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TEST REPORT
IEC 60947-3
Low-voltage switchgear and controlgear
Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units

Report Reference No.: Y231545E

Tested by (name + signature) .....:	Lechen Hu (胡乐晨)	
Approved by (name + signature) .....:	Xiaomu Ye（叶小木）	

Date of issue: Jan. 30, 2024

Standard: IEC 60947-3:2020

Test conclusion .....: The samples satisfy to the clauses examined

Testing Laboratory .....: Zhejiang Academy of Science and Technology for Inspection & Quarantine (Technology Center of Hangzhou Customs District)

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Applicant's Name .....: Zhejiang Changcheng Trading Co., Ltd.

Address .....: DianHou Village, Liushi Town, Yueqing City, Zhejiang, China

Test item description

Trademark .....: CNC

Manufacturer.....: Changcheng Electrical Group Zhejiang Technology Co., Ltd.

Model and/or type reference .....: LW28-160 LW28-125 LW28-63

General remarks

This report is not valid without official seal and signatures.
The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
Any objection should be raised to the testing laboratory in 15 days since the day this report be received.

Summary of testing:

Standard used:

IEC 60947-3:2020

IEC 60947-1:2020

Tests performed (name of test and test clause):

Type	Test sequence						
	I	II	III	IV	V	VI	Annex A
LW28-160 4P	1	1	1	-	-	-	1+1
LW28-125 4P	1	1	1	-	-	-	1+1
LW28-63 4P	1	1	1	-	-	-	1+1
LW28-63 2P	1	1	1	-	-	-	1+1

Testing location:

Inspection and Quarantine Mansion, Jingang Avenue, Liushi, Yueqing, Zhejiang, China

Copy of marking plate

Test item particulars ..... :	Changeover switch
- method of operation ..... :	Independent manual operation
- suitability for isolation ..... :	~~suitable /~~ not suitable
- degree of protection ..... :	IP20(After installation)
- number of poles..... :	4P for LW28-160 and LW28-125
	4P and 2P for LW28-63
- kind of current..... :	AC ~~/ DC~~
-in the case of a.c., number of phases and rated frequency..... :	50Hz
- number of positions of the main contacts (if more than two)..... :	3(0,1,2)
-breaking arrangement for fused devices ..... :	~~single break / double break~~
Rated and limiting values, main circuit..... :	
- rated operational voltage U_e (V)..... :	440V~
- rated insulation voltage U_i (V) ..... :	660V~
- rated impulse withstand voltage U_{imp} (kV) ..... :	6kV
- conventional free air thermal current I_{th} (A) ..... :	160A for LW28-160
	125A for LW28-125
	63A for LW28-63
- conventional enclosed thermal current I_{the} (A)..... :	N/A
- rated operational current I_e (A)..... :	LW28-160: AC-23A Ie:135A AC-3 Ie:95A AC-4 Ie:55A
	LW28-125: AC-23A Ie:90A AC-3 Ie:75A AC-4 Ie:30A
	LW28-63: AC-23A Ie:57A AC-3 Ie:36A AC-4 Ie:15A
- rated uninterrupted current I_u (A) ..... :	Same as Ie
- rated frequency (Hz)..... :	50Hz
- utilization category..... :	AC-23A AC-3 AC-4
Short-circuit characteristic ..... :	
- rated short-time withstand current I_{cw} (kA)..... :	12Ie
- rated short-time making capacity I_{cm} (kA)..... :	n*12Ie
- 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 .....:	2023-12-29
Date (s) of performance of tests.....:	2023-12-29 to 2024-01-26

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.

General product information:

Changeover switch

LW28-160, LW28-125, LW28-63

AC-23A, AC-3, AC-4

Ui=660V~

Ith=160A(LW28-160), 125A(LW28-125), 63A(LW28-63)

50Hz

LW28-160: AC-23A Ie:135A, AC-3 Ie:95A, AC-4 Ie:55A

LW28-125: AC-23A Ie:90A, AC-3 Ie:75A, AC-4 Ie:30A

LW28-63: AC-23A Ie:57A, AC-3 Ie:36A, AC-4 Ie:15A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
6.2	MARKING		
	Visible from the front when the device is installed as in service in accordance with the manufacturer's instructions and the actuator is accessible and operable		
1	-Indication of the open and close position. With O and I respectively, if symbols are used		P
2	-suitability for isolation. The appropriate symbols of Table 1 shall be used.		N/A
3	-Additional marking for disconnectors. Devices of utilization category AC-20A, AC-20B, DC-20A, DC-20B and DC-PV0 shall be marked "Do not operate under load" adjacent to these categories, unless the device has interlocking means to prevent such an operation.		N/A
	Marked on the product		
4	- Manufacturer's name or trade mark.	CNC	P
5	-Type designation or catalogue reference.	LW28-160 LW28-125 LW28-63	P
6	-Rated operational currents (or rated powers) with the corresponding rated operational voltage and utilization category	LW28-160: AC-23A Ie:135A AC-3 Ie:95A AC-4 Ie:55A LW28-125: AC-23A Ie:90A AC-3 Ie:75A AC-4 Ie:30A LW28-63: AC-23A Ie:57A AC-3 Ie:36A AC-4 Ie:15A	P
7	-Value (or range) of the rated frequency or the indication "DC" (or the symbol ⎓)	50Hz	P
8	-For fuse-combination units, the fuse type characteristics and maximum rated current and the maximum power loss of the fuse-link.		N/A
9	-IEC 60947-3, if the manufacturer claims compliance with this document.		P
10	-Degree of protection of enclosed equipment	IP20	P
11	-Terminals shall be identified "load" and "line", unless the connection is immaterial		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
12	-Neutral pole terminal, if applicable, shall be identified by the letter "N"		N/A
13	-Protective earth terminal shall be identified by the symbol ⏚		N/A
23	"+" and "−" polarities, if applicable.		N/A
	Provided in the manufacture's literature:		
14	- Rated insulation voltage.		P
15	- Rated impulse withstand voltage for equipment suitable for isolation or when determined		P
16	- Pollution degree, if different from 3.		P
17	- Rated duty		P
18	-Rated short-time withstand current and duration, where applicable.		P
19	-Rated short-circuit making capacity, where applicable.		P
20	-Rated conditional short-circuit current, where applicable.		N/A
21	-Diagram and method of series connecting poles of mechanical switching devices for each operational rating, if applicable.		N/A
22	-For switches in accordance with Annex D – appropriate connections to the PV generator and load, if applicable.		N/A
24	-For devices in accordance with Annex D – suitable for indoor or outdoor use.		N/A
6.3	Instructions for installation, operation and maintenance		P
7	**NORMAL SERVICE, MOUNTING AND TRANSPORT CONDITIONS**		
7.1 part 1	**Normal service conditions**		
7.1.1	Ambient air temperature		
	The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C. The lower limit of the ambient air temperature is –5 °C.		P
7.1.2	Altitude		
	The altitude of the site of installation does not exceed 2 000 m.		P
7.1.3	Atmospheric conditions		
7.1.3.1	Humidity		P
7.1.3.2	Pollution degree		P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
7.1.4	Shock and vibration		P
7.2 part 1	**Conditions during transport and storage**		
	between –25 °C and +55 °C and, for short periods not exceeding 24 h, up to +70 °C		P
7.3 part 1	**Mounting**		
	The equipment shall be mounted in accordance with the manufacturer's instructions.		P
8	**CONSTRUCTIONAL AND PERFORMANCE REQUIREMENTS**		
8.1	**Constructional requirements**		
	Specific requirements for LV switchgear intended for the connections of aluminium conductors is given in Annex E.		N/A
	When switches and fuse-combination units coming into the scope of this document are normally used to start, accelerate and/or stop an individual motor, they shall also comply with the additional requirements given in Annex A.		P
	The requirements for single pole operated three-pole switches are included in Annex C.		N/A
	Auxiliary switches fitted to equipment within the scope of this document shall comply with the requirements of IEC 60947-5-1.		N/A
8.1.2 part1	**Materials**		
8.1.2.2	Glow wire Testing		
	The requirements of 8.1.2.2 of IEC 60947-1:2020 do not apply to parts with a mass lower than 2 g (insignificant mass as defined in 3.14 of IEC 60695-2-11:2014). For products containing a plurality of small parts, the total mass of non-tested parts located in close proximity to each other shall not exceed 10 g. Proximity shall be based on engineering judgment considering the risk of propagation of fire.		P
	The suitability of materials used is verified by :		
	a) making tests on the equipment;		N/A
	b) making tests on sections taken from the equipment;		P
	c) making tests on any parts of identical material having representative thickness;		N/A
	d) providing data from the insulating material supplier fulfilling the requirements according to IEC 60695-2-12.		N/A
	Glow-wire test according to IEC 60695-2-10 and IEC 60695-2-11		

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	Parts made of insulating material necessary to retain current-carrying parts in position:		
	-Main current carrying parts: 960 °C.		P
	No visible flame and no sustained glowing		N/A
	Flames and glowing extinguish within 30 s		P
	No ignition of the tissue paper		P
	-Auxiliary current carrying parts: 850 °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		P
	Flames and glowing extinguish within 30 s		N/A
	No ignition of the tissue paper		N/A
8.1.2.3	Test based on flammability category		
	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
8.1.3 part 1	Current-carrying parts and their connections		
	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
8.1.4 part 1	Clearances and creepage distances:		

