

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

High-voltage switchgear and controlgear –  
Part 206: Voltage presence indicating systems for rated voltages above 1 kV and  
up to and including 52 kV

Appareillage à haute tension –  
Partie 206: Systèmes indicateurs de présence de tension assignées supérieures  
à 1 kV et inférieures ou égales à 52 kV



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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 206: Voltage presence indicating systems for rated voltages  
above 1 kV and up to and including 52 kV**

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International Standard IEC 62271-206 has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

This first edition of IEC 62271-206 cancels and replaces the first edition of IEC 61958. This edition constitutes a minor revision.

The main changes with respect of the first edition of IEC 61958 are an actualization of references and the degree of protection which has been changed from IPXXB to IP2X.

The text of this standard is based on the following documents:

FDIS	Report on voting
17C/491/FDIS	17C/500/RVD

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

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

A list of all the parts in the IEC 62271 series under general title *High-voltage switchgear and controlgear* can be found on the IEC website.

The committee has decided that the contents of this publication 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

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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 206: Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV

#### 1 General

##### 1.1 Scope

This part of IEC 62271 is applicable to voltage presence indicating systems (VPIS) incorporated in a.c. switchgear and controlgear covered by IEC 62271-200 or IEC 62271-201.

Voltage presence indicating systems are devices used to provide information to operators about the voltage condition of the main circuit of the switchgear in which they are installed.

The indication of VPIS alone is not sufficient to prove that the system is dead: if operating procedures make it mandatory, relevant voltage detectors according to IEC 61243-1, IEC 61243-2 and IEC 61243-5 should be used.

This standard is also applicable to phase comparators specifically designed for use with VPIS.

##### 1.2 Normative references

The following referenced documents are indispensable for the application 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.

<https://standards.iteh.ai/catalog/standards/sist/b2eb4c11-3350-4da3-95b9-9b7561069573/iec-62271-206-2011>

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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

IEC 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-201, *High-voltage switchgear and controlgear – Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 61243-1, *Live working – Voltage detectors – Part 1: Capacitive type to be used for voltages exceeding 1 kV a.c.*

IEC 61243-2, *Live working – Voltage detectors – Part 2: Resistive type to be used for voltages of 1 kV to 36 kV a.c.*

IEC 61243-5, *Live working – Voltage detectors – Part 5: Voltage detecting systems (VDS)*

#### 2 Service conditions

VPIS are designed to be used under the same service conditions as the switchgear in which they are installed, as defined in Clause 2 of IEC 62271-1.

### 3 Terms and definitions

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

#### 3.1

##### **voltage presence indicating system (VPIS)**

device used to indicate the presence of operating voltage

NOTE 1 VPIS may also be used in conjunction with phase comparators.

NOTE 2 VPIS are not designed to detect reliably the absence of voltage: for this purpose, only voltage detectors or voltage detecting systems (VDS according to IEC 61243-5) should be used.

#### 3.2

##### **coupling element**

part of the VPIS connected to the main circuit which transmits to the indicating element a signal related to the voltage condition of this circuit. Different physical principles can be used for the coupling element, for example, capacitive, resistive, optical, etc.

#### 3.3

##### **indicating element**

part of the VPIS which gives a visual indication depending on the input signal received from the coupling element

#### 3.4

##### **connecting point**

point of the indicating element where a suitable phase comparator may be connected

#### 3.5

##### **phase comparator**

apparatus which indicates the phase relationship between the connecting points of two VPIS

#### 3.6

##### **nominal voltage ( $U_n$ )**

suitable approximate value of voltage used to identify a system or device  
[IEC 60050-601:1985, 601-01-21, modified]

NOTE 1 The nominal voltage of the VPIS is the parameter associated with its clear indication. VPIS may have one nominal voltage  $U_n$ , or a nominal voltage range. Limit values of the nominal voltage range are named  $U_{nmin}$  and  $U_{nmax}$ .

NOTE 2 In this standard, the nominal voltage of a three-phase system is the normal phase-to-phase voltage. The nominal voltage of a single-phase system is the normal voltage between lines.

#### 3.7

##### **voltage limiting device**

protective device that limits the voltage at the output terminal of the coupling element in the case of insulation failure

### 4 Ratings

The following ratings of the switchgear shall also be applicable to the VPIS incorporated in it:

- rated voltage;
- rated insulation level;
- rated frequency(ies).

In addition, the nominal voltage, or nominal voltage range, of the systems on which the VPIS can be used, shall be defined.

#### 4.1 Rated voltage

Refer to 4.1 of IEC 62271-1.

#### 4.2 Rated insulation level

Refer to 4.2 of IEC 62271-1.

#### 4.3 Rated frequency

Refer to 4.3 of IEC 62271-1.

