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TEST REPORT
IEC 60947-5-1
Part 5: Control circuit devices and switching elements
Electromechanical control circuit devices

Report Number. .....:	180600074SHA-003
Date of issue .....:	2018-10-08
Total number of pages.....	31
Name of Testing Laboratory preparing the Report.....:	Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China
Applicant's name.....:	Elmark Industries SC
Address .....:	2 Dobrudzha blvd., Dobrich, BULGARIA
Test specification:	
Standard .....:	IEC 60947-5-1:2016
Test procedure .....:	CB Scheme
Non-standard test method.....:	N/A
Test Report Form No.....:	IEC60947_5_1E
Test Report Form(s) Originator.....:	DEKRA Certification B.V.
Master TRF.....:	Dated 2017-10-06

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

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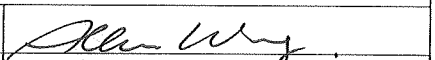
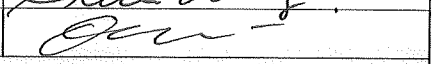
Test item description .....:	Auxiliary contacts
Trade Mark .....:	ELMARK
Manufacturer.....:	Same as applicant
Model/Type reference .....:	LT1-D4011, LT1-D5011, LT1-D6511, LT1-D8011, LT1-D9511
Ratings .....:	See general product information (page 6)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**	Intertek Testing Services Shanghai	
Testing location/ address.....:		Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China	
☒	**Associated Testing Laboratory:**	Inspection Center of Products' Quality of Low Voltage	
Testing location/ address.....:		Electric Apparatus in Zhejiang Province West Zhonghuan Road, Jiaxing City, Zhejiang Province, P.R.China	
Tested by (name, function, signature).....:		Allen Wang	
Approved by (name, function, signature)...:		Quiet Lin	
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address.....:			
Tested by (name + signature) .....:			
Witnessed by (name, function, signature)..:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 3:**		
☐	**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) :			

Summary of testing:

Clause	Testing items	Testing location
8.3.3.2	Operating limits of contactor relays	CBTL
8.3.3.3	temperature rise	ACTL
8.3.3.4	Dielectric properties	ACTL
8.2.4 of part 1	Mechanical properties of terminals	CBTL
8.3.3.5.2	Making and breaking capacities of switching elements under normal conditions	ACTL
8.3.3.5.5b	Dielectric verification	CBTL
8.3.3.5.3	Making and breaking capacities of switching elements under abnormal conditions	ACTL
8.3.3.5.5b	Dielectric verification	CBTL
8.3.4	Performance under conditional short-circuit current	ACTL
8.3.3.5.5b	Dielectric verification	CBTL

Tests performed on auxiliary circuit according to IEC/EN 60947-5-1:

180600074SHA-003	Type	Seq. I	Seq. II	Seq. III	Seq. IV	Seq. V	Seq. VI
	LT1-D9511	1	1	1	1	-	-

Summary of compliance with National Differences :

The products comply with the standard EN 60947-5-1: 2017

Copy of marking plate:

See report: 180600074SHA-001, -002

Test item particulars ..... :	
Classification of installation and use ..... :	Auxiliary circuit of Contactor
Supply Connection..... :	Cable connection
Kind of control circuit device..... :	☐ manual control switches, e.g. push-buttons, rotary switches, foot switches, etc.
	☒ electromagnetically operated control switches, either time delayed or instantaneous, e.g. contactor relays
	☐ pilot switches, e.g. pressure switches, temperature sensitive switches (thermostats)
	☐ position switches
	☐ associated control equipment, e.g. indicator lights, etc.
Kind of switching elements..... :	☒ auxiliary contacts of a switching device (e.g. contactor, circuit-breaker, etc) which are not dedicated exclusively for use with the coil of that device
	☐ interlocking contacts of enclosure doors
	☐ control circuit contacts of rotary switches
	☐ control circuit contacts of overload relays
Number of poles..... :	1NC+1NO
Kind of current..... :	☒ ac and~~/or~~ ☒ dc
Interrupting medium..... :	☒ air, ☐ oil, ☐ gas, ☐ vacuum, ☐ ...
Operating conditions..... :	
Method of operations ..... :	☐ manual
	☒ electromagnetic
	☐ pneumatic
	☐ electro-pneumatic
Method of control ..... :	☒ automatic
	☐ non-automatic
	☐ semi-automatic
Rated and limiting values for switching elements:	
Voltages:	
- rated operational voltage Ue (V) ..... :	415
- rated insulation voltage Ui (V) ..... :	690
- rated impulse withstand voltage Uimp (kV) ..... :	6
Currents:	
- conventional free air thermal current Ith (A) ..... :	10
- conventional enclosed thermal current Ithe (A)..... :	N/A
- rated operational current Ie (A) ..... :	0,95
Rated frequency (Hz)..... :	50/60
Utilization category..... :	AC-15
Short-circuit characteristic:	

- rated conditional short-circuit current (kA) ..... :	1kA
- kind of protective device ..... :	Fuse, RT16-00, 10A/500V
Electrically separated contact elements ..... :	Yes
Actuating quantities for pilot switches ..... :	N/A
Pilot switches having two or more contact elements ... :	N/A
Indication of contact elements of same polarity ..... :	N/A
IP code, in case of an enclosed control device ..... :	IP 20
Pollution degree ..... :	3
Suitability for isolation, with the symbol 07-13-06 of IEC 60617-7 ..... :	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 ..... :	2018-06-12
Date (s) of performance of tests ..... :	From 2018-06-12 to 2018-08-05

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
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Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

The test report shall be used in conjunction with reports: 180600074SHA-001, -002

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
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) ..... : Same as applicant

General product information:

Control circuit:
Us= 415V~
Auxiliary circuit:
Ith= 10A, Cat.: AC-15, Ue= 415V, Ie= 0,95A

The auxiliary circuits of LT1-D4011, LT1-D5011, LT1-D6511, LT1-D8011 are identical to LT1-D9511, all tests are performed on LT1-D9511.

