

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Railway applications – Fixed installations – Particular requirements for a.c. switchgear –**

**Part 1: Single-phase circuit-breakers with  $U_n$  above 1 kV**

**Applications ferroviaires – Installations fixes – Exigences particulières pour appareillage à courant alternatif –**

**Partie 1: Disjoncteurs monophasés avec  $U_n$  supérieur à 1 kV**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –  
FIXED INSTALLATIONS –  
PARTICULAR REQUIREMENTS FOR AC SWITCHGEAR –**

**Part 1: Single-phase circuit-breakers with  $U_n$  above 1 kV**

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International Standard IEC 62505-1 has been prepared IEC technical committee 9: Electrical equipment and systems for railways. This standard is based on EN 50152-1.

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

FDIS	Report on voting
9/1219/FDIS	9/1232/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 parts of IEC 62505 series, under the general title *Railway applications – Fixed installations – Particular requirements for a.c. switchgear*, can be found on the IEC website.

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Withdrawn

## INTRODUCTION

The IEC Standard series 62505 is divided as follows.

- Part 1: Single-phase circuit-breakers with  $U_n$  above 1 kV.
- Part 2: Single-phase disconnectors, earthing switches and switches with  $U_n$  above 1 kV.
- Part 3-1: Measurement, control and protection devices for specific use in a.c. traction systems – Application guide
- Part 3-2: Measurement, control and protection devices for specific use in a.c. traction systems – Single-phase current transformers
- Part 3-3: Measurement, control and protection devices for specific use in a.c. traction systems – Single-phase inductive voltage transformers

IEC 62505-1 is to be used in conjunction with IEC 62271-100 (2008).

The essential requirements of IEC 62271-100 have been transcribed in this International Standard. Other complementary clauses of IEC 62271-100 are mentioned in this Standard. Where a particular clause of IEC 62271-100 is not mentioned, but is not referred as "not applicable" in this Standard, that clause applies as far as reasonable. Where this Standard states "addition" or "replacement", the relevant text of IEC 62271-100 is to be adapted accordingly.

The numbering of clauses in the IEC 62271 series is not used in this Standard. The numbering in square brackets refers to the numbering of clauses in IEC 62271.

NOTE 1 Where terms defined in IEC 62271-100 conflict with definitions of the same terms as given in IEC 60050-811:1991 or of the other railway applications documents listed in the normative references, the definitions used in IEC 62271-100 are to be used.

NOTE 2 The suffix N which appears in this Standard for rated values is not present in IEC 62271-100.

# RAILWAY APPLICATIONS – FIXED INSTALLATIONS – PARTICULAR REQUIREMENTS FOR AC SWITCHGEAR –

## Part 1: Single-phase circuit-breakers with $U_n$ above 1 kV

### 1 Scope

This part of IEC 62505 is applicable to single-phase a.c. one-pole circuit-breakers designed for indoor or outdoor fixed installations for operation at frequencies of 16,7 Hz, 50 Hz and 60 Hz on traction systems having an  $U_{Nm}$  above 1 kV up to 52 kV.

This International Standard is also applicable to two-pole circuit-breakers when connected in the following manner: one pole supplying the connection to the contact line of the track, the second pole supplying the connection to the feeder cable which runs alongside the same track and which is used to boost the track voltage at regular intervals in combination with autotransformers. The centre of this circuit is connected to earth.

This Standard is also applicable to the operating devices of circuit-breakers and to their auxiliary equipment.

This Standard does not address circuit-breakers with dependent manual operating mechanism.

NOTE A rated short-circuit making current cannot be specified for these circuit-breakers and the use of these mechanisms may give reasons for the objection based on their safety in operation.

### 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.

IEC 60044-1:1999, *Instrument transformers – Part 1: Current transformers*

IEC 60850:2007, *Railway applications – Supply voltages of traction systems*

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

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

IEC 62271-102:2003, *High-voltage switchgear and controlgear – Part 102: Alternating-current disconnectors and earthing switches*

IEC 62497-1, *Railway applications – Insulation co-ordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62271-1 and IEC 62271-100, and the following apply:

### 3.1

#### **single-pole circuit-breaker**

circuit-breaker with one electrically separated conducting path for the main circuit suitable for use in a single phase circuit

NOTE The construction arrangement of this device is in principle identical to one phase of a three-phase circuit-breaker.

