

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Power transformers –
Part 22-1: Power transformer and reactor fittings – Protective devices
STANDARD PREVIEW
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Transformateurs de puissance –
Partie 22-1: Accessoires pour transformateurs de puissance et bobines
d'inductance – Dispositifs de protection
IEC 60076-22-1:2019
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**Transformateurs de puissance –
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d'inductance – Dispositifs de protection**

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POWER TRANSFORMERS –

Part 22-1: Power transformer and reactor fittings – Protective devices

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FDIS	Report on voting
14/992/FDIS	14/997/RVD

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

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

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INTRODUCTION

This Part 22-1 of the IEC 60076 series covers all accessories relevant to the safety of transformers or reactors and having a function of signalization of abnormal operating conditions, and outlines the operation requirements specific to each accessory.

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POWER TRANSFORMERS –

Part 22-1: Power transformer and reactor fittings – Protective devices

1 Scope

This part of IEC 60076-22 applies to protective devices mounted on liquid-immersed power transformers in accordance with IEC 60076-1 and reactors in accordance with IEC 60076-6 with or without conservator for indoor or outdoor installation. It outlines the service conditions and the mechanical and electrical requirements that are common to all the devices, which are relevant for the safety of the machine having a function of signalization of abnormal operating conditions.

It also outlines the operation requirements specific to each device as well as, in some cases, the preferred dimensions relevant for interchangeability and the type and routine test to be performed.

2 Normative references

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 60068-3-3:1991, *Environmental testing – Part 3-3: Guidance – Seismic test methods for equipments*

IEC 60076-1:2011, *Power transformers – Part 1: General*

IEC 60076-7, *Power transformers – Part 7: Loading guide for oil-immersed power transformers*

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 60721-3-4, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weatherprotected locations*

IEC 60947-5-1, *Low-voltage switchgear and control gear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 12944-6, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods*

3 Terms and definitions

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

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

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

3.1

gas and liquid actuated relay

Buchholz relay

device intended to detect gas release from the unit to be protected, liquid surge from the tank to the conservator and complete loss of liquid in the conservator

3.2

gas and liquid sampling device at man's height

device allowing gas and liquid sampling from the Buchholz relay from ground level

3.3

protective relay for hermetically sealed liquid-immersed equipment

multifunctional protective device for hermetically sealed, liquid-immersed equipment without gas cushion

3.4

direct reading dial type liquid level indicator

oil level indicator

OLI

device indicating the liquid level in the main conservator or in a separate compartment

Note 1 to entry: This note applies to the French language only.

3.5

liquid flow indicator

oil flow indicator

OFI

device that detects the liquid flow in a forced cooling system

Note 1 to entry: This note applies to the French language only.

3.6

pressure relief device

PRD

device that releases the internal overpressure over a pre-set value, on medium and large power transformers

Note 1 to entry: This note applies to the French language only.

3.7

pressure relief valve

PRV

device that releases the internal overpressure over a pre-set value, on small transformers

Note 1 to entry: This note applies to the French language only.

3.8**direct reading mechanical dial type liquid temperature indicator**

oil temperature indicator

OTI

device that indicates the temperature of the liquid of the transformer

Note 1 to entry: This note applies to the French language only.

3.9**direct reading mechanical dial type winding temperature indicator**

winding temperature indicator

WTI

device which indicates the estimated temperature of the winding of the transformer

Note 1 to entry: This note applies to the French language only.

3.10**shutter valve**

device which stops the liquid flow from conservator to tank in the event of a consistent liquid loss from the tank

3.11**liquid-flow control relay for on-load tap changer**

device installed in the pipe between the top of the diverter or selector switch of an on-load tap changer and the liquid conservator to respond at a predetermined liquid flow and enable the transformer to be tripped

3.12**sudden pressure relay**

mechanical device for detection of sudden pressure rise events

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3.13**dial type gas detecting device**

device for indication of gas accumulation in a sealed liquid filled transformer

3.14**gas detecting device for sealed compartment**

device for detecting the presence of gas in a sealed liquid filled compartment

3.15**leakage detector for insulating liquid to water heat exchangers**

device for detecting the leakage of water or insulating liquid in a double tube heat exchanger

4 Service conditions**4.1 General**

The service conditions set out in 4.2 of IEC 60076-1:2011 represent the normal scope of operation of the devices and equipment specified in this document.

For any unusual service conditions that require special consideration in the design of the devices and equipment, see 5.5 of IEC 60076-1:2011. Device specification for operation under such unusual service conditions shall be subject to agreement between the purchaser and the manufacturer.

4.2 Degree of protection

The degree of protection of the connecting box or terminal box for outdoor installation shall be at least IP 54 in accordance with IEC 60529, unless otherwise specified by the purchaser.

4.3 Corrosion protection

The materials used for the construction of the devices and equipment or the surface treatment shall be resistant to the insulating liquid and suitable to withstand the environmental conditions. Unless otherwise specified, minimum withstand level shall be C4 medium durability (see ISO 12944-6).

4.4 Resistance to ambient conditions

The materials used for the construction of the devices and equipment shall be UV resistant and suitable for outdoor operation; windows and sight glasses shall not become opaque over the life of the accessory.