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict

5	PRODUCT INFORMATION		
5.2	Marking		
	Data shall be preferably marked on the equipment:		
	a - manufacturer's name or trademark	ELMARK	P
	b - type designation or serial number	LT1 Series	P
	Data shall be included on the nameplate, or on the equipment, or in the manufacturer's published literature:		P
	c - number of this standard	IEC/EN 60947-5-1	P
	d - rated operational voltages	AC: 415V	P
	e - utilization category and rated operational currents, at the rated operational voltages of the control circuit device	AC-15: 0,95A	P
	f - rated insulation voltage:	690V	P
	g - rated impulse withstand voltage	6kV	P
	h - vacant		N/A
	i - IP code, in case of enclosed control circuit device		N/A
	j - pollution degree	3	P
	k - type and maximum ratings of short-circuit protective device	Fuse, RT16-00, 10A/500V	P
	l - conditional short-circuit current	1kA	P
	m - suitability for isolation, where applicable, with the symbol S00288 of IEC 60617		N/A
	n - indication of contact elements of same polarity		N/A
	Marking of data under n) shall be included on the nameplate of the control circuit device in order to ensure proper wiring at installation.		N/A
	o) length of insulation to be removed before insertion of the conductor into the terminal.		N/A
	p) for non-universal screwless terminals: – “s” or "sol" for terminals declared for rigid-solid conductors; – "r" for terminals declared for rigid (solid and stranded) conductors; – "f" for terminals declared for flexible conductors.		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
5.2.2	Terminal identification and marking (see 7.1.8.4 of IEC 60947-1)		
	Clearly and permanently identified according IEC 60445 and Annex L, unless superseded by relevant standard.		P

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Neutral terminal identified by letter ..... :		N/A
	Protective earth terminal identified by letter		N/A
5.2.3	Functional markings		
	Actuators may be identified by symbols in the form of engravings, but if a stop button carries any symbol engraved or marked this symbol shall be a circle or oval		N/A
	Letters or words may used where space is available		N/A
	Symbols shall be in accordance with IEC 60417		N/A
5.2.4	Emergency stop		
	Actuator shape and colour, background colour and direction of unlatching for emergency stop devices with mechanical latching function shall be in accordance with 4.2 of IEC 60947-5-5		N/A
5.2.5	Operating diagram		
5.2.5.1	General		
	As rotary switches may have multiplicity of contacts elements and a multiplicity of actuator positions, it necessary that the manufacturer indicates the relationship between the actuator positions and the associated contact elements position		N/A
5.2.5.2	Position indication and contact position		
	Sub clause 7.1.6.1 of IEC 60947-1 applies		N/A
	The position indication shall be clear, and the associated text or symbols shall be indelible and easily legible		N/A
5.2.5.3	Terminal markings for operating diagrams		
	Terminal markings shall be clearly identifiable with respect to the operating diagram (see also Annex M)		N/A
5.2.6	Time delay markings		
	The manufacturer shall indicate, for each time-delay contact element, the characteristic of the delay, according to 2.4.1.1 or 2.4.1.2		N/A
5.3	Instructions for installation, operation and maintenance		
	The manufacture shall specify, in his documents or catalogues:		
	- the conditions for installation, operation and maintenance, if any, of the equipment during operation and after a fault		P
	- the specify the measures to be taken with regard to EMC, if any,		N/A

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict
	- equipment only suitable in environment A shall provided with the following notice	NOTICE This product has been designed for environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.	N/A
	- if necessary, the instructions for transport, installation and operation of the equipment shall indicate the measures that are particular importance for the proper and correct installation, commissioning and operation of the equipment.		P
6	**Normal service, mounting and transport conditions**		
6.1.1	Ambient temperature		
	Ambient air temperature does not exceed +40 °C and its average over 24 hours does not exceed +35°C and the lower limit is –5°C		P
6.1.2	Altitude		
	Altitude of side of installation does not exceed 2000m		P
6.1.3	Atmospheric conditions		
6.1.3.1	Relative humidity does not exceed 50 % at max temp +40 °C, higher rel. hum may at lower temperatures e.g. 90% at +20 °C		P
6.1.3.2	Pollution degree		
	Unless otherwise stated, equipment for: - industrial use shall have a degree 3, depending upon micro-environment - household and similar shall have degree 2	3	P
6.1.4	Shock and vibration		
	Under consideration		N/A
6.2	Conditions during transport and storage		
	Under consideration		N/A
6.3	Mounting		
	According manufacturer’s instruction	see	N/A
6.3.1	Mounting of single hole mounted devices		
	Dimensions according Table 2		N/A
6.3.1.1	Location of key recess (if any)		
	Dimensions according Table 3		N/A
6.3.1.2	Range of panel thickness		
	The device shall be capable of being mounted on any thickness between 1 and 6 mm		N/A
6.3.1.3	Grouping of devices		