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Clause	Requirement + Test	Result - Remark	Verdict
	Clearances distances:		
	- Uimp is given as:	6kV	
	-max. value of rated operational voltage to earth:	600V	
	- nominal voltage of supply system:	440V	
	-overvoltage category:	III	
	- pollution degree:	3	
	- field-in or homogeneous:	field-in	
	- minimum clearances (mm)……:	5,5	
	- measured clearances (mm)……...:	see appended table 8.1.4	P
	Creepage distances:		
	- rated insulation voltage Ui (V)……:	660V	
	- pollution degree…….. :	3	
	- comparative tracking index (V)……..:	400 ≤ CTI <600	
	- material group…….. :	IIIa	
	- minimum creepage distances (mm)…… :	10	
	- measured creepage (mm)……..:	see appended table 8.1.4	P
8.1.5 part 1	Actuator		P
8.1.5.1	Insulation		
	Actuator insulated from live parts for		
	- rated insulation voltage	660V	P
	- rated impulse withstand voltage	6kV	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 :		
	- 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
8.1.5.2	Direction of movement		
	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
8.1.6 part 1	Indication of contact position		

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Clause	Requirement + Test	Result - Remark	Verdict
8.1.6.1	Indicating means		
	When an equipment is provided with means for indicating the closed and open positions, these positions shall be unambiguous and clearly indicated		P
	This is done by means of a position indicating device (see 2.3.18)		P
	If symbols are used, they shall indicate the closed and open positions respectively, in accordance with IEC 60417:		
	IEC 60417-5007 (2002-10) I On (power)		N/A
	IEC 60417-5007 (2002-10) O Off (power)		N/A
	For equipment operated by means of two push-buttons, only the push-button designated for the opening operation shall be red or marked with the symbol "O".		N/A
	Red colour shall not be used for any other push-button.		N/A
	The colours of other push-buttons, illuminated push-buttons and indicator lights shall be in accordance with IEC 60073.		N/A
8.1.6.2	Indication by the actuator		
	When the actuator is used to indicate the position of the contacts, it shall automatically take up or stay, when released, in the position corresponding to that of the moving contacts; in this case, the actuator shall have two distinct rest positions corresponding to those of the moving contacts, but for automatic opening a third distinct position of the actuator may be provided.		P
8.1.7 part 1	Additional safety requirements for equipment suitable for isolation		
8.1.7.1	Additional constructional requirements		
	Equipment suitable for isolation shall provide in the open position an isolating distance in accordance with the requirements necessary to satisfy the isolation function. Indication of the position of the main contacts provided by one or more of the following means		
	– the position of the actuator;		N/A
	– a separate mechanical indicator;		N/A
	– visibility of all moving main contacts.		N/A
	The effectiveness of each of the means of indication provided on the equipment and its mechanical strength shall be verified in accordance with 9.2.6.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When means are provided or specified by the manufacturer to lock the equipment in the open position, locking in that position shall only be possible when the main contacts are in the open position. This shall be verified in accordance with 9.2.6.		N/A
	Equipment shall be designed so that the actuator, front plate or cover are fitted to the equipment in a manner which ensures correct contact position indication and locking, if provided.		N/A
	If auxiliary contacts are provided for interlocking purposes, the operating time of the auxiliary and main contacts shall be declared by manufacturer. More specific requirements may be given in the relevant product standard.		N/A
	The indicated open position is the only position in which the specified isolating distance between the contacts is ensured.		N/A
	For equipment provided with actuator or indicator positions such as “tripped position”, which are not the indicated open position, those positions shall be clearly identified. The marking of such positions shall not include the symbols “I” or “O”.		N/A
	An actuator having only one position of rest shall not be considered as appropriate to indicate the position of the main contact.		N/A
8.1.7.2	Additional constructional requirements of IEC 60947-3		
	The equipment shall be marked according to Table 3, item 2.		P
	When no indication of the position of the contacts is provided, for example by the actuator or a separate indicator, all the main contacts shall be clearly visible in the open position.		N/A
	The strength of the actuating mechanism and the reliability of the indication of the open position shall be checked according to 9.2.6. Moreover, when means are provided by the manufacturer to lock the equipment in the open position, locking shall only be possible when the main contacts are in the open position (see 9.2.6).		P
	This requirement does not apply to equipment where the main contact position is visible in the open position and/or the open position is indicated by other means than the actuator.		N/A
	The clearance across the open contacts of the same pole when in the open position shall not be less than the minimum clearance given in Table 13 of IEC 60947-1:2020 and shall also comply with the requirements of 8.2.3.2 item 1) b) of IEC 60947-1:2020.		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.1.7.3 part 1	Supplementary requirements for equipment provided with means for padlocking the open position:		
	The locking means shall be designed in such a way that it cannot be removed with the appropriate padlock(s) installed.		N/A
	When the equipment is locked by even of a single padlock, it shall not be possible by operating the actuator, to reduce the clearance between open contacts to the extent that it no longer complies with the requirements of 8.2.3.2 1) b).		N/A
	Alternatively, the design may provide padlockable means to prevent access to the actuator.		N/A
	Compliance with the requirements to padlock the actuator shall be verified using a padlock specified by the manufacturer or an equivalent gauge, giving the most adverse conditions, to simulate locking		N/A
	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
8.1.8 part1	Terminals		
8.1.8.1	All parts of terminals which maintain contact and carry current shall be of metal having adequate mechanical strength.		P
	Terminal connections shall be such that the force to connect the conductors may be applied by screws, screwless-type or other equivalent means so as to ensure that the necessary contact pressure is maintained.		P
	Terminals shall be so constructed that the conductors can be clamped between suitable surfaces without any significant damage either to conductors or terminals.		P
	Terminals shall not allow the conductors to be displaced or be displaced themselves in a manner detrimental to the operation of equipment and the insulation voltage shall not be reduced below the rated values.		P
	If required by the application, terminals and conductors may be connected by means of cable lugs for copper conductors only (see Table P.1).		N/A
	Screwless-type clamping units, unless otherwise specified by the manufacturer, shall accept solid, stranded 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:		

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Clause	Requirement + Test	Result - Remark	Verdict
	– 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
8.1.8.2	Connecting capacity		
	Type of conductors :	Rigid –Stranded and flexible	
	Minimum cross-sectional area of conductor (mm^2)	LW28-160: 70mm^2 LW28-125: 50mm^2 LW28-63: 16mm^2	
	Maximum cross-sectional area of conductor (mm^2)	LW28-160: 35mm^2 LW28-125: 25mm^2 LW28-63: 6mm^2	
	Number of conductors simultaneously connectable to the terminal :	Declared not suitable by the manufacturer	
8.1.8.3	Connection		
	Terminals for connection to external conductors shall be readily accessible during installation.		P
	Clamping screws and nuts shall not serve to fix any other component although they may hold the terminals in place or prevent them from turning.		P
8.1.8.4	Terminal identification and marking		
	Terminals intended exclusively for the neutral conductor shall be identified by the letter "N"		N/A
	The protective earth terminal shall be identified in accordance with 8.1.10.3.		N/A
	Other terminals		P
8.1.9 part1	Additional requirements for equipment provided with a neutral pole		
	When an equipment is provided with a pole intended only for connecting the neutral conductor, this pole shall be clearly identified to that effect by the letter “N” (see 8.1.8.4).		N/A
	A switched neutral pole shall break not before and shall make not after the other poles.		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	If a pole having an appropriate short-circuit breaking and making capacity (see 3.7.14 and 3.7.15) is used as a neutral pole, then all poles, including the neutral pole, may operate substantially together.		N/A
	For equipment having a value of conventional thermal current not exceeding 63 A, this value shall be identical for all poles.		N/A
	For higher conventional thermal current values, the neutral pole may have a value of conventional thermal current different from that of the other poles, but not less than half that value or 63 A, whichever is the higher.		N/A
8.1.10 part1	Provisions for protective earthing		
8.1.10.1	Constructional requirements		
	The exposed conductive parts (e.g. chassis, heat sink, framework and fixed parts of metal enclosures) other than those which cannot constitute a danger shall be electrically interconnected and connected to a protective earth terminal for connection to an protective earthing conductor.		N/A
	This requirement can be met by the normal structural parts providing adequate electrical continuity and applies whether the equipment is used on its own or incorporated in an assembly.		N/A
	Exposed conductive parts are considered not to constitute a danger if they cannot be touched on large areas or grasped with the hand or if they are of small size (approximately 50 mm × 50 mm) or are so located as to exclude any contact with live parts.		N/A
8.1.10.2	Protective earth terminal		
	The protective earth terminal shall be readily accessible and so placed that the connection of the equipment to the protective earthing conductor is maintained when the cover or any other removable part is removed.		N/A
	The protective earth terminal shall be suitably protected against corrosion		N/A
	In the case of equipment with conductive structures, enclosures, etc., means shall be provided, if necessary, to ensure electrical continuity between the exposed conductive parts the equipment and the metal sheathing of connecting conductors		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	The protective earth terminal shall have no other function, except when it is intended to be connected to a PEN conductor (see 3.3.29), PEM conductor (see 3.3.28) or PEL conductor (see 3.3.30). In this case, it shall also have the function of a neutral terminal, mid terminal or earthed line terminal in addition to meeting the requirements applicable to the protective earth terminal.		N/A
8.1.10.3	Protective earth terminal marking and identification		
	The identification shall be achieved by colour (green-yellow mark) or by the notation PE, PEN, PEM or PEL, as applicable, in accordance with 7.3 of IEC 60445:2017, or by a graphical symbol for use on equipment.		N/A
	The graphical symbol to be used is the symbol 60417-5019 (2006-08) ⏚ Protective earth (ground) in accordance with the IEC 60417 database.		N/A
8.1.10.4	Protective earth continuity		
	All exposed conductive parts of the equipment and/or its enclosure connected to the terminal for the incoming external protective conductor.		N/A
	The resistance of the circuit from the exposed conductive part to the protective earth terminal shall not exceed 0,1 Ω.		N/A
8.1.11 part 1	Dedicated enclosures for equipment		
8.1.11.1	Design		
	The enclosure, when it is opened: all parts requiring access for installation and maintenance are readily accessible		N/A
	Sufficient space shall be provided inside the enclosure		N/A
	The fixed parts of a metal enclosure shall be 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 shall a removable metal part of the enclosure be insulated from the part carrying the earth terminal when the removable part is in place.		N/A
	The removable parts of the enclosure shall be firmly secured to the fixed parts by a device so 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 shall be provided to prevent loss of the fastening devices		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	An integral enclosure is considered to be a non-removable part.		N/A
	If the enclosure is used for mounting push-buttons, removal of buttons should be from the inside of the enclosure. Removal from the outside shall only be by use of a tool intended for this purpose.		N/A
8.1.11.2	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
8.1.12 part 1	Degree of protection of enclosed equipment		
	Degree of protection .....:	IP20(After installation)	
	Test for first characteristic:	IP2X	
	Test for first numeral (1, 2, 3, 4, 5, 6) .....:	2 This clause is for enclosed equipment and is not applicable to this product. However, the test was conducted on the front cover of the product with positive result	P
	Test for second characteristic:		
	Test for second numeral (1, 2, 3, 4, 5, 6, 7, 8) .....:		N/A
8.1.13 part 1	Conduit pull-out, torque and bending with metallic conduits		
	Polymeric enclosures of equipment, whether integral or not, provided with threaded conduit entries, intended for the connection of extra heavy duty, rigid threaded metal conduits complying with IEC 60981, shall withstand the stresses occurring during its installation such as pull-out, torque, bending.		N/A
	Compliance verified by the test of 9.2.8.		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict

