



Test Report issued under the responsibility of:



<b>TEST REPORT</b> <b>IEC 60947-3</b> <b>Low-voltage switchgear and controlgear</b> <b>Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units</b>	
<b>Report Reference No.</b> .....	2131728.52
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<b>CB Testing Laboratory</b> .....	DEKRA Certification B.V.
<b>Address</b> .....	Utrechtseweg 310, 6812 ARNHEM, The Netherlands
<b>Applicant's name</b> .....	LS Industrial Systems Co., Ltd.
<b>Address</b> .....	1026-6, Hogye-dong, Dong-an-gu Anyang-si, Gyeonggi-do, Korea
<b>Test specification:</b>	
<b>Standard</b> .....	IEC 60947-3: 3 <sup>rd</sup> Edition (2008) in conjunction with IEC 60947-1: 5 <sup>th</sup> Edition (2007)
<b>Test procedure</b> .....	CB
<b>Non-standard test method</b> .....	N/A
<b>Test Report Form No.</b> .....	IEC60947_3B
<b>Test Report Form(s) Originator</b> .....	OVE
<b>Master TRF</b> .....	Dated 2009-08
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<b>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.</b>	
<b>Test item description</b> .....	Switch-disconnector
<b>Trade Mark</b> .....	LS
<b>Manufacturer</b> .....	LS Industrial Systems Co., Ltd.
<b>Model/Type reference</b> .....	TS1000NA, TS1250NA, TS1600NA
<b>Ratings</b> .....	1000, 1250, 1600 A; 690 V; AC-23B

<b>Testing procedure and testing location:</b>	
<input type="checkbox"/> <b>CB Testing Laboratory:</b> Testing location/ address.....:	
<input type="checkbox"/> <b>Associated CB Test Laboratory:</b> Testing location/ address.....:	
Tested by (name + signature).....: Approved by (+ signature) .....:	
<input type="checkbox"/> <b>Testing procedure: TMP</b> Testing location/ address.....:	
Tested by (name + signature).....: Approved by (+ signature) .....:	
<input checked="" type="checkbox"/> <b>Testing procedure: WMT</b> Testing location/ address.....:	LS Industrial Systems Co., Ltd. CheongJu Plant 1, Songjeong-dong, Heungdeok-gu Cheongju-si, Chungcheongbuk-do, Korea
Tested by (name + signature).....:	Oh Junsick
Witnessed by (+ signature).....:	F.S.Strikwerda
Approved by (+ signature) .....:	H.G.M. Kormelink
<input type="checkbox"/> <b>Testing procedure: SMT</b> Testing location/ address.....:	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
Supervised by (+ signature).....:	
<input type="checkbox"/> <b>Testing procedure: RMT</b> Testing location/ address.....:	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
Supervised by (+ signature).....:	

### Summary of testing:

#### Tests performed (name of test and test clause):

Sequence I ;

8.3.3.1 Temperature-rise

8.3.3.2 Test of dielectric properties

8.3.3.3 Making and breaking capacities

8.3.3.4 Dielectric verification

8.3.3.5 Leakage current

8.3.3.6 Temperature-rise verification

8.3.3.7 Strength of actuator mechanism

Sequence II ;

8.3.4.1 Operational performance

8.3.4.2 Dielectric verification

8.3.4.3 Leakage current

8.3.4.4 Temperature-rise verification

Sequence III ;

8.3.5.1 Short-time withstand current

8.3.5.2 Short-circuit making capacity

8.3.5.3 Dielectric verification

8.3.5.4 Leakage current

8.3.5.5 Temperature-rise verification

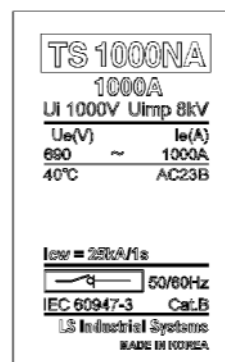
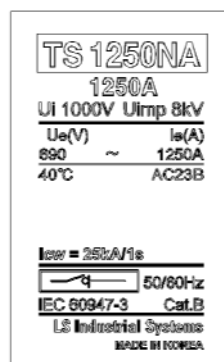
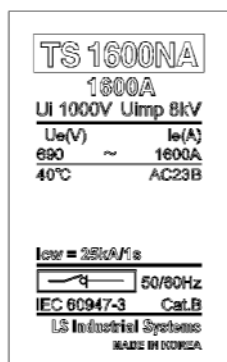
TS1600NA (4 pole) was tested and covers the other types because the construction is identical, only difference in marking.