### 3.2

#### **two-pole circuit-breaker**

circuit-breaker with two independent electrically separated conducting paths for the main circuit

NOTE 1 The two paths may be connected in series for use in a single phase circuit where the establishment and the separation of the two paths are simultaneous.

NOTE 2 The construction arrangement of this device is in principle identical to two phases of a three phase circuit-breaker.

### 3.3

#### **index of definitions**

same as in 3.8 of IEC 62271-100, but amended according to the definitions above

## 4 Service conditions

Clause 2 of IEC 62271-1:2007 is applicable with the following addition:

The equipment covered by this Standard shall be suitable for installation in trackside locations subject to vibrations from passing trains, airborne iron dust contamination from train brakes and shall meet the electromagnetic compatibility (EMC) requirements.

For special service conditions, agreement shall be made between purchaser and supplier.

## 5 Rating

### 5.1 General

A circuit-breaker in correct condition of maintenance and adjustment shall be able to withstand all stresses that occur in service provided that these do not exceed its rated characteristics.

The characteristics of a circuit-breaker, including its operating devices and auxiliary equipment, that shall be used to determine the rating are the following:

Rated characteristics to be given for all circuit-breakers:

- a) rated voltage;
- b) rated insulation level;
- c) rated frequency;
- d) rated normal current;
- e) rated short-time withstand current;
- f) rated peak withstand current;
- g) rated duration of short circuit, for circuit-breakers not fitted with direct over-current release;
- h) rated supply voltage of closing and opening devices and of auxiliary circuits;
- i) rated supply frequency of closing and opening devices and of auxiliary circuits;

- j) rated pressures of compressed gas supply for operation and for interruption, if applicable;
- k) rated gas pressure for sealed gas pressure devices;
- l) rated short-circuit breaking current;
- m) rated transient recovery voltage for terminal faults;
- n) rated short-circuit making current;
- o) rated operating sequence.

## 5.2 Rated voltage ( $U_{Ne}$ )

The rated voltage  $U_{Ne}$  shall be chosen taking into consideration the maximum voltage level suitable to be permanently applied to the circuit-breaker (i.e. highest permanent voltage  $U_{max1}$  as defined in IEC 60850).

NOTE This standard makes reference to the values  $U_{max1}$  and  $U_{max2}$ , taken from IEC 60850. These values are used to express the values of  $U_{Ne}$ , which are expected to be equal or higher than  $U_{max1}$ . The insulation characteristics are also expected to be suitable to allow, when required in Clause 5 and Clause 7, the highest non-permanent voltage  $U_{max2}$ .

## 5.3 Nominal voltage ( $U_n$ )

The nominal voltage  $U_n$  shall be one of the voltages listed in Table 1 of IEC 60850.

## 5.4 Rated insulation voltage ( $U_{Nm}$ ) [4.2]

The value of the rated insulation voltage  $U_{Nm}$ , of the rated impulse withstand voltage  $U_{Ni}$  and of the power-frequency withstand voltage  $U_a$  shall be as given in Table 1, taken from the values listed in IEC 62497-1.

**Table 1 – Nominal voltages ( $U_n$ ), rated impulse voltages ( $U_{Ni}$ ) and short-duration power-frequency (AC) test levels  $U_a$  for circuits connected to the contact line**