9	**TESTS**		
9.2.5 part 1	**Mechanical and electrical properties of terminals**		
9.2.5.2	Tests of mechanical strength of terminals		
	maximum cross-sectional area of conductor (mm²) :	LW28-160: 70mm² LW28-125: 50mm² LW28-63: 16mm²	
	diameter of thread (mm) .....:	LW28-160: 5,86mm LW28-125: 5,86mm LW28-63: 5,88mm	
	torque (Nm) .....:	LW28-160: 3,0Nm LW28-125: 3,0Nm LW28-63: 2,5Nm	
	5 times on 2 separate clamping units		P
	During the test, clamping units and terminals shall not work loose and there shall be no damage.		P
9.2.5.3 9.2.5.4	Testing for damage to and accidental loosening of conductor (flexion test) Pull-out test		
a)	Conductor of the smallest cross-sectional area (mm²)	LW28-160: Terminal for prepared conductors LW28-125: Terminal for prepared conductors LW28-63: 6mm²	
	Number of conductors of the smallest cross section :	2	
	Diameter of bushing hole (mm) .....:	9,5	
	Height between the equipment and the platen :	280	
	Mass at the conductor(s) (kg) .....:	1,4	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit	135	P
	Pull-out test		
	Force (N) :	80N	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		P

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Clause	Requirement + Test	Result - Remark	Verdict
b)	Conductor of the largest cross-sectional area (mm²) :	LW28-160: Terminal for prepared conductors LW28-125: Terminal for prepared conductors LW28-63: Terminal for prepared conductors	
	Number of conductors of the largest cross section. :		
	Dameter of bushing hole (mm) .....:		
	Height between the equipment and the platen.....:		
	Mass at the conductor(s) (kg) .....:		
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
	Pull-out test		
	Force (N) .....:		
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
c)	Conductor of the largest and smallest cross-sectional area (mm²) .....:	LW28-160: Terminal for prepared conductors LW28-125: Terminal for prepared conductors LW28-63: 10 and 6mm²	
	Number of conductors of the smallest cross section, number of conductors of the largest cross section .:	LW28-63: 1 and 1	
	Diameter of bushing hole (mm) .....:	9,5 and 9,5	
	Height between the equipment and the platen :	280 and 280	
	Mass at the conductor(s) (kg) .....:	2,0 and 1,4	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit	135	P
	Pull-out test		
	force (N) .....:	90N and 80N	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		P

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Clause	Requirement + Test	Result - Remark	Verdict
9.3.4	**TEST SEQUENCE I: GENERAL PERFORMANCE CHARACTERISTICS** **#1 LW28-160, 4P** **#2 LW28-125, 4P** **#3 LW28-63, 4P** **#4 LW28-63, 2P**		
9.3.4.2	Temperature-rise		
	ambient temperature 10-40 °C .....:	23,0	
	test enclosure W x H x D (mm x mm x mm) .....:		
	material of enclosure .....:		
	Main circuits, test conditions:		P
	- rated operational current Ie (A) .....:	#1: 135A(AC-23A) Test performed at value Ith=160A #2: 90A(AC-23A) Test performed at value Ith=125A #3: 57A(AC-23A) Test performed at value Ith=63A #4: 57A(AC-23A) Test performed at value Ith=63A	
	- cable/busbar cross-section (mm²) / length (mm)..:	#1: 70mm²/2000mm #2: 50mm²/2000mm #3: 16mm²/1000mm #4: 16mm²/1000mm	
	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) .....:		

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Clause	Requirement + Test	Result - Remark	Verdict
	Measured temperature-rise .....:	#1 Terminals≤62,8K Manual operating means≤12,1K Parts intended to be touched≤32,5K Parts which need not be touched≤45,1K #2 Terminals≤62,9K Manual operating means≤12,1K Parts intended to be touched≤32,5K Parts which need not be touched≤40,9K #3 Terminals≤59,3K Manual operating means≤11,9K Parts intended to be touched≤33,8K Parts which need not be touched≤43,2K #4 Terminals≤58,2K Manual operating means≤11,9K Parts intended to be touched≤33,1K Parts which need not be touched≤42,0K	P
	Auxiliary circuits, test conditions:		
	- rated operation current (A) .....:		

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Clause	Requirement + Test	Result - Remark	Verdict
	- cable cross-section (mm²).....:		
	Measured temperature-rise .....:		N/A
9.3.4.3 9.3.3.4part1	Test of dielectric properties		
2)	Verification of impulse withstand voltage		
	Rated impulse withstand voltage (kV) .....:	6kV	
	- sea level of the laboratory.....:	Sea level	
b)	Test voltage		
	The 1,2/50µs impulse voltage applied five times for each polarity at intervals of 1s minimum		P
	- test Uimp main circuits (kV) .....:	7,3kV	P
	- test Uimp auxiliary circuits (kV) .....:		N/A
	- test Uimp control circuits (kV) .....::		N/A
	- test Uimp on open main contacts (equipment suitable for isolating) (kV) .....:		N/A
c)	Application of test voltage		
	i) between all the terminals of the main circuit connected together (including the control and auxiliary circuits connected to the main circuit) and the enclosure or mounting plate, with the contacts in all normal positions of operation;		P
	ii) between each pole of the main circuit and the other poles connected together and to the enclosure or mounting plate, with the contacts in all normal positions of operation;		P
	iii) between each control and auxiliary circuit not normally connected to the main circuit and: – the main circuit,		N/A
	- the other circuits		N/A
	- the exposed conductive parts		N/A
	- enclosure of mounting plate		N/A
	iv) for equipment suitable for isolation, across the poles of the main circuit, the line terminals being connected together and the load terminals connected together		N/A
d)	Acceptance criteria		

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Clause	Requirement + Test	Result - Remark	Verdict
	There shall be no unintentional disruptive discharge during the tests	#1: Pass #2: Pass #3: Pass #4: Pass	P
3)	Power-frequency or DC withstand verification		
	- rated insulation voltage (V) .....:	660V~	P
b)	Test voltage		
	-main circuits, test voltage for 1 min. (V) :	1890V	P
	- auxiliary circuits, test voltage for 1 min (V)		N/A
	- control circuits, test voltage for 1 min (V) :		N/A
c)	Application of test voltage		
	i) between all the terminals of the main circuit connected together (including the control and auxiliary circuits connected to the main circuit) and the enclosure or mounting plate, with the contacts in all normal positions of operation;		P
	ii) between each pole of the main circuit and the other poles connected together and to the enclosure or mounting plate, with the contacts in all normal positions of operation;		P
	iii) between each control and auxiliary circuit not normally connected to the main circuit and: – the main circuit,		N/A
	- the other circuits		N/A
	- the exposed conductive parts		N/A
	- enclosure of mounting plate		N/A
d)	Acceptance criteria		
	During the test, no flashover, breakdown of insulation either internally (puncture) or externally (tracking) or any other manifestation of disruptive discharge shall occur	#1: Pass #2: Pass #3: Pass #4: Pass	P
	Equipment suitable for isolation, leakage current not exceed 0,5 mA		N/A
	Test voltage 1,1 Ue (V) .....:		
	Measured leakage current (mA) .....:		N/A
9.3.4.4	Making and breaking capacity		
	- utilization category .....:	AC-23A	

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Clause	Requirement + Test	Result - Remark	Verdict

	- rated operational voltage Ue (V) ..... :	440V~		
	- rated operational current Ie (A) or power (kW) .... :	#1: 135A #2: 90A #3: 57A #4: 57A		
	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) ..... :			
	Conditions for make/break operations or make operation, AC-23A and AC-23B only:			P
	- test voltage, U = 1,05 Ue ..... (V):	#1	L1: 463V L2: 463V L3: 465V	
		#2	L1: 466V L2: 466V L3: 466V	
		#3	L1: 467V L2: 466V L3: 467V	
		#4	L1: 467V L2: 467V L3: -	
	- test current, I = ... 10x Ie (A):	#1	L1: 1352A L2: 1355A L3: 1355A	
		#2	L1: 905A L2: 905A L3: 904A	
		#3	L1: 575A L2: 572A L3: 575A	
		#4	L1: 576A L2: 576A L3: -	
	- power factor ..... :	#1	L1: 0,35 L2: 0,36 L3: 0,35	

