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Draft Indian Standard

Specification for Gas - Operated Relays

(*First Revision*)

ICS 29.120.70

Power System Relay	Last date of receipt of comment
Sectional Committee, ETD 35	19 February 2025

NATIONAL FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Power System Relays Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1966. This revision has been undertaken to take into account the technological developments taken place in gas-operated relays.

This standard has been prepared to outline the requirements of gas-operated relay (also known as Buchholz relay), which is widely applied for protecting oil immersed electrical apparatus fitted with separate conservator vessel. The ability of the relay to detect variety of faults inside an oil immersed electrical apparatus has made it a popular protective device for such apparatus. Its simplicity in application and its relative inexpensiveness are also factors commending it to wide use.

With increasing production and use of oil immersed electrical apparatus in this country, the demand for this relay is on the increase. This standard has been prepared to guide the indigenous producers and the users of this relay as to its minimum requirements.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2: 2022 'Rules for rounding of numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard

1 SCOPE

1.1 This standards covers requirements and methods of test for gas-operated relays intended for installation in the connecting passage of oil between the main tank of an oil immersed electrical apparatus and its oil conservator vessel.

1.2 This standards covers gas-operated relays fitted with both alarm and trip elements. The relay is intended to detect

- Gas release from the unit to be protected,
- Oil surge from the tank to the conservator,
- Complete loss of oil in the conservator.

1.3 Although this standard does not specifically exclude gas-operatec relays intended only for alarm, special provisions intended only for such relays have not been included.

1.4 This standard does not cover gas-operated relays which are not intended to be installed in the oil passage between the main tank and the conservator. It also does not cover gas-operated relays used for the protection of oil immersed apparatus mounted on railway vehicles.

2 REFERENCES

IS: 1885: Part 9: Sec 1:2019—Electrotechnical vocabulary: Part 9 electrical relays (Second Revision) (Withdrawn)

IS: 3639-1966—Specification for fittings and accessories for power transformers

IS: 554-1964—Pipe threads where pressure - Tight joints are made on the threads - Dimensions, tolerances and designation (Fourth Revision)

IS: 2026-1962—

IS/IEC 60529: 2001—Degrees of protection provided by enclosures (IP Code)

IS/IEC 60721-3-4:2019–Classification of Environmental Conditions Part 3 Classification of groups of environmental parameters and their severities Section 4 Stationary use at non- weather protected locations

3 TERM INOLOGY

For the purpose of this standard, the following definitions shall apply.

NOTE—Reference is also invited to IS 1885: Part 9: Sec 1:2019.

3.1 Relay

A device designed to produce sudden predetermined changes in one or more physical system(s) on the appearance of certain conditions in the physical system controlling it.

NOTE — In the case of gas-operated relay the cause of response is considered in-directly electrical.

3.2 Gas-Operated Relay

A relay whose operation depends upon the quantity and/or pressure of gas and/or velocity of flow of liquid.

3.3 Energizing Quantity

The quantity which alone or in combination with other quantities, must be applied to the relay to enable it to function (for example, the voltage and current for all-or-nothing relay, the voltage and current for a power relay and impedance relay, the voltage for a frequency relay, the current for a bias current relay or gas or flow of liquid for a gas-operated relay.

3.4 Operating Time
For a given operation and the relay in its initial position, the time between the instant when a specified value of energizing quantity able to operate the relay is suddenly applied and the instant when the relay operates.

3.5 Make Contact (Normally Open Contact)
A contact which is open when the relay is de-energized.

3.6 Making Capacity
The maximum current and volt-amperes that the contact is able to make successfully under specified conditions without significant damage to the contact

3.7 Current Carrying Capacity
The maximum current which the contactis able to carry continuously.

3.8 Alarm Device
A device which responds to accumulation of gas, in the relay body and causes a switch to close for an external alarm circuit.