#### Testing location:

LS Industrial Systems Co., Ltd. CheongJu Plant  
1, Songjeong-dong, Heungdeok-gu Cheongju-si, Chungcheongbuk-do, Korea, Republic Of

### Summary of compliance with National Differences: N/A

### Copy of marking plate



<b>Test item particulars</b> .....	
- method of operation .....	Independent manual operation
- suitability for isolation .....	suitable
- degree of protection .....	IP30
- number of poles.....	3/4 P
- kind of current.....	a.c
- number of positions of the main contacts .....	2
Rated and limiting values, main circuit.....	
- rated operational voltage Ue (V) .....	690 Vac
- rated insulation voltage Ui (V) .....	1000 V
- rated impulse withstand voltage Uimp (kV) .....	8 kV
- conventional free air thermal current Ith (A) .....	1600 A
- conventional enclosed thermal current Ithe (A) .....	
- rated operational current Ie (A) .....	1000, 1250, 1600 A
- rated uninterrupted current Iu (A).....	1000, 1250, 1600 A
- rated frequency (Hz).....	50/60 Hz
- utilization category .....	AC-23B
Short-circuit characteristic .....	
- rated short-time withstand current Icw (kA) .....	25 kA 1sec
- rated short-time making capacity Icm (kA) .....	52,5 kA
- rated conditional short-circuit current.....	
Control circuits .....	
Auxiliary circuits .....	
Relays and releases .....	
Co-ordination of short-circuit protective devices .....	
- kind of protective device.....	
<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> .....	
Date of receipt of test item .....	
Date (s) of performance of tests .....	

**General remarks:**

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 comma (point) is used as the decimal separator.

**General product information:**

Subject	Switch-disconnector	
Manufacturer	LS Industrial Systems Co., Ltd.	
Type designation	TS1000NA, TS1250NA, TS1600NA	
Frame size	1000, 1250, 1600 AF	
Number of poles	3/4P	
Rated frequency	50/60 Hz	
Rated operational voltage	AC 690 V	
Rated insulation voltage	AC 1000 V	
Rated impulse withstand voltage	8 kV	
Suitability for isolation	Yes	
Rated current	1000, 1250, 1600A	
Rated ultimate short-circuit breaking capacity	-	
Rated service short-circuit breaking capacity	-	
Rated short-time withstand current	25kA 1sec	
Utilization category	AC-23B	
Type of tripping device	-	
Short time releases:	-	
Current setting (or range of settings)	-	
Time setting (or range of setting)	-	
Instantaneous releases:	-	
Current setting (or range of settings)	-	
Time setting (or range of setting)	-	
Long time release:	-	
Current setting (or range of settings)	-	
Time setting (or range of setting)	-	
Release dependent on ambient air temperature	No	
Reference temperature	-	
Dimension of specimen	327(H)X210(W)X152.5(D)[3P] / 327(H)X280(W)X152.5(D)[4P]	

Dimension of metal screen	644(H)X357(W)X152.5(D)[3P] / 644(H)X427(W)X152.5(D)[4P]	