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict
	The distances a between the mounting centres in the same row and b between the centre lines of the rows shall be not less than those given in table 3. Distances a and b may be interchanged		N/A
7	**CONSTRUCTIONAL AND PERFORMANCE REQUIREMENTS**		
7.1	Constructional requirements		
7.1.1	General		
	Sub clause 7.1 of IEC 60947-1 applies except for 7.1.2, 7.1.3, 7.1.7, 7.1.9 and 7.1.13, and with the following additions:		
7.1.2	Materials		
7.1.2.2	Glow-wire testing		
		See report:180600074SHA-001, -002	P
7.1.2.3	Test based on flammability category		
		See Table	N/A
7.1.3	Current-carrying parts and their connection		
	No contact pressure through insulating materials		P
7.1.4	Clearances and creepage distances		
	Clause 7.1.4 of IEC 60947-1 applies		
	Clearances		
	Minimum values are given in Table 13 and Table 15 of IEC 60947-1		
	Rated impulse withstand voltage	6kV	
	Minimum clearance - Case B (mm)	Required : __ mm	
	Minimum clearance - Case A (mm)	Required : 5,5 mm	
	Measured clearances (mm) ..... :	Measured: .8,0 mm	P
	Creepage distances		
	Pollution degree ..... :	3	
	Comparative tracking index (V) ..... :	175	
	Material group ..... :	IIIa	
	Rated insulation voltage Ui (V) ..... :	690	
	Minimum creepage distances (mm) ..... :	10,0	
	Measured creepage distances (mm) ..... :	>15	P
7.1.5	Actuator		
7.1.5.1	Insulation		
	Clause 7.1.5.1 of IEC 60947-1 applies		N/A
7.1.5.2	Direction		
	Clause 7.1.5.2 of IEC 60947-1 applies		N/A
7.1.5.3	Actuating force (or moment)		

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Clause	Requirement + Test	Result - Remark	Verdict
		See test sequence V	N/A
7.1.5.4	Limitation of rotation (of rotary switch)		
	When actuators with limited or unidirectional movement are used, they shall be fitted with robust means of limitation, capable of withstanding five times the actual maximum actuating moment.		N/A
7.1.5.5	Emergency stop		
	The actuator shall preferably latch in the actuated position with the control contact open. This latching shall be released by a separate action, e.g. by pulling, rotation, or by means of a key.		N/A
7.1.6	Indication of the contact position		
	Clause 7.1.6 of IEC 60947-1 applies		N/A
7.1.7	Conditions for control switches suitable for isolation		
	A control switch suitable for isolation shall be manually operated with a direct opening action (see Annex K) and shall comply with the isolating function in the open position (see 2.1.19 and 7.1.7 of IEC 60947-1).		N/A
	The open position of a control switch suitable for isolation shall be a position in which the switch can remain when no actuating force is applied.		N/A
	In order to avoid unintentional reclosing, it shall be possible to prevent the operation of the control switches suitable for isolation when the contact elements are in the open position. This may be obtained by padlocking or by a latch which shall only be releasable by a special tool or key.		N/A
7.1.8	Terminals		
		See clause 8.2.4	P
7.1.10	Provisions for protective earthing		
	Clause 7.1.10 of IEC 60947-1 applies		N/A
7.1.11	Enclosures for equipment		
	Clause 7.1.11 of IEC 60947-1 applies		N/A
7.1.12	Degree of protection of enclosed equipment		
	Degree of protection ..... :	IP20	
	Test for first characteristic		
	Test for first numeral ..... :	☐ 1: ☒ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6:	P
	Test for second characteristic		

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Clause	Requirement + Test	Result - Remark	Verdict
	Test for second numeral ..... :	☐ 1: ☐ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6: ☐ 7: ☐ 8:	N/A
7.1.14	Class II control circuit devices		
	These devices shall not be provided with means for protective earthing (see IEC 61140)		N/A
	For class II control circuit devices insulated by encapsulation, see Annex F	See annex F	
7.1.15	Requirements for control devices with integrally connected cables		
		See annex G	N/A
7.2	Performance requirements		
	Subclauses 7.2.1.1 and 7.2.2 of IEC 60947-1 apply with the following additions:		
7.2.1.2	Limits of operation of contactor relays		
	The limits of operation for contactor relays shall be in accordance with IEC 60947-4-1	See clause 8.3.3.2	P
7.2.3	Dielectric properties		
	Subclause 7.2.3 of IEC 60947-1 applies with the following addition	See clause 8.3.3.4	P
	For class II control circuit devices insulated by encapsulation	See Annex F	N/A
7.2.4	Ability to make and break under normal and abnormal load conditions		
7.2.4.1	Making and breaking capacities		
	Making and breaking capacities under normal conditions as state in table 4	See clause 8.3.3.5.2	P
	Making and breaking capacities under abnormal conditions as state in table 5	See clause 8.3.3.5.3	P
7.2.4.3	Durability		
	Sub-clause 7.2.4.3 of IEC 60947-1 applies with the following additions:		
	Mechanical durability	See Annex C	N/A
	Electrical durability	See Annex C	N/A
7.2.5	Conditional short-circuit current		
	The switching element shall withstand the stresses resulting from short-circuit current under the conditions specified in 8.3.4		P
7.2.7	Additional requirements for control switches suitable for isolation		

