



Test Report issued under the responsibility of:



**TEST REPORT**  
**IEC 60947-5-1**

**Part 5: Control circuit devices and switching elements**  
**Electromechanical control circuit devices**

Report Number ..... 11CA60676A

Date of issue ..... 2012/07/30

Total number of pages ..... 35 Pages

CB Testing Laboratory ..... UL INTERNATIONAL DEMKO A/S

Address ..... Borupvang 5A, 2750 Ballerup, Denmark

Applicant's name ..... LSIS Co., Ltd.

Address ..... CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea

**Test specification:**

Standard ..... IEC 60947-5-1: 2003 (3rd Edition) + A1: 2009 / IEC 60947-1:2007

Test procedure ..... CB Scheme

Non-standard test method ..... N/A

Test Report Form No. .... IEC60947\_5\_1D

Test Report Form(s) ..... KEMA Quality BV

Originator .....

Master TRF ..... Dated 2010-01

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Test item description ..... In-built Auxiliary Contacts of Thermal Overload Relay

Trade Mark .....



Manufacturer ..... LSIS Co., Ltd.

CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea

Factory..... LSIS Co., Ltd.

CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea

Model/Type reference ..... In-built Auxiliary contacts of Thermal Overload Relays, GTK-12M, GTK-12MH, GTH-12M, GTH-12M/3, GTH-12MH, GTH-12MH/3

Ratings ..... See Table 1A

Table 1A (Utilization category: AC-15 (C600))

Utilization Category : AC-15						
Rated Operational Voltage U <sub>e</sub> (Vac)	120	240	380	480	500	600
Rated Operational Current I <sub>e</sub> (Aac)	1.5	0.75	0.47	0.375	0.35	0.3

1) Rated Insulation Voltage (U<sub>i</sub>) : 690 Vac

2) Rated Impulse Withstand Voltage (U<sub>imp</sub>) : 6 kV

3) Conventional free air thermal current (I<sub>th</sub>): 4 A

4) Prospective Short circuit current – 1 kA

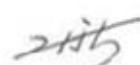


5) SCPD: Bussmann, gL-gG, 4 A

6) IP rating for terminals : IP20

7) Contact element ( figure / form) / no. of contacts : 1 NO and 1 NC configuration, 4b), 1X 1 Y

8) Tightening torque : 8 kgf.cm

9) Wire size : 0.75 mm<sup>2</sup>

<b>Testing procedure and testing location:</b>		
<input type="checkbox"/>	<b>CB Testing Laboratory:</b>	UL INTERNATIONAL DEMKO A/S
Testing location/ address .....		Borupvang 5A, 2750 Ballerup, Denmark
<input type="checkbox"/>	<b>Associated CB Laboratory:</b>	N/A
Testing location/ address .....		N/A
Tested by (name + signature) .....		N/A
Approved by (+ signature)		N/A
<input type="checkbox"/>	Testing procedure: TMP	N/A
Testing location/ address .....		N/A
Tested by (name + signature) .....		N/A
Approved by (+ signature) .....		N/A
<input checked="" type="checkbox"/>	Testing procedure: WMT	LSIS Co., Ltd.
Testing location/ address .....		CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea
Tested by (name + signature) :		Jae-Kyu Park 
Witnessed by (+ signature) :		KangSik Lee 
Approved by (+ signature) :		S. Chandrakumar 
<input type="checkbox"/>	Testing procedure: SMT	N/A
Testing location/ address .....		N/A
Tested by (name + signature) .....		N/A
Approved by (+ signature) .....		N/A
Supervised by (+ signature) .....		N/A
<input type="checkbox"/>	Testing procedure: RMT	N/A
Testing location/ address .....		N/A
Tested by (name + signature) .....		N/A
Approved by (+ signature) .....		N/A
Supervised by (+ signature) .....		N/A