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
5.2	MARKING		
	Marking on equipment itself or on nameplate or nameplates attached to the equipment and legible from the front after mounting		
	- indication of the open and closed position	Compliance	P
	- suitability for isolation	Compliance	P
	- disconnectors AC-20 and DC-20 only: marked "Do not operate under load"	-	N/A
	Marking on equipment not needed to be visible after mounting:		
	- manufacturer's name or trademark	LS	P
	- type designation or serial number	TS1000NA, TS1250NA, TS1600NA	P
	- rated operational currents	1000, 1250, 1600 A	P
	- rated operational voltage	690 V	P
	- utilization category	AC-23B	P
	- rated frequency	50/60 Hz	P
	- manufacturer's claim for compliance with IEC 60947-3	Compliance	P
	- degree of protection	IP30	P
	Marking on fuse-combination units:		
	- fuse type	-	N/A
	- maximum rated current	-	N/A
	- power loss of the fuse-link	-	N/A
	Identification of terminals:		
	- line terminals, unless connection is immaterial	-	N/A
	- load terminals, unless connection is immaterial	-	N/A
	- neutral pole terminal	Compliance	P
	- protective earth terminal		N/A
	Data in the manufacturer's published information:		
	- rated insulation voltage	1000 V	P
	- rated impulse withstand voltage for equipment suitable for isolation or when determined	8 kV	P
	- pollution degree, if different from 3	3	
	- rated duty	Uninterrupted duty	P
	- rated short-time withstand current and duration	25 kA 1sec	P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated short-circuit making capacity	52.5 kA	P
	- rated conditional short-circuit current	-	N/A
5.3	Instructions for installation, operation and maintenance		
6	Normal service, mounting and transport conditions		
7.1	CONSTRUCTIONAL AND PERFORMANCE REQUIREMENTS		
7.1.2	Materials		
7.1.2.2	Resistance to abnormal heat and fire		
	Test performed on ..... :	- the equipment - sections taken from the equipment - samples of identical material	
	Glow-wire test according to IEC 60695-2-10 and IEC 60695-2-11		—
	Parts made of insulating material necessary to retain current-carrying parts in position: test temperature 960 °C		
	No visible flame and no sustained glowing	Compliance	P
	Flames and glowing extinguish within 30 s	Compliance	P
	No ignition of the tissue paper	Compliance	P
	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	Compliance	P
	Flames and glowing extinguish within 30 s	Compliance	P
	No ignition of the tissue paper	Compliance	P
7.1.3 of Part 1	Current-carrying parts and their connection	Compliance	P
7.1.4	Clearances ..... :	see appended table 7.1.4 on page 22	P
	Creepage distances ..... :	see appended table 7.1.4 on page 22	P
	Pollution degree ..... :	3	—
	Comparative tracking index (V) ..... :	$175 \leq CTI < 400$	—
	Material group ..... :	IIIa	—
7.1.5 of Part 1	Actuator		
7.1.5.1	Insulation		—
	Actuator insulated from live parts for		—



IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated insulation voltage	1000 V	P
	- rated impulse withstand voltage	8 kV	P
	Actuator made of metal		—
	- connected to a protective conductor or provided with an additional insulation	-	N/A
	Actuator made of or covered by insulating material :		—
	- 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	-	N/A
7.1.5.2	Direction of movement		
	The direction of operation for actuators shall where applicable conform to IEC 60447	Compliance	P
	There is no doubt of the “I” and “O” position and the direction of operation	Compliance	P
7.1.6 of Part 1	Indication of contact position		
7.1.6.1	Indicating means	Position indicating	P
7.1.6.2	Indication by the actuator	Compliance	P
7.1.7	Additional safety requirements for equipment suitable for isolation		
7.1.7.1	Additional constructional requirements		
	- marking according to 5.2.1b	Compliance	P
	- indication of the position of the contacts	Compliance	P
	- construction of the actuating mechanism	Compliance	P
	- minimum clearances across open contacts (see Table 13, Part 1) (mm) .....	8 mm	—
	- measured clearances (mm) .....	31,3 mm	P
	- test Uimp across gap (kV) .....	12,3 kV	P
7.1.7.2	Supplementary requirements for equipment with provision for electrical interlocking with contactors or circuit-breakers:		
	Auxiliary switch is rated according to IEC 60947-5-1 (unless the equipment is rated AC-23)	-	N/A
	Time interval between opening of the contacts of the auxiliary contact and the contacts of the main poles: ≥20 ms .....		—
	Measured time interval (ms) .....	-	N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	During the closing operation the contacts of the auxiliary switch closes after or simultaneously with the contacts of the main poles	-	N/A
7.1.7.3	Supplementary requirements for equipment provided with means for padlocking the open position:		
	The locking means is so designed that it cannot be removed with the appropriate padlock(s) installed	-	N/A
	Test force F applied to the actuator in an attempt to operate to the closed position (N) .....		—
	Rated impulse withstand voltage (kV) .....		—
	Test Uimp on open main contacts at the test force	-	N/A
7.1.8 of Part 1	Terminals		
7.1.8.1	All parts of terminals which maintain contact and carry current are of metal having adequate mechanical strength	(see 8.2.4 below)	P
	Terminal connections are such that necessary contact pressure is maintained	(see 8.2.4 below)	P
	Terminals are so constructed that the conductor is clamped between suitable surfaces without damage to the conductor and terminal	(see 8.2.4 below)	P
	Terminals do not allow the conductor to be displaced or to be displaced themselves in a manner detrimental to the operator of equipment and the insulation voltage is not reduced below the rated value	(see 8.2.4 below)	P
8.2.4	Mechanical properties of terminals		
	Mechanical strength of terminals		
	Maximum cross-sectional area of conductor (mm <sup>2</sup> ) .....	1000 mm <sup>2</sup> or 2x(50 mm x 10 mm)	—
	Diameter of thread (mm) .....	10 mm	—
	Torque (Nm) .....	50 Nm	—
	5 times on 2 separate clamping units	Compliance	P
	Testing for damage to and accidental loosening of conductor (flexion test)		
	Conductor of the smallest cross-sectional area (mm <sup>2</sup> ) .....		—
	Number of conductor of the smallest cross section :		—
	Diameter of bushing hole (mm) .....		—