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Clause	Requirement + Test	Result - Remark		Verdict
		#2	L1: 0,45 L2: 0,45 L3: 0,46	
		#3	L1: 0,46 L2: 0,46 L3: 0,47	
		#4	L1: 0,46 L2: 0,46 L3: -	
	Conditions for break operation, AC-23A and AC-23B only:			P
	- test voltage, U = 1,05 Ue ..... (V):	#1	L1: 463V L2: 463V L3: 465V	
		#2	L1: 466V L2: 466V L3: 466V	
		#3	L1: 467V L2: 466V L3: 467V	
		#4	L1: 467V L2: 467V L3: -	
	- test current, I = ... 8x Ie (A):	#1	L1: 1087A L2: 1085A L3: 1088A	
		#2	L1: 721A L2: 722A L3: 721A	
		#3	L1: 459A L2: 459A L3: 458A	
		#4	L1: 459A L2: 459A L3: -	
	- power factor ..... :	#1	L1: 0,35 L2: 0,35 L3: 0,36	
		#2	L1: 0,45 L2: 0,45 L3: 0,46	
		#3	L1: 0,46 L2: 0,45 L3: 0,46	
		#4	L1: 0,46 L2: 0,46 L3: -	

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Clause	Requirement + Test	Result - Remark	Verdict

	Conditions for make/break operations, other than AC-23A/B:			N/A
	- test voltage, U = 1,05 Ue ..... (V):	L1: L2: L3:		
	- test current, I = ... x Ie (A):	L1: L2: L3:		
	- power factor/ time constant .....:	L1: L2: L3:		
	Number of make/break or make and break operations .....:	3		P
	- recovery voltage duration (≥ 50 ms)	≥ 50 ms		P
	- current duration (ms) .....:	≥ 200 ms		
	- time interval between operations .....:	30s		P
	Characteristic of transient recovery voltage for AC-22 and AC-23 only			P
	- oscillatory frequency (kHz) .....:	#1: 62,1 #2: 57,2 #3: 52,2 #4: 52,2		
	- measured oscillatory frequency (kHz) .....:	#1	L1: 63,1 L2: 62,7 L3: 62,3	P
		#2	L1: 57,8 L2: 58,2 L3: 57,9	
		#3	L1: 52,1 L2: 52,4 L3: 52,3	
		#4	L1: 52,3 L2: 52,3 L3: -	
	- factor γ .....:	#1	L1: 1,12 L2: 1,12 L3: 1,12	P
		#2	L1: 1,10 L2: 1,12 L3: 1,12	
		#3	L1: 1,11 L2: 1,11 L3: 1,11	

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Clause	Requirement + Test	Result - Remark	Verdict
		#4 L1: 1,12 L2: 1,12 L3: -	
9.3.4.4.4	Behaviour of the equipment during the test		
	The equipment performed during the above tests		
	Not to endanger an operator		P
	Not to 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
	The equipment remain mechanically operable.		P
	No contact welding		P
9.3.4.4.5	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 9.2.6.2 and table 17 of IEC 60947-1:2020		P
	- equipment is able to carry its rated current after normal closing operation		P
9.3.4.5	Dielectric verification		
	Test voltage: 2 Ue with a minimum of 1000V~:	1000V~	
	No flashover or breakdown		P
9.3.4.6	Leakage current		
	test voltage (1,1 Ue) (V) .....:		
	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) .....:		N/A
9.3.4.7	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) .....:		

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Clause	Requirement + Test	Result - Remark	Verdict
	- conductor cross-section (mm²) .....:	#1: 70mm²/2000mm #2: 50mm²/2000mm #3: 16mm²/1000mm #4: 16mm²/1000mm	
	- test current Ie (A) .....:	#1: 135A(AC-23A) Test performed at value Ith=160A #2: 90A(AC-23A) Test performed at value Ith=125A #3: 57A(AC-23A) Test performed at value Ith=63A #4: 57A(AC-23A) Test performed at value Ith=63A	

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Clause	Requirement + Test	Result - Remark	Verdict
	Measured temperature-rise .....:	#1 Terminals≤65,9K Manual operating means≤13,5K Parts intended to be touched≤35,4K Parts which need not be touched≤47,6K #2 Terminals≤65,3K Manual operating means≤13,2K Parts intended to be touched≤35,1K Parts which need not be touched≤41,1K #3 Terminals≤61,2K Manual operating means≤13,2K Parts intended to be touched≤35,2K Parts which need not be touched≤45,3K #4 Terminals≤62,1K Manual operating means≤13,5K Parts intended to be touched≤35,3K Parts which need not be touched≤44,1K	P
9.3.4.8	Strength of actuator mechanism		
9.2.6 part1	Verification of the strength of actuator mechanism and position indicating device		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- actuator type (fig.) ..... :	Figure 16 (c)	
9.2.6.2.1	Dependent and independent manual operation		P
	- actuating force for opening (N) ..... :	#1: 18N #2: 15N #3:10N #4: 9N	
	- test force with blocked main contacts (N) ..... :	#1: 100N #2: 100N #3: 100N #4: 100N	
	- used method to keep the contact closed ..... :	Welding	
	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
9.2.6.2.2	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
9.2.6.2.3	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
	Equipment with locking mean, no locking in the open position while test force is applied ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

9.3.5	**TEST SEQUENCE II: OPERATIONAL PERFORMANCE CAPABILITY** **#5 LW28-160, 4P** **#6 LW28-125, 4P** **#7 LW28-63, 4P** **#8 LW28-63, 2P**			
9.3.5.2	Operational performance test			
	- utilization category .....:	AC-23A		
	- rated operational voltage (V) .....:	440V~		
	- rated operational current (A) .....:	#5: 135A #6: 90A #7: 57A #8: 57A		
	Test conditions for electrical operation cycles:			
	- test voltage (V) .....:	#5	L1: 442V L2: 443V L3: 442V	P
		#6	L1: 443V L2: 443V L3: 443V	
		#7	L1: 444V L2: 443V L3: 444V	
		#8	L1: 442V L2: 442V L3: -	
	- test current (A) .....:	#5	L1: 135,9A L2: 136,1A L3: 136,2A	P
		#6	L1: 92,2A L2: 91,3A L3: 92,9A	
		#7	L1: 63,6A L2: 64,2A L3: 63,8A	
		#8	L1: 64,2A L2: 64,2A L3: -	
	- power factor/time constant .....:	#5	L1: 0,68 L2: 0,68 L3: 0,68	P

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Clause	Requirement + Test	Result - Remark	Verdict
		#6: L1: 0,45 L2: 0,45 L3: 0,46 #7: L1: 0,46 L2: 0,45 L3: 0,46 #8: L1: 0,46 L2: 0,46 L3: -	
	Number of cycles with current .....:	#5: 7000 cycles #6: 8500 cycles #7: 8500 cycles #8: 8500 cycles	P
	Number of cycles without current .....:	#5: 1000 cycles #6: 1500 cycles #7: 1500 cycles #8: 1500 cycles	P
	First test sequence (with/without current) .....:	without current	P
	Second test sequence (with/without current) .....:	with current	P
	- time interval between first and second test sequence .....:	60min	P
	- recovery voltage duration (≥ 50 ms)	≥ 50 ms	P
	- current duration (ms) .....:	≥ 200 ms	P
	- time interval between operations .....:	#5: 30s #6: 30s #7: 30s #8: 30s	P
9.3.5.2.5	Behaviour of the equipment during the operational performance test		
	Not to endanger an operator		P
	Not to 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
	The equipment remain mechanically operable.		P
	No contact welding		P

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Clause	Requirement + Test	Result - Remark	Verdict
9.3.5.2.6	Condition of the equipment after the operational performance tests		
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 9.2.6.2 and table 17 of IEC 60947-1:2020		P
	- equipment is able to carry its rated current after normal closing operation		P
9.3.5.3	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1000V:	1000V	P
	No breakdown or flashover		P
9.3.5.4	Leakage current		
	test voltage (1,1 Ue) (V) .....:		N/A
	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 .....:		N/A
9.3.5.5	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 (mm²) .....:	#5: 70mm²/2000mm #6: 50mm²/2000mm #7: 16mm²/1000mm #8: 16mm²/1000mm	
	- test current Ie (A) .....:	#5: 135A(AC-23A) Test performed at value Ith=160A #6: 90A(AC-23A) Test performed at value Ith=125A #7: 57A(AC-23A) Test performed at value Ith=63A #8: 57A(AC-23A) Test performed at value Ith=63A	

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Clause	Requirement + Test	Result - Remark	Verdict
	Measured temperature-rise ..... :	#5 Terminals≤66,1K Manual operating means≤13,3K Parts intended to be touched≤34,6K Parts which need not be touched≤46,8K #6 Terminals≤64,1K Manual operating means≤13,0K Parts intended to be touched≤34,7K Parts which need not be touched≤40,4K #7 Terminals≤61,3K Manual operating means≤12,8K Parts intended to be touched≤34,8K Parts which need not be touched≤44,8K #8 Terminals≤61,9K Manual operating means≤13,1K Parts intended to be touched≤34,7K Parts which need not be touched≤43,3K	P

