IEC 61039

Edition 3.0 2025-02
COMMENTED VERSION

INTERNATIONAL STANDARD

Classification of insulating liquids

IEC 61039:2025-02 CMV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CLASSIFICATION OF INSULATING LIQUIDS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
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This commented version (CMV) of the official standard IEC 61039:2025 edition 3.0 allows the user to identify the changes made to the previous IEC 61039:2008 edition 2.0. Furthermore, comments from IEC TC 10 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

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

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

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a) updating of the classification of insulating liquids, taking into account the largest number possible of substances that have, or may have, a possible application in electrical components.

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WARNING – Health and safety

This document does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this document 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 document should be handled with due regard to personal hygiene. Direct contact with eyes ~~may~~ can 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 document involve the use of processes that could lead to a hazardous situation. Attention is drawn to the relevant standard for guidance.

WARNING – Environment

This document involves insulating liquids, chemicals and used sample containers. The disposal of these items ~~should~~ can be ~~carried out in accordance with current national legislation~~ subject to regulatory requirements with regard to their impact on the environment.

All insulating liquids that float on water are generally a water hazard, as they reduce oxygen ingress into the water. No liquid, regardless of its classification, can be freely spilled in the environment. The handling of insulating liquids can be subject to regulatory requirements with regard to their impact on the environment **1**. Every precaution should be taken to prevent the release of insulating liquids into the environment.

CLASSIFICATION OF INSULATING LIQUIDS

1 Scope

This document 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.

This document applies to unused liquids. For liquids in service, additional testing can be required to ensure compliance with this document. **2**

2 Normative references **3**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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~~ electrical equipment*

~~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*~~

~~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~~, *Petroleum and related products – 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 guidelines for testing of chemicals – Ready biodegradability*

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses: **4**

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 ISO classification system

ISO 8681 sets out the main rules of the classification system that applies to petroleum products, lubricants and related products. This document sets out the classification method which can be used for electrical insulating liquids.

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, for example 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~~ shall be clearly separated from the other symbols;
– the category, indicated by a group of four 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:

ISO – CLASS – CATEGORY –~~ (eventual)~~ NUMBERS (if applicable)

or the short form:

CLASS – CATEGORY –~~ (eventual)~~ NUMBERS (if applicable)

5 Classification of electrical insulating liquids 5

5.1 General

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 indicated by a letter that in this document has the meaning defined in Table 1;
– the category indicated by four letters whose meaning is explained in 5.3;
– a seven-~~figure~~digit number that makes up the identification code (described in 5.4).

5.2 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~~ ISO 6743-99:2002, the electrical insulating liquids belong to class L "lubricants, industrial oils and related products".

5.3 Category classification

In the case where the specific classification of insulating liquids is described in the corresponding standard, it shall have priority over the classification given in this document. For example, for mineral oils, IEC 60296 shall be applied. 6

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 (ISO 6743-99:2002, Table 1).

- 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 °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, if applicable. Liquids may contain different antioxidants and different levels of antioxidants. Check with corresponding liquid standards **7**. The third letter is defined as:

– U if no antioxidant additives are present;

~~– T if additives are present in trace (% wt. < 0,08);~~

– I if antioxidant additives are present ~~(percentage > 0,08 % wt).~~

NOTE 2 In this document Classification I also encompasses category T according to IEC 60296.

- Fourth letter

The fourth letter identifies the fire point as determined in accordance with ISO 2592. At the time of writing of this document, liquids falling into category L are being phased out from use. There is no IEC International Standard covering such liquids. **8**

– O if the fire point is ~~≤~~ < 300 °C;

– K if the fire point is ~~></~~ ≥ 300 °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 °C, then the product is classified with the letter "O"; if the flash point is > 250 °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".~~

5.4 Identifying code

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

- First three ~~figures~~ digits

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

- Fourth ~~figure~~ digit

The fourth ~~figure~~ digit identifies the ~~eventual~~ IEC sub-classification, if applicable, using number 0 if there is no sub-classification. Examples of sub-classifications occur with IEC 60867 (aromatic hydrocarbons, Table 2 of this document, rows 5, 6, 7) and IEC 63012 (modified and blended esters, Table 2 of this document, row 12). See Table 2 for reference. **9**

- Fifth ~~figure~~ digit

The fifth ~~figure~~ digit identifies the net calorific value as determined in accordance with ASTM D240 (also known as the low heat value), as follows:

– 1 if the low heat value is ≥ 42 MJ/kg;

– 2 if the low heat value is < 42 MJ/kg and ≥ 32 MJ/Kg;

– 3 if the low heat value is < 32 MJ/kg.