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Control switches suitable for isolation shall be tested according to 8.3.3.4 of IEC 60947-1 with a value of test voltage as specified in Table 14 or IEC 60947-1 corresponding to the rated impulse withstand voltage Uimp declared by the manufacturer.		N/A
	Other additional requirements applicable to such control switches are under consideration		N/A
7.2.8	Maximum recovery time		
	For equipment incorporating electronic circuits the maximum recovery time and the measuring method shall be stated by the manufacturer		N/A
7.3	Electromagnetic compatibility (EMC)		
	Subclause 7.3 of IEC 60947-1 applies with the following additions:		N/A
	The control circuit device to be tested shall have all the essential design details of the type which it represents and shall be in a clean and new condition.		N/A
	The EMC tests shall be conducted at rated operational voltage Ue, or if the rated operational voltage is given as a range, then the test shall be conducted at a voltage which represents the worst case condition.		N/A
	Maintenance or replacement of parts during or after a testing cycle is not permitted.		N/A
	The products covered by this standard are intended for use in environment A.		N/A
	Contactor relays incorporating electronic circuits shall follow the requirements of 8.3.2.2 of IEC 60947-4-1		N/A

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	**TEST SEQUENCE I (-1 sample: LT1-D9511)**	
Test No. 1	- operating limits of contactor relays (8.3.3.2)	
Test No. 2	- temperature rise (Clause 8.3.3.3.)	
Test No. 3	- dielectric properties (Clause 8.3.3.4)	
Test No. 4	- mechanical properties of terminals (8.2.4 of IEC 60947-1)	

8.3.3.2	**Operating limits of contactor relays**		
9.3.3.2.1	Power-operated equipment:		
8.2.1.2.1	Electromagnetic contactors and starters		
	rated control supply voltage Us (V) ..... :	See result in test report: 180600074SHA-001, -002	
	frequency (Hz) ..... :		
	declared ambient temperature(>40 °C) for 100% Us		
	limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage Us . :		N/A
	limits of drop out and open fully are: 75% to 20% for a.c. and 75% to 10% for d.c. ..... :		N/A
	ambient temperature(-5 °C) for 100% Us		
	limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage Us . :		N/A
	Limits of drop out and open fully are: 75% to 20% for a.c. and 75% to 10% for d.c. ..... :		N/A
8.2.1.2.2	Contactors and starters with electronically controlled electromagnet		
	Rated control supply voltage Us (V) ..... :		
	Frequency (Hz) ..... :		
	Declared ambient temperature(>40 °C) for 100% Us		
	Limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage Us . :		N/A
	Limits of drop out and open fully are: 75% to 20% for a.c. and 75% to 10% for d.c. ..... :		N/A
	Ambient temperature(-5 °C) for 100% Us		
	Limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage Us . :		N/A
	Limits of drop out and open fully are: 75% to 20% for a.c. and 75% to 10% for d.c. ..... :		N/A
8.2.1.2.3	Electro-pneumatic contactors and starters		
	Rated air supply pressure(Bar) ..... :		
	Declared ambient temperature(>40 °C) for 100% of the rated air supply pressure(Bar)		

IEC 60947-5-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Limits of close satisfactorily at any value between 85% and 110% of rated air supply pressure(Bar) .. :		N/A
	Limits of drop out and open fully are: 75% to 10% of rated air supply pressure(Bar) ..... :		N/A
	Ambient temperature(-5 °C) for 100% of the rated air supply pressure(Bar)		
	Limits of close satisfactorily at any value between 85% and 110% of rated air supply pressure(Bar) .. :		N/A
	Limits of drop out and open fully are: 75% to 10% for the rated air supply pressure(Bar) ..... :		N/A
8.3.3.3	Temperature rise		
	ambient temperature 10-40 °C ..... :	See result in test report: 180600074SHA-001, -002	
	test enclosure W x H x D (mm x mm x mm) ..... :	-	
	material of enclosure ..... :	-	
	NO-contacts, test conditions:		
	- rated operational current Ie (A) ..... :		
	- conventional free air thermal current Ith (A).....		
	- cable cross-section (mm²) ..... :		
	- cable length (m) ..... :		
	- temperature rise of NO terminals (K) ..... :		N/A
	NC-contacts, test conditions:		
	- rated operational current Ie (A) ..... :		
	- cable cross-section (mm²) ..... :		
	- cable length (m) ..... :		
	- temperature rise of NC terminals (K) ..... :		N/A
	Coils and electromagnets, test conditions:		
	- rated control supply voltage Us (V / Hz) ..... :		
	- Class of insulating material ..... :		
	- temperature rise of coil and electromagnets (K) ... :	See table	N/A
8.3.3.4	**Dielectric properties**		
	Test of dielectric properties, impulse withstand voltage (Uimp indicated):		
	- verification by measurement of clearances instead of testing		
	- rated impulse withstand voltage (kV) ..... :	6	
	- test Uimp auxiliary circuits (kV) ..... :	7,3	P
	Test of dielectric properties, dielectric withstand voltage (Uimp not indicated):		
	- rated insulation voltage (V) ..... :		
	- control and auxiliary circuits, test voltage (V) for 60 sec ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.2.4	**Mechanical and electrical properties of terminals**		
8.2.4.2	Mechanical strength of terminals		
	maximum cross-sectional area of conductor (mm^2) :	2,5 mm^2	
	diameter of thread (mm) ..... :	3,4 mm	
	torque (Nm) ..... :	0,8 Nm	
	5 times on 2 separate clamping units		P
8.2.4.3	Testing for damage to and accidental loosening of conductor (flexion test)		
	conductor of the smallest cross-sectional area (mm^2) ..... :	1,0 mm^2	
	number of conductor of the smallest cross section . :	2	
	diameter of bushing hole (mm) ..... :	6,4 mm	
	height between the equipment and the platen (mm) ..... :	260 mm	
	mass at the conductor(s) (kg) ..... :	0,4 kg	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.4	Pull-out test		
	force (N) ..... :	35	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.3	Flexion test		
	conductor of the largest cross-sectional area (mm^2) :	2,5 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 (mm) ..... :	280 mm	
	mass at the conductor(s) (kg) ..... :	0,7 kg	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.4	Pull-out test		
	force (N) ..... :	50	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.3	Flexion test		
	conductor of the largest and smallest cross-sectional area (mm^2) ..... :	2,5/1,0	
	number of conductor of the smallest cross sectional, number of conductor of the largest cross sectional . :	1/2	

