



Test Report issued under the responsibility of:



TEST REPORT IEC 60947-3 Low-voltage switchgear and controlgear Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units	
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Name of Testing Laboratory preparing the Report	DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem, The Netherlands
Applicant's name	Koncar Niskonaponske Sklopke
Address	I Prekidaci d.o.o. Borongajska B.B. 81b, 10001 Zagreb, Croatia
Test specification:	
Standard	IEC 60947-3:2008, AMD1:2012, AMD2:2015 in conjunction with IEC 60947-1:2007, AMD1:2010, AMD2:2014
Test procedure.....:	CB-Scheme
Non-standard test method.....:	N/A
Test Report Form No.:	IEC60947_3D
Test Report Form(s) Originator....:	OVE
Master TRF	Dated 2017-04
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Test item description	Switch-disconnector	
Trade Mark	Koncar	
Manufacturer	Koncar Niskonaponske Sklopke	
Model/Type reference	PV25 – PV32 – PV40	
Ratings	DC-21B 1000 Vdc	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/> CB Testing Laboratory:	DEKRA Certification B.V.	
Testing location/ address	Meander 1051, 6825 MJ Arnhem, The Netherlands	
Tested by (name, function, signature)	C.H.J. Addink	
Approved by (name, function, signature) ..	M.T.H. van Gemen	
<input type="checkbox"/> Testing procedure: CTF Stage 1:		
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature) ..		
<input type="checkbox"/> Testing procedure: CTF Stage 2:		
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name, function, signature) ..		
Approved by (name, function, signature) ..		
<input type="checkbox"/> Testing procedure: CTF Stage 3:		
<input type="checkbox"/> Testing procedure: CTF Stage 4:		
Testing location/ address		
Tested by (name, function, signature)		
Witnessed by (name, function, signature) ..		
Approved by (name, function, signature) ..		
Supervised by (name, function, signature)		

List of Attachments (including a total number of pages in each attachment):

N/A

Summary of testing:

Complete type test

The PV25, PV32 and PV40 are inherently the same switch with the only difference of the number of contacts, all other mechanics, contacts, materials etc. are exactly the same.

Number of contacts, contact configuration and rated current at 1000 Vdc DC-21B:

For example contact configuration 3-1 means 3 series contacts in the “Plus” path and 1 series contact in the “Negative” path.

Contacts	Configuration	PV25	PV32	PV40
2-Poles	1-1	16 A	16 A	16 A
3-Poles	2-1	25 A	32 A	32 A
4-Poles	3-1	25 A	32 A	40 A
4-Poles	2-2	25 A	32 A	40 A
2x 2-Poles	1-1 and 1-1	16 A	16 A	16 A

Tests performed (name of test and test clause):
Sequence 1

PV25 with 2 Poles in a 1-1 configuration
Rated 1000 Vdc 16 A

PV32 with 3 Poles in a 2-1 configuration
Rated 1000 Vdc 32 A

PV40 with 4 Poles in a 3-1 configuration
Rated 1000 Vdc 40 A

Sequence 2

PV25 with 2 Poles in a 1-1 configuration
Rated 1000 Vdc 16 A

PV32 with 3 Poles in a 2-1 configuration
Rated 1000 Vdc 32 A

PV40 with 4 Poles in a 3-1 configuration
Rated 1000 Vdc 40 A

Sequence 3

PV40 with 4 Poles in a 3-1 configuration
Rated Icw 1000 Vdc 500 A – 1 sec.
Rated Icm 1000 Vdc 550 A

Testing location:



DEKRA Certification B.V.
Arnhem The Netherlands



<p>Summary of compliance with National Differences (List of countries addressed):</p> <p>N/A</p> <p><input type="checkbox"/> The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis or delete the whole sentence if not applicable)</p>	

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

KONČAR	IEC 60947-1.3 / IEC 60204 10 mm ² /AWG8 U _i =1000V I _{th} =25A DC21B 25A - 800V 16A - 1000V	DC21B 1000V 16A 	PV25-11-O Made in CROATIA	49	
				16	

KONČAR	IEC 60947-1.3 / IEC 60204 10 mm ² /AWG8 U _i =1000V I _{th} =32A DC21B 32A - 1000V	DC21B 1000V 32A 	PV32-21-O Made in CROATIA	49	
				16	

KONČAR	IEC 60947-1.3 / IEC 60204 10 mm ² /AWG8 U _i =1000V PD3, 1500V PD2, I _{th} =40A DC21B 40A - 1000V 32A - 1200V 25A - 1500V	DC21B 1000V 40A 	PV40-31-O Made in CROATIA	49	
				16	

Test item particulars.....:	
- method of operation.....:	Manual
- suitability for isolation	Suitable
- degree of protection.....:	IP00
- number of poles.....:	2, 3 or 4
- kind of current.....:	DC
-in the case of a.c., number of phases and rated frequency.....:	N/A
- number of positions of the main contacts (if more than two).....:	2 positions (ON and OFF)
-breaking arrangement for fused devices	Double break
Rated and limiting values, main circuit.....:	-
- rated operational voltage U_e (V).....:	1000 Vdc
- rated insulation voltage U_i (V)	1000 Vdc
- rated impulse withstand voltage U_{imp} (kV)	8 kV
- conventional free air thermal current I_{th} (A).....:	25 A, 32 A and 40 A
- conventional enclosed thermal current I_{the} (A).....:	N/A
- rated operational current I_e (A).....:	16 A, 32 A or 40 A
- rated uninterrupted current I_u (A).....:	16 A, 32 A or 40 A
- rated frequency (Hz)	DC
- utilization category	DC-21B
Short-circuit characteristic.....:	-
- rated short-time withstand current I_{cw} (A).....:	500 A – 1 sec.
- rated short-time making capacity I_{cm} (A).....:	550 A
- rated conditional short-circuit current	N/A
Control circuits.....:	N/A
Auxiliary circuits.....:	N/A
Relays and releases.....:	N/A
Co-ordination with short-circuit protective devices.....:	N/A
- kind of protective device	N/A

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test object does meet the requirement..... : P (Pass)
- test object does not meet the requirement : F (Fail)

Testing :

Date of receipt of test item : 2016-07

Date (s) of performance of tests : 2016-07 up to and including 2017-03

General remarks:

"(see Enclosure #)" refers to additional information appended to the report.
 "(see appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 6.2.5 of IEC60947-1:

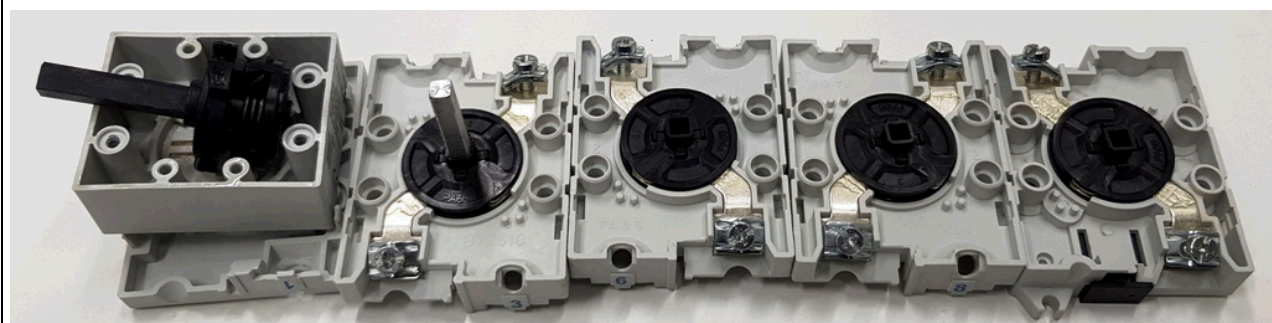
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:

