

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

**Part 2: Single-phase disconnectors, earthing switches and switches with  $U_n$  above 1 kV**

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

**Partie 2: Sectionneurs monophasés, sectionneurs de terre et commutateurs avec  $U_n$  supérieur à 1 kV**



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## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions.....	6
4 Normal and special service conditions [2].....	7
5 Rating [4].....	7
5.1 General.....	7
5.2 Rated voltage ( $U_{Ne}$ ).....	7
5.3 Nominal voltage ( $U_n$ ).....	7
5.4 Rated insulation voltage ( $U_{Nm}$ ) [4.2].....	7
5.5 Rated short-time withstand current [4.5].....	8
5.6 Rated peak withstand current [4.6].....	8
5.7 Rated duration of short-circuit current [4.7].....	8
5.8 Rated breaking current [4.101].....	9
5.9 Rated no-load transformer breaking current [4.105].....	9
5.9.1 Rated no-load transformer breaking current for switch-disconnectors [4.105.1].....	9
5.9.2 Rated no-load transformer breaking current for general purpose switches [4.105.2].....	9
5.9.3 Rated line charging breaking current [4.105.3].....	9
5.10 Rated short-circuit making current [4.108].....	9
5.11 Co-ordination of rated values.....	9
6 Design and construction [5].....	10
7 Type tests [6].....	11
7.1 General.....	11
7.2 Test voltages [6.1.5].....	11
7.3 Mechanical operation test at ambient air temperature [6.102].....	11
8 Routine tests [7].....	11
Bibliography.....	12
Table 1 – Nominal voltages ( $U_n$ ), rated impulse voltages ( $U_{Ni}$ ) and short-duration power-frequency (a.c.) test levels ( $U_a$ ) for circuits connected to the contact line.....	8
Table 2 – Co-ordination table of rated values for devices.....	10

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 2: Single-phase disconnectors, earthing  
switches and switches with  $U_n$  above 1 kV**

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International Standard IEC 62505-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. This standard is based on EN 50152-2.

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

FDIS	Report on voting
9/1220/FDIS	9/1233/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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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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## 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 62505-2 has to be used in conjunction with IEC 62271-102 and IEC 60265-1.

Where a particular Clause of IEC 62271-102 and IEC 60265-1 is not mentioned in this standard, that Clause applies as far as reasonable. Where requirements relate exclusively to three-phase systems or to voltages outside those in use in traction systems, they are not applicable. Where this standard states "addition" or "replacement", the relevant text of IEC 62271-102 and IEC 60265-1 is to be adapted accordingly.

The numbering of clauses in the IEC 62271 series and IEC 60265-1 is not used in this Standard. The numbering in square brackets refers to the numbering of clauses in the IEC 62271 series and IEC 60265-1.

NOTE 1 Where terms defined in IEC 62271-102 and IEC 60265-1 conflict with definitions of the same terms as given in IEC 60050-811:1991, or the other railway applications documents listed in the normative references, the definitions used in IEC 62271-102 and IEC 60265-1 are to be used.

NOTE 2 The suffix N which appears in this Standard for rated values is not used in IEC 62271-102 and IEC 60265-1.

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

## Part 2: Single-phase disconnectors, earthing switches and switches with $U_n$ above 1 kV

### 1 Scope

This part of IEC 62505 is applicable to single-phase a.c. one-pole disconnectors, earthing switches and switches (switch-disconnectors and general purpose switches) 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 disconnectors, earthing switches and switches (switch-disconnectors and general purpose switches) connected in the following manner either:

- one pole supplying the connection to the contact line of the track, the other supplying the connection to the feeder cable which runs alongside the same track and is used to boost the track voltage at regular intervals in combination with autotransformers;
- or the two poles of the disconnector, earthing switch or switch (switch-disconnector or general purpose switch) are connected in series to provide secure isolation (i.e. two breaks in series).