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	Height between the equipment and the platen .....		—
	Mass at the conductor(s) (kg) .....		—
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit	-	N/A
	Pull-out test		
	Force (N), applied for 1 min. ....		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit		
	Conductor of the largest cross-sectional area (mm <sup>2</sup> ) .....		—
	Number of conductor of the largest cross section ..		—
	Diameter of bushing hole (mm) .....		—
	Height between the equipment and the platen .....		—
	Mass at the conductor(s) (kg) .....		—
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit	-	N/A
	Pull-out test		
	Force (N), applied for 1 min. ....		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit	-	N/A
	Conductor of the largest and smallest cross-sectional area (mm <sup>2</sup> ) .....		—
	Number of conductor of the smallest cross section, number of conductor of the largest cross section ...		—
	Diameter of bushing hole (mm) .....		—
	Height between the equipment and the platen .....		—
	Mass at the conductor(s) (kg) .....		—
	135 continuous revolutions: the conductor neither slips out of the terminal nor breaks near the clamping unit	-	N/A
	Pull-out test		
	Force (N), applied for 1 min. ....		—
	During the test, the conductor neither slips out of the terminal nor breaks near the clamping unit	-	N/A
7.1.8.2	Connection capacity		

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	Type of conductors .....		—
	Minimum cross-sectional area of conductor (mm <sup>2</sup> ) :		—
	Maximum cross-sectional area of conductor (mm <sup>2</sup> ) .....		—
	Number of conductors simultaneously connectable to the terminal .....		—
7.1.8.3	Connection		
	Terminals for connection to external conductors are readily accessible during installation	Compliance	P
	Clamping screws and nuts do not serve to fix any other component	Compliance	P
7.1.8.4	Terminal identification and marking		
	Terminal intended exclusively for the neutral conductor	Compliance	P
	Protective earth terminal	-	N/A
	Other terminals	-	N/A
7.1.9	Additional requirements for equipment provided with a neutral pole		
	Equipment provided with a pole intended for the connection of neutral, this pole shall be clearly marked by the letter "N"	Compliance	P
	The switched neutral pole does not break before and does not make after the other poles except	Compliance	P
	- a pole having the appropriate short-circuit breaking and making capacity is used as neutral pole, all poles may operate together		N/A
	Conventional thermal current of neutral pole	1600 A	P
7.1.10	Provisions for protective earthing		
7.1.10.1	The exposed conductive parts are electrically interconnected and connected to a protective earth terminal	-	N/A
7.1.10.2	Protective earth terminal is readily accessible	-	N/A
	Protective earth terminal is suitably protected against corrosion	-	N/A
	Electrical continuity between the exposed conductive parts of the protective earth terminal and the metal sheathing of connecting conductors	-	N/A
	Protective earth terminal has no other functions	-	N/A
7.1.10.3	Protective earth terminal marking and identification	-	N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
7.1.11	Enclosure for equipment		
7.1.11.1	Design		
	When the enclosure is opened, all parts requiring access for installation and maintenance are readily accessible	-	N/A
	Sufficient space is provided inside the enclosure	-	N/A
	The fixed parts of a metal enclosure are electrically connected to the other exposed conductive parts of the equipment and connected to a terminal which enables them to be earthed or connected to a protective conductor	-	N/A
	Under no circumstances a removable metal part of the enclosure is insulated from the part carrying the earth terminal when the removable part is in place	-	N/A