3.9 Trip Device
A device which responds to velocity of flow of oil towards the free oil level in a protected apparatus and/or loss of oil causes a switch to close for an external trip circuit.

3.10 Type Tests
Tests carried out to prove conformity with the requirements of this specification. These are intended to prove the general quality and design of a given type of relay.

3.11 Routine Tests
Tests carried out on each relay to check requirements likely to vary during production.

4 GENERAL REQUIREMENTS
4.1 General Overall Dimensions

Table is to be read with Figure 1

Table 1 - Preferred Dimensions of Relay in mm

Nominal diameter DN	A max.	B max.	C max.	D a min	L	E b
25	200	140	200	250	128 - 160	-
50	200	150	210	250	185 - 215	-
80	200	150	230	250	185 - 215	-

a Minimum clearance for access of petcock

b Minimum clearance for mounting and access to the relay

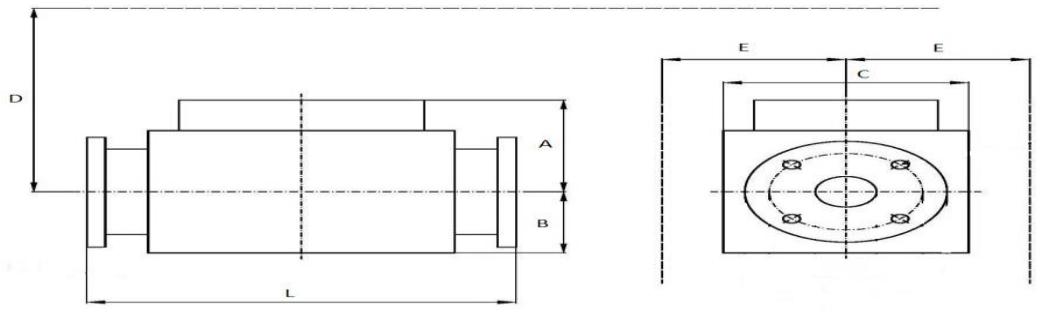

Fig. 1 Illustration of Relay's Outer Dimensions (Excluding Flange Dimension)

4.2 Sensitivity of the relay contacts to magnetic fields

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

NOTE— During operation or in event of faults, the surroundings of the transformers or reactors are subjected to magnetic fields which could produce inadvertent operation of the relay equipped with magnetic contacts (reed type switches)

4.3 RATING

The standard ratings of a relay shall be in accordance with Table 1.

TABLE 2 STANDARD RATINGS

NOMINAL PIPE BORE	ENERGIZING QUANTITY	
	Gas Volume for Alarm at 5° Pitch Angle	Steady Oil Flow for Trip at 1° to 9° Pipe Angle
mm	cm3	cm /sec
25	90 to 165	85 to 115
50	175 to 225	85 to 115
80	200 to 300	125 to 170

The relay shall operate satisfactorily in the following conditions of oil:

Oil temperature	10° to 100°C
Oil viscosity	65 to 75 centistokes at 10°C
	2 to 3.5 centistokes at 100°C

5 GENERAL REQUIREMENTS FOR TESTS

Tests shall be carried out at an ambient temperature between 10^0 C and 40 °C, unless otherwise specified.

6 CONSTRUCTION

6.1 The relay housing shall be weather resistant, shall be free from mechanical defects and shall withstand pressures encountered in normal service. No rain-water shall be allowed to accumulate on the relay, or to seep into its interior.

6.2 A surface on the top of housing shall be machined to facilitate mounting of relay at site to its correct orientation.

6.3 A substantial inspection window of tough transparent material shall be fitted on each side of the relay housing through which it is possible to see the oil level. Viewed from the front, it shall be possible to ascertain the volume of gas present in the relay in cubic centimeters on a calibrated scale.

6.4 A pet-cock complete with a screwed cap shall be provided on the top of the relay for the purposes of gas sampling.

6.5 The inner parts of the relay shall be built of material which will with- stand effects of hot transformer oil and its disintegration products likely to be encountered in service.