### 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 60265-1:1998, *High voltage switches – Part 1: Switches for rated voltages above 1 kV and less than 52 kV*

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

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

IEC 62271-102:2003, *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*

IEC 62505-1:2009, *Railway applications – Fixed installations – Particular requirements for a.c. switchgear – Part 1: Single phase circuit breakers with  $U_n$  above 1 kV*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60265-1 and IEC 62271-102 and the following apply:



### 3.1

#### **disconnecting device**

general term covering circuit-breakers, disconnectors, earthing switches, switches, including switch-disconnectors and general purpose switches

### 3.2

#### **single-pole disconnecting device**

disconnecting device 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 disconnecting device.

### 3.3

#### **two-pole disconnecting device**

disconnecting device 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 of the two paths is simultaneous. The construction arrangement of this device is in principle identical to two phases of a three phase disconnecting device.

NOTE 2 This device is intended to be suitable to interrupt or establish simultaneously a single phase circuit in two different points.

## 4 Normal and special service conditions [2]

Clause 2 of IEC 62271-102 and IEC 60265-1 is applicable except as follows:

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 is necessary between purchaser and supplier.

## 5 Rating [4]

### 5.1 General

Clause 4 of IEC 62271-102 and IEC 60265-1 is applicable except as follows:

### 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 disconnecting device (i.e. highest permanent voltage  $U_{max1}$  as defined in IEC 60850).

### 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 values 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 (a.c.) 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)		$U_a^{b, c}$	
				A kV	B kV	A kV	B kV
<b>IEC 60850</b>	<b>IEC 62497-1</b>	<b>(IEC 62271-1)</b>	<b>IEC 62497-1</b>				
15	17,5	(24,0)	3	95	110	38 or 50	50 or 60
			4	125	145	50	60
		(36,0)	3	145	165 <sup>d</sup>	70	80
			4	170	195 <sup>d</sup>	70 or 95	95 or 110
20	24	not applicable	3				
			4	150	175	50	60
25	27,5 <sup>b</sup>	not applicable	3	170	200 <sup>b</sup>	70 or 95	95 or 110
			4	200 <sup>b</sup>	220 <sup>b</sup>	95	110
		(52,0)	3	200 <sup>b</sup>	220 <sup>b</sup>	95	110
			4	250	290 <sup>d</sup>	95	110
	30	not applicable	3				
			4	200	230	70	80
see Note 3	52,0	(72,5)	3	250	290 <sup>d</sup>	95	110
			4	300	375	140	160
<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 levels 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 disconnecting 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><sup>a</sup> 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 values for single-phase equipment given in this Table.</p> <p><sup>b</sup> These values are used in railway application only and are not of wide industrial use.</p> <p><sup>c</sup> Alternative values are left to purchaser choice or by agreement.</p> <p><sup>d</sup> Values derived from IEC 62271-1.</p> <p>A To earth and between poles.</p> <p>B Across the isolating distance (not applicable to earthing switches).</p>							

**5.5 Rated short-time withstand current [4.5]**

Subclause 4.5 of IEC 62271-102 and 4.5 of IEC 60265-1 are applicable.

**5.6 Rated peak withstand current [4.6]**

Subclause 4.6 of IEC 62271-102 and 4.6 of IEC 60265-1 are applicable.

**5.7 Rated duration of short-circuit current [4.7]**

Subclause 4.7 of IEC 62271-102 and 4.7 of IEC 60265-1 are applicable.

This does not apply to disconnectors, but is applicable to earthing switches operating as make-proof earthing switches.

## 5.8 Rated breaking current [4.101]

Subclause 4.101 of IEC 60265-1 is applicable for general purpose switches.

In addition, when specified by the purchaser, a disconnecting device may be specified capable of switching the capacitive current of the feeder cable or the catenary at a voltage value not less than  $U_{\max 1}$  (see IEC 60850), and with a current not exceeding 10 A. Moreover switches, when required to do so, shall be suitable to disconnect a capacitor bank. The resulting breaking current shall be tested in accordance with the requirements of IEC 62505-1 at the power factor and test requirements agreed between purchaser and supplier.

