

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Classification of insulating liquids

Classification des liquides isolants

ITU STANDARD PREVIEW  
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IEC 61039:2008

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## CLASSIFICATION OF INSULATING LIQUIDS

## FOREWORD

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International Standard IEC 61039 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications.

This second edition cancels and replaces the first edition, published in 1990, and constitutes a technical revision.

The main change with regard to the previous edition concerns the updating of the classification of insulating liquids, taking into account the largest number possible of substances that have, or may have, possible application in electrical components.

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

FDIS	Report on voting
10/741/FDIS	10/747/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
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## INTRODUCTION

### Health and safety

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 eyes may cause slight irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice sought.

Some of the tests specified in this standard involve the use of processes that could lead to a hazardous situation. Attention is drawn to the relevant standard for guidance.

### Environment

This standard involves insulating liquids, chemicals and used sample containers. The disposal of these items should be carried out in accordance with current national legislation with regard to the impact on the environment. Every precaution should be taken to prevent the release into the environment of the insulating liquids.

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## CLASSIFICATION OF INSULATING LIQUIDS

### 1 Scope

This International Standard establishes the detailed classification of the N family (insulating liquids) that belongs to class L (lubricants, industrial oils and related products) in accordance with ISO 8681 and ISO 6743-99, affecting product categories that include products derived from petroleum processing, synthetic chemical products and synthetic and natural esters.

### 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/TS 60076-14:2004, *Power transformers – Part 14: Design and application of liquid-immersed power transformers using high-temperature insulation materials*

IEC 60296:2003, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60465:1988, *Specification for unused insulating mineral oils for cables with oil ducts*

IEC 60836:2005, *Specifications for unused silicone insulating liquids for electrotechnical purposes*  
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IEC 60867:1993, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 60963:1988, *Specification for unused polybutenes*

IEC 61099:1992, *Specifications for unused synthetic organic esters for electrical purposes*

ISO 1928:1995, *Solid mineral fuels – Determination of gross calorific value by the bomb calorimetric method, and calculation of net calorific value*

ISO 2592:2000, *Determination of flash and fire points – Cleveland open cup method*

ISO 6743-99:2002, *Lubricants, industrial oils and related products (class L) – Classification – Part 99: General*

ISO 8681:1986, *Petroleum products and lubricants – Method of classification - Definition of classes*

OECD 301:1992, *OECD guideline for testing of chemicals – Ready biodegradability*

ASTM D240-02, *Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter*



### 3 ISO classification system

ISO 8681 sets out the main rules of the classification system that applies to petroleum products, lubricants and related products.

ISO 8681 suggests, as far as possible, to choose the application field as the main principle for the classification of petroleum products, lubricants, and related products. It also suggests classifying on the basis of the product typology, e.g. fuels are classified first of all on the basis of typology and secondly on the basis of end use.

The ISO classification principle is based on the allocation of a code consisting of letters and numbers for the main classes and categories of petroleum products.

The complete nomination consists of:

- the initials “ISO”;
- the class of the petroleum product or related product, indicated by a letter (see Table 1), which has to be clearly separated from the other symbols;
- the category, indicated by a group of letters ranging from 1 to 4, the first one always identifying the family to which it belongs and the others assuming a meaning, appropriately explained in the reference standard, which depends on the particular category of concerned products;
- (optional) some numbers, which can be added, to complete the nomination and that have a meaning appropriately explained in the reference standard for that particular category of products.

In compliance with ISO 8681, the code should have the following general form:

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ISO CLASS – CATEGORY – (eventual) NUMBERS –  
<http://standards.iteh.ai/standards/iec-61039-2008-d5795220b202/iec-61039-2008>

or the short form:

CLASS – CATEGORY – (eventual) NUMBERS

### 4 Classification of insulating liquids

In accordance with ISO 8681, the classification system indicates the products with a nomination that includes:

- the abbreviation “ISO”;
- the class of the petroleum products or related products is indicated by a letter that in this standard has the meaning defined in Table 1;
- the category is indicated by four letters whose meaning is explained in 4.2;
- a seven-figure number that makes up the identification code (described in 4.3).