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Clause	Requirement + Test	Result - Remark	Verdict
	diameter of bushing hole (mm) ..... :	9,5/6,5	
	height between the equipment and the platen (mm) ..... :	280/260	
	mass at the conductor(s) (kg) ..... :	0,7/0,4	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.4	Pull-out test		
	force (N) ..... :	50/35	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		P
8.2.4.5	Test for insertability of unprepared round copper conductors having the maximum cross-section		
	The test shall be carried out using the appropriate gauge form A or form B specified in Table 7.		N/A
	The measuring section of the gauge shall be able to penetrate freely into the terminal aperture to the full depth of the terminal (see also note to Table 7).		N/A
	Alternatively, the test can be carried out by inserting the largest conductor of type and rated cross-section among those recommended by the manufacturer, the diameter of which corresponds to the theoretical diameter according to Table 7a, after the insulation has been removed and the end has been reshaped. The stripped end of the conductor shall be able to enter completely within the clamping unit aperture, without use of undue force.		N/A
8.2.4.7	Electrical performance of screwless-type clamping units		
	If terminals are used which are qualified according to IEC 60999-1 and the operating conditions of the terminals in the device are according to the operating conditions specified by the manufacturer of the terminals, then the test does not need to be performed.		N/A
	Sub clause 8.2.4.7 of IEC 60947-1 applies with the following changes:		N/A
	– The test shall be done on the connecting device equipped with the clamping units; – The number of specimens shall be at least 8; – The test shall be done as a single 8 test: • Eight clamping units shall be tested to the declared voltage drop; • If the number of failed clamping units does not exceed two, the test is considered passed.		N/A
	test current (A) ..... :		N/A
	voltage drop $<$ 15 mV. (V)..... :		N/A
8.2.4.8	Ageing test for screwless-type clamping units		

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Clause	Requirement + Test	Result - Remark	Verdict
	If terminals are used which are qualified according to IEC 60999-1 and the operating conditions of the terminals in the device are according to the operating conditions specified by the manufacturer of the terminals, then the test does not need to be performed.		N/A
	Subclause 8.2.4.8 of IEC 60947-1 applies with the following changes:		N/A
	The test shall be done on the connecting device equipped with the clamping units.		N/A
	test current (A) ..... :		N/A
	maximum temperature for the temperature cycles shall be 40°C. Max. temperature (°C) ..... :		N/A
	voltage drop ≤ 22,5 mV or 1,5 times the value measured after the 24th cycle. (V) ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	**TEST SEQUENCE II (-1 sample: LT1-D9511)**	
Auxiliary Contact (NO), 1 sample: LT1-D9511		
Test No. 1	- Making and breaking capacities of switching elements under normal conditions (8.3.3.5.3)	
Test No. 2	- Dielectric verification (8.3.3.5.6.b)	

8.3.3.5.3	**Making and breaking capacities of switching elements under normal conditions**		
	contact element (figure / form) ..... :	Figure 4e)/ form Zb	
	contact polarity..... :	-	
	utilization category (AC / DC)..... :	AC-15	
	rated operational voltage Ue (V) ..... :	415V	
	rated operational current Ie (A) or power (kW) ..... :	0,95A	
No.1	- test voltage U/Ue = 1,1 (V) ..... :	L1: 457 L2: - L3: -	P
	- power factor/~~time constant~~ ..... :	L1: 0,31 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=1 (A) ..... :	L1: 0,97 L2: - L3: -	P
	- a.c. test: Inductor shunted by a resistor taking 3% of the total power consumed - d.c. test: test current increase from zero to steady-state value within limits of figure 9		
	- on-time (ms) ..... :	340	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	50	
	- test voltage U/Ue = 1,0 (V) ..... :	L1: 417 L2: - L3: -	P
	- power factor/~~time constant~~ ..... :	L1: 0,31 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=1 (A) ..... :	L1: 0,97 L2: - L3: -	P
No. 2	- on-time (ms) ..... :	340	
	- operating cycles per minute ..... :	Rapidly as possible (60)	
	- number of operating cycles ..... :	10	P