Summary of testing:	
<p><b>Tests performed (name of test and test clause):</b></p> <p><b>Test sequences</b></p> <p>The type and sequence of tests to be performed on representative samples are as follows.</p> <p><b>Test sequence I</b>  Test No. 1 – Operating limits of contactor relays (8.3.3.2)  Test No. 2 – Temperature rise (8.3.3.3)  Test No. 3 – Dielectric properties (8.3.3.4 and 8.3.3.4 of IEC 60947-1)  Test No. 4 – Mechanical properties of terminals (8.2.4 of IEC 60947-1)</p> <p><b>Test sequence II</b>  Test No. 1 – Making and breaking capacities of switching elements under normal conditions (8.3.3.5.2)  Test No. 2 – Dielectric verification (8.3.3.5.5 b)</p> <p><b>Test sequence III</b>  Test No. 1 – Making and breaking capacities of switching elements under abnormal conditions (8.3.3.5.3)  Test No. 2 – Dielectric verification (8.3.3.5.5 b)</p> <p><b>Test sequence IV</b>  Test No. 1 – Performance under conditional short-circuit current (8.3.4)  Test No. 2 – Dielectric verification (8.3.3.5.5 b)</p> <p><b>Test sequence IV</b>  Test No. 1 – Degree of protection of enclosed control circuit devices (Annex C of IEC 60947-1)</p> <p><b>Test sequence VI</b>  Test No. 1 – Measurement of clearances and creepage distances (7.1.3)</p>	<p><b>Testing location:</b></p> <p>LSIS Co., Ltd.</p>

## Testing items reference Table with representative samples

Seq	Test Condition	GTK-12M	Remark
I	1) Operating limits of contactor relays (8.3.3.2), if applicable 2) Temperature-rise (8.3.3.3 and 8.3.3.3 of Part 1) 3) Dielectric properties (8.3.3.4 and 8.3.3.4 of Part 1) 4) Mechanical properties of terminals (8.2.4 of Part 1)	N/A	These tests were done with TOR
II	1) Making and breaking capacities of switching elements under normal conditions (8.3.3.5.2) 2) Dielectric verification (8.3.3.5.5.b)	○	AC-15
III	1) Making and breaking capacities of switching elements under abnormal conditions (8.3.3.5.3) 2) Dielectric properties (8.3.3.5.5.b)	○	AC-15
IV	1) Performance under conditional short-circuit current (8.3.4) 2) Dielectric properties (8.3.3.5.5.b)	○	
V	1) Degree of protection of enclosed control circuit devices (Annex C of Part 1) 2) Verification of actuation force or moment (8.2.5)	N/A	These tests were done with TOR
VI	1) Measurement of clearances and creepage distances, if applicable (7.1.3) 2) Verification of limitation of rotation of a rotary switch (8.2.6)	N/A	These tests were done with TOR

## Additional Information :

**Test Sequence I, V and VI :** Test sequence I, V and VI were done with TOR. See the Report of 11CA60676.

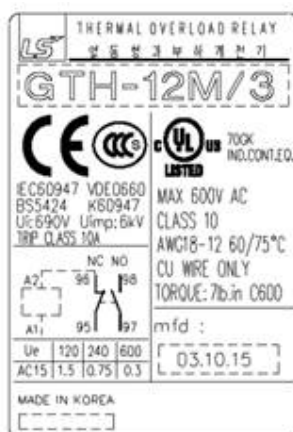
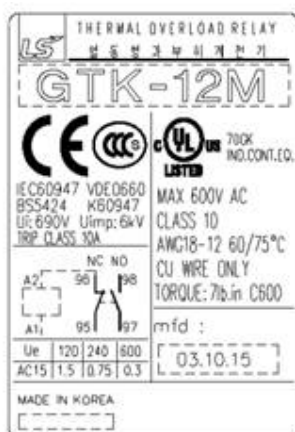
**Test Sequence II and III :** Test sequence II and III were done with the following condition;

- AC15, 120 V,1.5 A (NO)
- AC15, 120 V,1.5 A (NC)
- AC15, 600 V,0.3 A (NO)
- AC15, 600 V,0.3 A (NC)

**Test Sequence IV :** Test sequence IV was done with GTK-12M.

The auxiliary contacts are tested for NO and NC separately and it is in-built auxiliary contact of Thermal Overload relay. For Main Thermal Overload Relay test results, see the Report of 11CA60676.