- Sixth ~~figure~~ digit

The sixth ~~figure~~ digit identifies the ~~eventual~~ "lowest cold start energizing temperature" (LCSET) defined as follows.

The information below is based largely on IEC 60296: **10**

– 0 if LCSET is not ~~prescribed~~ known;

– 1 if LCSET is ≥ 0 °C;

– 2 if 0 °C > LCSET ≥ −10 °C;

– 3 if −10 °C > LCSET ≥ −30 °C;

– 4 if −30 °C > LCSET ≥ −40 °C.

- Seventh ~~figure~~ digit

The seventh ~~figure~~ digit identifies the biodegradability of the insulating liquid, according to OECD 301:~~1992~~ methods B, C or F, defined as follows.

Note different methods may give different results.

– 0 if liquid is not biodegradable~~; (ThOD removed ≤ 20 %)~~

– 1 if liquid is ~~slightly~~ inherently biodegradable; ~~(40 % ≥ ThOD removed > 20 %)~~

– 2 if liquid is ~~well~~ readily biodegradable~~; (70 % ≥ ThOD removed > 40 %)~~. **11**

~~3 if liquid is fully biodegradable. (ThOD removed > 70 %)~~

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

Note that the disposal of these items can be subject to regulatory requirements with regard to their impact on the environment. Refer to the environmental warning in the introduction. **12**

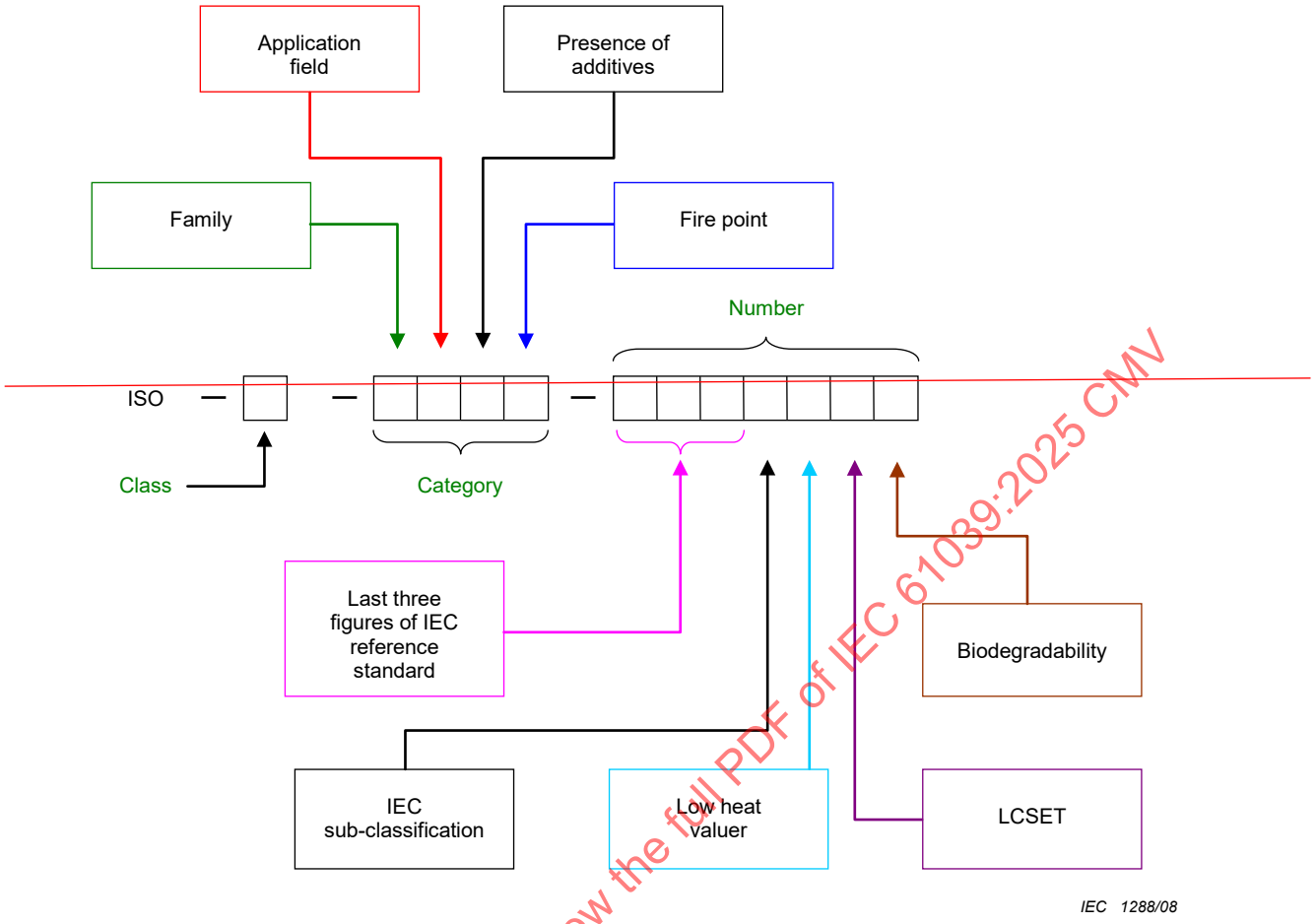
Table 2 – Examples of classification for different insulating liquids