	The removable parts of the enclosure are firmly secured to the fixed parts by a device such that they cannot be accidentally loosened or detached owing to the effects of operation of the equipment or vibrations	-	N/A
	When an enclosure is so designed as to allow the covers to be opened without the use of tools, means is provided to prevent loss of the fastening devices	-	N/A
	If the enclosure is used for mounting push-buttons, it is not possible to remove the buttons from the outside of the enclosure	-	N/A
7.1.11.2	Insulation		
	If, in order to prevent accidental contact between a metallic enclosure and live parts, the enclosure is partly or completely lined with insulating material, then this lining is securely fixed to the enclosure	-	N/A
7.1.12	Degree of protection of enclosed equipment		
	Degree of protection .....: IP		N/A
7.1.13	Conduit pull-out, torque and bending with metallic conduits		
	Withstand the stress occurring during its installation .....: IP		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3	TEST SEQUENCE I: GENERAL PERFORMANCE CHARACTERISTICS		
8.3.3.1	Temperature-rise		
	ambient temperature 10-40 °C .....	23,7 °C	—
	test enclosure W x H x D (mm x mm x mm) .....		—
	material of enclosure .....		—
	Main circuits, test conditions:		—
	- rated operational current I <sub>e</sub> (A) .....	1600 A	—
	- cable/busbar cross-section (mm <sup>2</sup> ) / length (mm) ..	500 mm <sup>2</sup> X 2 / 2 000 mm	—
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark .....		—
	- manufacturer's model or type reference .....	TS1600NA	—
	- rated current (A) .....	1600 A	—
	- power loss (W) .....		—
	- rated breaking capacity (kA) .....		—
	Measured temperature-rise .....	see appended table 8.3.3.1 on page 22	P
	Auxiliary circuits, test conditions:		
	- rated operation current (A) .....		—
	- cable cross-section (mm <sup>2</sup> ) .....		—
	Measured temperature-rise .....	see appended table 8.3.3.1 on page __	N/A
8.3.3.2	Test of dielectric properties		
	Rated impulse withstand voltage (kV) .....	8 kV	—
	- test U <sub>imp</sub> main circuits (kV) .....	9,8 kV	P
	- test U <sub>imp</sub> auxiliary circuits (kV) .....		N/A
	- test U <sub>imp</sub> on open main contacts (equipment suitable for isolation) (kV) .....	12,3 kV	P
	Power-frequency withstand voltage (V) .....		—
	- main circuits, test voltage for 5 sec. (V) .....	2200 V	P
	- control and auxiliary circuits, test voltage for 5 sec. (V) .....		N/A
	Devices, which have been disconnected for the power-frequency withstand voltage test .....		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	Equipment suitable for isolation, leakage current not exceed 0,5 mA		—
	Test voltage 1,1 U <sub>e</sub> (V) .....	759 V	—
	Measured leakage current (mA).....	≤ 0,01 mA	P
8.3.3.3	Making and breaking capacity		
	- utilization category .....	AC-23B	—
	- rated operational voltage U <sub>e</sub> (V) .....	690 V	—
	- rated operational current I <sub>e</sub> (A) or power (kW) .....	1600 A	—
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark .....	LS	—
	- manufacturer's model or type reference .....	TS1600NA	—
	- rated current (A) .....	1600 A	—
	- power loss (W) .....		—
	- rated breaking capacity (kA) .....		—
	Conditions for make/break operations or make operation, AC-23A and AC-23B only:		
	- test voltage, U = 1,05 U <sub>e</sub> ..... (V):	L1: Not captured L2: 743,7 V L3: 742,6 V	—
	- test current, I = ..... x I <sub>e</sub> (A):	L1: 16,2 kA L2: 16,2 kA L3: 16,0 kA	—
	- power factor .....	L1: 0,35 L2: 0,35 L3: 0,35	—
	Conditions for break operation, AC-23A and AC-23B only:		
	- test voltage, U = 1,05 U <sub>e</sub> ..... (V):	L1: Not captured L2: 743,7 V L3: 742,6 V	—
	- test current, I = ..... x I <sub>e</sub> (A):	L1: 16,2 kA L2: 16,2 kA L3: 16,0 kA	—
	- power factor .....	L1: 0,35 L2: 0,35 L3: 0,35	—
	Conditions for make/break operations, other than AC-23A/B:		

