

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Explosive atmospheres –
Part 6: Equipment protection by liquid immersion "o"**

**Atmosphères explosives –
Partie 6: Protection du matériel par immersion dans le liquide "o"**

[IEC 60079-6:2015](#)

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NORME INTERNATIONALE



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CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Constructional requirements	9
4.1 General.....	9
4.2 Levels of protection and requirements of electrical equipment.....	9
4.2.1 Level of Protection.....	9
4.2.2 Requirements for Level of Protection “ob”	9
4.2.3 Requirements for Level of Protection “oc”	10
4.3 Switching device	10
4.4 Creepage and clearance	10
4.5 Liquid containment enclosures	10
4.5.1 General	10
4.5.2 Sealed enclosures	10
4.5.3 Unsealed enclosures	11
4.5.4 Outlet of breathing device or pressure relief device	11
4.5.5 Enclosures intended to be opened	11
4.5.6 Determination of the maximum/minimum criteria of the protective liquid.....	11
4.6 Immersion depth	11
4.7 Protective liquid level indication	12
4.7.1 General	12
4.7.2 Remote-indicating protective liquid level indicator.....	12
4.7.3 Safety devices for Level of Protection “ob”	13
4.8 Temperature limitations	13
4.8.1 General	13
4.8.2 Maximum Surface Temperature	13
4.8.3 Flashpoint of the protective liquid	13
4.9 Field wiring connections to liquid immersion equipment	13
4.10 Constructional elements of enclosures	13
4.10.1 Operating rods, shafts etc.....	13
4.10.2 Devices for draining of liquid.....	13
5 Protective Liquid.....	14
5.1 Protective liquid specification.....	14
5.2 Detailed alternative specification.....	14
5.3 Group I equipment	14
5.4 Liquid contamination and gassing that may result from arcing.....	14
5.5 Total volume of the protective liquid.....	14
6 Verifications and tests	15
6.1 Type tests	15
6.1.1 Overpressure test on sealed enclosures	15
6.1.2 Reduced pressure test on sealed enclosures	15
6.1.3 Overpressure test on unsealed enclosures	15
6.1.4 Maximum temperature	15
6.1.5 Switching Tests	15
6.2 Routine tests.....	16

6.2.1	Sealed enclosures	16
6.2.2	Unsealed enclosures	16
7	Marking	16
8	Instructions	17
	Annex A (normative) Selection and erection requirements	18
	Annex B (normative) Maintenance requirements	19
	Annex C (normative) Repair and Overhaul requirements	20
	Annex D (normative) Supplementary requirements for electrical equipment with Level of Protection "oc" for voltages greater than 15 kV and up to and including 245 kV	21
	Bibliography	24
	Table 1 – Working voltage	10
	Table 2 – Depth of immersion	12
	Table B.1 – Inspection requirements	19

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EXPLOSIVE ATMOSPHERES –**Part 6: Equipment protection by liquid immersion "o"**

FOREWORD

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This consolidated version of the official IEC Standard and its amendment(s) has been prepared for user convenience.

IEC 60079-6 edition 4.1 contains the fourth edition (2015-02) [documents 31/1157/FDIS and 31/1172/RVD] and its amendment 1 (2020-02) [documents 31/1517/FDIS and 31/1526/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60079-6 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This fourth edition constitutes a technical revision.

The significant changes with respect to the previous edition are listed below:

- Edition 4 represents a major technical revision of the requirements for oil immersion “o” and should be considered as introducing all new requirements. The normal “Table of Significant Changes” has not been included for this reason. In particular:
 - The requirements for oil immersion “o” have been redefined into liquid immersion , levels of protection “ob” and “oc” as recommended by the responses to 31/715/DC
 - The ability to protect sparking contacts has been added to both “ob” and “oc”
- Additional requirements have been introduced for the protective liquid.

This part of IEC 60079 is to be used in conjunction with IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*.

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

A list of all parts in the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability 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

- reconfirmed,
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EXPLOSIVE ATMOSPHERES –

Part 6: Equipment protection by liquid immersion "o"

1 Scope

This part of IEC 60079 specifies the requirements for the design, construction, testing and marking of Ex Equipment and Ex Components with type of protection liquid immersion "o" intended for use in explosive gas atmospheres.

Ex Equipment and Ex Components of type of protection liquid immersion "o" are either:

- Level of Protection "ob" (EPL "Mb" or "Gb")
- Level of Protection "oc" (EPL "Gc")

For Level of Protection "ob", this standard applies where the rated voltage does not exceed 11 kV r.m.s. a.c. or d.c.

For Level of Protection "oc", this standard applies where the rated voltage does not exceed 15 kV r.m.s. a.c. or d.c.

Additionally, for Level of Protection "oc", Annex D applies where the rated voltage exceeds 15 kV AC RMS or DC and up to 245 kV AC RMS or DC.

Annex D applies specifically to liquid immersed transformers and reactors, and other liquid immersed equipment such as swivels for off-shore platforms, power regulators, tap changers and earthing/switching resistors.

~~NOTE—Requirements for higher voltages are under consideration.~~

This standard supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of this standard takes precedence.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60071 (all parts), *Insulation co-ordination*

IEC 60076-3, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60079-0, *Explosive Atmospheres – Part 0: Equipment – General requirements*

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*

IEC 60079-2, *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure "p"*

IEC 60079-33, *Explosive atmospheres – Part 33: Equipment protection by special protection 's'*

IEC 60137, *Insulated bushings for alternating voltages above 1000 V*

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

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

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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

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

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

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

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

IEC 62535, *Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oil*

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

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

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

ISO 3016, *Petroleum oils – Determination of pour point*

ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 and the following apply.