Example	Class	Category	Type of the insulating liquid					Comments~~/ examples~~
			IEC standard identification	IEC sub-classification	Low heat value (ASTM D240-02)	LCSET (°C)	Bio-degradability	
1	L	NTUO	296	–	43 MJ/kg	−7	~~Slight~~ Inherent **13**	Mineral insulating oil for transformers with ~~combustion~~ fire point equal to 200 °C, low heat value (net calorific value) equal to 43 MJ/kg, non-inhibited, with LCSET = −7 °C L-NTUO-2960121
2	L	~~NTTK~~ NTIK	296	–	43 MJ/kg	−7	~~Slight~~ Inherent	Mineral insulating oil for transformers with ~~combustion~~ fire point equal to ~~350~~ < 300 °C, low heat value equal to 43 MJ/kg, inhibited in trace, with LCSET = −7 °C L-~~NTTK~~NTIO-2960121
3	L	NTIO	296	–	43 MJ/kg	−7	~~Slight~~ Inherent	Mineral insulating oil for transformers with ~~combustion~~ fire point equal to 200 °C, low heat value equal to 43 MJ/kg, inhibited, with LCSET = −7 °C L-NTIO-2960121
4	L	NSIO	296	–	43 MJ/kg	−30	~~Slight~~ Inherent	Mineral insulating oil for switching equipment operating at low temperature with ~~combustion~~ fire point equal to 200 °C low heat value equal to 43 MJ/kg, inhibited, with LCSET = −30 °C L-NSIO-2960131
5	L	NYUO	867	1	43 MJ/kg	–	~~Slight~~ Inherent	IEC sheet 1 of IEC 60867 alkyl benzene: for cables, uninhibited, fire point < 300 °C L-NYUO-8671101

Example	Class	Category	Type of the insulating liquid					Comments~~/ examples~~
			IEC standard identification	IEC sub-classification	Low heat value (ASTM D240-02)	LCSET (°C)	Bio-degradability	
6	L	NCUO	867	2	43 MJ/kg	–	~~Slight~~ Inherent	~~IEC sheet 2, alkyl bibenzyl:~~ IEC sheet 2, of IEC 60867, alkyldiphenylethanes: for capacitors, uninhibited, fire point < 300 °C, LCSET not defined L-NCUO-~~867211018672101~~
7	L	NCUO	867	3	43 MJ/kg	–	~~Slight~~ Inherent	~~IEC sheet 3, alkyl naphthalene~~ IEC sheet 3, of IEC 60867, methylpolyarylmethanes uninhibited, for capacitors, fire point < 300 °C, LCSET not defined L-NCUO-~~867311018673101~~
8	L	NTUK	836	–	< 32 MJ/kg	≤ −40	Not biodegradable	IEC 60836 – unused silicone liquids for transformers, uninhibited, fire point > 300 °C L-NTUK-~~83603008360340~~
9 14	L	NTIK	099	–	> 42 MJ/Kg	–	Readily biodegradable	Synthetic ester with fire point > 300 °C for transformers, L-NTIK-0990102
10	L	NTIO	012	–	< 42 MJ/Kg	–	Readily biodegradable	Synthetic ester with fire point < 300 °C, inhibited L-NTIO-0120202
11	L	NTIK	770	–	< 42 MJ/Kg	–	Readily biodegradable	Natural ester with fire point > 300 °C, inhibited L-NTIK-7700202
12	L	NTIO	012	_	< 42 MJ/Kg	–	Readily biodegradable	Modified ester for transformers with fire point < 300 °C, inhibited, no defined LCSET L-NTIO0120202

6 Summarizing outline

Figure 1 summarizes how to build up a code for classifying an insulating liquid.