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Clause	Requirement + Test	Result - Remark	Verdict

No. 3	- on-time (ms) ..... :	291	
	- operating cycles per minute ..... :	60	
	- number of operating cycles ..... :	990	P
No. 4	- on-time (ms) ..... :	291	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	5000	P
	Behaviour and condition during and after the test:		
	- no electrical or mechanical failures		P
	- no contact welding or prolonged arcing		P
	- no blowing of the fusible element in the earth circuit		P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with a min.of 1000V:	1000 V	P

8.3.3.5.3	**Making and breaking capacities of switching elements under normal conditions**		
Auxiliary Contact (NC), 1 sample: LT1-D9511			
	contact element (figure / form) ..... :	Figure 4e)/ form Zb	
	contact polarity..... :	-	
	utilization category (AC / DC)..... :	AC-15	
	rated operational voltage Ue (V) ..... :	415V	
	rated operational current Ie (A) or power (kW) ..... :	0,95A	
No.1	- test voltage U/Ue = 1,1 (V) ..... :	L1: 457 L2: - L3: -	P
	- power factor~~/time constant~~ ..... :	L1: 0,31 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=1 (A) ..... :	L1: 0,97 L2: - L3: -	P
	- a.c. test: Inductor shunted by a resistor taking 3% of the total power consumed - d.c. test: test current increase from zero to steady-state value within limits of figure 9		
	- on-time (ms) ..... :	340	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	50	
	- test voltage U/Ue = 1,0 (V) ..... :	L1: 417 L2: - L3: -	P

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Clause	Requirement + Test	Result - Remark	Verdict
	- power factor/~~time constant~~ ..... :	L1: 0,31 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=1 (A) ..... :	L1: 0,97 L2: - L3: -	P
No. 2	- on-time (ms) ..... :	340	
	- operating cycles per minute ..... :	Rapidly as possible (60)	
	- number of operating cycles ..... :	10	P
No. 3	- on-time (ms) ..... :	291	
	- operating cycles per minute ..... :	60	
	- number of operating cycles ..... :	990	P
No. 4	- on-time (ms) ..... :	291	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	5000	P
	Behaviour and condition during and after the test:		
	- no electrical or mechanical failures		P
	- no contact welding or prolonged arcing		P
	- no blowing of the fusible element in the earth circuit		P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with a min.of 1000V:	1000 V	P

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Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	**TEST SEQUENCE III**	
-1 sample: III-1, AC-15, 415V/0,95A		
Test No. 1	- Making and breaking capacities of switching elements under abnormal conditions (8.3.3.5.4)	
Test No. 2	- Dielectric verification (8.3.3.5.6.b)	

8.3.3.5.4	**Making and breaking capacities of switching elements under abnormal conditions:**		
Auxiliary Contact , III-1, NO			
	contact element (figure / form) ..... :	Figure 4e) / form Zb	
	contact polarity..... :	-	
	utilization category (AC / DC)..... :	AC-15	
	rated operational voltage Ue (V) ..... :	415V	
	rated operational current Ie (A) ~~or power (kW)~~ ..... :	0,95A	
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,1 (V) ..... :	L1: 460 L2: - L3: -	P
	- power factor~~/time constant~~ ..... :	L1: 0,30 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- a.c. test: Inductor shunted by a resistor taking 3% of the total power consumed - d.c. test: test current increase from zero to steady-state value within limits of figure 9		
	- on-time (ms) ..... :	68	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	10	P
	Behaviour and condition during and after the test:		
	- no electrical or mechanical failures		P
	- no contact welding or prolonged arcing		P
	- no blowing of the fusible element in the earth circuit		P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with min.of 1000V.. :	1000V	P

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Clause	Requirement + Test	Result - Remark	Verdict

8.3.3.5.4	**Making and breaking capacities of switching elements under abnormal conditions:**		
Auxiliary Contact , III-1, NC			
	contact element (figure / form) ..... :	Figure 4e) / form Zb	
	contact polarity..... :	-	
	utilization category (AC / DC)..... :	AC-15	
	rated operational voltage Ue (V) ..... :	415V	
	rated operational current Ie (A) ~~or power (kW)~~ ..... :	0,95A	
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,1 (V) ..... :	L1: 460 L2: - L3: -	P
	- power factor~~/time constant~~ ..... :	L1: 0,30 L2: - L3: -	P
	- make operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- break operations: test current I/Ie=10 (A) ..... :	L1: 9,70 L2: - L3: -	P
	- a.c. test: Inductor shunted by a resistor taking 3% of the total power consumed - d.c. test: test current increase from zero to steady-state value within limits of figure 9		
	- on-time (ms) ..... :	68	
	- operating cycles per minute ..... :	6	
	- number of operating cycles ..... :	10	P
	Behaviour and condition during and after the test:		
	- no electrical or mechanical failures		P
	- no contact welding or prolonged arcing		P
	- no blowing of the fusible element in the earth circuit		P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with min.of 1000V.. :	1000V	P

