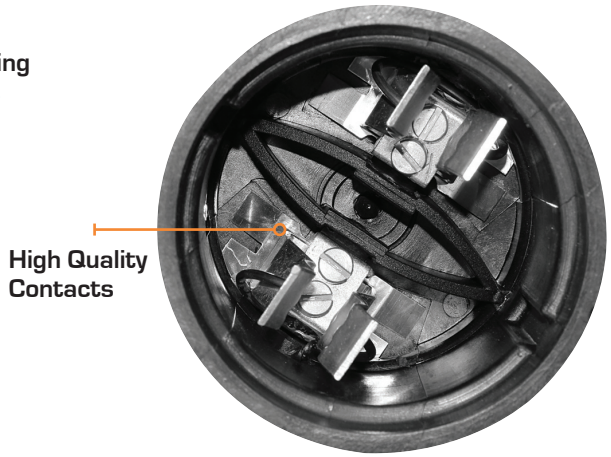
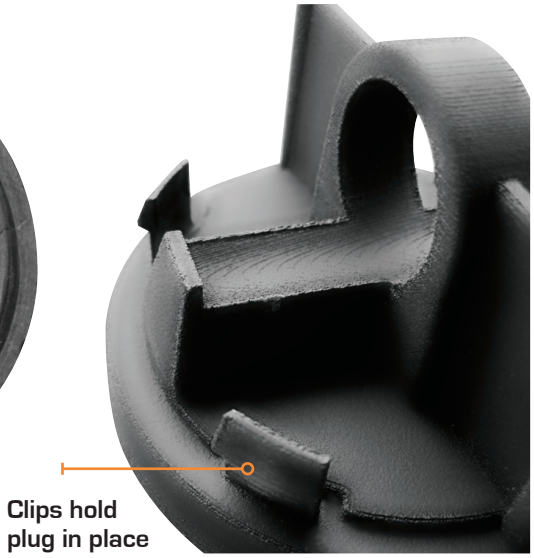
TNNHP100
HOUSE SERVICE FUSE
New & Improved

The TNNHP100 house service fuse carrier boasts some excellent quality improvements to the existing model. Retaining the same physical size and dimension, this model offers great quality gains which in turn will extend the life of the unit.

KEY FEATURES

- Rubber sealing grommets on the cable entry ports to protect from moisture ingress thus offering extended life to the connections.
- Superior quality contacts, tested to ensure an improved product life as well as a better overall connection. (Test reports attached)
- Stainless steel contact pressure spring to maintain contact presure during load cycling.
- Accommodates standard 22x58mm barrel fuselinks, up to 100amps.
- Captured fuse base, will stay in place even without a fuselink.
- The Fuse holder plug base is interchangeable with existing fuse units of the same style and can be retrofitted at any stage.





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There are a number of tools used to remove the TNNHP100 base for installing and removing fuselinks. Options include hotstick attachments as well as hand held tools. All tools will also fit existing units of the same style.

HSFP

DUALPULLER

2-0361609-0

CATALOGUE NUMBER	DESCRIPTION
HSFP	FUSE REMOVAL TOOL WITH UNIVERSAL FITTING
2-0361609-0	FUSE REMOVAL TOOL-HAND HELD
DUALPULLER	DUAL DDO/POLE FUSE REMOVAL TOOL

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MICHAUD
MATERIEL ELECTRIQUE

BP 11 - Z.I. LE BLANCHON - 01160 PONT D'AIN - (FRANCE)

TEST LABORATORY

TEST REPORT

QUALIFICATION TESTS OF
« TRANSNET BELL FUSE 100A (TN NHP 100) »
N° 010-11-01-03
03/03/2011

REQUESTED BY : **TRANSNET NZ LTD** (20 Neilpark Drive - East Tamaki - Auckland 2013 - New-Zealand)

INTRODUCTION : This document gathers the qualification tests of the Fuse Unit type BELL FUSE 100A (TN NHP100) designed for fuse cartridge 22x58. Tested products are of TRANSNET's design & production.

Test procedures are performed according to the international standard CEI 60947-3 of 2008 and CEI 60269-2 of 2010.

The test laboratory Technician
JP. RAPY

The test laboratory Head
N. PETITJEAN

ISSUANCE : On the 03/03/2011 - 1 original to UR (LE)
On the 03/03/2011 - 1 original to **TRANSNET** (New-Zealand)
- 1 original to COM (Customer filing)

Any copy of this test report is authorized only as a complete content after written authorization from the test laboratory of **MICHAUD SA**. The test report hereafter concerns only the samples tested.