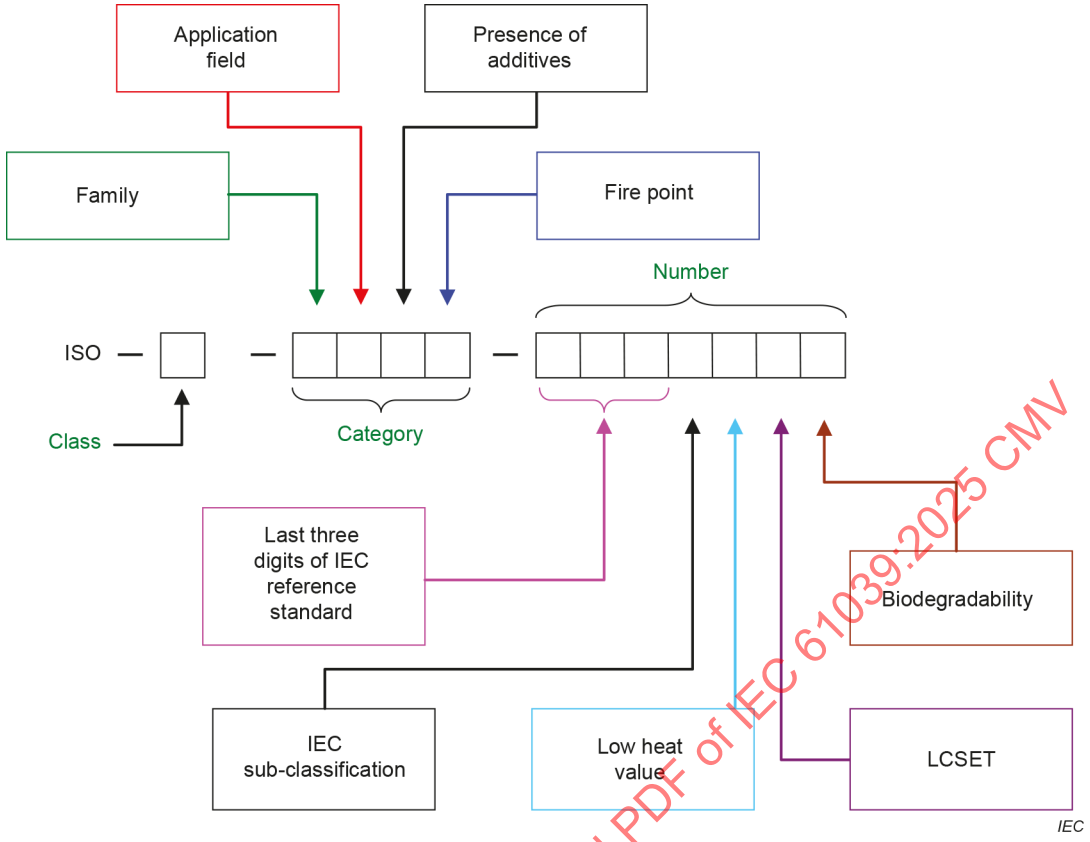


Figure 1 – Meaning of all the letters and digits present in the classification of insulating liquids

Bibliography 15

~~IEC 61100 :1992, *Classification of insulating liquids according to fire-point and net calorific value*~~

IEC 60836, *Specifications for unused silicone insulating liquids for electrotechnical purposes*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 61099, *Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes*

IEC 62770, *Fluids for electrotechnical applications – Unused natural esters for transformers and similar electrical equipment*

IEC 63012, *Insulating liquids – Unused modified or blended esters for electrotechnical applications*

~~ISO 2719:2002, *Determination of flash point – Pensky-Martens closed cup method*~~

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

List of comments

1 Additional wording is inserted to alert the reader of the latest environmental position on oils that float on water, which most electrical insulating liquids do.