#### 4.1 Class classification

The class of petroleum products or related products is indicated by a letter having the meaning reported in Table 1.

**Table 1 – Class classification of petroleum products or related products**

Class	Indication
F	Fuels
S	Solvents and raw materials for chemical industry
L	Lubricants, industrial oils and related products
W	Waxes
B	Bitumen

In accordance with the ISO/IEC agreement, the insulating liquids belong to class L “lubricants, industrial oils and related products”.

## 4.2 Category classification

The four letters identify the category, with the following meaning:

### First letter

The first letter, which identifies the insulating liquid family, will be N: Electrical insulation (Table 1, ISO 6743-99:2002).

### Second letter

The second letter identifies the main application field as follows:

- **C** capacitors;
- **T** transformers and switching equipment;
- **S** switching equipment operating at temperature lower than  $-10\text{ °C}$ ;
- **Y** cables.

NOTE 1 In order to provide an indication of fire behaviour of insulating liquids, and also wishing to benefit from the experience gained by CT 14 of CENELEC, the following parameters have been added as well as the classifications “fire point” and “low heat value”. These employ the same classification criteria as the ones used for IEC 61100:1992.

### Third letter

The third letter identifies the eventual presence of antioxidant additives, defined as follows:

- **U** if no additives are present;
- **T** if additives are present in trace (% wt.  $< 0,08$ );
- **I** if additives are present (percentage  $> 0,08$  % wt).

### Fourth letter

The fourth letter identifies the fire point (fire point: ISO 2592:2000) as follows:

- **O** if the fire point is  $\leq 300\text{ °C}$ ;
- **K** if the fire point is  $> 300\text{ °C}$ ;
- **L** if the fire point of the liquid is not detectable.

NOTE 2 IEC TC10 usually adopts ISO 2719:2002 in order to measure the flash point using the Pensky-Martens methodology (closed cup). If the value of the flash point determined by this method is  $< 250\text{ °C}$ , then the product is classified with the letter “O”; if the flash point is  $> 250\text{ °C}$ , then the product is classified with the letter “K”, and, if there is no detectable flash point, the product is classified with the letter “L”.

## 4.3 Identifying code

To complete the nomination, a seven-figure number is added, with the following meaning:

**First three figures**

The first three figures correspond to the last three numbers of the code that identifies the eventual IEC reference standard, using number 000 in case the IEC reference standard is missing.

**Fourth figure**

The fourth figure identifies the eventual IEC sub-classification, using number 0 if there is no sub-classification.

**Fifth figure**

The fifth figure identifies the low heat value (ASTM D240-02) as follows:

- **1** if the low heat value is  $\geq 42$  MJ/kg;
- **2** if the low heat value is  $< 42$  MJ/kg;
- **3** if the low heat value is  $< 32$  MJ/kg.

**Sixth figure**

The sixth figure identifies the eventual “lowest cold start energizing temperature” (LCSET), defined as follows:

- **0** if LCSET is not prescribed;
- **1** if LCSET is  $\geq 0$  °C;
- **2** if  $0 > \text{LCSET} \geq -10$  °C;
- **3** if  $-10 > \text{LCSET} \geq -30$  °C;
- **4** if  $-30 > \text{LCSET} \geq -40$  °C.

**Seventh figure**

The seventh figure identifies the biodegradability of the insulating liquid, according to OECD 301:1992, *method C or F*, defined as follows:

- **0** if liquid is not biodegradable; (ThOD removed  $\leq 20$  %)
- **1** if liquid is slightly biodegradable; (40 %  $\geq$  ThOD removed  $> 20$  %)
- **2** if liquid is well biodegradable; (70 %  $\geq$  ThOD removed  $> 40$  %)
- **3** if liquid is fully biodegradable. (ThOD removed  $> 70$  %)

Table 2 depicts some examples of classification for different insulating liquids.