## Copy of Marking Plate




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

Test item particulars .....	
	N/A
Classification of installation and use .....	
	N/A
Supply Connection .....	
	N/A
- kind of control circuit device.....	<input type="checkbox"/> manual control switches, e.g. push-buttons, rotary switches, foot switches, ect. <input checked="" type="checkbox"/> electromagnetically operated control switches, either time delayed or instantaneous, e.g. contactor relays <input type="checkbox"/> pilot switches, e.g. pressure switches, temperature sensitive switches (thermostats) <input type="checkbox"/> position switches <input type="checkbox"/> associated control equipment, e.g. indicator lights, etc.
- kind of switching elements.....	<input checked="" type="checkbox"/> 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 <input type="checkbox"/> interlocking contacts of enclosure doors <input type="checkbox"/> control circuit contacts of rotary switches <input type="checkbox"/> control circuit contacts of overload relays
- number of poles .....	2
	1 NO and 1 NC
- kind of current .....	
	<input checked="" type="checkbox"/> ac and/or <input type="checkbox"/> dc
- interrupting medium .....	
	<input checked="" type="checkbox"/> air, <input type="checkbox"/> oil, <input type="checkbox"/> gas, <input type="checkbox"/> vacuum, <input type="checkbox"/> _____
- operating conditions .....	
- method of operations .....	<input type="checkbox"/> manual <input checked="" type="checkbox"/> electromagnetic <input type="checkbox"/> pneumatic <input type="checkbox"/> electro-pneumatic
- method of control .....	<input checked="" type="checkbox"/> automatic <input type="checkbox"/> non-automatic <input type="checkbox"/> semi-automatic

- rated and limiting values for switching elements:	
- voltages:	
- rated operational voltage Ue (V) .....	See Table 1A in detail
- rated insulation voltage Ui (V).....	690
- rated impulse withstand voltage Uimp (kV) .....	6
- currents:	
- conventional free air thermal current Ith (A).....	4 A
- conventional enclosed thermal current Ithe (A) ..	N/A
- rated operational current Ie (A).....	See Table 1A in detail
- rated frequency ( Hz) .....	50/60
- utilization category .....	AC-15
- short-circuit characteristic:	
- rated conditional short-circuit current (kA).....	1 kA
- kind of protective device.....	Fuse (gL-gG) rated 600 Vac, 4 A
- electrically separated contact elements .....	N/A
- 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 for terminals only
- pollution degree	
	3
- Suitability for isolation, with the symbol 07-13-06 of IEC 60617-7	N/A



<b>Possible test case verdicts:</b>	
- 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)
<b>Testing .....</b>	<b>CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea</b>
<b>Date of receipt of test item .....</b>	<b>2012/02/07</b>
<b>Date (s) of performance of tests .....</b>	<b>2012-03-19 to 2012-04-19</b>
<b>General remarks:</b> 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. "(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 <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
<b>Manufacturer's Declaration per Sub-clause 6.2.5 of IEC60947-5-1:</b> 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 .....:	
When differences exist; they shall be identified in the General Product Information section.	
<b>Name and address of factory (ies) .....</b> <b>LSIS Co., Ltd.</b> <div style="text-align: right;"><b>CHEONG JU PLANT 1, Song Jung-Dong, Hung Duk-Ku, Cheong Ju-Shi, Chung Cheong Buk-Do, 361-720, Korea</b></div>	
<b>General product information:</b>	

5.2	MARKING			
5.2.1	Data shall be preferably marked on the equipment:			
	a - manufacturer's name or trademark			P
	b - type designation or serial number	Marked on the Label		P
	Data shall be included on the nameplate, or on the equipment, or in the manufacturer's published literature:			
	c - number of this standard	IEC 60947-5-1 Marked on the Label		P
	d - rated operational voltages	See Table 1A. Marked on the Label		P
	e - utilization category and rated operational currents, at the rated operational voltages of the control circuit device	AC-15 See Table 1A in details Marked on the Label		P
	f - rated insulation voltage:	690 Vac Marked on the Label		P
	g - rated impulse withstand voltage	6 kV Marked on the Label		P
	h - switching overvoltages, if applicable			N/A
	i - IP code, in case of enclosed control circuit device	IP 20 for terminals only mentioned in the Manufacturer's Published Literature		P
	j - pollution degree	Pollution degree 3		P
	k - type and maximum ratings of short-circuit protective device	Short-circuit protective device mentioned in the Manufacturer's Published Literature		P
	l - conditional short-circuit current if less than 1000 A			N/A
	m - suitability for isolation, where applicable, with the symbol 07-13-06 of IEC 60617-7			N/A
	n - indication of contact elements of same polarity			N/A
5.2.2	Terminal identification and marking	(See 7.1.8.4 of IEC 60947-1)		P
	Clearly and permanently identified according IEC 60445 and Annex L, unless superseded by relevant standard.	Marked on the product		P
	Neutral terminal identified by letter :			N/A
	Protective earth terminal identified by letter			N/A
5.2.3	Functional markings			N/A
	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		N/A
	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		N/A
	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
5.2.5.1	The position indication shall be clear, and the associated text or symbols shall be indelible and easily legible		N/A
5.2.5.2	Terminal markings for operating diagrams		N/A
	Terminal markings shall be clearly identifiable with respect to the operating diagram (see also Annex M)		N/A
5.2.6	Time delay markings		N/A
	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		
5.3	Instructions for installation, operation and maintenance	Mentioned in the manufacturer's Published Literature	P
	The manufacture shall specify, in his documents or catalogues:		P
	- 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
	- equipment only suiTable in environment A shall provided with the following notice	<p>NOTICE</p> <p>This product has been designed for environment B may cause unwanted electromagnetic disturbances in which case the user may be required to taken adequate mitigation measures.</p>	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.		N/A