This document includes 20 pages (including this page 1).

CONTENT

I) INTRODUCTION

1.1 Subject

This document gathers the qualification tests of the Fuse Unit type BELL FUSE 100A (**TH NHP100**) designed for fuse cartridge 22x58. Tested products are of **TRANSNET**'s design & production.

Test procedures are performed according to the international standards CEI 60947-3 of 2008 and CEI 60269-2 of 2010.

For each test, there is a test sheet gathering procedures and results.

1.2 Tested products

Tested products are single phase Fuse Unit 100A size 22x58 100A (**TN NHP100**) according to the **TRANSNET**'s technical file «BELL FUSE». These products are coming from an industrial series and have been delivered to Test Laboratory on 01/02/2011.

DÉSIGNATION	CODE	BATCH NUMBER
TRANSNET BELL FUSE 100A 22x58	**TN NHP100**	02/11

Bell Fuse TN NHP100 ratings are as follows:

- Rated operational voltage: 500V,
- Rated operational current: 100A,
- Rated frequency: 50 Hz.

1.3 Order of tests

Samples are numbered from 1 up to 11.

a) Orders according to Standard CEI 60947-3

ORDER OF TESTS	NUMBER OF SAMPLES	TESTS (CLAUSE OF STANDARD CEI 60947-3)	
/	**1**	8.2.4	Terminal block mechanical properties
	2	8.2.3 8.2.4	Enclosure for the equipment Terminal block mechanical properties
I	**3**	8.3.3.1 8.3.3.2 8.3.3.3 8.3.3.4 8.3.3.5 8.3.3.6	Temperature rise Test of dielectric properties Making and breaking capacities Verification of dielectric properties Leakage current Verification of temperature rise
	6	8.3.3.1	Temperature rise
II	**4**	8.3.4.1 8.3.4.2 (=8.3.3.4) 8.3.4.3 (=8.3.3.5) 8.3.4.4 (=8.3.3.6)	Operational performance test Verification of dielectric properties Leakage current Verification of temperature rise
III	/	Non applicable	
IV	/	Non applicable	
V	**5**	8.3.7.1 8.3.7.2 (=8.3.3.4) 8.3.7.3 (=8.3.3.5) 8.3.7.4 (=8.3.3.6)	Overload test Verification of dielectric properties Leakage current Verification of temperature rise

b) Additional order of tests

ORDER OF TESTS	NUMBER OF SAMPLES	TESTS
VI	**7 up to 11**	Verification of non deterioration of the contacts and direct terminal clamps

II) STANDARD DOCUMENTS REFERRED TO IN THIS REPORT

- **International standards**

CEI 60269-2 : 2010
«Low voltage fuses - Part 2 : Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Examples of type of standardized fuses A up to J».

CEI 60529 : 2001
«Degree of protection provided by enclosures (IP Code)».

CEI 60947-1 : 2007
«Low-voltage switchgear and controlgear - Part 1 : General rules».

CEI 60947-3 : 2008
«Low-voltage switchgear and controlgear - Part 3 : Switches, disconnectors, switch-disconnectors and fuse-combination units».

- **French Standards**

NFC 32-201-3 : October 1998 + Additive 1 dated November 2000 + Additive 2 dated January 2009
«Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 3 : Cables for fixed wiring».

III) GENERAL CONDITIONS

- **Temperature**

  Tests are carried out at the room temperature of the test laboratory between 20°C and 26°C.

- **Conductors used**

REFERENCE STANDARD	COME FROM	NOMINAL CROSS-SECTIONAL AREA (in mm²)	NUMBER OF STRANDS AND COMPOSITION OF CONDUCTOR	Ø OVER INSULATION (in mm)	Ø OVER CONDUCTOR (in mm)
NF C 32-201-3	**NEXANS** France	35 H07 VR	7 strands Copper	9,4	7,2
NF C 32-201-3	**NEXANS** France	6 H07 VR	7 strands Copper	4,2	2,8
/	**OLEX** Australia	35	7 strands Aluminium	10,4	7,1

- **Fuse link**

REFERENCE STANDARD	COME FROM	TYPE	REFERENCE
CEI 60269-2	**LEGRAND**	**22 x 58 100A gG**	153 96

IV) TESTS

On the following pages, sheets of each performed test can be found.

