422, Annex C.

NOTE 2 The methods specified are only applicable to measurements related to a limited range of size and number.

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 60475: *Method of sampling liquid dielectrics*

ISO 4406: *Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles*

ISO 4407: *Hydraulic fluid power – Fluid contamination – Determination of particulate contamination by the counting method using an optical microscope*

ISO 5884: *Aerospace – Fluid systems and components – Methods for sampling and measuring the solid particle contamination of hydraulic fluids*

EN 50353: *Insulating oil – Determination of fibre contamination by the counting method using a microscope*

3 General caution, health, safety and environmental protection

This International Standard does not purport to address all the safety problems associated with its use. It is the responsibility of the user of the standard to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

The insulating liquids which are the subject of this standard should be handled with due regard to personal hygiene. Direct contact with the eyes may cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out