

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

Power transformers – **STANDARD PREVIEW**  
Part 22-8: Power transformer and reactor fittings – Devices suitable for use in  
communication networks **(standards.iteh.ai)**

IEC 60076-22-8:2021  
Transformateurs de puissance –  
Partie 22-8: Accessoires pour transformateurs de puissance et bobines  
d'inductance – Dispositifs compatibles avec les réseaux de communication



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Part 22-8: Power transformer and reactor fittings – Devices suitable for use in  
communication networks**

**Transformateurs de puissance –  
Partie 22-8: Accessoires pour transformateurs de puissance et bobines  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## POWER TRANSFORMERS –

**Part 22-8: Power transformer and reactor fittings –  
Devices suitable for use in communication networks**

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IEC 60076-22-8 has been prepared by IEC technical committee 14: Power transformers. It is an International Standard.

The text of this International Standard is based on the following documents:

CDV	Report on voting
14/1057/CDV	14/1062A/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in the IEC 60076 series, published under the general title *Power transformers*, can be found on the IEC website.

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## INTRODUCTION

Under the title "Power transformer and reactor fittings – Devices suitable for use in communication networks", IEC 60076-22-8 covers an exhaustive selection of devices that are currently used in communication networks.

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## POWER TRANSFORMERS –

### Part 22-8: Power transformer and reactor fittings – Devices suitable for use in communication networks

#### 1 Scope

This part of IEC 60076-22 applies to a selection of accessories and fittings mounted on liquid immersed power transformers according to IEC 60076-1 and reactors according to IEC 60076-6 with or without conservator for indoor or outdoor installation.

It outlines the operation requirements specific to each device as well as the data made available to the communication network and the type and routine test to be performed.

The communication network is not part of the scope of this document.

#### 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 60076-22-1:2019, *Power transformers – Part 22-1: Power transformer and reactor fittings – Protective devices* IEC 60076-22-1:2019  
<https://standards.iteh.ai/catalog/standards/sist/73adc330-20cd-4a07-a0bd-8989acb02138/iec-60076-22-8-2021>

IEC 60076-22-7, *Power transformers – Part 22-7: Power transformer and reactor fittings – Accessories and fittings*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

#### 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

##### **communication network**

collection of terminal nodes

Note 1 to entry: Links are connected to enable communication between the devices.

Note 2 to entry: Means of transmission of signals in one direction between two points.

### **3.2 communication protocol**

defined set of procedures adopted to ensure communication between sets of processes which exist within the same layer of a hierarchy of layers

[SOURCE: IEC 60050-716-1:1995, 716-01-17, modified – In the term "communication" has been added.]

### **3.3 Modbus protocol** serial communications protocol

Note 1 to entry: Modbus is a de facto standard communication protocol and it is now a commonly available means of connecting industrial electronic devices.

Note 2 to entry: Modbus is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems.

### **3.4 4 mA to 20 mA output** point-to-point or multi-drop circuit

Note 1 to entry: This type of circuit sends an analogue signal from 4 mA to 20 mA that represents the extremes of the process variable.

### **3.5 electrical and electronic liquid temperature measuring device** device measuring the liquid temperature using electrical or electronic sensors

### **3.6 electrical and electronic winding temperature simulating device** device simulating the winding temperature using electrical or electronic sensors

### **3.7 dissolved gas analysis device** DGA device

device used to measure the dissolved gas concentration within a liquid on a regular time basis

Note 1 to entry: This device usually also measures relative humidity and temperature of the liquid.

Note 2 to entry: This note applies to the French language only.

## **4 General requirements**

### **4.1 Standard compliance**

All devices shall comply with IEC 60076-22-1 and IEC 60076-22-7 as applicable.

All devices shall be subject to type tests to verify the electromagnetic compatibility.

### **4.2 Modbus requirements**

If not otherwise specified, Modbus output shall be of the RTU type. The manufacturer shall provide all information about the Modbus connection needed by the customer to configure the connection.

The digital information shall be available via an RS485 port.

Table 1 shows a summary of Modbus parameters.

**Table 1 – Summary of Modbus parameters**

Parameters	Possible values	Code	Default values
Address Add	1 to 247	001 to 247	NA
Baud rate	4 800 bits/s 9 600 bits/s 19 200 bits/s	4,8 9,6 19,2	19 200 bits/s or alternatively 9 600 bits/s
Number, parity and stop bits	8 databits, uneven parity, 1 stop bit 8 databits, even parity, 1 stop bit 8 databits, no parity, 1 stop bit 8 databits, no parity, 2 stop bits	8O1 8E1 8N1 8N2	8E1 or alternatively 8N1

On special request TCP/IP can be provided.

### 4.3 Type tests for EMC

#### 4.3.1 Emission

The equipment shall comply with IEC 61000-6-4, measured as table top arrangement, at 3 m with all doors and caps closed. All relevant tests shall be performed.

#### 4.3.2 Immunity

The equipment shall comply with IEC 61000-6-5, interface 4 for both substation and power station. All relevant tests shall be performed.