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Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	**TEST SEQUENCE IV**		
Auxiliary Contact (NO), 1 sample: LT1-D9511			
Test No. 1	- Performance under conditional short-circuit current (8.3.4)		
Test No. 2	- Dielectric verification (8.3.3.5.6.b)		

8.3.4	Performance under conditional short-circuit current		
	contact element (figure / form) ..... :	Figure 4e) / form Zb	
	contact polarity..... :	-	
	type of SCPD ..... :	Fuse, RT16-00,	
	ratings of SCPD (A / V) ..... :	10A/500V	
	prospective current (kA) ..... :	1kA	
	test voltage (V) U/Ue = 1,1 (V) ..... :	L1: 458	P
	r.m.s. test current obtained (kA) ..... :	L1: 1,02	P
	power factor (max. 0,7) ..... :	0,67	P
	Auxiliary Contact (NC)	IV-1	
	first CO operation by closing the separate making switch: test Ip / I²dt (A / A²s) ..... :	L1: 426A / 0,223kA²s	P
	time interval between test (min. 3 min) ..... :	3	P
	second CO operation by closing the separate making switch: test Ip / I²dt (A / A²s) ..... :	L1: 409A / 0,186kA²s	P
	time interval between test (min. 3 min) ..... :	**3**	P
	third making operation to closed switching elements: test Ip / I²dt (A / A²s) ..... :	L1: 429A / 0,200kA²s	P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with min.of 1000V.. :	1000V	P

8.3.4	Performance under conditional short-circuit current **Auxiliary Contact (NC), 1 sample: LT1-D9511**		
	contact element (figure / form) ..... :	Figure 4e) / form Zb	
	contact polarity..... :	-	
	type of SCPD ..... :	Fuse, RT16-00,	
	ratings of SCPD (A / V) ..... :	10A/500V	
	prospective current (kA) ..... :	1kA	
	test voltage (V) U/Ue = 1,1 (V) ..... :	L1: 458	P
	r.m.s. test current obtained (kA) ..... :	L1: 1,02	P
	power factor (max. 0,7) ..... :	0,67	P
	Auxiliary Contact (NC)	IV-1	
	first CO operation by closing the separate making switch: test Ip / I²dt (A / A²s) ..... :	L1: 411A / 0,233kA²s	P

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Clause	Requirement + Test	Result - Remark	Verdict
	time interval between test (min. 3 min) ..... :	**3**	P
	second CO operation by closing the separate making switch: test Ip / I²dt (A / A²s) ..... :	L1: 407A / 0,196kA²s	P
	time interval between test (min. 3 min) ..... :	**3**	P
	third making operation to closed switching elements: test Ip / I²dt (A / A²s) ..... :	L1: 431A / 0,211kA²s	P
8.3.3.5.6.b	Dielectric verification:		
	dielectric test voltage (V) 2 xUe with min.of 1000V.. :	1000V	P

8.3.1	TEST SEQUENCE V (sample No. 5)		
Test No. 1	- Degree of protection of enclosed control circuit-devices (Annex C of IEC 60947-1)		
Test No. 2	- Verification of actuation force or moment (8.2.5)		
Annex C	Degree of protection of enclosed control circuit-devices		
	The enclosed control circuit devices shall comply with the requirements of Annex C of IEC60947-1		N/A
8.2.5	Verification of actuation force or moment		
	When required in 7.1.5.3, the minimum actuating force or moment shall be tested during sequence V of 8.3.1. The performance shall be as stated in 7.1.5.3		N/A
7.1.5.3	Actuating force (or moment)		
	The force (or moment) required to operate the actuator shall be compatible with the intended application, taking into account the size of the actuator, the type of enclosure or panel, the environment of the installation and the use for which it is intended		N/A
	The minimum starting force (or moment) shall be sufficiently large to prevent inadvertent operation; e.g. push-buttons and rotary switches to be used with enclosures complying with degrees of protection IPX5 or IPX6 shall not become actuated when hit by the jet of water applied during the test of the enclosed equipment.		N/A
	Minimum force (N)		N/A
	Minimum moment (Nm)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

8.3.1.	**TEST SEQUENCE VI**	
- 1 sample: VI-1		
Test No. 1	- Measurement of clearances and creepage distances (7.1.4 of IEC 60947-1)	
Test No. 2	- Verification of limitation of rotation of a rotary switch (8.2.6)	