TEST DESCRIPTION : **8.2.3 Enclosures for the equipment** — Page 1/1

DATE : ON 04/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 2

TEST EQUIPMENTS :

- Degree of protection provided by the enclosures (IP rating)

PROCEDURES

Procedures and acceptance criteria are the ones of the standard CEI 60529.

The Fuse Units are equipped with conductors of minimum and maximum sections advised for the product use.

The Fuse Units are installed as usual.

The IP 23D is checked according to the standard CEI 60529 :

- Verification against access to dangerous parts: The accessibility gauge of 1 mm diameter shall remain at a sufficient distance of the live parts.
- Verification against the penetration of foreign solid elements: The ball gauge of 12.5 mm diameter shall not penetrate at all.
- Verification against water penetration: Water falling in fine drops from sprinkling rose in an angle less or equal to 60° shall not have any harmful effects.

TESTS RESULTS

N° OF SAMPLE	PREVIOUS TEST	CONDUCTOR CROSS-SECTION AREA IMPLEMENTED ON INLET & OUTLET TERMINAL BLOCKS (in mm²)	PROTECTION DEGREE CHECKED	COMMENTS	NEXT TEST
2	/	6 mm² Copper 35 mm² Copper	IP 23D	Satisfactory	8.2.4

TEST DESCRIPTION : **8.2.4 Terminal blocks mechanical properties**

DATE : ON 04/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 1 and 2

TEST EQUIPMENT :

- Dynamometric equipment GRIN 15N.m and 70N.m
- Dimension metrology
- Rotating conductors test equipment
- FLUKE 45 multimeter
- Stabilised power supply 8V - 20A

PROCEDURES

Procedures and acceptance criteria are the ones of & 8.2.4 of the standard CEI 60947-3 referring to the standard CEI 60947-1.

1. Test of terminal blocks mechanical resistance (8.2.4.2)

Maximal section conductor (35 mm²) is stripped over 23 mm and then introduced into the terminal block.

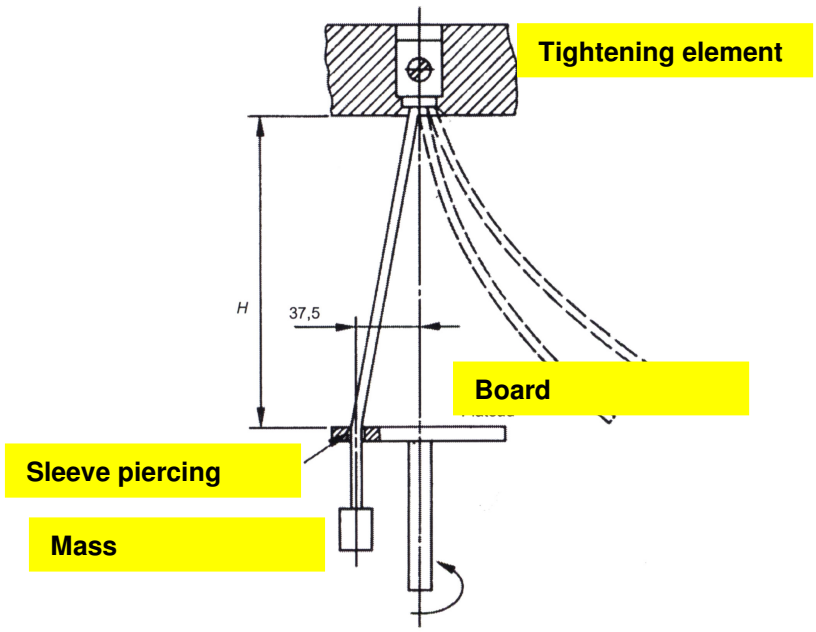
Terminal screws are tightened and untightened 5 times according to 2.5 Nm torque. Each tightening test is performed on a conductor.

During test, no damage being in a position to deteriorate future terminal blocks behaviour shall occur (screw breakage, screw threads damages, screw head damages).

In addition, the terminal blocks shall not demonstrate any loose behaviour.

2. Bending test (8.2.4.3)

The terminal block is connected onto a conductor, the screws being tightened at a torque of 2.5 N.m. Then, the terminal block is fixed to the test bench as described in figure 1 according to standard CEI 60947-1 :



TEST DESCRIPTION : **8.2.4 Terminal blocks mechanical properties**

Test parameters are as follows :

CONNECTED CONDUCTOR	SLEEVE DIAMETER HOLE	HEIGHT H	MASS
6 mm² Copper	9,5 mm	280 mm	1,4 kg
35 mm² Copper	14,5 mm	320 mm	6,8 kg

Speed of the board is about 10 turns / minute. Duration of test is 13.5 minutes (ie: 135 turns).