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- test voltage, $U = 1,05 U_e$ ..... (V):	L1: L2: L3:	—
	- test current, $I =$ ..... $\times I_e$ (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 ( $\geq 50$ ms)	77 ms	P
	- current duration (ms) .....	60 ms	—
	- time interval between operations .....	3 min	P
	Characteristic of transient recovery voltage for AC-22 and AC-23 only		
	- oscillatory frequency (kHz) .....		—
	- measured oscillatory frequency (kHz) .....	L1: No damping L2: No damping L3: No damping	P
	- factor $\gamma$ .....	L1: No damping L2: No damping L3: No damping	P
8.3.3.3.5	Behaviour of the equipment during making and breaking capacity tests		
	Test performed without:		—
	- endanger to the operator	Compliance	P
	- cause damage to adjacent equipment	Compliance	P
	No permanent arcing	Compliance	P
	No flash over between poles and poles and frame	Compliance	P
	No melting of the fuse in the detection circuit	Compliance	P
8.3.3.3.6	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily	Compliance	P
	- required opening force not greater than the test force of 8.2.5.2 and table 8	212 N	P
	- equipment is able to carry its rated current after normal closing operation	Compliance	P



IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.4	Dielectric verification		
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ .....	1380 V	—
	No flashover or breakdown	No	P
8.3.3.5	Leakage current		
	test voltage (1,1 $U_e$ ) (V) .....	759 V	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B): $\leq 0,5$ mA/pole .....		N/A
	Leakage current (other utilization categories): $\leq 2$ mA/pole) .....	$\leq 0,78$ mA	P
8.3.3.6	Temperature-rise verification		
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark .....		—
	- manufacturer's model or type reference .....	TS1600NA	—
	- rated current (A) .....	1600 A	—
	- power loss (W) .....		—
	- rated breaking capacity (kA) .....		—
	- conductor cross-section (mm <sup>2</sup> ) .....	500 mm <sup>2</sup> X 2	—
	- test current $I_e$ (A) .....	1600 A	—
	Measured temperature-rise .....	see appended table 8.3.3.6 on page 23	P
8.3.3.7	Strength of actuator mechanism		
8.2.5	Verification of the strength of actuator mechanism and position indicating device		
	- actuator type (fig.) .....	type 1e	—
8.2.5.2.1	Dependent and independent manual operation		
	- actuating force for opening (N) .....	216 N	—
	- test force with blocked main contacts (N) .....	648 N	—
	- used method to keep the contact closed .....	By pushing the moving contact	—
	During and after the test, open position not indicated .....	Compliance	P
	Equipment with locking mean, no locking in the open position while test force is applied .....		N/A
8.2.5.2.2	Dependent power operation		
	- main contacts fixed together in the closed position:		N/A
	- used method to keep the contact closed .....		N/A

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- 110% of the rated supply voltage applied to the equipment (3 times) .....		N/A
	During and after the test, open position not indicated .....		N/A
	Equipment show no damage impairing its normal operation .....		N/A
	Equipment with locking mean, no locking in the open position while test force is applied .....		N/A
8.2.5.2.3	Independent power operation		
	- 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

8.3.4	TEST SEQUENCE II: OPERATIONAL PERFORMANCE CAPABILITY		
8.3.4.1	Operational performance test		
	- utilization category .....	AC-23B	—
	- rated operational voltage (V) .....	690 V	—
	- rated operational current (A) .....	1600 A	—
	Test conditions for electrical operation cycles:		
	- test voltage (V) .....	L1: 711,2 V L2: 709,4 V L3: 708,6 V	—
	- test current (A) .....	L1: 1612 A L2: 1619 A L3: 1604 A	—
	- power factor/time constant .....	L1: 0,70 L2: 0,69 L3: 0,69	—
	Number of cycles with current .....	100 Cycles	
	Number of cycles without current .....	500 Cycles	