6.6 The design and mounting arrangements for the switches shall be such that mal operation does not occur under normal service conditions of the protected apparatus on which the relay is mounted. A glass encapsulated/hermetically sealed switch shall be used. Preferably Magnetic Reed type switches may be used.

Switches containing mercury are not allowed as per the "Minamata Convention" whose India is a signatory.

6.7 The connecting leads from the switch shall be made of tinned copper flexible wire insulated with ceramic beads or with braided silk or with any other equivalent insulating material. They shall be terminated on outlet bushings by means of compressed terminal lugs or by other similar method. Soldered connection shall not be employed.

A terminal box shall be provided to connect the switches of the device, with a minimum of 4 terminals. Additionally it shall also include one earth terminal. The number and marking of the terminals shall comply with the connection diagram.

6.8 The outlet terminals shall be suitable for connection to external conductors of size 1.5 to 4 mm2 and housed in a weather-proof air insulated terminal chamber on the relay housing. A suitable conduit entry and bottom drain hole in the chamber shall be provided.

The degree of protection of the terminal box shall be at least IP67 as per IS/IEC 60529.

6.9 A mechanical device capable of being operated from the exterior of the relay to check the continuity of electrical circuits and lock the alarm and, trip devices whilst the relay is in transit, may be provided.

6.10 The dimensions of mounting flanges shall be in accordance with IS:3639. If threaded connections are used in the pipe, the relay flanges and the pipes shall be threaded to sizes P1, P2 and P3 in accordance with IS:554 for relay sizes 25, 50 and 80 mm nominal pipe bore respectively.

7 NORMAL SERVICE CONDITIONS

7.1 The relay shall be suitable for operation at the conditions at which the apparatus on which it is mounted is expected to operate (for mounting on transformers *see* Appendix A of IS: 2026).

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

7.3 The relay shall withstand a non-stationary vibration causing a vertical shock of 100m/s^2.

8 OPERATIONAL PERFORMANCE REQUIREMENTS

8.1 Alarm and Trip Contacts

The device shall be provided with two electrical contacts The alarm contact shall operate due to gas displacement (volume of gas collected as per Table 2).

Gas shall not freely pass from the relay body and escape into the pipework before the contact has operated.

The trip contact shall operate at a steady oil flow as indicated in Table 2.

The trip operation shall not be adversely affected when the alarm contact has already closed and gas is escaping freely.

The relay shall be insensitive to oil flow from conservator to tank. The relay shall operate within 0.5 sec.

8.2 Oil Loss from Tank

The liquid loss and liquid surge switches are usually the same, unless a different setting is agreed between the purchaser and the manufacturer.

In case of oil loss from the tank the alarm contact shall operate if the oil level in the relay drops by the same volume as for gas collection. Further oil loss shall cause the trip element to operate before the relay pipework is free of oil

9 MARKING

9.1 The following particulars shall be marked distinctly and permanently on every relay in a position preferably visible from the front:

a) A reference to this standard, that is 'Ref IS 3637';

b) Manufacturers' name and/or trade-mark;

c) Country of manufacture; and

d) Manufacturers type reference and serial number.

9.2 The direction of oil flow through the relay causing operation of the relay shall be indelibly marked by an arrow head which should be conspicuously visible.

9.3 The outlet terminals of the alarm and trip devices shall be indelibly marked by letters A and T in their proximity in the terminal enclosure.

9.4 A graduated scale to read the volume in cubic centimetres of gas accumulated inside the relay shall be provided.

9.5 BIS Certification Marking

The product may also be marked with Standard Mark.

9.5.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act,2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

10 CHARACTERISTICS OF SWITCH

10.1 Switch Type

Switches shall be potential free. Unless otherwise specified the switches shall be "normally open" under normal operating conditions(normal operating conditions are when the relay is filled with oil and there is no fault on the protected equipment).