- ☐ Yes
☒ Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) : Koncar Niskonaponske Sklopke,
 I Prekidaci d.o.o.
 Borongajska cesta 81b
 10001 Zagreb, Croatia

General product information:

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
5.2	MARKING		
	Marking on equipment itself or on nameplate or nameplates attached to the equipment and legible from the front after mounting		P
	- indication of the open and closed position	ON 1 – OFF 0	P
	- suitability for isolation	Symbol for isolation	P
	- disconnecter AC-20 and DC-20 only: marked "Do not operate under load"		N/A
	Following marking is visible after mounting:		
	- direction of movement of the actuator (see 7.1.5.2)		P
	- indication of the position of the actuator (see also 7.1.6.1 and 7.1.6.2)		P
	- approval or certification mark, if applicable		P
	- for miniaturized equipment, symbol, colour code or letter code		N/A
	- terminal identification and marking (see 7.1.8.4)		P
	- IP code and class of protection against electric shock, when applicable (marked preferably on the equipment as far as possible)		N/A
	- suitability for isolation, where applicable, with the isolation function symbol according to IEC 60617-7, reference 07-01-03, combined with the appropriate function symbol for the equipment		P
	- this symbols are clearly and unmistakably marked		P
	- this symbols are visible when the equipment is installed as in service and the actuator is accessible		P
	In the case of electronically controlled electromagnets, information other than that given in 5.1 may also be necessary (see also 4.5 and Annex U)		N/A
	The indication "s", "sol", "r" or "f" for non-universal screwless terminals shall be marked on the device or, if the space available is not sufficient, on the smallest package unit or in technical information provided with the product		N/A
	Marking on equipment not needed to be visible after mounting:		
	- manufacturer's name or trademark	Koncar	P
	- type designation or serial number	PV25, PV32 and PV40	P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated operational currents or rated powers	16 A, 25 A, 32 A and 40 A	P
	- rated operational voltage	1000 Vdc	P
	- utilization category	DC-21B	P
	- rated frequency or the indication "DC"	DC	P
	- manufacturer's claim for compliance with IEC 60947-3	EN/IEC 60947-3	P
	- degree of protection	IP00	P
	Marking on fuse-combination units:		N/A
	- fuse type characteristics		N/A
	- maximum rated current		N/A
	- maximum power loss of the fuse-link		N/A
	Identification of terminals:		P
	- line terminals, unless connection is immaterial		P
	- load terminals, unless connection is immaterial		P
	- neutral pole terminal		N/A
	- protective earth terminal		N/A
	Data in the manufacturer's published information:		P
	- rated insulation voltage		P
	- rated impulse withstand voltage for equipment suitable for isolation or when determined		P
	- pollution degree, if different from 3	Pollution degree 3	P
	- rated duty	Uninterrupted	P
	- rated short-time withstand current and duration	500 A – 1 sec.	P
	- rated short-circuit making capacity	550 A	P
	- rated conditional short-circuit current		N/A
5.3	Instructions for installation, operation and maintenance		P
6	NORMAL SERVICE, MOUNTING AND TRANSPORT CONDITIONS		
6.1	Normal service conditions		P
6.1.1	Ambient air temperature		P
6.1.2	Altitude		P
6.1.3	Atmospheric conditions		P
6.1.3.1	Humidity		P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
6.1.3.2	Pollution degree	Pollution degree 3	P
6.1.4	Shock and vibration		P
6.2	Conditions during transport and storage		P
6.3	Mounting		P
7	CONSTRUCTIONAL AND PERFORMANCE REQUIREMENTS		
7.1	Constructional requirements		
7.1.1	General		
7.1.2	Materials		
7.1.2.1	General material requirements		
	Parts of insulating materials which might be exposed to thermal stresses due to electrical effects within the equipment shall not be adversely affected by abnormal heat and by fire.		P
	The manufacturer specifies which test method, 7.1.2.2 or 7.1.2.3, is to be used		
7.1.2.2	Glow wire Testing		
	The suitability of materials used is verified by making tests on : or	- the equipment - sections taken from the equipment - samples of identical material	N/A
	- providing data from the insulating material supplier fulfilling the requirements according to IEC 60695-2-12		P
	Glow-wire test according to IEC 60695-2-10 and IEC 60695-2-11		—
	Parts made of insulating material necessary to retain current-carrying parts in position: test temperature 960 °C		N/A
	No visible flame and no sustained glowing		N/A
	Flames and glowing extinguish within 30 s		N/A
	No ignition of the tissue paper		N/A
	Parts of insulating material not necessary to retain current-carrying parts in position, even though in contact with them: test temperature 650 °C		
	No visible flame and no sustained glowing		N/A
	Flames and glowing extinguish within 30 s		N/A
	No ignition of the tissue paper		N/A
7.1.2.3	Test based on flammability category		

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	For parts of insulating materials, hot wire ignition and, where applicable, arc ignition tests as specified in 8.2.1.1.2, shall be made based on flammability category		N/A
	Tests on materials are made in accordance with Annex M		N/A
	The hot wire ignition (HWI) and arc ignition (AI) test value requirements related to the material flammability category shall conform to Table M.1 or M.2		N/A
	Alternatively, the manufacturer may provide data from the insulating material supplier fulfilling the requirements given in Annex M		N/A
7.1.3	Current-carrying parts and their connections		P
	Current-carrying parts have the necessary mechanical strength and current-carrying capacity for their intended use		P
	For electrical connections, no contact pressure is transmitted through insulating material other than ceramic or other material with characteristics not less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulation material		P
7.1.4	Clearances..... :	see appended table 7.1.4	P
	Creepage distances..... :	see appended table 7.1.4	P
	Pollution degree	3	—
	Comparative tracking index (V)	600 V	—
	Material group	1	—
7.1.5	Actuator		P
7.1.5.1	Insulation		—
	Actuator insulated from live parts for		—
	- rated insulation voltage	1000 Vdc	P
	- rated impulse withstand voltage	8 kV	P
	Actuator made of metal		—
	- connected to a protective conductor or provided with an additional insulation		N/A
	Actuator made of or covered by insulating material..... :		—