2 Wording is added to remind the reader that the standard only applies to unused liquids.

3 The normative references list is updated since the previous edition of this standard.

4 Web addresses for terms and definitions reference documents are added for clarity.

5 The heading of this chapter reminds the reader that the section applies to electrical insulating liquids.

6 Statement is added to remind the reader that specific classifications given in fluid specific standards (e.g. IEC 60296 for mineral oils) take precedent over classifications derived from this standard.

7 Wording is added to remind the reader that different manufacturers of a type of liquid may use different types and concentrations of antioxidants in their liquids, even if the liquids fall into the same type, e.g. synthetic esters.

8 Wording is added to advise that category L liquids (e.g. PCB) are being phased out of use.

9 Wording is added to explain sub-classes.

10 Wording is added to explain where LCSET information comes from.

11 Biodegradable terms are aligned with OECD terminology.

12 Wording is added to underline the importance of proper liquid disposal.

13 Biodegradation category is aligned with OECD terminology.

14 Examples 9 to 12 are added for clarity in categorizing non mineral oils.

15 The bibliography list is updated since the previous edition of this standard.

IEC 61039

Edition 3.0 2025-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Classification of insulating liquids

Classification des liquides isolants

IEC 61039:2025-02(en-fr)

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No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 ISO classification system

ISO 8681 sets out the main rules of the classification system that applies to petroleum products, lubricants and related products. This document sets out the classification method which can be used for electrical insulating liquids.

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, for example 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 shall be clearly separated from the other symbols;
– the category, indicated by a group of four letters, 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:

ISO – CLASS – CATEGORY –NUMBERS (if applicable)

or the short form:

CLASS – CATEGORY –NUMBERS (if applicable)

5 Classification of electrical insulating liquids

5.1 General

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 indicated by a letter that in this document has the meaning defined in Table 1;
– the category indicated by four letters whose meaning is explained in 5.3;
– a seven-digit number that makes up the identification code (described in 5.4).

5.2 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 ISO 6743-99:2002, the electrical insulating liquids belong to class L "lubricants, industrial oils and related products".

5.3 Category classification

In the case where the specific classification of insulating liquids is described in the corresponding standard, it shall have priority over the classification given in this document. For example, for mineral oils, IEC 60296 shall be applied.

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 (ISO 6743-99:2002, Table 1).

- 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 °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".

- Third letter

The third letter identifies the presence of antioxidant additives, if applicable. Liquids may contain different antioxidants and different levels of antioxidants. Check with corresponding liquid standards. The third letter is defined as:

– U if no antioxidant additives are present;
– I if antioxidant additives are present.

NOTE 2 In this document Classification I also encompasses category T according to IEC 60296.

- Fourth letter

The fourth letter identifies the fire point as determined in accordance with ISO 2592. At the time of writing of this document, liquids falling into category L are being phased out from use. There is no IEC International Standard covering such liquids.

– O if the fire point is < 300 °C;
– K if the fire point is ≥ 300 °C;
– L if the fire point of the liquid is not detectable.

5.4 Identifying code

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

- First three digits

The first three digits correspond to the last three digits of the IEC reference standard identifier, if applicable, using number 000 in the case where the IEC reference standard is missing.

- Fourth digit

The fourth digit identifies the IEC sub-classification, if applicable, using number 0 if there is no sub-classification. Examples of sub-classifications occur with IEC 60867 (aromatic hydrocarbons, Table 2 of this document, rows 5, 6, 7) and IEC 63012 (modified and blended esters, Table 2 of this document, row 12). See Table 2 for reference.

- Fifth digit

The fifth digit identifies the net calorific value as determined in accordance with ASTM D240 (also known as the low heat value), as follows:

– 1 if the low heat value is ≥ 42 MJ/kg;
– 2 if the low heat value is < 42 MJ/kg and ≥ 32 MJ/Kg;
– 3 if the low heat value is < 32 MJ/kg.

- Sixth digit

The sixth digit identifies the "lowest cold start energizing temperature" (LCSET) defined as follows.

The information below is based largely on IEC 60296:

– 0 if LCSET is not known;
– 1 if LCSET is ≥ 0 °C;
– 2 if 0 °C > LCSET ≥ −10 °C;
– 3 if −10 °C > LCSET ≥ −30 °C;
– 4 if −30 °C > LCSET ≥ −40 °C.

- Seventh digit

The seventh digit identifies the biodegradability of the insulating liquid, according to OECD 301: methods B, C or F, defined as follows.

Note different methods may give different results.