### 4.4 Additional requirements

#### 4.4.1 Terminals

In addition to the terminals defined in IEC 60076-22-1, the device shall be equipped with a minimum of 2 additional terminals for each 4 mA to 20 mA output and 3 for each Modbus in and output and 2 additional terminals for power supply if the 4 mA to 20 mA outputs are active.

Unless otherwise specified, the 4 mA to 20 mA output shall be active.

The terminal block shall be suitable for cables of 1,5 mm<sup>2</sup>, unless otherwise specified.

By agreement between manufacturer and purchaser the device can be fitted with plug and socket.

#### 4.4.2 Signal and control ports

##### 4.4.2.1 4 mA to 20 mA

Maximum cable length between the device and the data acquisition system shall be 30 m.

Maximum resistance to be applied shall be 450 Ω.

##### 4.4.2.2 Modbus

Maximum cable length between the device and the data acquisition system shall be 30 m.

## 4.5 Cybersecurity

Electronic devices covered by this document are not linked to Internet or other external networks. Therefore there are no requirements for cybersecurity in this document.

If on special request the device is connected to Internet, cybersecurity issues shall be addressed.

## 5 Power supply

Preferred power supply for the communication part of the device is 24 V DC. The tolerance on the rated voltage shall be  $\pm 20\%$  permanently. The residual alternative voltage component shall be less than 2 % of the voltage peak to peak.

If the device (for example self-regenerating dehydrating breather) needs for its operation (beside the communication) an AC or DC power supply, then the communication power can be derived from the operation power supply.

## 6 Devices

### 6.1 Gas and liquid actuated relays (Buchholz relays)

#### 6.1.1 General

The volume of gas is monitored continuously by an additional component embedded in the Buchholz relay.

Upon customer requirements, the information can be analogue given via a 4 mA to 20 mA output and/or digital via the Modbus protocol.

The performance of the contacts specified in IEC 60076-22-1 shall not be affected by the requirements detailed in this Subclause 6.1.1.

#### 6.1.2 4 mA to 20 mA output

The 4 mA to 20 mA output monitors the gas volume accumulation.

Therefore the 4 mA shall correspond to the Buchholz relay completely full of liquid (no gas) and the 20 mA shall correspond to the Buchholz relay completely empty of liquid (full of gas).

The manufacturer shall state a transfer function of the 4 mA to 20 mA output signal to the volume of the accumulated gas.

If the gas accumulation from zero to the point before gas escapes into the pipework towards the conservator can be expected to be linear within  $\pm 5\%$ , then the manufacturer may declare, as a simplification, only the value of the accumulated gas volume before any gas escapes into the pipework towards the conservator and the corresponding value of mA.

#### 6.1.3 Modbus output

The digital output by Modbus shall transmit at least the gas volume monitored, measured in  $\text{cm}^3$ .

#### 6.1.4 Tests

##### 6.1.4.1 Routine test

The electronic board shall be checked to verify that all the functions are performed correctly.

##### 6.1.4.2 Type test

The manufacturer shall perform a test to determine the transfer function of the 4 mA to 20 mA output signal to the volume of the accumulated gas for each design of Buchholz relay.

### 6.2 Protective relays for hermetically sealed liquid-immersed equipment

#### 6.2.1 General

The volume of gas, the temperature and the pressure are monitored.

Upon customer requirements, the information can be analogue given via a 4 mA to 20 mA output or digital via the Modbus protocol, or both.

The performance of the contacts specified in IEC 60076-22-1 shall not be affected by the requirements detailed in this Subclause 6.2.1.

#### 6.2.2 4 mA to 20 mA output

Separate 4 mA to 20 mA outputs monitor the gas volume accumulation, the temperature and the pressure.

For the gas volume monitoring, the 4 mA output value shall correspond to the protective relay completely full of liquid (no gas) and the 20 mA output value shall correspond to the protective relay completely empty of liquid (full of gas).

The manufacturer shall state a transfer function of the 4 mA to 20 mA output signal to the volume of the accumulated gas, if not linear.

For the temperature monitoring, the temperature of 40 °C shall generate the 4 mA signal; the temperature of 120 °C shall generate the 20 mA signal.

For the pressure monitoring, the value of 4 mA shall indicate the overpressure of 10 kPa; the value of overpressure corresponding to 20 mA shall be 50 kPa.

#### 6.2.3 Modbus output

The digital output by Modbus shall transmit at least the gas volume, measured in cm<sup>3</sup>, the temperature and the pressure.

#### 6.2.4 Tests

##### 6.2.4.1 Routine test

##### 6.2.4.1.1 Electronic board test

The electronic board shall be checked to verify that all the functions are performed correctly.

##### 6.2.4.1.2 Accuracy tests

During the functional test of the protective relay according to IEC 60076-22-1, the accuracy of the temperature output shall be verified. The tolerance between the liquid thermostatic bath temperature and the output shall be less than  $\pm 4$  °C.