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- internal metal parts, which might become accessible in the event of an insulation failure, are also insulated from live parts for the rated insulation voltage		P
7.1.5.2	Direction of movement		P
	The direction of operation for actuators shall where applicable conform to IEC 60447		P
	There is no doubt of the "I" and "O" position and the direction of operation		P
7.1.6	Indication of contact position		
7.1.6.1	Indicating means	ON 1 and OFF 0	P
7.1.6.2	Indication by the actuator		P
7.1.7	Additional safety requirements for equipment suitable for isolation		
7.1.7.1	Additional constructional requirements		
	- marking according to 5.2.1b		P
	- indication of the position of the contacts		P
	- construction of the actuating mechanism		P
	- minimum clearances across open contacts (see Table 13, Part 1) (mm) : 8 mm		—
	- measured clearances (mm) : 8,66 mm		P
	- test U _{imp} across gap (kV) : 12,3 kV		P
7.1.7.2	Supplementary requirements for equipment with provision for electrical interlocking with contactors or circuit-breakers:		N/A
	Auxiliary switch is rated according to IEC 60947-5-1 (unless the equipment is rated AC-23)		N/A
	Time interval between opening of the contacts of the auxiliary contact and the contacts of the main poles: ≥20 ms :		—
	Measured time interval (ms) :		N/A
	During the closing operation the contacts of the auxiliary switch closes after or simultaneously with the contacts of the main poles		N/A
7.1.7.3	Supplementary requirements for equipment provided with means for padlocking the open position:		
	The locking means is so designed that it cannot be removed with the appropriate padlock(s) installed		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Test force F applied to the actuator in an attempt to operate to the closed position (N)		—
	Rated impulse withstand voltage (kV)		—
	Test Uimp on open main contacts at the test force		N/A
7.1.8	Terminals		
7.1.8.1	All parts of terminals which maintain contact and carry current are of metal having adequate mechanical strength	(see 8.2.4 below)	P
	Terminal connections are such that necessary contact pressure is maintained	(see 8.2.4 below)	P
	Terminals are so constructed that the conductor is clamped between suitable surfaces without damage to the conductor and terminal	(see 8.2.4 below)	P
	Terminals do not allow the conductor to be displaced or to be displaced themselves in a manner detrimental to the operator of equipment and the insulation voltage is not reduced below the rated value	(see 8.2.4 below)	P
	Screwless-type clamping units, unless otherwise specified by the manufacturer, shall accept rigid and flexible conductors as indicated in Table 1		N/A
	On screwless-type clamping unit, the connection or disconnection of conductors shall be made as follows:		
	– on universal clamping units by the use of a general purpose tool or a convenient device, integral with the clamping unit to open it for the insertion or withdrawal of the conductors		N/A
	– on push-wire clamping units by simple insertion. For the disconnection of the conductors an operation other than a pull only on the conductor shall be necessary. The use of a general purpose tool or of a convenient device, integral with the clamping unit is allowed in order to "open" it and to assist the insertion or the withdrawal of the conductor		N/A
8.2.4	Mechanical and electrical properties of terminals		
	Mechanical strength of terminals		P
	Maximum cross-sectional area of conductor (mm ²)	10 mm ²	—
	Diameter of thread (mm)	4	—
	Torque (Nm)	1,2 Nm	—
	5 times on 2 separate clamping units		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Testing for damage to and accidental loosening of conductor (flexion test)		
	Conductor of the smallest cross-sectional area (mm ²) : 4 mm ²		—
	Number of conductor of the smallest cross section : 1		—
	Diameter of bushing hole (mm) : 9,5 mm		—
	Height between the equipment and the platen ... : 280 mm		—
	Mass at the conductor(s) (kg) : 0,9 kg		—
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit		P
	Pull-out test		
	Force (N), applied for 1 min. : 60 N		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit		P
	Conductor of the largest cross-sectional area (mm ²) : 10 mm ²		—
	Number of conductor of the largest cross section : 1		—
	Diameter of bushing hole (mm) : 9,5 mm		—
	Height between the equipment and the platen ... : 280 mm		—
	Mass at the conductor(s) (kg) : 2,0 kg		—
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit		P
	Pull-out test		
	Force (N), applied for 1 min. : 90 N		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit		P
	Conductor of the largest and smallest cross-sectional area (mm ²) :		—
	Number of conductor of the smallest cross section, number of conductor of the largest cross section :		—
	Diameter of bushing hole (mm) :		—
	Height between the equipment and the platen ... :		—
	Mass at the conductor(s) (kg) :		—

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit		N/A
	Pull-out test		
	Force (N), applied for 1 min..... :		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit		N/A
7.1.8.2	Connection capacity		
	Type of conductors		—
	Minimum cross-sectional area of conductor (mm ²)		—
	Maximum cross-sectional area of conductor (mm ²)		—
	Number of conductors simultaneously connectable to the terminal		—
7.1.8.3	Connection		
	Terminals for connection to external conductors are readily accessible during installation		P
	Clamping screws and nuts do not serve to fix any other component		P
7.1.8.4	Terminal identification and marking		
	Terminal intended exclusively for the neutral conductor		N/A
	Protective earth terminal		N/A
	Other terminals		N/A
7.1.9	Additional requirements for equipment provided with a neutral pole		
	Equipment provided with a pole intended for the connection of neutral, this pole shall be clearly marked by the letter "N"		N/A
	The switched neutral pole does not break before and does not make after the other poles except		N/A
	- a pole having the appropriate short-circuit breaking and making capacity is used as neutral pole, all poles may operate together		N/A
	Conventional thermal current of neutral pole		N/A
7.1.10	Provisions for protective earthing		
7.1.10.1	The exposed conductive parts are electrically interconnected and connected to a protective earth terminal		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
7.1.10.2	Protective earth terminal is readily accessible		N/A
	Protective earth terminal is suitably protected against corrosion		N/A
	Electrical continuity between the exposed conductive parts of the protective earth terminal and the metal sheathing of connecting conductors		N/A
	Protective earth terminal has no other functions		N/A
7.1.10.3	Protective earth terminal marking and identification		N/A
7.1.11	Enclosure for equipment		
7.1.11.1	Design		
	When the enclosure is opened, all parts requiring access for installation and maintenance are readily accessible		N/A
	Sufficient space is provided inside the enclosure		N/A
	The fixed parts of a metal enclosure are electrically connected to the other exposed conductive parts of the equipment and connected to a terminal which enables them to be earthed or connected to a protective conductor		N/A
	Under no circumstances a removable metal part of the enclosure is insulated from the part carrying the earth terminal when the removable part is in place		N/A
	The removable parts of the enclosure are firmly secured to the fixed parts by a device such that they cannot be accidentally loosened or detached owing to the effects of operation of the equipment or vibrations		N/A
	When an enclosure is so designed as to allow the covers to be opened without the use of tools, means is provided to prevent loss of the fastening devices		N/A
	If the enclosure is used for mounting push-buttons, it is not possible to remove the buttons from the outside of the enclosure		N/A
7.1.11.2	Insulation		
	If, in order to prevent accidental contact between a metallic enclosure and live parts, the enclosure is partly or completely lined with insulating material, then this lining is securely fixed to the enclosure		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
7.1.12	Degree of protection of enclosed equipment		
	Degree of protection : IP00		P
7.1.13	Conduit pull-out, torque and bending with metallic conduits		
	Withstand the stress occurring during its installation : IP		N/A