4.5 Insulating liquid characteristics

This subclause concerns only the accessories that are in contact with the insulating liquid.

If not otherwise specified, the insulating liquid is mineral liquid in accordance with IEC 60296 and the operating temperature shall be in accordance with IEC 60076-7.

If the insulating liquid is not mineral oil, then the viscosity variation and the operating temperature shall be indicated by the purchaser. The performance of the devices depends on the liquid properties and should be adapted if necessary.

NOTE IEC 60296 specifies a maximum viscosity of 12 mm²/s at 40 °C and 1 800 mm²/s at – 30 °C; IEC 60076-7 indicates a top liquid temperature for normal cyclic loading of 105 °C and 115 °C for emergency loading.

4.6 Vibration withstand

The accessories shall withstand: [IEC 60076-22-1:2019](https://standards.iteh.ai/catalog/standards/sist/4d395328-e6b9-4299-89c1-b9c47270ca2/iec-60076-22-1-2019)

- a non-stationary vibration causing a vertical shock of 100 m/s², with type 1 spectrum in accordance with IEC 60721-3-4;
- a stationary sinusoidal vibration class 4M4 according to IEC 60721-3-4. By agreement between purchaser and supplier, class 4M6 may also be specified.

4.7 Seismic requirements

When the accessory is specified with a seismic requirement without specified acceleration values, the performance level shall be chosen in accordance with IEC 60068-3-3 as follows:

- classification: criterion 0 (see 4.3 of IEC 60068-3-3:1991);
- performance level II (see 7.1 of IEC 60068-3-3:1991; a starting frequency of 2 Hz is acceptable).

5 Characteristics of switches

5.1 General

This clause defines the minimum performance characteristics that the electric switches used in these accessories are expected to have, in accordance with IEC 60947-5-1. Switches containing mercury are not allowed.

5.2 Dielectric strength (in accordance with IEC 60255-27)

The minimum dielectric withstand strength is given in the following Table 1 and Table 2.

Table 1 – Dielectric strength of switches – Power frequency

	Short duration power frequency withstand voltage 1 min kV (RMS)
Between circuits and earth	2
Between contacts in open position	1

Table 2 – Dielectric strength of switches – Impulse

	Lightning impulse withstand voltage kV (peak)
Between circuits and earth	4
Between contacts in open position	3

6 General requirements for routine and type test

Tests shall be carried out at an ambient temperature between 10 °C and 40 °C, unless otherwise specified.

All measuring instruments used for the tests shall have traceable accuracy and be subject to periodic calibration, according to the rules given in a system like ISO 9001 or similar.

7 Protective devices

7.1 Gas and liquid actuated relay (Buchholz relay)

7.1.1 Additional service conditions

7.1.1.1 Maximum inclination

The relay is intended to function in a horizontal position; a positive inclination of up to 5° to the horizontal axis is admissible in the direction towards the conservator. A tilt of max 5° on either side of the vertical is admissible.

Other values may be agreed between the purchaser and the supplier.

7.1.1.2 Operating pressure

The relay shall be designed for a continuous internal pressure of 50 kPa over ambient.

7.1.1.3 Sensitivity of the relay switches to magnetic fields

The relay shall be able to withstand a DC magnetic field of up to 25 mT, in any direction and any polarity, without unintentional operations.

7.1.2 Mechanical requirements

7.1.2.1 Nameplate

The nameplate shall contain the following information:

- name or logo of the supplier;
- country and manufacturing location;
- number of this standard;

- device manufacturer's identification;
- manufacturer's serial number;
- connection diagram (incorporated on the nameplate or included in the terminal box);
- seismic withstand class, if applicable.

The device manufacturer's identification shall allow identification of the device characteristics from the mounting, operating and maintenance manual supplied by the supplier.

7.1.2.2 Terminal box

A terminal box shall be provided to connect the switches of the device; it shall include also one protective conductor or earth terminal. The number and marking of the terminals shall comply with the connection diagram.

The terminals shall be designed to accept cables having a cross-sectional area of between 1,5 mm² to 4 mm².

A minimum of two threaded holes for cable glands M25 × 1,5 shall be provided; one shall be closed by a weather-resistant plug, the other being protected for transport and storage. Other thread dimensions are subject to agreement between the supplier and the purchaser.

Cable glands are supplied on demand.

7.1.2.3 Testing facility

The relay shall be provided with a device to functionally check the operation and sequence of the switches. The mechanical test device shall differentiate between the alarm and trip contact.

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7.1.2.4 Gas and liquid sampling facility

The relay shall be fitted with a gas release and sampling petcock.

A facility shall be provided for the connection of the gas and liquid sampling device at man's height.

7.1.2.5 Draining device

A draining device shall be provided.

If required, a provision shall be provided for draining at man height.

7.1.2.6 Inspection windows

The relay shall be fitted with at least two scaled inspection windows for the visual check of the presence of gas from both sides. On request, the windows are provided with protection covers.

7.1.2.7 Mounting arrangement

An arrow on the relay shall indicate the liquid flow direction towards the conservator.

7.1.2.8 General overall dimensions

Table 3 and Table 4 are to be read with Figure 1 and Figure 2.