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Clause	Requirement + Test	Result - Remark	Verdict

9.3.6	**TEST SEQUENCE III: SHORT-CIRCUIT PERFORMANCE CAPABILITY** **#9 LW28-160, 4P** **#10 LW28-125, 4P** **#11 LW28-63, 4P** **#12 LW28-63, 2P**			
9.3.6.2	Short-time withstand current test			
	Rated short-time withstand current Icw (A) (>12.Ie max) .....:	12Ie		P
	test voltage (V) .....:	#9	L1: 464V L2: 463V L3: 464V	P
		#10	L1: 467V L2: 467V L3: 465V	
		#11	L1: 465V L2: 467V L3: 465V	
		#12	L1: 467V L2: 467V L3: -	
	r.m.s. test current (A) .....:	#9	L1: 1625A L2: 1628A L3: 1626A	P
		#10	L1: 1514A L2: 1517A L3: 1518A	
		#11	L1: 780A L2: 784A L3: 780A	
		#12	L1: 780A L2: 780A L3: -	
	peak test current (A) .....:	#9	L1: 2320A L2: 2322A L3: 2320A	P
		#10	L1: 2154A L2: 2155A L3: 2156A	
		#11	L1: 1132A L2: 1135A L3: 1211A	

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Clause	Requirement + Test	Result - Remark		Verdict
		#12	L1: 1129A L2: 1129A L3: -	
	power factor/time constant .....:	#9	L1: 0,87 L2: 0,87 L3: 0,87	P
		#10	L1: 0,92 L2: 0,92 L3: 0,92	
		#11	L1: 0,90 L2: 0,90 L3: 0,90	
		#12	L1: 0,91 L2: 0,91 L3: -	
	test duration (s) .....:	1s		P
9.3.6.2.5	Behaviour of the equipment during the test			
	Not to endanger an operator			P
	Not to 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
	The equipment remain mechanically operable.			P
	No contact welding			P
9.3.6.3.6	Condition of the equipment after short-time withstand current test			
	Immediately after the test equipment must work satisfactorily			P
	- required opening force not greater than the test force of 9.2.6.2 and table 17 of IEC 60947-1			P
	- equipment is able to carry its rated current after normal closing operation			P
9.3.6.3	Short-circuit making capacity			
	Rated short-circuit making capacity Icm (A) .....:	#9: 1,42x12Ie #10: 1,41x12Ie #11: 1,41x12Ie #12: 1,41x12Ie		
	test voltage (1,05 x Ue) .....(V):	#9	L1: 464V L2: 463V L3: 464V	P

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Clause	Requirement + Test	Result - Remark		Verdict
		#10	L1: 467V L2: 467V L3: 465V	
		#11	L1: 465V L2: 467V L3: 465V	
		#12	L1: 467V L2: 467V L3: -	
	r.m.s. test current (A) .....:	#9	L1: 1625A L2: 1628A L3: 1626A	P
		#10	L1: 1514A L2: 1517A L3: 1518A	
		#11	L1: 780A L2: 784A L3: 780A	
		#12	L1: 780A L2: 780A L3: -	
	maximum peak test current (factor n)	#9: 1,42 #10: 1,41 #11: 1,41 #12: 1,41		P
	power factor/time constant .....:	#9	L1: 0,87 L2: 0,87 L3: 0,87	P
		#10	L1: 0,92 L2: 0,92 L3: 0,92	
		#11	L1: 0,90 L2: 0,90 L3: 0,90	
		#12	L1: 0,91 L2: 0,91 L3: -	
	current duration (s) .....:	≥50ms		P
	Number of making cycles .....:	2		P
	Time interval between the cycles	3min		P
9.3.6.3.5	Behaviour of the equipment during the test			
	Not to endanger an operator			P
	Not to cause damage to adjacent equipment			P

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Clause	Requirement + Test	Result - Remark	Verdict
	No permanent arcing		P
	No flash over between poles and poles and frame		P
	No melting of the fuse in the detection circuit		P
	The equipment remain mechanically operable.		P
	No contact welding		P
9.3.6.3.6	Condition of the equipment after short-circuit making capacity tests		
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 9.2.6.2 and table 17 of IEC 60947-1:2020		P
	- equipment is able to carry its rated current after normal closing operation		P
9.3.6.4	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1000V:	1000V	P
	No flashover or breakdown		P
9.3.6.5	Leakage current		
	test voltage (1,1x Ue) (V) .....:		N/A
	Leakage current ≤ 2,0 mA/pole .....:		N/A
9.3.6.6	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 (mm²) .....:	#9: 70mm²/2000mm #10: 50mm²/2000mm #11: 16mm²/1000mm #12: 16mm²/1000mm	

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Clause	Requirement + Test	Result - Remark	Verdict
	- test current Ie (A) .....:	#5: 135A(AC-23A) Test performed at value Ith=160A #6: 90A(AC-23A) Test performed at value Ith=125A #7: 57A(AC-23A) Test performed at value Ith=63A #8: 57A(AC-23A) Test performed at value Ith=63A	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Measured temperature-rise ..... :	#9 Terminals≤66,1K Manual operating means≤13,3K Parts intended to be touched≤34,6K Parts which need not be touched≤46,8K #10 Terminals≤64,1K Manual operating means≤13,0K Parts intended to be touched≤34,7K Parts which need not be touched≤40,4K #11 Terminals≤61,3K Manual operating means≤12,8K Parts intended to be touched≤34,8K Parts which need not be touched≤44,8K #12 Terminals≤61,9K Manual operating means≤13,1K Parts intended to be touched≤34,7K Parts which need not be touched≤43,3K	P

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Clause	Requirement + Test	Result - Remark	Verdict

9.3.7	**TEST SEQUENCE IV: CONDITIONAL SHORT-CIRCUIT CURRENT**		
	Protective device details:		
	- manufacturer's name, trademark or identification mark .....:		
	- manufacturer's model or type reference .....:		
	- rated voltage (V) .....:		
	- rated current (A) .....:		
	- rated breaking capacity (kA) .....:		
9.3.7.2.1 a)	Circuit-breaker protected short-circuit withstand (equipment in the closed position)		
	test voltage (1,05 x Ue) (V) .....:	L1: L2: L3:	N/A
	test current (kA) .....:	L1: L2: L3:	N/A
	rated frequency (Hz) .....:		N/A
	power factor .....:		N/A
	Time constant (ms).....:		N/A
	The circuit breaker shall interrupt the current.		N/A
	- max. let-through current (kA) .....:	L1: L2: L3:	N/A
	- Joule integral I^2dt (A^2s) .....:	L1: L2: L3:	N/A
9.3.7.2.1b)	Circuit-breaker protected making test		
	- mean velocity of 15 manually under no-load conditions operations (m/s) .....:		N/A
	- point at which the measurement is made .....:		N/A
	- test speed during the circuit-breaker protected short-circuit making (m/s) .....:		N/A
	- max. let-through current (kA) .....:	L1: L2: L3:	N/A
	- Joule integral I^2dt (A^2s) .....:	L1: L2: L3:	N/A
9.3.7.3.1a)	Fuse protected short-circuit withstand(equipment in the closed position)		

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Clause	Requirement + Test	Result - Remark	Verdict
	test voltage (1,05 x Ue) (V) .....:	L1: L2: L3:	N/A
	test current (kA) .....:	L1: L2: L3:	N/A
	rated frequency (Hz) .....:		N/A
	power factor .....:		N/A
	Time constant (ms).....:		N/A
	Fuse protected short-circuit withstand		N/A
	- max. let-through current (kA) .....:	L1: L2: L3:	N/A
	- Joule integral I^2dt (A^2s) .....:	L1: L2: L3:	N/A
9.3.7.3.1b)	Fuse protected short-circuit making		
	- mean velocity of 15 manually under no-load conditions operations (m/s) .....:		N/A
	- point at which the measurement is made .....:		N/A
	- test speed during the fuse protected short-circuit making (m/s) .....:		N/A
	- max. let-through current (kA) .....:	L1: L2: L3:	N/A
	- Joule integral I^2dt (A^2s) .....:	L1: L2: L3:	N/A
9.3.7.3.5	Behaviour of the equipment during the test		
	Not to endanger an operator		N/A
	Not to 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
	The equipment remain mechanically operable.		N/A
	No contact welding		N/A
9.3.7.3.6	Condition of the equipment after the test		
	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 9.2.6.2 and table 17 of IEC 60947-1:2020		N/A
	- equipment is able to carry its rated current after normal closing operation		N/A
9.3.7.4	Dielectric verification		
	test voltage: 2Ue with a minimum of 1000V:		N/A
9.3.7.5	No flashover or breakdown		N/A
	Leakage current		N/A
	test voltage (1,1 Ue) (V) .....:		N/A
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) ≤ 0,5 mA/pole .....:		N/A
	Leakage current (other utilization categories) ≤ 2,0 mA/pole .....:		N/A
9.3.7.6	Temperature-rise verification		
	- conductor cross-section (mm²) .....:		N/A
	- test current Ie (A) .....:		N/A
	Measured temperature-rise .....:		N/A
9.3.8	**TEST SEQUENCE V: OVERLOAD PERFORMANCE CAPABILITY**		
9.3.8.2	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 1,6xIthe or 1,6xIth (A) .....:		
	cable/busbar cross-section (mm²) / length (mm) ...:		
	Fuse-link details:		
	- 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 9.2.9.2 and table 17 of IEC 60947-1:2020		N/A
	The equipment has not undergone any impairment hindering such operation		N/A
9.3.8.3	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1000V:		N/A
	No flashover or breakdown		N/A
9.3.8.4	Leakage current		
	test voltage (1,1 Ue) (V) .....:		N/A
	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 .....:		N/A
9.3.8.5	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) .....:		
	Fuse links aged during the overload test are replaced by new fuse-links .....:		N/A
	- conductor cross-section (mm²) .....:		
	- test current Ie (A) .....:		
	Measured temperature-rise .....:		N/A