8.3.3	TEST SEQUENCE I: GENERAL PERFORMANCE CHARACTERISTICS		
8.3.3.1	Temperature-rise		
	ambient temperature 10-40 °C : 22,9 °C		—
	Main circuits, test conditions:		
	- rated operational current I _e (A) : 40 A		—
	- cable/busbar cross-section (mm ²) / length (mm): 10 mm ²		—
	Fuse-link details (fuse-combination units only):		N/A
	- manufacturer's name, trademark or identification mark :		—
	- manufacturer's model or type reference :		—
	- rated current (A) :		—
	- power loss (W) :		—
	- rated breaking capacity (kA) :		—
	Measured temperature-rise : see appended table 8.3.3.1		P
	Auxiliary circuits, test conditions:		N/A
	- rated operation current (A) :		—
	- cable cross-section (mm ²) :		—
	Measured temperature-rise : see appended table 8.3.3.1		N/A
8.3.3.2	Test of dielectric properties		P
	Rated impulse withstand voltage (kV) : 8 kV		—
	- test U _{imp} main circuits (kV) : 9,8 kV		P
	- test U _{imp} auxiliary circuits (kV) :		N/A
	- test U _{imp} on open main contacts (equipment suitable for isolation) (kV) : 12,3 kV		P
	Power-frequency withstand voltage (V) :		—
	- main circuits, test voltage for 60 sec. (V) : 3110 Vdc		P
	- control and auxiliary circuits, test voltage for 60 sec. (V) :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Devices, which have been disconnected for the power-frequency withstand voltage test.....		N/A
	Equipment suitable for isolation, leakage current not exceed 0,5 mA		—
	Test voltage 1,1 U _e (V)	1100 Vdc	—
	Measured leakage current (μA)	< 0,1 μA	P
8.3.3.3	Making breaking capacity – PV25 in 2 contacts 1-1 configuration 1000 Vdc 16 A		P
	- utilization category	DC-21B	—
	- rated operational voltage U _e (V)	1000 Vdc	—
	- rated operational current I _e (A) or power (kW) .	16 A	—
	Conditions for make/break operations, other than AC-23A/B:		P
	- test voltage, U = 1,05 U _e	1050 Vdc	—
	- test current, I = 1,5 I _e	24 A	—
	- power factor/ time constant	1,01 ms	—
	Number of make/break or make and break operations	5	P
	- recovery voltage duration (≥ 50 ms)	> 100 ms	P
	- current duration (ms)	700 ms	—
	- time interval between operations	30 sec.	P
	Characteristic of transient recovery voltage for AC-22 and AC-23 only		N/A
	- oscillatory frequency (kHz)		—
	- measured oscillatory frequency (kHz)	L1: L2: L3:	N/A
	- factor γ	L1: L2: L3:	N/A
8.3.3.3.5	Behaviour of the equipment during making and breaking capacity tests		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.3.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 47 N Force after: 48 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.3.4	Dielectric verification		P
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :	2000 V	—
	No flashover or breakdown		P
8.3.3.5	Leakage current		
	test voltage (1,1 U_e) (V)	1100 vdc	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B): $\leq 0,5$ mA/pole .. :		N/A
	Leakage current (other utilization categories): ≤ 2 mA/pole)	$< 0,1 \mu A$	P
8.3.3.6	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	- conductor cross-section (mm ²)		—
	- test current I_e (A)		—
	Measured temperature-rise	see appended table 8.3.3.6.a	P
8.3.3.3	Making breaking capacity – PV32 in 3 contacts 2-1 configuration 1000 Vdc 32 A		P
	- utilization category	DC-21B	—
	- rated operational voltage U_e (V)	1000 Vdc	—
	- rated operational current I_e (A) or power (kW) .. :	32 A	—
	Conditions for make/break operations, other than AC-23A/B:		P
	- test voltage, $U = 1,05 U_e$	1050 Vdc 1057 Vdc	—
	- test current, $I = 1,5 I_e$	48 A 48,5 A	—

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Clause	Requirement + Test	Result - Remark	Verdict
	- power factor/ time constant	1,03 ms	—
	Number of make/break or make and break operations	5	P
	- recovery voltage duration (≥ 50 ms)	> 100 ms	P
	- current duration (ms)	710 ms	—
	- time interval between operations	30 sec.	P
	Characteristic of transient recovery voltage for AC-22 and AC-23 only		N/A
	- oscillatory frequency (kHz)		—
	- measured oscillatory frequency (kHz)	L1: L2: L3:	N/A
	- factor γ	L1: L2: L3:	N/A
8.3.3.3.5	Behaviour of the equipment during making and breaking capacity tests		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.3.3.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 49 N Force after: 50 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.3.4	Dielectric verification		P
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~	2000 V	—
	No flashover or breakdown		P
8.3.3.5	Leakage current		
	test voltage (1,1 U_e) (V)	1100 Vdc	—

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Clause	Requirement + Test	Result - Remark	Verdict
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B): $\leq 0,5$ mA/pole .. :		N/A
	Leakage current (other utilization categories): ≤ 2 mA/pole) :	$< 0,1 \mu\text{A}$	P
8.3.3.6	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark :		—
	- manufacturer's model or type reference :		—
	- rated current (A) :		—
	- power loss (W) :		—
	- rated breaking capacity (kA) :		—
	- conductor cross-section (mm^2) :		—
	- test current I_e (A) :		—
	Measured temperature-rise :	see appended table 8.3.3.6.b	P
8.3.3.3	Making breaking capacity – PV40 in 4 contacts 3-1 configuration 1000 Vdc 40 A		P
	- utilization category :	DC-21B	—
	- rated operational voltage U_e (V) :	1000 Vdc	—
	- rated operational current I_e (A) or power (kW) .. :	40 A	—
	Conditions for make/break operations, other than AC-23A/B:		P
	- test voltage, $U = 1,05 U_e$:	1050 Vdc 1075 Vdc	—
	- test current, $I = 1,5 I_e$:	60 A 61,3 A	—
	- power factor/ time constant :	1,08 ms	—
	Number of make/break or make and break operations :	5	P
	- recovery voltage duration (≥ 50 ms)	> 100 ms	P
	- current duration (ms) :	715 ms	—
	- time interval between operations :	30 sec.	P
	Characteristic of transient recovery voltage for AC-22 and AC-23 only		N/A
	- oscillatory frequency (kHz) :		—
	- measured oscillatory frequency (kHz) :	L1: L2: L3:	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- factor γ	L1: L2: L3:	N/A
8.3.3.3.5	Behaviour of the equipment during making and breaking capacity tests		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.3.3.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 52 N Force after: 52 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.3.4	Dielectric verification		P
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :	2000 V	—
	No flashover or breakdown		P
8.3.3.5	Leakage current		
	test voltage (1,1 U_e) (V)	1100 Vdc	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B): $\leq 0,5$ mA/pole .. :		N/A
	Leakage current (other utilization categories): ≤ 2 mA/pole)	$< 0,1 \mu A$	P
8.3.3.6	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—

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Clause	Requirement + Test	Result - Remark	Verdict
	- conductor cross-section (mm ²)		—
	- test current I _e (A)		—
	Measured temperature-rise	see appended table 8.3.3.6.c	P
8.3.3.7	Strength of actuator mechanism		P
8.2.5	Verification of the strength of actuator mechanism and position indicating device		P
	- actuator type (fig.)	1c	—
8.2.5.2.1	Dependent and independent manual operation		P
	- actuating force for opening (N)	55 N	—
	- test force with blocked main contacts (N)	165 N	—
	- used method to keep the contact closed.....	Soldering	—
	During and after the test, open position not indicated		P
	Equipment with locking mean, no locking in the open position while test force is applied.....		N/A
8.2.5.2.2	Dependent power operation		N/A
	- main contacts fixed together in the closed position		N/A
	- used method to keep the contact closed.....		N/A
	- 110% of the rated supply voltage applied to the equipment (3 times)		N/A
	During and after the test, open position not indicated		N/A
	Equipment show no damage impairing its normal operation.....		N/A
	Equipment with locking mean, no locking in the open position while test force is applied.....		N/A
8.2.5.2.3	Independent power operation		N/A
	- main contacts fixed together in the closed position		N/A
	- used method to keep the contact closed.....		N/A
	- stored energy of the power operator released (3 times).....		N/A
	During and after the test, open position not indicated		N/A
	Equipment show no damage impairing its normal operation.....		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	Equipment with locking mean, no locking in the open position while test force is applied..... :		N/A
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8.3.4	TEST SEQUENCE II: OPERATIONAL PERFORMANCE CAPABILITY		
8.3.4.1	Operational performance – PV25 in 2 contacts 1-1 configuration 1000 Vdc 16 A		
	- utilization category	DC-21B	—
	- rated operational voltage (V)	1000 Vdc	—
	- rated operational current (A)	16 A	—
	Test conditions for electrical operation cycles:		
	- test voltage (V)	1030 Vdc	—
	- test current (A)	16,5 A	—
	- power factor/time constant	1,00 ms	—
	Number of cycles with current	300	P
	Number of cycles without current	1700	P
	First test sequence (with/without current)	With current	—
	Second test sequence (with/without current)	Without current	—
	- time interval between first and second test sequence	30 sec	—
8.3.4.1.5	Behaviour of the equipment during the operational performance test		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.4.1.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 46 N Force after: 48 N	P
	- equipment is able to carry its rated current after normal closing operation		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.3.4.2	Dielectric verification		P
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :	2000 V	—
	No breakdown or flashover		P
8.3.4.3	Leakage current		
	test voltage (1,1 U_e) (V)	1100 Vdc	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ... :		N/A
	Leakage current (other utilization categories) ≤ 2 mA/pole	$< 0,1 \mu A$	P
8.3.4.4	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	- conductor cross-section (mm ²)		—
	- test current I_e (A)		—
	Measured temperature-rise	see appended table 8.3.4.4.a	P
8.3.4.1	Operational performance – PV32 in 3 contacts 2-1 configuration 1000 Vdc 32 A		
	- utilization category	DC-21B	—
	- rated operational voltage (V)	1000 Vdc	—
	- rated operational current (A)	32 A	—
	Test conditions for electrical operation cycles:		
	- test voltage (V)	1028 Vdc	—
	- test current (A)	32,8 A	—
	- power factor/time constant	1,05 ms	—
	Number of cycles with current	300	P
	Number of cycles without current	1700	P
	First test sequence (with/without current)	With current	—
	Second test sequence (with/without current)	Without current	—
	- time interval between first and second test sequence	30 sec	—