<b>6</b>	<b>Normal service, mounting and transport conditions</b>		
6.1.1	Ambient temperature	Mentioned in the manufacturer's Published Literature	P
	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	Storage - Mentioned in the Manufacturer's Published Literature	
6.1.2	Altitude of side of installation does not exceed 2000m		P
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	3	P
	Unless otherwise stated, equipment for: - industrial use shall have a degree 3, depending upon micro-environment - household and similar shall have degree 2		P
6.1.4	Shock and vibration		N/A
	Under consideration		N/A
6.2	Conditions during transport and storage		N/A
	Under consideration		N/A
6.3	Mounting	Mentioned in the Manufacturer's Published Literature	P
	According manufacturer's instruction		P
6.3.1	Mounting of single hole mounted devices		N/A
	Dimensions according Table 2		N/A
6.3.1.1	Location of key recess(if any)		N/A
	Dimensions according Table 3		N/A
6.3.1.2	Range of panel thickness		N/A
	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		N/A
	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
<b>7.1</b>	<b>CONSTRUCTION</b>		
7.1.1	Materials		P
7.1.2	Current-carrying parts and their connection		P

	No contact pressure through insulating materials		P
7.1.3	Clearances		P
	Clause 7.1.3 of IEC 60947 applies		P
	Minimum values are given in Table 13 and Table 15 of IEC 60947-1		P
	Rated impulse withstand voltage	Uimp= 6 kV	P
	Case B (mm)		N/A
	Case A (mm)	Required : 5.5 mm	P
	Creepage distances		P
	Pollution degree : 3		P
	Comparative tracking index (V) : $100V \leq CTI < 175V$		P
	Material group : IIIa		P
	Rated insulation voltage Ui (V) : 690		P
	Minimum creepage distances (mm) : 12.8 mm		P
	Measured creepage distances (mm) : Main to Auxiliary: 29.0 mm Auxiliary to Auxiliary: 13.5 mm for Model GTK-12M between phases and between phases and aux. contact		P
7.1.4	Actuator		N/A
7.1.4.1	Insulation		N/A
7.1.4.2	Direction		N/A
7.1.4.3	Actuating force (or moment) :		N/A
7.1.4.4	Limitation of rotation (of rotary switch)		N/A
7.1.4.5	Emergency stop		N/A
7.1.5	Indication of the contact position		N/A
7.1.5.1	Indication means		N/A
7.1.5.2	Indication by the actuator		N/A
7.1.6	Conditions for control switches suiTable for is olation		N/A
7.1.7	Class II control circuit devices		N/A
	Not provided with means for protective earthing and insulated by encapsulation		N/A
7.1.8	Requirements for control devices with integrally connected cables		N/A
7.1.11	Degree of protection of enclosed equipment		P
	Degree of protection .....: IP20 for terminals only		P
	Test for first characteristic		P