10.2 Switch Performance

The current rating of the switches shall be 3 amperes at 240V, 50Hz ac or dc. The short time current rating for switches shall be 10 A r.m.s. for 30 ms. The resistance of the switches shall not exceed 0.1 ohm.

The cross-section of current leads connected to switch shall preferably not be less than 0.25 mm^2.

11 TESTS

11.1 Classification of Tests

11.1.1 *Type Tests* — The following shall comprise the type tests:

a) Porosity test (7.2),
b) High voltage and insulation resistance test (7.3),
c) Elements test (7.4),
d) Gas volume test (7.5),
e) Surge test (7.6),
f) Loss of oil test (7.7),
g) Mechanical strength test (7.8), and
h) Reverse liquid flow test (7.9),
i) Magnetic field test (7.10),
j) Vibration withstand test (7.11)

11.1.2 *Routine Tests* — The following shall comprise the routine tests and shall be carried out on all relays:

a) Porosity test (7.2),
b) High voltage and insulation resistance test (7.3),
c) Elements test (7.4),
d) Gas volume test (7.5), and
e) Surge test (7.6)
f) Loss of oil test (7.7)

11.2 Porosity Test

Each finished relay casing complete with cover shall be filled, with oil at ambient temperature and at a pressure of 1.5 kg/cm^2 for aduration of 4 hours or 3 kg/cm^2 for a duration of 0.5 hour. There shall be no leakage or sweating to the exterior or other sign of mechanical fault.

11.3 High Voltage and Insulation Resistance Test

An alternating voltage of2 000 volts at 50 Hz shall be applied for one minute (alternatively 2 500 volts for one second) between each electrical circuit in turn and the casing, the remaining circuit being connected to the casing, the switches having beenput to 'ON' position and the relay being devoid of oil. The test voltage shall be satisfactorily withstood. The insulation resistance to earth at each terminal and between terminals of the relay measured with a 500-volts megger shall not be less than 10 megohms.

11.4 Elements test

Each completely assembled relay shall be filled with oil at ambient temperature at a pressure of 1.75 kg/cm^2 for 15 minutes. No leakageshall occur from the casing or into normally oil free spaces, such as floats within the casing.

11.5 Gas Volume Test

The completely assembled relay filled with oil shall be mounted at an angle of 5° to the horizontal and air or gas shall be introduced in it until the alarm device closes the alarm contacts. The volumeof gas collected in the relay shall be within the rated range specified in Table 1. The air or gas shall be further allowed to escape freely from relay in the direction marked on the relay. The trip device shall not operate and shall hold the trip contacts open.

11.6 Surge Test

Each completely assembled relay filled with oil at ambient temperature shall be mounted at an angle within 5 ° to the horizontal and a steady oil flow velocity in the direction of the

marked arrow shall be produced and the minimum steady oil flow velocity at which the trip device operates to close the trip contacts shall be determined.

Now the relay is subjected to a sudden surge of oil to operate thetrip device. Trip device should operate to close the trip contacts.

11.7 Loss of oil test

The oil level in the relay shall be dropped to the bottom of the pipe bore on the conservator side and the trip device shall operate to close the trip contacts.

11.8 Mechanical Strength Test

The relay casing and cover in a finished state shall be filled with oil at 70^0C and subjected to an internal pressure of 3 kg/cm^2 for a period of two minute. There shall be no mechanical failure and verified by routine tests.

11.9 Magnetic field test

The relay shall be able to withstand a DC magnetic field up to 25mT, in any direction and any polarity, without unintentional operations.
Note- Use of magnetic reed type switches in almost all GOR needs this test.

11.10 Vibration Withstand Test

The device shall be subjected to vibrations as following.

- A non-stationary vibration causing a vertical shock of 100 m/s2, with type 1 spectrum in accordance with IS/IEC 60721-3-4.
- a stationary sinusoidal vibration class 4M4 according to IS/IEC 60721-3-4.