$U_n$ kV	$U_{Nm}$ kV	$U^a$ kV	OV	$U_{Ni}$ (1,2/50 $\mu$ s) kV	$U_a$ kV
<b>IEC 60850</b>	<b>IEC 62497-1</b>	<b>(IEC 62271-1)</b>	<b>IEC 62497-1</b>		
15	17,25	(24,0)	3	95	38 or 50 <sup>b</sup>
			4	125	50
		(36,0)	3	145	70
			4	170	70 or 95 <sup>b</sup>
20	24	N/A	3		
			4	150	50
25	27,5 <sup>c</sup>	N/A	3	170	70 or 95 <sup>b</sup>
			4	200 <sup>c</sup>	95
		(52,0)	3	200 <sup>c</sup>	95
			4	250	95
	30	N/A	3		
			4	200	70
See Note 3	52,0	(72,5)	3	250	95
			4	300	140
<p>NOTE 1 The choice of the different values of <math>U_{Ni}</math> given for the same <math>U_n</math>, depends upon the highest non-permanent voltages (such as <math>U_{max2}</math> of IEC 60850) actually appearing in the system.</p> <p>NOTE 2 OV3 and OV4 are overvoltage categories depending on the system configuration and degree of overvoltage control (inherent control or protective control) as given in IEC 62497-1.</p> <p>NOTE 3 Take care that in those cases in which for circuit reasons it may happen that a higher voltage is applied to the device terminals in transient conditions, a higher rated insulation voltage between contacts might be necessary (e. g. <math>U_{Nm} = 52</math> kV for <math>U_n = 25</math> kV).</p> <p>a The values in brackets give the rated voltages according to Table 1a of IEC 62271-1 having the nearest equivalence in test withstand voltages with the test values for single-phase voltages given in this Table.</p> <p>b At purchaser's choice or by agreement</p> <p>c These values are used in railway application only and are not of wide industrial use.</p>					

### 5.5 Rated frequency [4.3]

Subclause 4.3 of IEC 62271-1 is applicable.

### 5.6 Rated normal current and temperature rise [4.4]

Subclauses 4.4.1 and 4.4.2 of IEC 62271-1 are applicable with the following additions:

The values of rated currents shall be selected from the following standard values:

400 A; 630 A; 800 A; 1 250 A; 1 600 A; 2 000 A; 2 500 A; 4 000 A.

NOTE The above values are selected from the R 10 series, and, if required, higher values than those shown should also be selected from this series.

If the circuit-breaker is fitted with a series connected accessory, such as a direct over-current release, the rated normal current of the accessory is the r.m.s. value of the current which the

accessory shall be able to carry continuously without deterioration at its rated frequency, with a temperature rise not exceeding the values specified in Table 3 of IEC 62271-1.

Current transformers shall comply with IEC 60044-1.

#### **5.7 Rated short-time withstand current [4.5]**

Subclause 4.5 of IEC 62271-1 is applicable with the following addition:

The rated short-time withstand current is equal to the rated short-circuit breaking current (see 5.13).

#### **5.8 Rated peak withstand current [4.6]**

Subclause 4.6 of IEC 62271-1 is applicable with the following addition:

The rated peak withstand current is equal to the rated short-circuit making current (see 5.16).

#### **5.9 Rated duration of short-circuit [4.7]**

Subclause 4.7 of IEC 62271-1 is applicable with the following addition:

A rated duration of a short-circuit need not be assigned to a circuit-breaker fitted with a direct over-current release provided that, when connected in a circuit the prospective breaking current of which is equal to its rated short-circuit breaking current, the circuit-breaker shall be capable of carrying the resulting current for the break-time required by the circuit-breaker with the over-current release set for the maximum setting and maximum time delay if adjustable, when operating in accordance with its rated operating sequence (see 7.6.1).

#### **5.10 Rated supply voltage of closing and opening devices and auxiliary circuit [4.8]**

Subclause 4.8 of IEC 62271-1 is applicable.

#### **5.11 Rated supply frequency of closing and opening devices and auxiliary circuits [4.9]**

Subclause 4.9 of IEC 62271-1 is applicable.

#### **5.12 Rated pressures of compressed gas supply for operation and for interruption [4.10]**

The value of the pressures to which the circuit-breaker is filled.

Subclause 4.10 of IEC 62271-1 is applicable to the pressure of the compressed gas supply for operation.

No standard values are given for rated pressure of compressed gas supply for interruption.

The rated pressures of compressed gas shall be given by the manufacturer of the circuit-breaker.

#### **5.13 Rated short-circuit breaking current ( $I_{Nss}$ ) [4.101]**

##### **5.13.1 General [4.101]**

The rated short-circuit breaking current ( $I_{Nss}$ ) is the highest short-circuit current which the circuit-breaker shall be capable of breaking under the conditions of use and behaviour prescribed in this standard in a circuit having a power-frequency recovery voltage