	Test for first numeral .....	<input type="checkbox"/> 1: <input checked="" type="checkbox"/> 2: <input type="checkbox"/> 3: <input type="checkbox"/> 4: <input type="checkbox"/> 5: <input type="checkbox"/> 6:	
	Test for second characteristic		P
	Test for second numeral .....	<input checked="" type="checkbox"/> 0: <input type="checkbox"/> 1: <input type="checkbox"/> 2: <input type="checkbox"/> 3: <input type="checkbox"/> 4: <input type="checkbox"/> 5: <input type="checkbox"/> 6: <input type="checkbox"/> 7: <input type="checkbox"/> 8:	-
7.2	Performance requirements		P
	Subclauses 7.2.1.1 and 7.2.2 of IEC 60947-1 apply with the following additions:		P
7.2.1.2	Limits of operation of contactor relays		P
	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		P
	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		N/A
7.2.4	Ability to make and break under normal and abnormal load conditions		P
7.2.4.1	Making and breaking capacities		P
	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
7.2.4.2	Vacant		N/A
7.2.4.3	Durability		N/A
	Sub-clause 7.2.4.3 of IEC 60947-1 applies with the following additions:		N/A
	Mechanical durability		N/A
	Electrical durability		N/A
7.2.5	Conditional short-circuit current	See clause 8.3.4	P

	The switching element shall withstand the stresses resulting from short-circuit current under the conditions specified in 8.3.4		P
7.2.6	Switching overvoltage		N/A
	Subclause 7.2.6 of IEC 60947-1 applies		
7.2.7	Additional requirements for control switches suitable for isolation		N/A
	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 $U_{imp}$ declared by the manufacturer.		N/A
	Other additional requirements applicable to such control switches are under consideration		N/A
7.3	Electromagnetic compatibility (EMC)		N/A
	Subclause 7.3 of IEC 60947-1 applies unless otherwise specified in this standard		N/A

8.3.1.a	TEST SEQUENCE I	
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 $U_s$ (V) .....	N/A
	frequency (Hz) .....	N/A
	declared ambient temperature(>40 °C) for 100% $U_s$	N/A
	limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage $U_s$ :	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% $U_s$	N/A
	limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage $U_s$ :	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 $U_s$ (V) .....	N/A
	Frequency (Hz) .....	N/A
	Declared ambient temperature(>40 °C) for 100% $U_s$	N/A
	Limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage $U_s$ :	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% $U_s$	N/A
	Limits of close satisfactorily at any value between 85% and 110% of rated control supply voltage $U_s$ :	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	N/A
8.3.3.3	Temperature rise - Model	



	ambient temperature 10-40 C .....		
	test enclosure W x H x D (mm x mm x mm) ....		
	material of enclosure .....		
	NO-contacts, test conditions:		
	- rated operational current I <sub>e</sub> (A) .....		N/A
	- cable cross-section (mm <sup>2</sup> ) .....		N/A
	- temperature rise of NO terminals (K) .....		N/A
	NC-contacts, test conditions:		
	- rated operational current I <sub>e</sub> (A) .....		N/A
	- cable cross-section (mm <sup>2</sup> ) .....		N/A
	- temperature rise of NC terminals (K) .....		N/A
	Coils and electromagnets, test conditions:		
	- rated control supply voltage U <sub>s</sub> (V) .....		N/A
	- Class of insulating material .....		N/A
	- temperature rise of coil and electromagnets (K) .....		N/A
8.3.3.3	Temperature rise : Model GMR-8M, AC 240 V coil		
	ambient temperature 10-40 C .....		
	test enclosure W x H x D (mm x mm x mm) ....		
	material of enclosure .....		
	NO-contacts, test conditions:		
	- rated operational current I <sub>e</sub> (A) .....		N/A
	- cable cross-section (mm <sup>2</sup> ) .....		N/A
	- temperature rise of NO terminals (K) .....		N/A
	NC-contacts, test conditions:		
	- rated operational current I <sub>e</sub> (A) .....		N/A
	- cable cross-section (mm <sup>2</sup> ) .....		N/A
	- temperature rise of NC terminals (K) .....		N/A
	Coils and electromagnets, test conditions:		
	- rated control supply voltage U <sub>s</sub> (V) .....		N/A
	- Class of insulating material .....		N/A
	- temperature rise of coil and electromagnets (K) :		N/A
8.3.3.4	Test of dielectric properties, impulse withstand voltage (U <sub>imp</sub> indicated):		
	- verification by measurement of clearances instead of testing		N/A
	- rated impulse withstand voltage (V) .....		N/A