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Clause	Requirement + Test	Result - Remark	Verdict
8.3.4.1.5	Behaviour of the equipment during the operational performance test		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.4.1.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 47 N Force after: 50 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.4.2	Dielectric verification		P
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :	2000 V	—
	No breakdown or flashover		P
8.3.4.3	Leakage current		
	test voltage (1,1 U_e) (V)	1100 Vdc	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ... :		N/A
	Leakage current (other utilization categories) ≤ 2 mA/pole	$< 0,1 \mu A$	P
8.3.4.4	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	- conductor cross-section (mm ²)		—
	- test current I_e (A)		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Measured temperature-rise	see appended table 8.3.4.4.b	P
8.3.4.1	Operational performance – PV40 in 4 contacts 3-1 configuration 1000 Vdc 40 A		
	- utilization category	DC-21B	—
	- rated operational voltage (V)	1000 Vdc	—
	- rated operational current (A)	40 A	—
	Test conditions for electrical operation cycles:		
	- test voltage (V)	1034 Vdc	—
	- test current (A)	40,9 A	—
	- power factor/time constant	1,10 ms	—
	Number of cycles with current	300	P
	Number of cycles without current	1700	P
	First test sequence (with/without current)	With current	—
	Second test sequence (with/without current)	Without current	—
	- time interval between first and second test sequence	30 sec	—
8.3.4.1.5	Behaviour of the equipment during the operational performance test		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.4.1.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 49 N Force after: 52 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.4.2	Dielectric verification		P
	test voltage: 2*Ue with a minimum of 1000V~	2000 V	—
	No breakdown or flashover		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.3.4.3	Leakage current		
	test voltage (1,1 U _e) (V) :	1100 Vdc	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) ≤ 0,5 mA/pole ... :		N/A
	Leakage current (other utilization categories) ≤ 2 mA/pole :	< 0,1 µA	P
8.3.4.4	Temperature-rise verification		P
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark :		—
	- manufacturer's model or type reference :		—
	- rated current (A) :		—
	- power loss (W) :		—
	- rated breaking capacity (kA) :		—
	- conductor cross-section (mm ²) :		—
	- test current I _e (A) :		—
	Measured temperature-rise :	see appended table 8.3.4.4.c	P

8.3.5	TEST SEQUENCE III: SHORT-CIRCUIT PERFORMANCE CAPABILITY		
8.3.5.1	Short-time withstand current test		P
	Rated short-time withstand current I _{cw} (A) (>12.I _e max) :	500 A – 1 sec	P
	test voltage (V) :	673 Vdc	—
	r.m.s. test current (A) :	502 A	—
	power factor/time constant :	5,07 ms	—
	test duration (s) :	1,001 sec.	—
8.3.5.1.5	Behaviour of the equipment during the test		P
	Test performed without:		—
	- endanger to the operator		P
	- cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.3.5.1.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 48 N Force after: 49 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.5.2	Short-circuit making capacity		P
	Rated short-circuit making capacity I _{cm} (A)		P
	test voltage(V):	1039 Vdc	—
	r.m.s. test current (A)	554 A	—
	power factor/time constant	5,001 ms	P
	current duration (s)	63 ms	—
	Time interval between the cycles	3 min	—
8.3.5.2.5	Behaviour of the equipment during the test		P
	Test performed without:		—
	- endanger to the operator		P
	-cause damage to adjacent equipment		P
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
8.3.5.2.6	Condition of the equipment after making and breaking capacity tests		P
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1	Force new: 49 N Force after: 55 N	P
	- equipment is able to carry its rated current after normal closing operation		P
8.3.5.3	Dielectric verification		
	test voltage: 2*U _e with a minimum of 1000V~	2000 V	—
	No flashover or breakdown		P
8.3.5.4	Leakage current		
	test voltage (1,1x U _e) (V)	1100 Vdc	—

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Clause	Requirement + Test	Result - Remark	Verdict
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ... :		N/A
	Leakage current (other utilization categories) $\leq 2,0$ mA/pole :	$< 0,1 \mu\text{A}$	P
8.3.5.5	Temperature-rise verification		
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark :		—
	- manufacturer's model or type reference :		—
	- rated current (A) :		—
	- power loss (W) :		—
	- rated breaking capacity (kA) :		—
	- conductor cross-section (mm^2) :		—
	- test current I_e (A) :		—
	Measured temperature-rise :	see appended table 8.3.5.5	P

8.3.6	TEST SEQUENCE IV: CONDITIONAL SHORT-CIRCUIT CURRENT		
	Protective device details:		N/A
	- manufacturer's name, trademark or identification mark :		—
	- manufacturer's model or type reference :		—
	- rated voltage (V) :		—
	- rated current (A) :		—
	- rated breaking capacity (kA) :		—
8.3.6.2	Fuse protected short-circuit withstand		N/A
	test voltage ($1,05 \times U_e$) (V) :	L1: L2: L3:	—
	test current (kA) :	L1: L2: L3:	—
	rated frequency (Hz) :		—
	power factor :		—
	Time constant (ms) :		—
	Fuse protected short-circuit withstand (equipment in closed position)		

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Clause	Requirement + Test	Result - Remark	Verdict
	- max. let-through current (kA)	L1: L2: L3:	—
	- Joule integral I^2dt (A ² s)	L1: L2: L3:	—
	Fuse protected short-circuit making		N/A
	- mean velocity of 15 manually under no-load conditions operations (m/s)		—
	- point at which the measurement is made		—
	- test speed during the fuse protected short-circuit making (m/s)		—
	- max. let-through current (kA)	L1: L2: L3:	—
	- Joule integral I^2dt (A ² s)	L1: L2: L3:	—
8.3.6.2.5	Behaviour of the equipment during the test		N/A
	Test performed without:		—
	- endanger to the operator		N/A
	- cause damage to adjacent equipment		N/A
	No permanent arcing		N/A
	No flash over between poles and poles and frame		N/A
	No melting of the fuse in the detection circuit		N/A
8.3.6.2.6	Condition of the equipment after making and breaking capacity tests		N/A
	Immediately after the test equipment must work satisfactorily		N/A
	- required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1		N/A
	- equipment is able to carry its rated current after normal closing operation		N/A
8.3.6.3	Dielectric verification		N/A
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~		—
	No flashover or breakdown		N/A
8.3.6.4	Leakage current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	test voltage (1,1 Ue) (V)		—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ...		N/A
	Leakage current (other utilization categories) $\leq 2,0$ mA/pole		N/A
8.3.6.5	Temperature-rise verification		N/A
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	- conductor cross-section (mm ²)		—
	- test current I _e (A)		—
	Measured temperature-rise	see appended table 8.3.6.5	N/A