During test, the conductor shall not slide out of the terminal block, neither break near the tightening screws.

3. Tensile test (8.2.4.4)

Further to the bending test (8.2.4.3), without tighten again the terminal blocks screws, a tensile strength is applied on the conductor during 1 minute, according to the conductor axis and without bump. The strength is applied with the help of masses reaching 80 N for the 6 mm² conductor and 190 N for the 35 mm² one.

During test, the conductor shall not slide out of the terminal block, neither break near the tightening screws.

4. Insertion test (8.2.4.5)

The terminal block capacity is checked, introducing a gauge of 8 mm diameter, corresponding to the conductor of maximum section allowed by the Fuse Unit (35 mm²).

The gauge shall be introduced freely into the terminal block.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	TERMINAL BLOCK	INSERTION TEST OF GAUGE OF 8 mm DIAMETER	TERMINAL BLOCK MECHANICAL RESISTANCE			NEXT TEST
				CONDUCTOR CROSS-SECTION AREA (in mm²)	TIGHTENING TORQUE	CHECKING FOLLOWING 5 TIGHTENINGS	
2	8.2.3	N° 1	Satisfactory	35 Copper	2.5 N.m	Satisfactory	/
		N° 2	Satisfactory	35 Copper	2.5 N.m	Satisfactory	

N° OF SAMPLE	PREVIOUS TEST	TERMINAL BLOCK	BENDING TEST			TENSILE TEST		NEXT TEST
			CONDUCTOR CROSS-SECTION AREA (in mm²)	TIGHTENING TORQUE	COMMENTS	FORCE	COMMENTS	
1	/	N° 1	6 Copper	2.5 N.m	Satisfactory	80 N	Satisfactory	/
		N° 2	35 Copper	2.5 N.m	Satisfactory	190 N	Satisfactory	

TEST DESCRIPTION : **8.3.3.1 Temperature rise** | Page 1/2

DATE : ON 05 & 07/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 3 & 6

TEST EQUIPMENT :

- Temperature rise bench 300A
- Measure station SA 70 N1
- Dynamometric equipment GRIN 15N.m and 70N.m
- FLUKE 45 multimeter

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.1 of standard CEI 60947-3 which refers to § 8.3.3.3 of standard CEI 60947-1.

1. Assembly

The Fuse Unit is installed as usual on a fixing bracket.

Each terminal is equipped with a 35 mm² core linked to the temperature rise bench terminals by means of compression lugs. Screws are tightened at the torque 2.5 N.m.

A fuse link is installed in the sample that dissipates a power lightly greater than the maximal power (9.5 W) of the 22 x 58 100A gG fuses.

FUSE LINK USED		SECTION OF CONDUCTORS (in mm²)
TYPE	POWER DISSIPATED	
22 x 58	10W under 100A	35

A thermocouple is installed on each jaw (TC 1 and TC 2) nearer the contact between the fuse link and terminal.

Two other thermocouples (TC 3 and TC 4) are installed on the insulation piercing terminal.

Then, two thermocouples are placed on the Fuse Unit exterior enclosure : one (TC 5) is installed on the body made of insulated materials (top body), the other one (TC 6) is installed on the fuse holder, above the fuse link.

2) Test

An intensity current is flowed in the circuit (100A). The test is made during a sufficient duration to let the temperature rise reaching an established value (that is to say that the temperature rise variation does not exceed 1K/h).

When the stabilization is reached, temperature rise values of the different Fuse Unit elements are recorded.

Temperature rise must not exceed:

- 65 K for the terminal block,
- 50 K for the exterior enclosure.

No acceptance criteria has been defined for the jaws (fuse contact clip). However, due to such heating, no damage shall occur on the fuse contact clip components that may deteriorate the future Fuse Unit behaviour.