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	First test sequence (with/without current) .....	without current	—
	Second test sequence (with/without current) .....	with current	—
	- time interval between first and second test sequence .....	30 min	—
8.3.4.1.5	Behaviour of the equipment during the operational performance test		
	Test performed without:		—
	- endanger to the operator	Compliance	P
	- cause damage to adjacent equipment	Compliance	P
	No permanent arcing	Compliance	P
	No flash over between poles and poles and frame	Compliance	P
	No melting of the fuse in the detection circuit	Compliance	P
8.3.4.1.6	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily	Compliance	P
	- required opening force not greater than the test force of 8.2.5.2 and table 8	216 N	P
	- equipment is able to carry its rated current after normal closing operation	Compliance	P
8.3.4.2	Dielectric verification		
	test voltage: $2 \cdot U_e$ with a minimum of 1000V~ .....	1380 V	—
	No breakdown or flashover	No	P
8.3.4.3	Leakage current		
	test voltage (1,1 $U_e$ ) (V) .....	759 V	—
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole .....		
	Leakage current (other utilization categories) $\leq 2$ mA/pole .....	$\leq 0,01$ mA	P
8.3.4.4	Temperature-rise verification		
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark .....		—
	- manufacturer's model or type reference .....	TS1600NA	—
	- rated current (A) .....	1600 A	—
	- power loss (W) .....		—

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated breaking capacity (kA) .....		—
	- conductor cross-section (mm <sup>2</sup> ) .....	500 mm <sup>2</sup> x 2	—
	- test current I <sub>e</sub> (A) .....	1600 A	—
	Measured temperature-rise .....	see appended table 8.3.4.4 on page 23	P

8.3.5	TEST SEQUENCE III: SHORT-CIRCUIT PERFORMANCE CAPABILITY		
8.3.5.1	Short-time withstand current test		
	Rated short-time withstand current I <sub>cw</sub> (A) (>12.I <sub>e</sub> max) .....	25 kA	P
	test voltage (V) .....	L1: 26,3 V L2: 25,8 V L3: 24,7 V	—
	r.m.s. test current (A) .....	L1: 25,0 kA L2: 25,0 kA L3: 25,3 kA	—
	peak test current (A) .....	L1: 53,6 kA L2: 41,6 kA L3: 46,8 kA	—
	power factor/time constant .....	L1: - L2: - L3: -	—
	test duration (s) .....	1,017	—
8.3.5.1.5	Behaviour of the equipment during the test		
	Test performed without:		—
	- endanger to the operator	Compliance	P
	- cause damage to adjacent equipment	Compliance	P
	No permanent arcing	Compliance	P
	No flash over between poles and poles and frame	Compliance	P
	No melting of the fuse in the detection circuit	Compliance	P
8.3.5.1.6	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily	Compliance	P
	- required opening force not greater than the test force of 8.2.5.2 and table 8	215 N	P

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	- equipment is able to carry its rated current after normal closing operation	Compliance	P
8.3.5.2	Short-circuit making capacity		
	Rated short-circuit making capacity I <sub>cm</sub> (A) .....	52,5 kA	
	test voltage (1.05xU <sub>e</sub> ) ..... (V):	L1: Not captured L2: 698,2 V L3: 698,3 V (tested at 1,0 U <sub>e</sub> )	—
	r.m.s. test current (A) .....	L1: 52,6 kA <sub>peak</sub> L2: 38,5 kA <sub>peak</sub> L3: 51,1 kA <sub>peak</sub>	—
	maximum peak test current (factor n)	2,1	P
	power factor/time constant .....	L1: 0,25 L2: 0,25 L3: 0,25	P
	current duration (s) .....	78,8 ms	—
	Time interval between the cycles		—
8.3.5.2.5	Behaviour of the equipment during the test		
	Test performed without:		—
	- endanger to the operator	Compliance	P
	-cause damage to adjacent equipment	Compliance	P
	No permanent arcing	Compliance	P
	No flash over between poles and poles and frame	Compliance	P
	No melting of the fuse in the detection circuit	Compliance	P
8.3.5.2.6	Condition of the equipment after making and breaking capacity tests		
	Immediately after the test equipment must work satisfactorily	Compliance	P
	- required opening force not greater than the test force of 8.2.5.2 and table 8	213 N	P
	- equipment is able to carry its rated current after normal closing operation	Compliance	P
8.3.5.3	Dielectric verification		
	test voltage: 2*U <sub>e</sub> with a minimum of 1000V~ .....	1380 V	—
	No flashover or breakdown	No	
8.3.5.4	Leakage current		
	test voltage (1,1 U <sub>e</sub> ) (V) .....	759 V	—