	- test Uimp auxiliary circuits (kV) .....		N/A
	Test of dielectric properties, dielectric withstand voltage (Uimp not indicated):		N/A
	- rated insulation voltage (V) .....		N/A
	- control and auxiliary circuits, test voltage (V) for 5 sec :		N/A
<b>8.2.4</b>	<b>Mechanical properties of terminals</b>		
<b>8.2.4.2</b>	<b>Mechanical strength of terminals</b>		
	maximum cross-sectional area of conductor (mm <sup>2</sup> ) :		N/A
	diameter of thread (mm) .....		N/A
	torque (Nm) .....		N/A
	5 times on 2 separate clamping units		N/A
	maximum cross-sectional area of conductor (mm <sup>2</sup> ) :		N/A
	diameter of thread (mm) .....		N/A
	torque (Nm) .....		N/A
	5 times on 2 separate clamping units		N/A
<b>8.2.4.3</b>	<b>Testing for damage to and accidental loosening of conductor (flexion test)</b>		
	conductor of the smallest cross-sectional area (mm <sup>2</sup> ) :		N/A
	number of conductor of the smallest cross section :		—
	diameter of bushing hole (mm) .....		—
	height between the equipment and the platen (mm) :		—
	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
	conductor of the smallest cross-sectional area (mm <sup>2</sup> ) :		N/A
	number of conductor of the smallest cross section :		—
	diameter of bushing hole (mm) .....		—
	height between the equipment and the platen (mm) :		—
	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
	conductor of the largest cross-sectional area (mm <sup>2</sup> ) :		N/A
	number of conductor of the smallest cross section :		—
	diameter of bushing hole (mm) .....		—

	height between the equipment and the platen (mm) :		—
	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
	conductor of the largest cross-sectional area (mm <sup>2</sup> ) :		N/A
	number of conductor of the smallest cross section :		—
	diameter of bushing hole (mm) .....		—
	height between the equipment and the platen (mm) :		—
	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

8.2.4.4	flexion test - 1 mm <sup>2</sup> , solid		
	force (N) .....		—
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
8.2.4.4	Pull-out test - 1 mm <sup>2</sup> , stranded		
	force (N) .....		—
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
8.2.4.4	Pull-out test – 2.5 mm <sup>2</sup> , solid		
	force (N) .....		—
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A
8.2.4.4	Pull-out test – 2.5 mm <sup>2</sup> , stranded		
	force (N) .....		—
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit		N/A

8.3.1.a	TEST SEQUENCE II GTK-12M Auxiliary Unit			
	- Making and breaking capacities of switching elements under normal conditions (8.3.3.5.2)			P
	- Dielectric verification (8.3.3.5.5.b)			P
8.3.3.5	TEST SEQUENCE II (IEC 60947-5-1, 2003) GTK-12M Auxiliary Unit			
8.3.3.5.2	Making and breaking capacities of switching elements under normal conditions – GMC-6M+GTK-12M (14A, 3 Heater)			
	contact element (figure / form)	1a, 1b	1a, 1b	P
	contact polarity	NO, NC	NO, NC	P
	utilization category :	AC-15, C600		P
	rated operational voltage Ue (V) :	AC 120 V	AC 600 V	P
	rated operational current Ie (A) or power (kW) :	1.5 A	0.3 A	P
Test No.1	- test voltage U/Ue = 1,1 (V) :	L1: 135.2 V L2: ____ V L3: ____ V	L1: 660.8 V	P
	- power factor :	L1: 0.29 L2: ____ L3: ____	L1: 0.32	P
	- make operations: test current I/Ie (A) :	L1: 16.5 A L2: ____ A L3: ____ A	L1: 3.5 A	P
	- break operations: test current I/Ie (A) :	L1: 1.65 A L2: ____ A L3: ____ A	L1: 0.33 A	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			P
	- on-time (ms) :	50 ms	50 ms	P
	- operating cycles per minute :	6	6	P
	- number of operating cycles :	50	50	P
	- test voltage U/Ue = 1,0 (V) :	L1: 123.1 V L2: ____ V L3: ____ V	L1: 602.5 V	P
	- power factor :	L1: 0.29 L2: - L3: -	L1: 0.32	P
	- make operations: test current I/Ie (A) :	L1: 15.1 A L2: ____ A L3: ____ A	L1: 3.13 A	P
	- break operations: test current I/Ie (A) :	L1: 1.51 A L2: ____ A L3: ____ A	L1: 0.30 A	P
Test No. 2	- on-time (ms) :	50 ms	50 ms	P
	- operating cycles per minute :	Rapidly	Rapidly	P
	- number of operating cycles :	10	10	P
Test No. 3	- on-time (ms) :	50 ms	50 ms	P
	- operating cycles per minute :	60	60	P
	- number of operating cycles :	990	990	P
Test No. 4	- on-time (ms) :	50 ms	50 ms	P
	- operating cycles per minute :	6	6	P