8.3.7	TEST SEQUENCE V: OVERLOAD PERFORMANCE CAPABILITY		
8.3.7.1	Overload test		N/A
	ambient temperature 10-40 °C		—
	test enclosure W x H x D (mm x mm x mm)		—
	material of enclosure		—
	test current 1,6xI _{the} or 1,6xI _{th} (A)		—
	cable/busbar cross-section (mm ²) / length (mm) :		—
	Fuse-link details:		N/A
	- manufacturer's name, trademark or identification mark		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	- time duration of the overload test (s)		—
	Within 3 to 5 min after the fuse(s) has(have) operated (or 1 h), the equipment has been operated once, i.e. opened and closed		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Required opening force not greater than the test force of 8.2.5.2 and table 17 of IEC 60947-1		N/A
	The equipment has not undergone any impairment hindering such operation		N/A
8.3.7.2	Dielectric verification		N/A
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :		—
	No flashover or breakdown		N/A
8.3.7.3	Leakage current		N/A
	test voltage (1,1 U_e) (V)		—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ... :		N/A
	Leakage current (other utilization categories) ≤ 2 mA/pole		N/A
8.3.7.4	Temperature-rise verification		N/A
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark		—
	- manufacturer's model or type reference		—
	- rated current (A)		—
	- power loss (W)		—
	- rated breaking capacity (kA)		—
	Fuse links aged during the overload test are replaced by new fuse-links		N/A
	- conductor cross-section (mm ²)		—
	- test current I_e (A)		—
	Measured temperature-rise	see appended table 8.3.7.4	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

8.4	ELECTROMAGNETIC COMPATIBILITY TESTS		
8.4.1	Immunity		N/A
8.4.1.1	Equipment not incorporating electronic circuits: no tests necessary		N/A
8.4.1.2	Equipment incorporating electronic circuits:		N/A
	Equipment utilizing circuits in which all components are passive are not required to be tested		N/A
	All other equipment, requirements according to 7.3.3.2 of IEC 60947-1 and limits according table 6 apply		N/A
	Performed tests..... :	see _____	N/A
	No unintentional separation or closing of contacts has occurred during these tests		N/A
8.4.2	Emission		N/A
8.4.2.1	Equipment not incorporating electronic circuits: no tests necessary		N/A
8.4.2.2	Equipment incorporating electronic circuits:		N/A
	Equipment utilizing circuits in which all components are passive are not required to be tested		N/A
	All other equipment, requirements according to 7.3.3.2 and limits according table 7 apply		N/A
	Performed tests..... :	see _____	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
Annex A (normative)			
A	Equipment for direct switching of a single motor		
A.2	Additional rated duties..... :		N/A
A.2.1	- intermittent periodic duty		N/A
	- intermittent duty		N/A
	Classes of intermittent duty :		
	-class 1: up to 1 operating cycle per hour		N/A
	-class 3: up to 3 operating cycle per hour		N/A
	-class 12: up to 12 operating cycles per hour		N/A
	-class 30: up to 30 operating cycles per hour		N/A
	-class 120: up to 120 operating cycles per hour		N/A
A.2.2	Temporary duty..... :		N/A
A.6	Mechanical durability:		
	Equipment mounted according to manufacturer's instruction		N/A
	Preferred number of no-load operating cycles expressed in millions..... :		N/A
	0,001 – 0,003 – 0,01 – 0,03 – 0,1 – 0,3 - 1		N/A
	If no mechanical endurance is stated by the manufacturer, a minimum mechanical endurance according to the class of intermittent duty shall be tested.	Class of intermittent duty:	N/A
	Number of no-load operating cycles performed .. :	_____	N/A
A.7	Electrical durability:		N/A
	- test according to manufacturer's instruction		N/A
A.8	Verification of making and breaking capacities:		
	- utilization category :		—
	- rated operational voltage U_e (V) :		—
	- rated operational current I_e (A) or power (kW) . :		—
	Conditions for make/break operations or make operations:		—
	- test voltage, $U = 1,05 U_e$(V):	L1: L2: L3:	—
	- test current, $I =$ x I_e (A):	L1: L2: L3:	—

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Clause	Requirement + Test	Result - Remark	Verdict
	- power factor :	L1: L2: L3:	—
	Conditions for make/break operations:		N/A
	- test voltage, $U = 1,05 U_e$(V):	L1: L2: L3:	—
	- test current, $I =$ x I_e (A):	L1: L2: L3:	—
	- power factor/ time constant :	L1: L2: L3:	—
	Number of make/break or make and break operations :		N/A
	- recovery voltage duration (≥ 50 ms)		N/A
	- current duration (ms) :		—
	- time interval between operations :		N/A
	Characteristic of transient recovery voltage if necessary:		N/A
	- oscillatory frequency (kHz) :		—
	- measured oscillatory frequency (kHz) :	L1: L2: L3:	N/A
	- factor γ :	L1: L2: L3:	N/A
8.3.3.3.5	Behaviour of the equipment during making and breaking capacity tests		N/A
	Test performed without:		—
	- endanger to the operator		N/A
	- cause damage to adjacent equipment		N/A
	No permanent arcing		N/A
	No flash over between poles and poles and frame		N/A
	No melting of the fuse in the detection circuit		N/A
8.3.3.3.6	Condition of the equipment after making and breaking capacity tests		N/A
	Immediately after the test equipment must work satisfactorily		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- required opening force not greater than the test force of 8.2.5.2 and table 8		N/A
	- equipment is able to carry its rated current after normal closing operation		N/A
8.3.3.4	Dielectric verification		N/A
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :		—
	No flashover or breakdown		N/A
8.3.3.5	Leakage current		N/A
	test voltage (1,1 U_e) (V)		—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B): $\leq 0,5$ mA/pole .. :		N/A
	Leakage current (other utilization categories): ≤ 2 mA/pole)		N/A
8.3.3.6	Temperature-rise verification		N/A
	- conductor cross-section (mm ²)		—
	- test current I_e (A)		—
	Measured temperature-rise	see __	N/A
A.9	Operational performance test:		N/A
	- utilization category		—
	- rated operational voltage (V)		—
	- rated operational current (A)		—
	Test conditions for electrical operation cycles:		N/A
	- test voltage (V)	L1: L2: L3:	—
	- test current (A)	L1: L2: L3:	—
	- power factor/time constant	L1: L2: L3:	—
	Number of cycles with current		N/A
	Number of cycles without current		N/A
	First test sequence (with/without current)		—
	Second test sequence (with/without current)		—
	- time interval between first and second test sequence		—