TRV values and out-of-phase breaking current are not applicable to disconnecting devices covered by this standard.

## 5.9 Rated no-load transformer breaking current [4.105]

### 5.9.1 Rated no-load transformer breaking current for switch-disconnectors [4.105.1]

When specified by the purchaser a switch-disconnector may be required to break the no-load current of a transformer. The no-load current and the  $\cos \phi$  of the transformer shall be specified by the purchaser.

The test procedure is subject to agreement between purchaser and supplier.

### 5.9.2 Rated no-load transformer breaking current for general purpose switches [4.105.2]

The no-load requirements of the current and  $\cos \phi$  of the transformer are to be given by the purchaser.

The test procedure is subject to agreement between purchaser and supplier.

### 5.9.3 Rated line charging breaking current [4.105.3]

When specified by the purchaser the unit shall be capable of switching the capacitive current of the feeder cable or the catenary at a voltage value of not less than  $U_{\max 1}$  (see IEC 60850) and with a current not exceeding 10 A.

## 5.10 Rated short-circuit making current [4.108]

Subclause 4.101 of IEC 62271-102 and 4.108 of IEC 60265-1 are applicable.

This does not apply to disconnectors.

## 5.11 Co-ordination of rated values

Co-ordinated values of rated voltages, short-circuit breaking currents (if any) and rated normal currents are given in Table 2.

**Table 2 – Co-ordination table of rated values for devices**

Basic voltages			Rated withstand current		Rated current							
$U_n$	$U_{Nm}$	$U^a$	Short time r.m.s. kA	Peak kA	$I_n$ A							
kV	kV	kV			400	630	630	630	630	1 250	1 600	2 000
15 <sup>b</sup>	17,5 <sup>b</sup>	(24)	8 12,5 16 20 25 31,5 40 50	20 32 40 50 63 80 100	400	630 630 630 630		1 250 1 250 1 250 1 250 1 250 1 250 1 250 1 250	1 600 1 600 1 600 1 600 1 600 1 600 1 600	2 000 2 000 2 000 2 000 2 000 2 000	2 500 2 500 2 500 2 500 2 500	4 000 4 000
15 25 <sup>b</sup>	24,0 27,5 <sup>b</sup>	(36)	8 12,5 16 20 25 31,5 40 50	20 32 40 50 63 80 100		630 630 630 630		1 250 1 250 1 250 1 250 1 250 1 250 1 250	1 600 1 600 1 600 1 600 1 600 1 600	2 000 2 000 2 000 2 000 2 000	2 500 2 500 2 500 2 500 2 500	4 000 4 000 4 000
20	24,0	N/A	12,5 20 25 40 50 63	32 50 63 100 125 158		600 600 600		1 200 1 200 1 200 1 200 1 200		2 000 2 000	3 000 3 000	4 000 4 000
25	30,0	N/A	12,5 16 25 31,5 40	32 40 63 80 100		600 600 600		1 200 1 200 1 200 1 200 1 200		2 000 2 000 2 000	3 000 3 000	
25	36,0	(52)	8 12,5 20 31,5	20 32 50 80		630	800	1 250 1 250 1 250 1 250	1 600 1 600	2 000 2 000	2 500	
	52,0	(72,5)	12,5 16 20 31,5 50	32 40 50 80			800 800	1 250 1 250 1 250 1 250	1 600 1 600 1 600	2 000 2 000	2 500 2 500 2 500	4 000

<sup>a</sup> 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 values for single-phase equipment given in this Table..

<sup>b</sup> These values are used in railway applications only and are not of wide industrial use.

NOTE Table 2 is intended to be used as a guide and gives preferred values.

**6 Design and construction [5]**

Clause 5 of IEC 62271-102 and IEC 60265-1 is applicable, except as follows:

For switches with a breaking medium like gas, the effective pressure of this gas at 20 °C shall not exceed  $6 \times 10^5$  Pa (added on the atmospheric pressure of  $10^5$  Pa).