– 0 if liquid is not biodegradable
– 1 if liquid is inherently biodegradable;
– 2 if liquid is readily biodegradable.

Note that the disposal of these items can be subject to regulatory requirements with regard to their impact on the environment. Refer to the environmental warning in the introduction.

Table 2 – Examples of classification for different insulating liquids

Example	Class	Category	Type of the insulating liquid					Comments
			IEC standard identification	IEC sub-classification	Low heat value (ASTM D240-02)	LCSET (°C)	Bio-degradability	
1	L	NTUO	296	–	43 MJ/kg	−7	Inherent	Mineral insulating oil for transformers with fire point equal to 200 °C, low heat value (net calorific value) equal to 43 MJ/kg, non-inhibited, with LCSET = −7 °C L-NTUO-2960121
2	L	NTIK	296	–	43 MJ/kg	−7	Inherent	Mineral insulating oil for transformers with fire point equal to < 300 °C, low heat value equal to 43 MJ/kg, inhibited in trace, with LCSET = −7 °C L-NTIO-2960121
3	L	NTIO	296	–	43 MJ/kg	−7	Inherent	Mineral insulating oil for transformers with fire point equal to 200 °C, low heat value equal to 43 MJ/kg, inhibited, with LCSET = −7 °C L-NTIO-2960121
4	L	NSIO	296	–	43 MJ/kg	−30	Inherent	Mineral insulating oil for switching equipment operating at low temperature with fire point equal to 200 °C low heat value equal to 43 MJ/kg, inhibited, with LCSET = −30 °C L-NSIO-2960131
5	L	NYUO	867	1	43 MJ/kg	–	Inherent	IEC sheet 1 of IEC 60867 alkyl benzene: for cables, uninhibited, fire point < 300 °C L-NYUO-8671101
6	L	NCUO	867	2	43 MJ/kg	–	Inherent	IEC sheet 2, of IEC 60867, alkyldiphenylethanes: for capacitors, uninhibited, fire point < 300 °C, LCSET not defined L-NCUO-8672101
7	L	NCUO	867	3	43 MJ/kg	–	Inherent	IEC sheet 3, of IEC 60867, methylpolyarylmethanes uninhibited, for capacitors, fire point < 300 °C, LCSET not defined L-NCUO-8673101
8	L	NTUK	836	–	< 32 MJ/kg	≤ −40	Not biodegradable	IEC 60836 – unused silicone liquids for transformers, uninhibited, fire point > 300 °C L-NTUK-8360340
9	L	NTIK	099	–	> 42 MJ/Kg	–	Readily biodegradable	Synthetic ester with fire point > 300 °C for transformers, L-NTIK-0990102
10	L	NTIO	012	–	< 42 MJ/Kg	–	Readily biodegradable	Synthetic ester with fire point < 300 °C, inhibited L-NTIO-0120202
11	L	NTIK	770	–	< 42 MJ/Kg	–	Readily biodegradable	Natural ester with fire point > 300 °C, inhibited L-NTIK-7700202
12	L	NTIO	012	_	< 42 MJ/Kg	–	Readily biodegradable	Modified ester for transformers with fire point < 300 °C, inhibited, no defined LCSET L-NTIO0120202

6 Summarizing outline

Figure 1 summarizes how to build up a code for classifying an insulating liquid.