	- number of operating cycles :	5 000	5 000	P
8.3.3.5.5.a	Results to be obtained:			
	- no electrical or mechanical failures			P
	- no contact welding or prolonged arcing			P
	- no blowing of the fusible element in the earth circuit	0,8 mm diameter copper wire		P
8.3.3.5.5.b	Dielectric verification:			
	dielectric test voltage (V) 2 x Ue with a minimum .of 1000V :	2 500 V		P

8.3.1.	TEST SEQUENCE IV	GTK-12M Auxiliary Unit	
Test No. 1	- Performance under conditional short-circuit current ( 8.3.4)		P
Test No. 2	- Dielectric verification (8.3.3.5.5.b)		P

8.3.1.	TEST SEQUENCE IV	GTK-12M Auxiliary Unit	
8.3.4	Performance under conditional short-circuit current – GMC-6M+GTK-12M (14A, 3 Heater)		
	contact element (figure / form)	1b	
	contact polarity	NO (97-98) NC (95-96)	
	type of SCPD .....	Fuse, Bussman, Model gL-gG	
	ratings of SCPD .....	4 A, 690 V 4 A, 690 V	
	prospective current .....	1 kA 1 kA	—
	test voltage (V) U/Ue = 1,1 (V) .....	L1: 686.7 V L1: 686.7 V	—
	r.m.s. test current obtained (kA) .....	L1: 1.01 kA L1: 1.01 kA	—
	power factor (max. 0,7)	0.62 0.62	
	first CO operation by closing the separate making switch: test (Ip / I²dt (A / A²s) .....	L1: 0.359 kA / 0.053 kA²s L1: 0.280 kA / 0.052 kA²s	—
	time interval between test (min. 3 min) .....	3 min 3 min	—
	second CO operation by closing the separate making switch: test (Ip / I²dt (A / A²s) :	L1: 0.435 kA / 0.098 kA²s L1: 0.052 kA / 0.073 kA²s	—
	time interval between test (min. 3 min) .....	3 min 3 min	—
	third making operation to closed switching elements: test I²dta (A²s) :	L1: 0.375 kA / 0.074 kA²s L1: 0.073 kA / 0.011 kA²s	—
	Behaviour of the equipment during the test:		
	switching elements open by the normal actuating system		P
	Dielectric verification:		
	dielectric test voltage (V) 2 x Ue with min.of 1000V:	2 500 V 2 500 V	P

<b>8.3.1.</b>	<b>TEST SEQUENCE V</b>	
<b>Test No. 1 - Degree of protection of enclosed control circuit-devices (Annex C of IEC 60947-1)</b>		
<b>Test No. 2 - Verification of actuation force or moment (8.2.5)</b>		

<b>8.3.4</b>	<b>TEST SEQUENCE V</b> <b>Degree of protection of enclosed control circuit-devices</b>	
	The enclosed control circuit devices shall comply with the requirements of Annex C of IEC60947-1	N/A
	Verification of actuation force or moment	
<b>8.2.5</b>	When required in 7.1.4.3, the minimum actuating force or moment shall be tested during sequence V of 8.3.1. The performance shall be as stated in 7.1.4.3	N/A
<b>7.1.4.3</b>	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

<b>8.3.1.</b>	<b>TEST SEQUENCE VI</b>	
<b>Test No. 1 - Measurement of clearances and creepage distances (7.1.3)</b>		
<b>Test No. 2 - Verification of limitation of rotation of a rotary switch (8.2.6)</b>		

8.3.4		TEST SEQUENCE VI Measurement of clearances and creepage distances (7.1.3)	
	Clearances and creepage distances	See clause 7.1.3	
	Verification of limitation of rotation of a rotary switch (8.2.6)		
8.2.6	When this test is required in 7.1.4.4, it shall be tested during sequence VI of 8.3.1 The test sample shall be mounted according to the manufacturers instructions	See clause 7.1.3	N/A
7.1.4.4	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.		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.		N/A
	Means of limitation has not moved, become loose or prevented the actuator's normal operation		N/A

	<b>Annex C of IEC 60947-1</b>	

<b>Annex C</b>	<b>Degree of protection of enclosed control circuit-devices</b>	<b>N/A</b>
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	<b>Annex C</b>	
<b>Annex C</b>	<b>Special tests ----- Durability tests</b>	<b>N/A</b>