### 5 Design and construction

#### 5.1 General

##### 5.1.1 Parts of VPIS

A VPIS includes

- a coupling element;
- an indicating element;
- a connecting point (optional).

Both the coupling and indicating elements are fixed and incorporated in switchgear (see Figure 1).

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##### 5.1.2 Phase comparison

[IEC 62271-206:2011](#)

VPIS should allow checking of phase relationship by means of a suitable phase comparator. The characteristics of the phase comparator shall be defined by the manufacturer of the VPIS.

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##### 5.1.3 Degree of protection (IP code)

Parts of the VPIS which contribute to the switchgear enclosure shall meet the degree of protection defined for the switchgear.

If the VPIS includes hazardous parts when in service, it shall provide at least an IP2X degree of protection according to IEC 60529, even when replaceable parts are removed.

##### 5.1.4 Impact resistance

Accessible parts of VPIS shall be resistant to mechanical impact.

##### 5.1.5 Testing element

VPIS with a built-in power source shall be equipped with a testing element to check the condition of the battery.

#### 5.2 Threshold values for voltage presence indication

The threshold values for voltage presence indication are shown in the following Table 1.

**Table 1 – Indication corresponding to "voltage present"**

	The indication corresponding to "voltage present"	
	shall appear	shall not appear
in three-phase systems	when the actual line-to-earth voltage is between 45 % of the nominal voltage and the rated voltage	when the actual line-to-earth voltage is less than 10 % of the nominal voltage
in single-pole earthed single-phase systems	when the actual line-to-earth voltage is between 78 % of the nominal voltage and the rated voltage	when the actual line-to-earth voltage is less than 17 % of the nominal voltage
in mid-point earthed single-phase systems	when the actual line-to-earth voltage is between 39 % of the nominal voltage and 50 % of the rated voltage	when the actual line-to-earth voltage is less than 9 % of the nominal voltage

### 5.3 Indication and perceptibility

#### 5.3.1 General

The indicating element of a VPIS shall provide a clear visual indication of the voltage state.

The indication shall be clearly perceptible to the user when in the recommended operating position and under practical lighting conditions.

Some types of VPIS are restricted to indoor use, and others are suitable for indoor and outdoor use.

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#### 5.3.2 Frequency of repetition

In the case of a repetitive visual indication, the frequency of repetition shall be at least 1 Hz. This requirement shall be met for an actual line-to-earth voltage equal to, or greater than, 45 % of the nominal voltage. For a line-to-earth voltage lower than 10 % of the nominal voltage, the indication corresponding to "voltage not present" shall appear with no active signal allowed for a VPIS having no built-in power source.

For single-phase systems, the applicable threshold values according to Table 1 shall be used.

#### 5.3.3 Response time

The indicating element of a VPIS shall indicate the change of state of voltage within 1 s.

#### 5.3.4 Indication until power source is exhausted

VPIS with a built-in power source shall give a clear indication of voltage presence until the power source is exhausted, unless their usage is limited by an indication of non-readiness or automatic shut-off.

### 5.4 Coupling element and voltage limiting device

#### 5.4.1 Insulation of coupling element

The coupling element shall provide adequate insulation between its output terminal and the main circuit.

#### 5.4.2 Voltage limiting device

To provide protection for operators against the presence of operating voltage on the connecting point, it shall be ensured that any insulation failure of the coupling element will necessarily cause a permanent earth fault.

This shall be achieved by connecting the coupling element output terminal to earth via a voltage limiting device.

The voltage limiting device can be a specific component (for example, spark gap) or be one of the components permanently connected to the coupling element (for example, an indicating element component).

The effects caused by the response of the voltage limiting device shall be taken into account when determining the protection concept of the installation.

#### 5.4.3 Threshold voltage of voltage limiting device

The threshold voltage of the voltage limiting device shall comply with the following requirements:

- it shall be lower than 30 % of the nominal voltage of the power system;
- it shall be less than the lowest limiting value of the dielectric strength in the remaining components of the VPIS.

#### 5.4.4 Earth fault conditions

For systems with insulated or resonant earthed neutral, earth fault currents are limited to low values and the equipment can be maintained in operation for a long period of time under these conditions.

In such cases, additional precautions shall be taken to ensure that either the earth fault condition can easily be observed by operators, or no dangerous voltage can occur on the connecting point for the earth fault duration.

#### 5.4.5 Maximum current delivered by the connecting point

The current delivered by the connecting point when it is short-circuited to earth and with rated frequency and rated voltage between conductor and earth shall not exceed 2 mA. If the degree of protection of the connecting point is lower than IP2X, the current value shall be limited to 0,5 mA.

### 5.5 Marking

Marking shall be legible and permanent. It may be printed, engraved or moulded on the VPIS casing or switchgear front panel in the vicinity of the indicating element and connecting point.