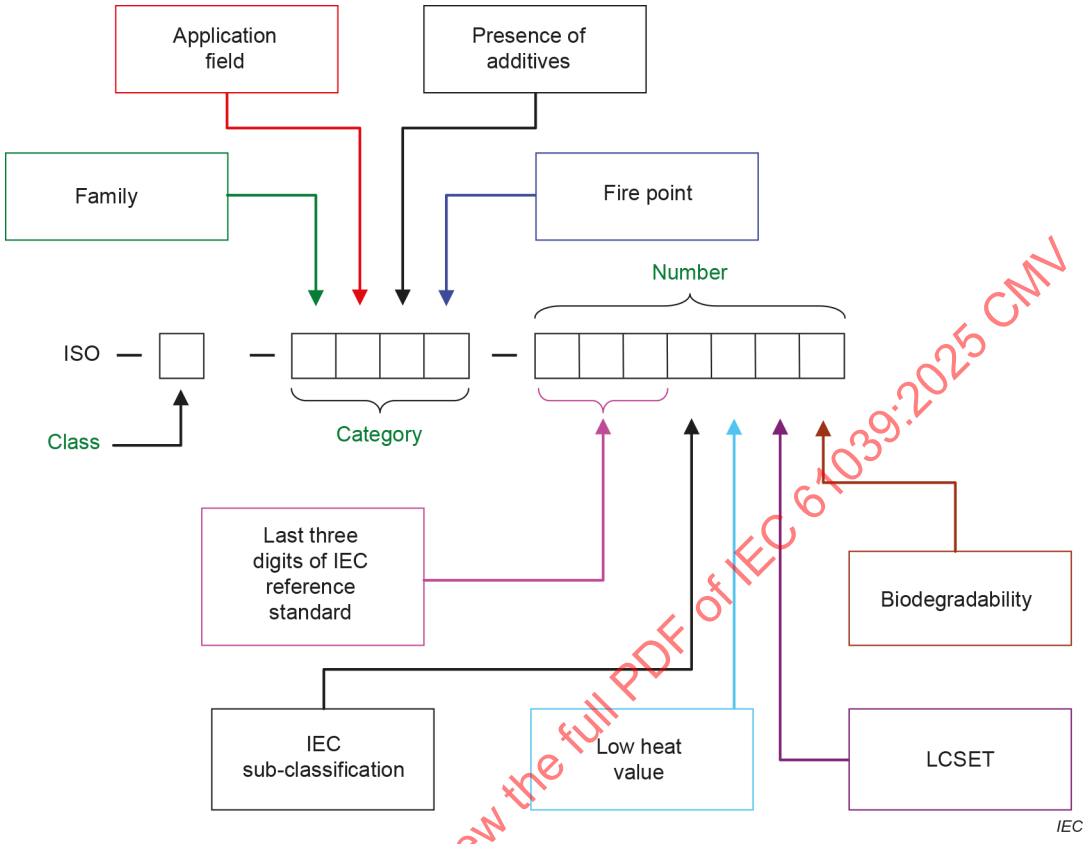

Figure 1 – Meaning of all the letters and digits present in the classification of insulating liquids

Bibliography

IEC 60836, *Specifications for unused silicone insulating liquids for electrotechnical purposes*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 61099, *Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes*

IEC 62770, *Fluids for electrotechnical applications – Unused natural esters for transformers and similar electrical equipment*

IEC 63012, *Insulating liquids – Unused modified or blended esters for electrotechnical applications*

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

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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CLASSIFICATION DES LIQUIDES ISOLANTS

AVANT-PROPOS

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L'IEC 61039 a été établie par le comité d'études 10 de l'IEC: Fluides pour applications électrotechniques. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2008. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) mise à jour de la classification des liquides isolants, en tenant compte d'un nombre maximal de substances qui ont, ou peuvent avoir, des applications possibles dans les composants électriques.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
10/1249/FDIS	10/1258/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

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- reconduit,
- supprimé, ou
- révisé.

INTRODUCTION

AVERTISSEMENT – Hygiène et sécurité

Le présent document ne vise pas à répondre à tous les problèmes de sécurité associés à son utilisation. Il incombe à l'utilisateur du présent document de mettre en place les pratiques d'hygiène et de sécurité adéquates, et de vérifier avant utilisation si des contraintes réglementaires s'appliquent.

Il convient de manipuler les liquides isolants dont traite le présent document en respectant l'hygiène personnelle. Un contact direct avec les yeux peut provoquer une légère irritation. En cas de contact oculaire, il est recommandé de laver abondamment à l'eau courante propre, et de consulter un médecin.

Certains des essais spécifiés dans le présent document impliquent des opérations qui peuvent conduire à une situation dangereuse. L'attention est attirée sur la norme à consulter pour obtenir des recommandations.

AVERTISSEMENT – Environnement

Le présent document concerne les liquides isolants, les produits chimiques et les récipients d'échantillons usagés. L'élimination de ces éléments peut être soumise à des exigences réglementaires en lien avec leur impact sur l'environnement.

Tous les liquides isolants qui flottent sur l'eau constituent généralement un danger dans la mesure où ils réduisent la pénétration de l'oxygène dans l'eau. Aucun liquide, quelle que soit sa classification, ne peut être déversé librement dans l'environnement. La manipulation des liquides isolants peut être soumise à des exigences réglementaires en lien avec leur impact sur l'environnement. Il convient de prendre des précautions pour éviter de rejeter des liquides isolants dans l’environnement.