IEC 60947-3			
Clause	Requirement + Test	Result - Remark	Verdict
	Leakage current (utilization categories AC-20A, AC-20B, DC-20A and DC-20B) $\leq 0,5$ mA/pole .....		N/A
	Leakage current (other utilization categories) $\leq 2,0$ mA/pole .....	$\leq 0,03$ mA	P
8.3.5.5	Temperature-rise verification		
	Fuse-link details (fuse-combination units only):		—
	- manufacturer's name, trademark or identification mark .....		—
	- manufacturer's model or type reference .....	TS1600NA	—
	- rated current (A) .....	1600 A	—
	- power loss (W) .....		—
	- rated breaking capacity (kA) .....		—
	- conductor cross-section (mm <sup>2</sup> ) .....	500 mm <sup>2</sup> x 2	—
	- test current I <sub>e</sub> (A) .....	1600 A	—
	Measured temperature-rise .....	see appended table 8.3.5.5 on page 24	P
8.3.6	TEST SEQUENCE IV: CONDITIONAL SHORT-CIRCUIT CURRENT		N/A
8.3.7	TEST SEQUENCE V: OVERLOAD PERFORMANCE CAPABILITY		N/A
8.4	ELECTROMAGNETIC COMPATIBILITY TESTS		N/A
Annex A (normative)			N/A
Annex C (normative)			N/A

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

7.1.4	<b>TABLE: clearance and creepage distance measurements</b>						
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)	
P-P		690	8	40,3	16	49	
L-A		690	8	32,9	16	32,9	
C-O		690	8	31,3	16	65,79	
<b>supplementary information:</b> P-P : Pole to Pole, L-A : Live part to accessible part, C-O : across open contacts.							

8.3.3.1	<b>TABLE: Temperature-rise (measurements)</b>			S1-1-A
Temperature rise dT of part:		dT (K) measured	dT (K) required	
Ambient (°C):		23,7 °C		
Terminals				
LINE L1		61,5	70	
LINE L2		67,1	70	
LINE L3		63,3	70	
LOAD L1		58,8	70	
LOAD L2		64,4	70	
LOAD L3		63,5	70	
Manual operating means: non-metallic		16,7	25	
Parts intended to be touched but not hand-held: non-metallic		20,2	40	
Parts which need not be touched during normal operation: non-metallic		35,5	50	
supplementary information:				

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

8.3.3.6	<b>TABLE: Temperature-rise (measurements)</b>		S1-1-B
Temperature rise dT of part:		dT (K) measured	dT (K) required
Ambient (°C):		23,2 °C	
Terminals			
LINE L1		63,0	80
LINE L2		65,9	80
LINE L3		65,3	80
LOAD L1		60,6	80
LOAD L2		68,6	80
LOAD L3		64,0	80
Manual operating means: non-metallic		17,3	35
Parts intended to be touched but not hand-held: non-metallic		16,6	50
Parts which need not be touched during normal operation: non-metallic		38,4	60
supplementary information:			

8.3.4.4	<b>TABLE: Temperature-rise (measurements)</b>		S2-1
Temperature rise dT of part:		dT (K) measured	dT (K) required
Ambient (°C):		21,1 °C	
Terminals			
LINE L1		64,2	80
LINE L2		62,3	80
LINE L3		58,6	80
LOAD L1		66,3	80
LOAD L2		65,8	80
LOAD L3		60,9	80
Manual operating means: non-metallic		16,4	35
Parts intended to be touched but not hand-held: non-metallic		19,9	50
Parts which need not be touched during normal operation: non-metallic		32,6	60
supplementary information:			



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

8.3.5.5	<b>TABLE: Temperature-rise (measurements)</b>		S3-1
Temperature rise dT of part:		dT (K) measured	dT (K) required
Ambient (°C):		22,9 °C	
Terminals			
LINE L1		66,8	80
LINE L2		66,8	80
LINE L3		65,0	80
LOAD L1		63,7	80
LOAD L2		66,8	80
LOAD L3		64,3	80
Manual operating means: non-metallic		15,9	35
Parts intended to be touched but not hand-held: non-metallic		19,5	50
Parts which need not be touched during normal operation: non-metallic		35,7	60
supplementary information:			

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

## Photographs

TS1600NA 3P



TS1600NA 4P