TEST DESCRIPTION : **8.3.3.1 Temperature rise**

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	CONDUCTOR CROSS-SECTION AREA (in mm²)	I_e (in A)	POWER DISSIPATED BY FUSE LINK (in W)	TEMPERATURE RISE (in K)						COMMENTS	NEXT TEST
					JAWS		T. BLOCKS		ENCLOSURE			
					TC1	TC2	TC3	TC4	TC5	TC6		
3	/	35 Copper	100	10	56.6	55.0	53.5	53.0	22.7	14.6	Satisfactory	8.3.3.2
6	/	35 Aluminium	100	10	64.9	64.3	63.2	63.5	28.8	17.0	Satisfactory	/
				Authorized limit value (in K)	/		**65**		**50**			

TEST DESCRIPTION: **8.3.3.2 Test of dielectric properties** — Page 1/2

DATE : ON 07/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 3

TEST EQUIPMENTS :

- Dielectric test equipment A 1105
- P35 Impulse generator

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.2 of the standard CEI 60947-3.

1) Assembly

The Fuse Unit equipped with 35 mm² copper cores is installed as usual on a fixing bracket.

A fuse link is installed in the Fuse Unit. A metallic sheet is covering the Fuse Unit exterior insulating enclosure. That sheet is linked to the fixing bracket.

2) Tests

a) Impulse strength

The impulse strength rated voltage of the Fuse Unit is defined according to the Annexure H of the standard CEI 60947-1, being registered at 8 kV.

The Fuse Unit is equipped with a fuse link. Five impulse voltages of 9.6 kV are applied between the terminal blocks linked together and the bracket according to positive polarities and then negative ones.

The fuse link shall be removed from the Fuse Unit. Five impulse voltages of 12.1 kV are applied between the inlet and outlet terminal blocks according to positive polarities and then negative ones.

The wave shapes of the impulse voltage are of type 1.2/50 µs.

During test, no breakdown voltage shall occur.

b) Withstanding to industrial frequency

The Fuse Unit is equipped with a fuse link. A voltage of 1.9 kV / 50 Hz during one minute is applied between the terminal blocks linked together and the bracket.

The increase in voltage is performed at a speed of 1kV/s. The voltage generator used is regulated to release at a 100mA leakage current.

During test, no breakage or flashover shall occur.

c) Leakage current

The fuse link shall be removed from the Fuse Unit. A voltage of 1 kV / 50 Hz during one minute is applied between the conductors. The dielectric test equipment is released under 0.5 mA leakage.

Note : The test is more severe than the one of the standard CEI 60947-3 which sets a leakage current lower than 0.5 mA under 1.1Ue (550V).

The dielectric test equipment shall not trip.

TEST DESCRIPTION: **8.3.3.2 Test of dielectric properties**

TEST RESULTS

a) Impulse strength

N° OF SAMPLE	PREVIOUS TEST	VOLTAGE APPLICATION POINT		TEST VOLTAGE	COMMENTS
		1st POINT	2nd POINT		
3	8.3.3.1	Terminal block linked together	Fixing bracket	9.6 kV	Satisfactory
		Outlet Terminal block	Inlet Terminal block	12.1 kV	Satisfactory

b) Withstanding to industrial frequency

N° OF SAMPLE	VOLTAGE APPLICATION POINT		TEST VOLTAGE	COMMENTS
	1st POINT	2nd POINT		
3	Terminal block linked together	Fixing bracket	1.9 kV	Satisfactory

c) Leakage current

N° OF SAMPLE	LEAKAGE CURRENT	COMMENTS	NEXT TEST
3	< 0,5 mA	Satisfactory	8.3.3.3

TEST DESCRIPTION: **8.3.3.3 Making and breaking capacities** | Page 1/1

DATE : ON 07/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 1

TEST EQUIPMENTS :

- Connection and breaking on load bench
- Dynamometric equipment GRIN 15N.m and 70N.m

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.3 of the standard CEI 60947-3.

The Fuse Unit terminals are equipped with 35 mm² copper cores linked to the connection and breaking on load bench by means of compression lugs with deep necking.

The Fuse Unit screws are tightened at a torque 2.5 N.m.

A fuse link is installed on the Fuse Unit

The opening / closing movement of the fuse-carrier is made by a pneumatic jack, at a speed of around 0,5m/s.

The connection and breaking on load bench is regulated by the following parameters

TEST CURRENT (in A)	TEST VOLTAGE (in V)	COS φ	NUMBER OF CYCLES	CLOSING TIME (in s)	OPENING TIME (in s)
152	530	0,95	5	2	30

No permanent flashover should occur. The opening / closing mechanism of the fuse-carrier should work normally at the end of the test.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	COMMENTS	NEXT TEST
3	8.3.3.2	Satisfactory – no permanent flashover	8.3.3.4

TEST DESCRIPTION: **8.3.3.4 Verification of dielectric properties** — Page 1/1

DATE : ON 10/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 3 up to 5

TEST EQUIPMENT :

- Dielectric test equipment A 1105

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.4 of the standard CEI 60947-3.