3.1

liquid immersion "o"

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

3.2**protective liquid**

liquid which prevents the explosive atmosphere from making direct contact with potential ignition sources

3.3**sealed equipment**

equipment 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, for example, by means of an expansion vessel

3.4**non-sealed equipment**

equipment 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 that 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 equipment is designed

3.6**minimum permissible protective liquid level**

minimum level that 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

3.7**disconnecter**

mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements

Note 1 to entry: A disconnecter is capable of opening and closing a circuit when either negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the poles of the disconnecter occurs. It is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short circuit.

[SOURCE: IEC 60050-441:1984, 441-14-05]

3.8**switching device**

device designed to make or break the current in one or more electric circuits

[SOURCE: IEC 60050-441:1984, 441-14-01]

3.9**safety device**

device intended for use inside or outside explosive atmospheres but required for or contributing to the safe functioning of equipment and protective systems with respect to the risks of explosion

3.10**tap selector**

device designed to carry, but not to make or break current, used in conjunction with a diverter switch to select tapping connections

[SOURCE: IEC 60050-421:1990, 421-11-02]

3.11

oil-immersed swivel for HV connections

oil filled equipment to transfer power with coupling between two parts enabling one to revolve and the other to remain stationary (fixed)

3.12

oil-immersed earthing resistor

equipment intended for system neutral earthing

3.13

oil-immersed switching resistor

equipment intended for inrush current limitation

4 Constructional requirements

4.1 General

For Type of Protection “liquid immersion “o”, the Ex Equipment or parts of the Ex Equipment are immersed in a protective liquid in such a way that an explosive gas atmosphere, which may be above the liquid or outside the enclosure, cannot be ignited.

The Ex Equipment is constructed to ensure that the necessary amount of protective liquid is present. Dependent on the intended Equipment Protection Level, this is achieved by monitoring device(s), indicator(s) or a level control safety device with automatic switch off.

NOTE In accordance with the requirements for all electrical equipment given in IEC 60079-0, it is assumed that the relevant industrial requirements have been applied. The requirements of the IEC 60079 series of standards supplement those industrial requirements.

4.2 Levels of protection and requirements of electrical equipment

4.2.1 Level of Protection

Electrical equipment with liquid immersion “o” shall be either:

- a) Level of Protection “ob” (EPL Gb or Mb); or
- b) Level of Protection “oc” (EPL Gc).

The requirements of this standard shall apply to all levels of protection unless otherwise stated.

4.2.2 Requirements for Level of Protection “ob”

Electrical circuits and components, when liquid immersed in accordance with this standard, are considered to be not ignition capable in normal operation and during expected malfunctions, and shall be assigned a Level of Protection “ob” (EPL Gb or Mb).

A liquid level indication according to 4.7 is required.

Switching devices protected by liquid immersion level of protection “ob” shall comply with the following additional requirements:

- a) When a sealed enclosure is employed, the enclosure shall comply with the overpressure test in 6.1.1 using four times the prescribed pressure.
- b) Electrical equipment containing switching devices operated in the protective liquid, rated at 2 kVA per contact or less, are permitted without further test. Where the switching device is rated above 2 kVA per contact, neither pressure increases nor excessive decomposition products shall invalidate the type of protection as demonstrated by tests in accordance with 6.1.5.

- c) The equipment shall be suitable for a prospective short circuit current of 32 kA unless marked with a lower value.

Disconnectors and manual tap selectors, above 1 000 V, shall be lockable and provided with a warning according to 7 i). In addition, information on their use shall be included in the instructions.

4.2.3 Requirements for Level of Protection “oc”

Electrical circuits and components, when liquid immersed in accordance with this standard, are considered to be not ignition capable in normal operation or in the case of regular expected occurrences, and shall be assigned a Level of Protection “oc” (EPL Gc).

Ex Equipment containing switching devices operated in the protective liquid, rated at 10 kVA per contact or less, are permitted without further test. For switching devices rated above 10 kVA per contact, neither pressure increases nor excessive decomposition products shall invalidate the type of protection as demonstrated by tests in accordance with 6.1.5.

4.3 Switching device

Switching devices are only permitted for a.c. circuits where the working voltage of the switch does not exceed the values given in Table 1. Switching devices for d.c. circuits are not permitted.

Table 1 – Working voltage

Level of Protection	“ob”	“oc”
Working voltage of switching device	1 000 V r.m.s. a.c.	6,6 kV r.m.s. a.c.

4.4 Creepage and clearance

Electrical circuits and components intended to be immersed in the protective liquid shall meet the relevant industrial requirements for creepage and clearance distances in air before being immersed in the protective liquid. If the relevant industrial standard gives options for pollution degree, pollution degree 2 shall be assumed.

4.5 Liquid containment enclosures

4.5.1 General

The chemical resistance against the protective liquid shall be documented by the manufacturer.

NOTE It is not a requirement of this standard that conformity to the chemical resistance against the protective liquid be verified.

The enclosures shall be subjected to the type tests as specified in Clause 6 for sealed and unsealed enclosures respectively.

Connection bushings provided for termination of the electrical conductors shall be considered as part of the enclosure and subject to the requirements of this clause.

4.5.2 Sealed enclosures

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 special fasteners according to IEC 60079-0.