The following markings, at least, shall be assigned to the indicating element and connecting point in a perceptible manner with characters of at least 3 mm high:

- IEC 62271-206;
- nominal voltage(s) (or range of nominal voltages) of VPIS;
- phase designation (L1, L2, L3).

As an alternative, the first two items may be added to the nameplate of the switchgear.

### 5.6 Phase comparator and connecting point

#### 5.6.1 General

The manufacturer of VPIS shall state which types of phase comparators are suitable for use with the VPIS.

### 5.6.2 Clear indication of phase comparators

Phase comparators shall indicate "incorrect phase relationship" if the phase shift between line-to-earth voltages exceeds  $30^\circ$  and shall indicate "correct phase relationship" if the phase shift is less than  $10^\circ$ .

Phase comparators used on VPIS shall comply with these requirements for line-to-earth operating voltages in the range of  $U_n / \sqrt{3} \pm 8\%$ .

The clear indication of a phase comparator shall not be affected by the difference between signals delivered on connecting points which can result from

- a difference of up to 5 % between operating voltages,
- construction tolerances of identical VPIS.

NOTE Other threshold values for phase angles may be agreed between the manufacturer and the user according to the intended application, for example:

- if the purpose of phase comparison is to check that there are no interchanged connections before closing a circuit, then the upper threshold value can be increased from  $30^\circ$  to, for example,  $60^\circ$  because the resulting phase shift would be  $120^\circ$ ;
- in some specific situations, two different systems can be out of phase by exactly  $30^\circ$ ; in that case, the upper threshold value should be reduced from  $30^\circ$  to, for example,  $25^\circ$ .

### 5.6.3 Perceptibility of indication

Phase comparators shall indicate "incorrect phase relationship" by means of an active signal.

Phase comparators with a built-in power source shall indicate both "correct phase relationship" and "incorrect phase relationship" by means of active signals. The two active signals shall not rely solely on light of different colours for perceptibility. Additional characteristics, such as spatial separation of the light sources, distinctive form of the light signals, flashing light or audible signals with full sound pressure level, shall be used.

### 5.6.4 Indication in case of absence of voltage on one side

For phase comparators providing only one active signal, a voltage less than 10 % of  $U_n$  on one side and more than 45 % of  $U_n$  on the other shall lead to the indication "incorrect phase relationship". For phase comparators providing two or more active signals, absence of voltage on one side shall result in either no indication or a specific active signal.

### 5.6.5 Indication in case of absence of voltage on both sides

Voltages of less than 10 % of  $U_n$  on both sides shall lead to no indication.

## 5.7 Electromagnetic compatibility (EMC)

A VPIS is a part of the secondary system of switchgear as defined in 5.18 of IEC 62271-1. Therefore, 5.18 and 6.9 of IEC 62271-1 shall be applicable to VPIS.

## 6 Type tests

### 6.1 General

#### 6.1.1 Sequence of tests

The tests for VPIS are given in Table 2. The tests shall be carried out in the sequence given in this table. All tests shall be carried out on the same specimen, except for test of 6.7.3, which may be performed separately.

Where the following test requirements do not allow tests on individual parts, the respective tests shall be performed on complete devices.

Single-phase tests are normally sufficient. Three-phase tests are prescribed where needed.

#### 6.1.2 Test specimens

Type tests shall be performed on three test specimens and/or three complete devices. If a test specimen does not pass one of the type tests, the entire type test programme shall be repeated on three more specimens. If a specimen again does not pass one type test, the equipment has failed the test.

NOTE An individual type test need not be repeated for a change of construction detail, if the manufacturer can demonstrate that this change does not influence the result of that individual type test.

#### 6.1.3 Conditioning procedure

Prior to type tests, all test specimens shall be subjected, as a conditioning procedure, to a change of temperature test Nb according to IEC 60068-2-14 with the following test parameters:

- the lower temperature  $T_A$  shall be equal to the minimum ambient air temperature specified in the service conditions;
- the higher temperature  $T_B$  shall be 15 K over the maximum ambient air temperature specified in the service conditions;
- the rate of change of temperature shall be 0,5 °C/min;
- the exposure duration  $t_1$  shall be equal to 3 h;
- two cycles shall be performed.

#### 6.1.4 Test voltages

Voltage tests shall, if not otherwise specified below, be performed with alternating voltages at rated frequency complying with the requirements of IEC 60060-1.

#### 6.1.5 Test conditions

Unless otherwise specified in the individual test subclauses, the electrical tests shall be performed under the following standard atmospheric conditions:

- ambient temperature: 15 °C to 35 °C;
- relative humidity: 45 % to 75 %;
- atmospheric pressure: 86 kPa to 106 kPa.

For dielectric tests, atmospheric correction factors according to IEC 60060-1 shall be used when applicable.