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Clause	Requirement + Test	Result - Remark	Verdict
8.3.4.1.5	Behaviour of the equipment during the operational performance test		N/A
	Test performed without:		—
	- endanger to the operator		N/A
	- cause damage to adjacent equipment		N/A
	No permanent arcing		N/A
	No flash over between poles and poles and frame		N/A
	No melting of the fuse in the detection circuit		N/A
8.3.4.1.6	Condition of the equipment after making and breaking capacity tests		N/A
	Immediately after the test equipment must work satisfactorily		N/A
	- required opening force not greater than the test force of 8.2.5.2 and table 8		N/A
	- equipment is able to carry its rated current after normal closing operation		N/A
8.3.4.2	Dielectric verification		N/A
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ :		—
	No breakdown or flashover		N/A
8.3.4.3	Leakage current		N/A
	test voltage (1,1 U_e) (V) :		—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole ... :		N/A
	Leakage current (other utilization categories) ≤ 2 mA/pole :		N/A
8.3.4.4	Temperature-rise verification		N/A
	- conductor cross-section (mm ²) :		—
	- test current I_e (A) :		—
	Measured temperature-rise :	see __	N/A
			N/A
A.10	Special tests:	see __	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
Annex C (normative)			
C	Single pole operated three pole switches		
C.2	Additional-tests to be performed on single pole operated three pole switches		N/A
C.3.1	Test "8.3.3.3 Making and breaking capacities" according to test sequence I with following modifications:		N/A
	L1 and L2 are closed, L3 is subjected to the required make-break operation cycle..... :		N/A
	L2 closed and L3 opened, L1 is subjected to the required make-break operation cycle..... :		N/A
	Test performed in a three phase circuit according to Figure 5 of IEC 60947-1		N/A
C.3.1	Test "8.3.4.1 Operational performance" according to test sequence II with following modifications:		N/A
	L1 and L2 are closed, L3 is subjected to the required make-break operation cycle..... :		N/A
	L2 closed and L3 opened, L1 is subjected to the required make-break operation cycle..... :		N/A
	Test performed in a three phase circuit according to Figure 5 of IEC 60947-1		N/A
C.3.2	Test "8.3.6.2 Fuse protected short circuit test" according to test sequence IV with following modifications:		N/A
	For the making test L1 is open and L2 closed, L3 is subjected to the required make operation cycle:		N/A
	Test performed in a three phase circuit according to Figure 11 of IEC 60947-1		N/A
C.4	Condition of equipment after tests		N/A
	The equipment complies with the relevant clauses of 8.3.3.3.6, 8.3.4.1.6 and 8.3.5.2.6		N/A
C.5	Instruction for use		N/A
	The product literature includes following statement..... :		N/A
	These devices are intended for power distribution systems where switching and/or isolating of an individual phase may be necessary and shall not be used for the switching of the primary circuit of three-phase equipment.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
Annex D (normative)			
D	Switches, disconnectors, switch-disconnectors and fuse-combination units for use in photovoltaic (PV) d.c. applications		
D.3	Classification		
D.3.1	Utilization category (according Table D.1) :		
D.4	Characteristics		
D.4.3.5.1	Ability to withstand motor switching overload currents	4.3.5.1 not applicable	
D.4.3.5.2	Rated making capacity	See table D.5	
D.4.3.5.3	Rated breaking capacity	See table D.5	
D.4.3.6.1	Rated short-time withstand current (I_{CW})		N/A
	DC-PV1: rated short-time withstand current is not applicable		N/A
	DC-PV0 and DC-PV2: in accordance with 4.3.6.1.		N/A
D.5.2	Marking		N/A
	Devices of utilization category AC-20A, AC-20B, DC-20A, DC-20B and DC-PV0 shall be marked "Do not operate under load", unless the device is interlocked to prevent such operation.		N/A
	Rated operational currents (or rated powers) with the corresponding rated operational voltage and utilization category (see 4.3.1, 4.3.2 and D.4.4)		N/A
	PV category :		N/A
	Add to the existing list in 5.2.4 the following new items h), i), j) and k):		N/A
	h) diagram and method of series connecting poles of mechanical switching devices for each operational rating		N/A
	i) appropriate connection to the PV generator and load, if applicable		N/A
	j) "+" and "-" polarities, if applicable		N/A
	k) suitable for indoor or outdoor use		N/A
D.6	Normal service, mounting and transport conditions		
	Unenclosed PV switches		N/A
	Enclosed PV switches - indoor		N/A
	Enclosed PV switches- outdoor		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The ambient air temperature does not exceed the maximum and minimum values given in Table D.3. Daily average ambient temperature over a period of 24 h does not exceed 35 °C.		N/A
D.7	Constructional and performance requirements		N/A
	Clause 7 applies with the following addition:		N/A
	Enclosures comply with IEC 62208		N/A
D7.1.4	Clearances and creepage distances		N/A
	The minimum rated impulse voltage in accordance with Table D.4		N/A
D.7.1.12	Degrees of protection of enclosed equipment		N/A
	The degree of protection provided by the enclosure against contact with live parts, ingress of solid foreign bodies and water as indicated by the IP code according to Annex C of IEC 60947-1:2007/ AMD1:2010, declared by the manufacturer		N/A
	For indoor enclosed equipment not less than IP2X	IP	N/A
	For outdoor enclosed equipment not less than IP33	IP	N/A
D.7.2.3	Dielectric properties		N/A
	Subclause 7.2.3 of IEC 60947-1:2007/AMD1:2010 applies with the following changes:		N/A
	PV switches, PV disconnectors, PV switch-disconnectors and PV fuse-combination units shall have a rated impulse withstand voltage as given in Table D.4	kV	N/A
D.7.2.4.1	Making and breaking capacities		N/A
	PV switches, PV switch-disconnectors and PV fuse-combination units shall be capable of interrupting any current up to their rated making and breaking capacities. Compliance with these requirements is checked by the tests of 8.3.3 as modified by D.8.3.3.3.1.		N/A
	The rated making and breaking capacities are stated by reference to the rated operational voltage, rated operational current and to the PV utilization category according to Table D.5.		N/A
	Test conditions are as specified in D.8.3.3.3.1		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For PV switches, PV switch-disconnectors and PV fuse-combination units with a utilization category DC-PV1 the test supply shall be connected in accordance with the terminal markings (generator, load, “+” and “-“)		N/A
	Equipment with a utilization category DC-PV2 shall have one sequence of tests carried out on a sample with the test supply and load connected to the main poles as convenient.		N/A
	Unless the manufacturer can demonstrate the contact system and arc control arrangement is symmetrical in respect of current flow in each pole, the sequence shall then be repeated on a new sample with the supply and load terminals interchanged		N/A
D.7.2.4.2	Operational performance		N/A
	Compliance with the operational performance requirements are checked by the tests of 8.3.4 as modified by D.8.3.4.1.1.		N/A
	The number of operating cycles and the test circuit parameters for the operational performance tests for the various utilization categories are given in Table D.6 and Table D.7.		N/A
	Test conditions are as specified in D.8.3.4.1.1.		N/A
	For PV switches, PV disconnectors, PV switch-disconnectors and PV fuse-combination units with a utilization category DC-PV1, the test supply shall be connected in accordance with the terminal markings (generator, load, “+” and “-“).		N/A
	equipment with a utilization category DC-PV2 shall have one sequence of tests carried out on a sample with the test supply and load connected to the main poles as convenient		N/A
	Unless the manufacturer can demonstrate the contact system and arc control arrangement is symmetrical in respect of current flow in each pole, the sequence shall then be repeated on a new sample with the supply and load terminals interchanged.		N/A
D.7.2.4.4	Electrical durability		N/A
	Subclause 7.2.4.3.2 of IEC 60947-1:2007 applies. Test conditions are specified in D.8.5.2		N/A
D.7.2.8	Critical load current performance		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The main circuits of equipment shall be capable of making and breaking its critical load current according to D.8.3.8 and as verified by test sequence VI.		N/A
D.8	Tests		
D.8.3.1	Test sequences		N/A
	Add to existing Table 10 the following new sequences listed in new Table D.8:		N/A
D.8.3.2	General test conditions		N/A
	Subclause 8.3.2.1 applies with the following addition:		
	For all tests, the connection of poles of the PV switches, PV disconnectors, PV switch disconnectors and PV fuse-combination units shall be as in accordance with the manufacturer installation instructions.		N/A
	Replace all references to "Table 3" by "Table D.5"		N/A
	Subclause 8.3.3.3.1, seventh paragraph is not applicable.		N/A
	Subclause 8.3.4.1.1 applies with the following modifications:		N/A
	Replace all references to existing "Table 4" and "Table 5" by "Table D.6" and "Table D.7", respectively.		N/A
	Replace 8.3.5.1.2 by the following: Subclause 8.3.4.1.2 of IEC 60947-1:2007/AMD1:2010 applies The time constant of the test circuit shall be 1 ms		N/A
	Replace 8.3.6.2.2 by the following: Subclause D.8.3.5.1.2 applies.		N/A
	Subclause 8.3.7.1 applies with the following changes: Replace the existing first paragraph with the following: The equipment shall first be temperature-conditioned at room temperature. The test current is $1,45 \times I_{the}$ or $1,45 \times I_{th}$ for a period of 1 h, or until one or more of the gPV fuse-links operate.		N/A
	Time is less than the specified period..... :		N/A
D.8.3.8	Test sequence VI: critical load current performance		N/A
	This test does not apply to PV disconnectors, PV fuse-disconnectors and PV disconnector fuses.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The test shall be made at the rated operational voltage U_e assigned by the manufacturer to the PV switches, PV switch-disconnectors and PV fuse-combination units.		N/A
	The time constant of the test circuit shall be 1 ms.		N/A
	At the discretion of the manufacturer, a higher value of time constant may be used. :		N/A
	Tests as described		N/A
D.8.3.8.1.3	Critical load current		N/A
	The time of the arc extinction during the test shall be recorded and shall not exceed 1 s :		N/A
D.8.3.8.2	Critical load current performance		N/A
	Tests as described		N/A
D.8.3.9	Thermal cycling test		N/A
	Tests as described		N/A
	visual inspection to confirm that there is no distortion or damage to parts that will affect normal operation and protection		N/A
	one open and close operation to confirm normal mechanical operation		N/A
	temperature rise test of 8.3.3.6		N/A
	dielectric test in accordance with 8.3.3.4		N/A
D.8.3.10	Climatic test		N/A
	Tests as described		N/A
	Product verification during and after the test shall comply with the relevant requirements of 8.3.3.6.		N/A
D.8.3.11	Temperature rise verification with solar effects – Outdoor units only		N/A
	Tests as described		N/A
	Average level of radiation on each of the exposed surface..... :		N/A
	Temperature rise not exceeds 80 K on the terminals for external connections, assuming a maximum shade ambient temperature of 40 °C		N/A
	No damage is caused to adjacent parts of insulating materials		N/A
D.8.3.12	Verification of resistance of insulating materials to abnormal heat and fire		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Insulating materials meet glow wire test requirements in accordance with 8.2.1.1.1 of IEC 60947-1:2007		N/A
D.8.3.13	Degree of protection – Enclosed equipment		N/A
	Ingress protection (IP) tests are carried out on enclosed equipment in accordance with Annex C of IEC 60947-1:2007/AMD1:2010	IP	N/A
D.8.3.14	Clearance and creepage distances		N/A
	Clearance and creepage distances shall be measured to confirm compliance with D.7.1.4 (see Annex G of IEC 60947-1:2007 for guidance on measurement of clearance and creepage distances)		N/A
D.8.4	Electromagnetic compatibility tests		N/A
	Electromagnetic compatibility shall be verified in accordance with 8.4.		N/A
	Immunity		N/A
	Performed tests..... : See		N/A
	Emission		N/A
	Performed tests..... : See		N/A
	Electrical durability		N/A
	The electrical durability test (see D.7.2.4.4 and 8.1.5), where required, is made in accordance with the appropriate requirements of 8.3.4.1 as modified by D.8.3.4.1.1, except that for equipment suitable for isolation, the maximum value of leakage current shall not exceed 2 mA per pole for utilization categories DC-PV1 and DC-PV2.		N/A
	Total number of operating cycles, declared by the manufacturer..... :		N/A