9.3.9	**TEST SEQUENCE VI: CRITICAL LOAD CURRENT PERFORMANCE OF EQUIPMENT WITH A DC RATING**		
9.3.9.2	Determination of critical loadcurrent		
	The test shall be made at the maximum operational d.c. voltage (Ue max) assigned by the manufacturer		
	Ue max(V) .....:		
	Direction of current flow as specified by manufacturer		
	The equipment opened 7 times manually or mechanically at the manufacturer’s discretion		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Direction of current flow is not specified by manufacturer		
	4 operations in the forward direction and 3 in the reverse direction		N/A
	During each cycle, the equipment remain closed for a time sufficient to ensure that the full current is established, but not exceeding 2 s		N/A
	Time constant operational performance		N/A
	Number of operating cycles per hour:		N/A
	Arcing time during the test (≤1 s)		N/A
	Test currents to find critical d.c. load current		N/A
	The test current values shall be: 4 A, 8 A, 16 A, 32 A and 63 A d.c., with ± 10 % tolerance, but not exceeding the rated current.....		N/A
	For each test current, the average arcing time is calculated.		N/A
	If two current flow directions are permitted, the maximum of the two values for this test current is used for further evaluation		N/A
	An average arcing time exceeds 1,3 time the value of the average at the rated operational current at the highest rated operational voltage, this is considered a critical current		N/A
	If no critical value of current is found within these criteria, no further test according to 9.3.9.2.1 is required		N/A
	Forward direction		N/A
	Critical value		N/A
	Maximum mean arcing time		N/A
	Reversed direction		N/A
	Critical value		N/A
	Maximum mean arcing time		N/A
9.3.9.3	Critical load current performance		
	- utilization category .....:		
	- test voltage U/Ue = 1,0 (V)		
	- critical test current (A).....:		
	- time constant .....:		
	-number of operating cycles per hour .....:		
	- on-time (ms) .....:		

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Clause	Requirement + Test	Result - Remark	Verdict
	- off-time (s) ..... :		N/A
9.3.5.3	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1415 VDC		N/A
	No flashover or breakdown		N/A
9.3.5.4	Leakage current		
	test voltage (1,1 Ue) (V) ..... :		N/A
	Leakage current ≤ 2 mA/pole ..... :		N/A
9.3.5.5	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) ..... :		
	Fuse links aged during the overload test are replaced by new fuse-links ..... :		N/A
	- conductor cross-section (mm^2) ..... :		
	- test current Ie (A) ..... :		
	Measured temperature-rise ..... :		N/A
9.4	**ELECTROMAGNETIC COMPATIBILITY TESTS**		
9.4.2	Immunity		
	Equipment not incorporating electronic circuits: no tests necessary		N/A
9.4.2.1	Equipment incorporating electronic circuits:		N/A
	All other equipment, requirements according to 8.3.2 of IEC 60947-1:2020 and limits according table 7 apply		N/A
	Performed tests..... :	see _____	N/A
	No unintentional separation or closing of contacts has occurred during these tests ..... :		N/A
9.4.3	Emission		
9.4.3.1	Equipment not incorporating electronic circuits: no tests necessary		N/A
9.4.3.2	Equipment incorporating electronic circuits:		N/A
	Equipment utilizing circuits in which all components are passive are not required to be tested		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	All other equipment, requirements according to 8.3.3.2 and limits according table 8 apply		N/A
	Performed tests.....:	see _____	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

Annex A (normative) Equipment for direct switching of a single motor			
A	**Equipment for direct switching of a single motor**		
A.2	Additional rated duties.....:		P
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.....:		P
A.6	**Mechanical durability:**		
	Equipment mounted according to manufacturer's instruction		P
	Preferred number of no-load operating cycles expressed in millions.....:		P
	0,001 – 0,003 – 0,01 – 0,03 – 0,1 – 0,3 - 1	0,003	P
	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.....:	6000	P
A.7	**Electrical durability:**		
	- test according to manufacturer's instruction		P
A.8	**Verification of making and breaking capacities:** **#13 LW28-160, 4P** **#14 LW28-125, 4P** **#15 LW28-63, 4P** **#16 LW28-63, 2P**		
	- utilization category .....:	AC-3 AC-4	
	- rated operational voltage Ue (V) .....:	440V~	

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Clause	Requirement + Test	Result - Remark		Verdict
	- rated operational current Ie (A) or power (kW) ....:	LW28-160: AC-3 Ie:95A AC-4 Ie:55A LW28-125: AC-3 Ie:75A AC-4 Ie:30A LW28-63: AC-3 Ie:36A AC-4 Ie:15A		
	Conditions for make/break operations or make operations:			P
	- test voltage, U = 1,05 Ue ..... (V):	#13	L1: 464V L2: 465V L3: 465V	P
		#14	L1: 466V L2: 467V L3: 467V	
		#15	L1: 466V L2: 465V L3: 466V	
		#16	L1: 468V L2: 468V L3: -	
	- test current, I = ...10 or 12x Ie (A):	#13	L1: 955A L2: 956A L3: 955A	P
		#14	L1: 758A L2: 758A L3: 759A	
		#15	L1: 362A L2: 365A L3: 362A	
		#16	L1: 366A L2: 366A L3: -	
	- power factor .....:	#13	L1: 0,36 L2: 0,35 L3: 0,35	P
		#14	L1: 0,36 L2: 0,35 L3: 0,35	
		#15	L1: 0,45 L2: 0,46 L3: 0,45	

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Clause	Requirement + Test	Result - Remark		Verdict
		#16	L1: 0,45 L2: 0,45 L3: -	
	Conditions for make/break operations:			P
	- test voltage, U = 1,05 Ue ..... (V):	#13	L1: 465V L2: 466V L3: 465V	P
		#14	L1: 467V L2: 467V L3: 468V	
		#15	L1: 467V L2: 467V L3: 467V	
		#16	L1: 467V L2: 467V L3: -	
	- test current, I = ...8 or 10x Ie (A):	#13	L1: 762A L2: 763A L3: 765A	P
		#14	L1: 610A L2: 609A L3: 608A	
		#15	L1: 289A L2: 290A L3: 290A	
		#16	L1: 290A L2: 290A L3: -	
	- power factor/ time constant .....:	#13	L1: 0,35 L2: 0,35 L3: 0,35	P
		#14	L1: 0,35 L2: 0,35 L3: 0,35	
		#15	L1: 0,46 L2: 0,45 L3: 0,45	
		#16	L1: 0,45 L2: 0,45 L3: -	
	Number of make/break or make and break operations .....:	50		P
	- recovery voltage duration (≥ 50 ms)	≥ 50 ms		P
	- current duration (ms) .....:	≥ 200 ms		P

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Clause	Requirement + Test	Result - Remark		Verdict
	- time interval between operations .....:	#13: 80s #14: 60s #15: 30s #16: 30s		P
	Characteristic of transient recovery voltage if necessary:			P
	- oscillatory frequency (kHz) .....:	#13: 57,86 #14: 55,19 #15: 47,65 #16: 47,65		P
	- measured oscillatory frequency (kHz) .....:	#13	L1: 58,2 L2: 58,4 L3: 58,2	P
		#14	L1: 56,4 L2: 57,1 L3: 56,0	
		#15	L1: 48,8 L2: 49,2 L3: 49,1	
		#16	L1: 49,8 L2: 49,8 L3: -	
	- factor γ .....:	#13	L1: 1,11 L2: 1,11 L3: 1,10	P
		#14	L1: 1,11 L2: 1,11 L3: 1,12	
		#15	L1: 1,10 L2: 1,10 L3: 1,12	
		#16	L1: 1,13 L2: 1,13 L3: -	
9.3.4.4.4	Behaviour of the equipment during making and breaking capacity tests			
	Test performed without:			P
	- 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
9.3.4.4.5	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily		P
	- required opening force not greater than the test force of 9.2.6.2 and table 17 of IEC 60947-1:2020		P
	- equipment is able to carry its rated current after normal closing operation		P
9.3.4.5	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1000V~ :	1000V	P
	No flashover or breakdown		P
9.3.4.6	Leakage current		
	test voltage (1,1 Ue) (V) .....:		N/A
	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) .....:		N/A
9.3.4.7	Temperature-rise verification		
	- conductor cross-section (mm²) .....:	#9: 70mm²/2000mm #10: 50mm²/2000mm #11: 16mm²/1000mm #12: 16mm²/1000mm	
	- test current Ie (A) .....:	#5: 135A(AC-23A) Test performed at value Ith=160A #6: 90A(AC-23A) Test performed at value Ith=125A #7: 57A(AC-23A) Test performed at value Ith=63A #8: 57A(AC-23A) Test performed at value Ith=63A	
	Measured temperature-rise .....:		P
A.9	**Operational performance test:** **#17 LW28-160, 4P** **#18 LW28-125, 4P** **#19 LW28-63, 4P** **#20 LW28-63, 2P**		