7.1.4	Measurement of clearances and creepage distances		
	Clearances and creepage distances	See clause 7.1.4	P
	Verification of limitation of rotation of a rotary switch (8.2.6)		N/A
8.2.6	Verification of limitation of rotation of a rotary switch		
	When this test is required in 7.1.4.5, it shall be tested during sequence VI of 8.3.1 The test sample shall be mounted according to the manufacturer's instructions		N/A
7.1.4.5	Limitation of rotation (of a rotary switch)		
	When actuators with limited or unidirectional movement are used, they shall be fitted with robust means of limitation, capable of withstanding five times the actual maximum actuating moment		N/A
8.2.6	The operating moment shall be measured five times and the maximum value recorded (Nm) ..... :		N/A
	The maximum moment value, multiplied by five, shall be applied to the actuator by forcing it against the means of limitation. The moment shall be applied for 10 s (Nm)..... :		N/A
	Means of limitation has not moved, become loose or prevented the actuator's normal operation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.4	TEST FOR EMC		
8.4.1.	General		
	Control circuit devices having only passive components are not required to be tested.		N/A
	Subclauses 8.3.2.1 of IEC 60947-1 and 8.3.2.4 of IEC 60947-1 apply with the following additions:		
	Control circuit devices intended to be mounted in a hole of a panel shall be mounted in a hole which is located in the centre of a grounded square metal plate.		N/A
	Control circuit devices intended to be mounted on surfaces or on standard rails shall be mounted directly on the grounded square metal plate or on the standard rail which is fixed on the grounded square metal plate.		N/A
	Control circuit devices intended to be mounted in associated metal enclosures shall be mounted in the grounded metal enclosure with the smallest dimension available or on the grounded square metal plate, whichever configuration yields the worst results.		N/A
	The dimension of the square metal plate shall be (300 ± 50) mm and the thickness 1,5 $_{0}^{+0,5}$ mm.		N/A
	If not required otherwise by horizontal standard the connecting leads shall be 2 $_{0}^{+0,5}$ m. If the length of the connecting leads is other than 2 m. Cable length (m)……..:		N/A
	For control circuit devices not having integral cables, the type of cable or wire used shall be specified by the manufacturer: Type of cable……..:		N/A
	The test sample shall be in the ON-status or in the OFF-status, whichever is the worse. Tested state :	ON / OFF	N/A
	Where a range of control circuit devices are made according to the same principle and design, and using the same type of components, tests may be performed on representative samples.		N/A
8.4.2	Immunity		
8.4.2.1	Electrostatic discharges.		
	The test shall be performed according to IEC 61000-4-2 and 7.3.2.4, and shall be repeated 10 times at each measuring point, with a minimum time interval of 1 s between pulses.	See	N/A
8.4.2.2	Radiated radio-frequency electromagnetic fields		
	The test shall be performed according to IEC 61000-4-3 and 7.3.2.5.	See	N/A
8.4.2.3	Electrical fast transients/bursts		
	The test shall be performed according to IEC 61000-4-4 and 7.3.2.6, with all the connecting leads placed in the capacitive coupling clamp.	See	N/A
8.4.2.4	Surges		

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Clause	Requirement + Test	Result - Remark	Verdict
	The test shall be conducted using the methods of IEC 61000-4-5. Capacitive coupling shall be preferred. Surges shall be supplied between:	See	N/A
	a) between terminals intended to be connected to the power supply;		N/A
	b) between each output terminal and each terminal intended to be connected to the power supply		N/A
	The test voltage values are those of Table 8 but shall not exceed the corresponding U_{imp} value(s) given by the manufacturer following 7.2.3 of IEC 60947-1. Test voltages (V)……..:		N/A
	The repetition rate shall be one surge per minute, with the number of pulses being five positive and five negative.		N/A
8.4.2.5	Conducted disturbances induced by radio-frequency fields		
	The test shall be performed according to IEC 61000-4-6 and 7.3.2.8.	See	N/A
8.4.2.6	Power-frequency magnetic fields		
	The test shall be performed according to IEC 61000-4-8 and 7.3.2.9.	See	N/A
8.4.2.7	Voltage dips and interruptions		
	The test shall be performed according to IEC 61000-4-11 and 7.3.2.10.	See	N/A
8.4.2	Emission		
	The test shall be performed according to CISPR 11, group 1, class A, and 7.3.3.	See	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
Annex C of IEC 60947-1	**DEGREE OF PROTECTION OF ENCLOSED CONTROL CIRCUIT-DEVICES**		
Annex C	**SPECIAL TESTS - DURABILITY TESTS**		
Annex F	**CLASS II CONTROL CIRCUIT DEVICES INSULATED BY ENCAPSULATION REQUIREMENTS AND TESTS**		
Annex G	**ADDITIONAL REQUIREMENTS FOR CONTROL CIRCUIT DEVICES WITH INTEGRALLY CONNECTED CABLES**		
Annex H	**ADDITIONAL REQUIREMENTS FOR SEMICONDUCTOR SWITCHING ELEMENTS FOR CONTROL CIRCUIT DEVICES**		
Annex J	**SPECIAL REQUIREMENTS FOR INDICATOR LIGHTS AND INDICATING TOWERS**		
Annex K	**SPECIAL REQUIREMENTS FOR CONTROL SWITCHES WITH DIRECT OPENING ACTION**		
Annex L	**SPECIAL REQUIREMENTS FOR MECHANICALLY LINKED CONTACT ELEMENTS**		
Annex M	**TERMINAL MARKING, DISTINCTIVE NUMBER AND DISTINCTIVE LETTER FOR CONTROL CIRCUIT DEVICES**		
Annex N	**Procedure to determine reliability data for electromechanical devices in control circuits used in functional safety applications**		

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	TABLE: Clearance and Creepage Distance Measurements					P
clearance cl and creepage distance dcr at/of:	Uimp (V)	Ui (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Across the open contacts	6kV	690	5,5	>8,0	10,0	>15,0
Between poles	6kV	690	5,5	>8,0	10,0	>15,0
Between poles and accessible part	6kV	690	5,5	>8,0	10,0	>15,0
supplementary information:						

Photo of sample:

See reports: 180600074SHA-001, -002