<b>Annex E</b>	

<b>Annex E</b>	<b>Items subject to agree between manufacturer and user</b>	<b>N/A</b>
	<b>Annex J of IEC 60947-1 applies, as far as covered by clauses and of this standard, with the following additions</b>	

<b>Annex F</b>		
<b>Annex F</b>	<b>Class II control circuit devices insulated by encapsulation Requirements and tests</b>	<b>N/A</b>

<b>Annex G</b>		
<b>Annex G</b>	<b>Additional requirements for control circuit devices with integrally connected cables</b>	<b>N/A</b>

<b>Annex H</b>		
<b>Annex H</b>	<b>Additional requirements for semiconductor switching elements for control circuit devices</b>	<b>N/A</b>

Annex J	

Annex J	Special requirements for indicator lights and indicating towers	N/A
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<b>Annex K</b>	

<b>Annex K</b>	<b>Special requirements for control switches with direct opening action</b>	<b>N/A</b>
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	<b>Annex L</b>	

<b>Annex L</b>	<b>Special requirements for mechanically linked contact elements</b>	<b>N/A</b>
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	Annex M		
Annex M	Terminal marking, distinctive number and distinctive letter for control circuit devices		
M.1	General		
	This annex applies to control switches and contactor relays irrespective of their construction, having terminal marking.		
M.2	Terminal marking rule		
M.2.1	General		
	Terminal marking in accordance with this annex is based, in principle, on a two-digit number.		
M.2.2	Function digit		
	Sub clause L.3.2.1 of IEC 60947-1 applies.		
M.2.3	Sequence digit		
	The tens digit is a continuous sequence number beginning with 1 (except for control switches designated 01 and contactor relays designated 01E), independent of the contact function		N/A
	Terminals belonging to the same contact are marked with the same sequence digit.		N/A
	For contactor relays having 10 contact elements, the sequence digit 0 is used instead of 10.		N/A
	The sequence digit may be omitted from the terminal marking only if additional information provided by the manufacturer or the user clearly gives such digit.		N/A
M.2.4	Numbering method		
	The contact terminals shall be numbered sequentially from left to right on the device; for devices with tiers of terminals, the numbering shall begin with the tier nearest to the mounting level.		N/A
M.3	Distinctive number distinctive letter		
M.3.1	General		
	The quantity and type of the contact elements of a control switch according to this annex are indicated by a distinctive number. Contacts of contactor relays are indicated by a distinctive number followed by a distinctive letter.		N/A
M.3.2	Distinctive number		

	The first digit of the distinctive number gives the quantity of make contact elements and the second digit the quantity of break contact elements. The third digit, if any, shall give the quantity of change-over contact elements in control switches.		N/A
<b>M.3.2</b>	Distinctive letter		
	The distinctive letter indicates the location of the contact elements of a contactor relay in relation to each other and their terminal marking.		N/A
<b>M.4</b>	Terminal numbering sequence		
	For control switches having the same distinctive number, the terminal marking is specified in Table M.1.		N/A
	The position of the contact elements of the control switch need not correspond to that shown on diagrams of Table M.1.		N/A
<b>M.5</b>	Contactor relays designated by the distinctive letter E		
	For contactor relays having the same distinctive number and the distinctive letter E, independently of their construction, the sequence of the contact elements within the device is specified in accordance with the diagrams of Table M.2.		N/A
<b>M.6</b>	Contactor relays designated by the distinctive letter X, Y or Z		
<b>M.6.1</b>	Contactor relays designated by the distinctive letter Z		
	If the location of the contact elements within the device (but not the terminal marking) differs from the provisions of Clause M.5, the device shall be designated by the distinctive letter Z instead of the distinctive letter E.		N/A
<b>M.6.2</b>	Contactor relays designated by the distinctive letter X		
	If the location of the contact elements within the device and the terminal marking both differ from the requirements of Clause M.5, the device shall be designated by the distinctive letter X instead of the distinctive letter E.		N/A
	The device shall comply with the requirements of Clauses M.2 and M.3.		
<b>M.6.2</b>	Contactor relays designated by the distinctive letter Y		
	Devices consisting of combinations of contact elements and terminal marking in accordance with Table M.3 shall be designated by the distinctive letter Y instead of the distinctive letter E.		N/A