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Clause	Requirement + Test	Result - Remark		Verdict
	- utilization category .....:	AC-3 AC-4		
	- rated operational voltage (V) .....:	440V~		
	- rated operational current (A) .....:	LW28-160: AC-3 Ie:95A AC-4 Ie:55A LW28-125: AC-3 Ie:75A AC-4 Ie:30A LW28-63: AC-3 Ie:36A AC-4 Ie:15A		
	Test conditions for electrical operation cycles:			P
	- test voltage (V) .....:	#17	L1: 467V L2: 465V L3: 465V	P
		#18	L1: 468V L2: 467V L3: 467V	
		#19	L1: 466V L2: 466V L3: 468V	
		#20	L1: 468V L2: 468V L3: -	
	- test current (A) .....:	#17	L1: 331A L2: 332A L3: 332A	P
		#18	L1: 152A L2: 153A L3: 153A	
		#19	L1: 92,1A L2: 91,2A L3: 93,2A	
		#20	L1: 92,2A L2: 92,2A L3: -	
	- power factor/time constant .....:	#17	L1: 0,36 L2: 0,35 L3: 0,36	P

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Clause	Requirement + Test	Result - Remark		Verdict
		#18	L1: 0,36 L2: 0,36 L3: 0,35	
		#19	L1: 0,46 L2: 0,46 L3: 0,45	
		#20	L1: 0,46 L2: 0,46 L3: -	
	Number of cycles with current .....:	6000		P
	Number of cycles without current .....:			N/A
	First test sequence (with/without current) .....:			P
	Second test sequence (with/without current) .....:			N/A
	- time interval between first and second test sequence .....:	#13: 80s #14: 60s #15: 30s #16: 30s		P
9.3.5.2.5	Behaviour of the equipment during the operational performance test			
	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
9.3.5.2.6	Condition of the equipment after the operational performance test			
	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 8			P
	- equipment is able to carry its rated current after normal closing operation			P
9.3.5.3	Dielectric verification			
	test voltage: 2 Ue with a minimum of 1000V~:	1000V~		P
	No breakdown or flashover			P
9.3.5.4	Leakage current			
	test voltage (1,1 Ue) (V) .....:			N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 .....:		N/A
9.3.5.5	Temperature-rise verification		
	- conductor cross-section (mm²) .....:	#9: 70mm²/2000mm #10: 50mm²/2000mm #11: 16mm²/1000mm #12: 16mm²/1000mm	P
	- test current Ie (A) .....:	#5: 135A(AC-23A) Test performed at value Ith=160A #6: 90A(AC-23A) Test performed at value Ith=125A #7: 57A(AC-23A) Test performed at value Ith=63A #8: 57A(AC-23A) Test performed at value Ith=63A	P
	Measured temperature-rise .....:		P
A.10	**Special tests:**		N/A
A.11	**Critical load current performance for DC equipment**		
9.3.9.2	Determination of critical loadcurrent		
	The test made at the maximum operational DC voltage, Ue, assigned by the manufacturer.		
	Ue max(V) .....:		
	Direction of current flow as specified by manufacturer		
	The equipment opened 7 times manually or mechanically at the manufacturer's discretion		N/A
	Direction of current flow is not specified by manufacturer		
	4 operations in the forward direction and 3 in the reverse direction		N/A
	During each cycle, the equipment remain closed for a time sufficient to ensure that the full current is established, but not exceeding 2 s		N/A
	Time constant operational performance		N/A
	Number of operating cycles per hour:		N/A
	Arcing time during the test (≤1 s)		N/A
	Test currents to find critical d.c. load current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The test current values shall be: 4 A, 8 A, 16 A, 32 A and 63 A d.c., with ± 10 % tolerance, but not exceeding the rated current.....		N/A
	For each test current, the average arcing time is calculated.		N/A
	If two current flow directions are permitted, the maximum of the two values for this test current is used for further evaluation		N/A
	An average arcing time exceeds 1,3 time the value of the average at the rated operational current at the highest rated operational voltage, this is considered a critical current		N/A
	If no critical value of current is found within these criteria, no further test according to 9.3.9.2.1 is required		N/A
	Forward direction		N/A
	Critical value		N/A
	Maximum mean arcing time		N/A
	Reversed direction		N/A
	Critical value		N/A
	Maximum mean arcing time		N/A
9.3.9.3	Critical load current performance		
	- utilization category .....:		
	- test voltage U/Ue = 1,0 (V)		
	- critical test current (A).....:		
	- time constant .....:		
	-number of operating cycles per hour .....:		
	- on-time (ms) .....:		
	- off-time (s) .....:		N/A
9.3.5.3	Dielectric verification		
	test voltage: 2 Ue with a minimum of 1415 VDC		N/A
	No flashover or breakdown		N/A
9.3.5.4	Leakage current		
	test voltage (1,1 Ue) (V) .....:		N/A
	Leakage current ≤ 2 mA/pole .....:		N/A
9.3.5.5	Temperature-rise verification		
	Fuse-link details (fuse-combination units only):		

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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 Ie (A) .....:		
	Measured temperature-rise .....:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

Annex C (normative) **Single pole operated three-pole switches**			N/A
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 “9.3.4.3 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 60947-1:2020		N/A
C.3.1	Test “9.3.5.2 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 :2020		N/A
C.3.2	Test “9.3.7.3 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 60947-1:2020		N/A
C.4	Condition of equipment after tests		N/A
	The equipment complies with the relevant clauses of 9.3.4.4.5, 9.3.5.2.6 and 9.3.6.3.6		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) **Switches, disconnectors, switch-disconnectors and fuse-combination units for use in photovoltaic (PV) DC applications**		N/A
	This annex applies to DC switches, disconnectors, switch-disconnectors and fuse-combination units, rated up to 1 500 V DC, intended for use in photovoltaic (PV) systems.		
	Utilization category		
	DC-PV0,DC-PV1 or DC-PV2:		N/A
	Service arrangements		
	Unenclosed		N/A
	Enclosed-Indoor		N/A
	Enclosed-Outdoor		N/A
D.9	Tests		
D.9.3.4	General performance characteristics		
	see 9.3.4 sequence I as modified by D.9.3.4.4.1		N/A
D.9.3.4.4.1	Replace all references to Table 4 by Table D.5.		N/A
	9.3.4.4.1, sixth paragraph is not applicable		N/A
D.9.3.5	Operational performance capability – equipment types		
	see 9.3.5 sequence II as modified by D.9.3.5.2.1 and D.9.3.5.2.2		N/A
D.9.3.5.2.1	Replace all references to existing Table 5 and Table 6 by Table D.6 and Table D.7 respectively		N/A
D.9.3.5.2.2	The time constant of the test circuit 1 ms.		N/A
D.9.3.5	Operational performance capability – enclosed outdoor equipment		
	see 9.3.5 sequence II as modified by D.8.2.4.2.2 and D.9.3.5.2.1		N/A
D.8.2.4.2.2	Operational performance at a low ambient air temperature		N/A
	The test carried out following conditioning at a temperature not higher than −25 °C for a period of at least 24 h prior to the test being carried out.		N/A
	Repeat of operational performance sequence test detailed in D.8.2.4.2.1 on a sample in new and clean condition, with the following changes:		N/A
	-all operating cycles shall be carried out without current;		N/A
	-number of operating cycles shall be 100 at the frequency given in Table D.6;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	-operating cycles shall be carried out with the device under test located in an ambient air temperature between −25°C and −30°C.		N/A
D.9.3.5.2.1	Replace all references to existing Table 5 and Table 6 by Table D.6 and Table D.7 respectively		N/A
D.9.3.5.2.2	The time constant of the test circuit 1 ms.		N/A
D.9.3.6	Short-circuit performance capability		
	see 9.3.6 sequence III as modified by D.9.3.6.2.2		N/A
D.9.3.6.2.2	The time constant of the test circuit 1 ms.		N/A
D.9.3.7	Conditional short-circuit current		
	see 9.3.7 sequence IV		N/A
D.9.3.8	Overload performance capability		
	see 9.3.8 sequence V as modified by D.9.3.8.2		N/A
D.9.3.8.2	The equipment first be temperature conditioned at room temperature. The test current is 1,45 × Ithe or 1,45 × Ith for a period of 1 h, or until one or more of the gPV fuse-links operate		N/A
	If the time is less than the specified period, the time shall be recorded in the test report		N/A
D.9.3.9	Critical load current (DC) performance		
	see 9.3.9 as modified by D.9.3.9		N/A
D.9.3.9	Replace all references to existing Table 18 and Table 19 by Table D.9 and Table D.10 respectively.		N/A
D.9.3.10	Thermal cycling test		
	Type designation or catalogue reference		N/A
	Sample no:		N/A
	The product is in closed position.		N/A
	According to IEC 60068-2-14, test Nb		N/A
	Comprising 50 cycles:		N/A
	Each cycle consisting of : - 1 h at −40 °C - followed by 1 h at +85 °C. -The temperature change rate shall be 1 K/min		N/A
	After the 50 cycles, the devices are returned to room temperature of 25 ± 5 °C for a minimum of 3 h.		N/A
	The equipment shall then be subjected to		N/A
	a) No distortion or damage to parts affect normal operation and protection		N/A
	b) one open and close operation to confirm normal mechanical operation		N/A
9.3.4.7	Temperature-rise verification		

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Clause	Requirement + Test	Result - Remark	Verdict
	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 (mm²) .....:		
	- test current Ie (A) .....:		
	Measured temperature-rise .....:		N/A
9.3.4.5	Dielectric verification		
	test voltage: 2 Ue with a minimum of DC1415V:		N/A
	No flashover or breakdown		N/A
D.9.3.11	Climatic test		
	Type designation or catalogue reference		
	Sample no:		
	According to IEC 60947-1:2020, Annex Q, category B(dry heat test and the low temperature test are not required)		
	Damp heat test		
	Cyclic IEC 60068-2-30 Test Db		N/A
	2 cycles (24h/cycle):		N/A
	Temperature : 55 ±2 °C		N/A
9.3.4.7	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 (mm²) .....:		
	- test current Ie (A) .....:		
	Measured temperature-rise .....:		N/A
D.9.3.12	Temperature-rise verification with solar effects – Outdoor units only		