7.1.4	TABLE: Clearance and creepage distance measurements					
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Fixed contact to DIN rail	8 kV	1000 Vdc			12,5 mm	12,6 mm
Fixed contact to mounting plate	8 kV	1000 Vdc			12,5 mm	12,8 mm
Over the open contact	8 kV	1000 Vdc	8,0 mm	8,7 mm		
Fixed contact to mounting plate	8 kV	1000 Vdc	8,0 mm	10,1 mm		
supplementary information:						

8.3.3.1	TABLE: Temperature-rise (measurements) in new condition	Average ambient 22,9°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T2		37,6	65
Terminal T5		35,4	65
Terminal T7		28,0	65
Terminal T8		28,6	65
Contact bridge		54,5	65
Manual operating means: non-metallic		3,3	25
Parts which need not be touched during normal operation		18,7	50
supplementary information:			

8.3.3.6.a	TABLE: Temperature-rise PV25 after sequence I	Average ambient 21,4°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T5-		13,6	80
Terminal T4+		40,1	80
Terminal T2+		14,2	80
Terminal T6-		36,5	80
Manual operating means: non-metallic		1,8	25
Parts which need not be touched during normal operation		4,8	50
supplementary information:			

8.3.3.6.b	TABLE: Temperature-rise PV32 after sequence I	Average ambient 20,8°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T5-		39,1	80
Terminal T4+		40,5	80
Terminal T2+		42,2	80
Terminal T6-		38,6	80
Contact bridge		51,7	80
Manual operating means: non-metallic		4,6	25
Parts which need not be touched during normal operation		17,1	50
supplementary information:			

8.3.3.6.c	TABLE: Temperature-rise PV40 after sequence I	Average ambient 23,3°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T2+		52,5	80
Terminal T5+		55,8	80
Terminal T7-		45,8	80
Terminal T8-		51,6	80
Contact bridge		79,5	80
Manual operating means: non-metallic		6,1	25
Parts which need not be touched during normal operation		18,9	50
supplementary information:			

8.3.4.4.a	TABLE: Temperature-rise PV25 after sequence II	Average ambient 21,7°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T5-		29,0	80
Terminal T4+		28,5	80
Terminal T2+		33,6	80
Terminal T6-		27,8	80
Manual operating means: non-metallic		3,9	25
Parts which need not be touched during normal operation		21,7	50

supplementary information:

8.3.4.4.b	TABLE: Temperature-rise PV32 after sequence II	Average ambient 22,8°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T2+		49,7	80
Terminal T5+		44,9	80
Terminal T7-		47,5	80
Terminal T8-		48,3	80
Contact bridge		61,1	80
Manual operating means: non-metallic		3,2	25
Parts which need not be touched during normal operation		18,8	50
supplementary information:			

8.3.4.4.c	TABLE: Temperature-rise PV40 after sequence II	Average ambient 23,1°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T2+		49,2	80
Terminal T5+		45,5	80
Terminal T7-		37,7	80
Terminal T8-		41,0	80
Contact bridge		79,0	80
Manual operating means: non-metallic		2,8	25
Parts which need not be touched during normal operation		22,7	50
supplementary information:			

8.3.5.5.	TABLE: Temperature-rise PV40 after sequence III	Average ambient 22,4°C	
Temperature rise dT of part:		dT (K) measured	dT (K) required
Terminal T2+		53,2	80
Terminal T5+		61,3	80
Terminal T7-		44,3	80
Terminal T8-		46,3	80
Contact bridge		64,8	80
Manual operating means: non-metallic		2,2	25
Parts which need not be touched during normal operation		8,4	50
supplementary information:			