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Clause	Requirement + Test	Result - Remark	Verdict
	These tests only apply to enclosed units		
	The test shall be carried out in accordance with 9.3.4.2 plus the following additional solar effects.		N/A
	For the duration of the temperature-rise test, radiant heat lamps shall be used to simulate the effects of solar radiation on the top, front or back and one adjacent side of the test sample		N/A
	In mid-morning or mid-afternoon, the maximum solar radiation is reduced by approximately 10 %.		N/A
	A pyranometer shall be used to measure the simulated level of solar radiation		N/A
	The average level of radiation on each of the exposed surface:		N/A
	Ambient air temperature of 40 °C		N/A
	Temperature-rise ⩽ 80 K on the terminals		N/A
D.9.3.13	Verification of resistance of insulating materials to abnormal heat and fire		
	Glow-wire test (See 8.1.2.2.)		N/A
D.9.3.14	Degree of protection – Enclosed equipment		
	IPXX		N/A
D.9.3.15	Clearance and creepage distances		
	See		N/A
D.9.4	Electromagnetic compatibility tests (if applicable)		
	See -		N/A
D.9.5.2	Electrical durability(if applicable)		
	The total number of operating cycles shall be declared by the manufacturer		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

Annex E (normative) **Additional requirements for LV switchgear intended for connection of aluminium conductors**			N/A
E.1	**This annex specifies the requirements for use of solid and stranded aluminium conductors and aluminium busbars with low voltage switchgear within the scope of this document, as follows:**		
	-Aluminium test conductors that are equivalent to, and can be used as an alternative to the copper conductors given in Table 9/10/11 of IEC 60947-1:2020,for terminals as depicted in Figures D.2, D.3, D.4, D.5, D.6 (including busbars) and D.7 of IEC 60947-1:2020 or similar clamping units		
	-Method for verifying the means of connecting aluminium conductors, as used in normal service for terminals as depicted in Figures D.2, D.3, D.4, D.5 and D.7 of IEC 60947-1:2020 or similar clamping units. Testing of lug terminals depicted in Figure D.6 of IEC 60947-1:2020 is specified in IEC 61238-1-1.		N/A
	Not covered by this annex:		
	-screwless terminals as depicted in Figure D.8 of IEC 60947-1:2020		N/A
	-connection of flexible aluminium conductors		N/A
	-terminating aluminium and copper conductors in one clamping unit at the same time		N/A
E.4	**Classification**		
	– for use with copper only		N/A
	– for use with either copper or aluminium;		N/A
	– for use with aluminium only		N/A
E.6.2	**Marking**		
	If the rated current of the terminals is lower than the rated current of the switchgear, it shall be marked on the switchgear or the switchgear terminals, or in the manufacturer's literature, as appropriate.		N/A
	Marked on the switchgear or the switchgear terminals with the abbreviations "AL" and "AL/CU"		N/A
	Terminal for use with:		N/A
	- aluminium conductors only marked -AL		N/A
	-copper or aluminium conductors marked –AL/CU		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	-after removal of the conductor insulation and prior to termination, the aluminium conductor cleaned by wire-brushing the aluminium followed by application of an anti-oxidant compound to limit oxidization of the aluminium		N/A
	- treatment of the busbar at the termination points, by wire-brushing the aluminium followed by the application of an anti-oxidant compound or by use of an electrically conductive coating such as tin		N/A
	- use of specific hardware for termination		N/A
E.8	**Constructional and performance requirements**		
	Clamping units intended for use with aluminium conductors s treated with an electrically conductive coating such as tin, or alternative means that will inhibit corrosion due to the difference in electrochemical series.		N/A
	Terminals are suitable for		N/A
	-stranded or		N/A
	-solid or		N/A
	- stranded and solid		N/A
E.9	**TESTS**		
E.9.2	**Current cycling test**		
E.9.2.2	Preparation		
	The test performed on four specimens, each one consisting of a pair of terminals		N/A
	The conducting part not exceed:		
	- three times the length of the terminal		N/A
	-the width of the terminal		N/A
	6 mm to 13 mm of the bare conductor is exposed between the wire-entry face of the terminal and the beginning of the insulation		N/A
E.9.2.3	Test arrangement		
	The general arrangement of the samples in Figure E.1,		N/A
	Distance between the test and reference Conductors ≥150mm		N/A
	Thermal barriers installed mid- way between the conductors and shall extend 25 mm ± 5 mm widthways and 150 mm ± 10 mm lengthways beyond the terminals (see Figure E.1).		N/A
	Thermal barriers are not required provided the specimens are separated by at least 450 mm		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
E.9.2.5	Test method		
	Cross-section of aluminium conductors (mm^2)		N/A
	Conductor length (mm)		N/A
	Test cycle: 500		N/A
	each cycle consists of 1 on-period and 1 off-period		N/A
	Test current for current cycling test (A):		N/A
	On- (and off-) times for current cycling:		N/A
	Torque:		N/A
	Near the end of each on-period of the first 24 cycles, the temperature of each terminal attained a minimum of 105 °C.		N/A
	If the manufacturer demonstrates that the maximum temperature-rise of the terminals is less than 70 K, the 105 °C temperature reduced to this temperature rise plus 35 °C		N/A
	At the 25^{th} cycle, the test current adjusted for the last time and the corresponding temperature		N/A
	Temperatures recorded 50, 75, 100, 125, 175, 225, 275, 350, 425, and 500 cycles		N/A
E.9.2.6	Acceptance criteria		
	The evaluation of performance is based on both the limit of terminal temperature- rise and the temperature variation (stability factor) during the test.		N/A
	– the temperature-rise shall not exceed 125 K,		N/A
	- the stability factor Sf shall not exceed ±10 K.		N/A
E.9.3	**Mechanical properties of terminals**		
E.9.3.1 E.9.3.2	flexion test Pull-out test		
a)	Conductor of the smallest cross-sectional area (mm^2) :		N/A
	Number of conductors of the smallest cross section :		N/A
	Diameter of bushing hole (mm) :		N/A
	Height between the equipment and the platen :		N/A
	Mass at the conductor(s) (kg) :		N/A
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
	Pull-out test		N/A
	Force (N) :		N/A

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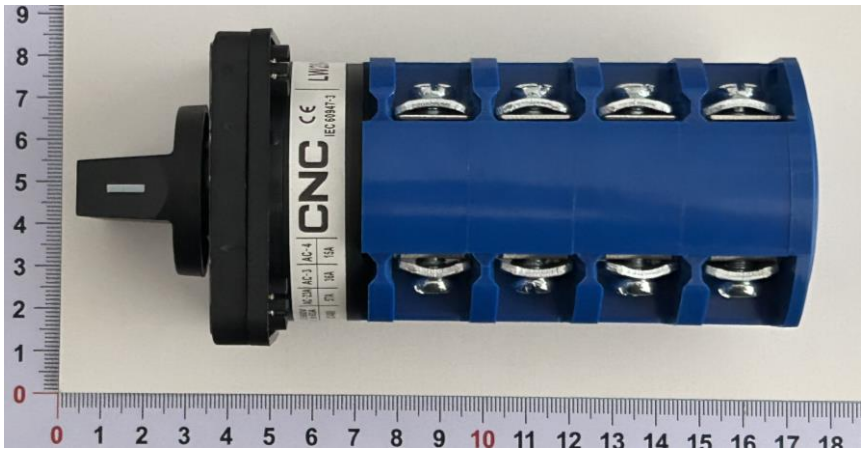
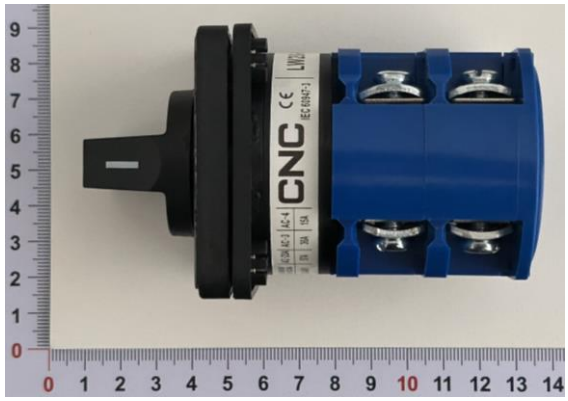
Clause	Requirement + Test	Result - Remark	Verdict
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
b)	Conductor of the largest cross-sectional area (mm²) :		N/A
	Number of conductors of the largest cross section :		N/A
	Dameter of bushing hole (mm) :		N/A
	Height between the equipment and the platen :		N/A
	Mass at the conductor(s) (kg) :		N/A
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
	Pull-out test		N/A
	Force (N) :		N/A
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
c)	Conductor of the largest and smallest cross-sectional area (mm²) :		N/A
	Number of conductors of the smallest cross section, number of conductors of the largest cross section :		N/A
	Diameter of bushing hole (mm) :		N/A
	Height between the equipment and the platen :		N/A
	Mass at the conductor(s) (kg) :		N/A
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
	Pull-out test		N/A
	force (N) :		N/A
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
E.9.4	**Test for insertability of unprepared round aluminium conductors having the maximum cross-section**		
	Solid or stranded conductors		N/A
	Conductor cross-section (mm^2):		N/A
	Gauge:		N/A

Photos of samples: LW28-63





Photos of samples: LW28-160

Photos of samples: LW28-125