1) Assembly

The Fuse Unit equipped with 35 mm² copper cores is installed as usual on a fixing bracket.

A fuse link is installed in the Fuse Unit.

2) Withstanding to industrial frequency

A 50 Hz voltage of 1 kV is applied for 1min between the terminal blocks linked together and the fixing bracket.

The increase in voltage is performed at a speed of 1 kV/s. The voltage generator used is regulated to release at a 100mA leakage current.

During test, no breakage or flashover shall occur.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	VOLTAGE APPLICATION POINT		COMMENTS AFTER 1 MIN UNDER 1 kV	NEXT TEST
		1st POINT	2nd POINT		
3	8.3.3.3	Terminal blocks linked together	Fixing bracket	Satisfactory	8.3.3.5
4	8.3.4.1	Terminal blocks linked together	Fixing bracket	Satisfactory	8.3.3.5
5	8.3.7.1	Terminal blocks linked together	Fixing bracket	Satisfactory	8.3.3.5

TEST DESCRIPTION : **8.3.3.5 Leakage current** — Page 1/1

DATE : ON 10/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 3 up to 5

TEST EQUIPMENTS

- Dielectric test equipment A 1105

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.5 of the standard CEI 60947-3

The Fuse Unit equipped with 35 mm² copper cores is installed as usual on a fixing bracket.

A 50 Hz voltage of 1 kV is applied for 1min between:

* Both conductors,
* Each conductor and the fixing bracket.

The dielectric test equipment is regulated to release at a 2mA leakage current.

Note : The test is more severe than the one of the standard CEI 60947-3 which sets a leakage current lower than 2mA under 1,1Ue (550V).

The dielectric test equipment should not trip.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	VOLTAGE APPLICATION POINT		COMMENT	LEAKAGE CURRENT	NEXT TEST
		1st POINT	2nd POINT			
3	8.3.3.4	Conductor (outlet terminal block)	Conductor (inlet terminal block)	Satisfactory	< 2 mA	8.3.3.6
		Conductor (outlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	
		Conductor (inlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	
4	8.3.3.4	Conductor (outlet terminal block)	Conductor (inlet terminal block)	Satisfactory	< 2 mA	8.3.3.6
		Conductor (outlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	
		Conductor (inlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	
5	8.3.3.4	Conductor (outlet terminal block)	Conductor (inlet terminal block)	Satisfactory	< 2 mA	8.3.3.6
		Conductor (outlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	
		Conductor (inlet terminal block)	Fixing bracket	Satisfactory	< 2 mA	

TEST DESCRIPTION : **8.3.3.6 Verification of temperature rise**

Page 1/1

DATE : ON 11 AND 14/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 3 up to 5

TEST EQUIPMENTS

- Temperature rise bench 300A
- Measure station SA 70 N1
- Dynamometric equipment GRIN 15N.m and 70N.m
- FLUKE 45 multimeter

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.3.6 of the standard CEI 60947-3.

The temperature rise test is performed according to the procedure of the test 8.3.3.1 of the present test report.

Temperature rise must not exceed:
* 80 K for the terminal blocks,
* 60 K for the exterior enclosure.

RÉSULTATS D'ESSAI

N° OF SAMPLE	PREVIOUS TEST	CONDUCTOR CROSS-SECTION AREA (in mm²)	Ie (IN A)	POWER DISSIPATED BY FUSE LINK (in W)	TEMPERATURE RISE (in K)						COMMENTS	NEXT TEST
					JAWS		T. BLOCKS		ENCLOSURE			
					TC1	TC2	TC3	TC4	TC5	TC6		
3	8.3.3.5	35 Copper	100	10	61.8	62.5	56.3	57.2	22.5	15.2	Satisfactory	/
4	8.3.3.5	35 Copper	100	10	64.2	65.0	57.9	58.2	23.0	15.9	Satisfactory	/
5	8.3.3.5	35 Copper	100	10	59.1	57.2	55.3	54.9	22.0	15.8	Satisfactory	/
				Authorized limit value (in K)	/		**80**		**60**			

TEST DESCRIPTION : **8.3.4.1 Operational performance test**

DATE : ON 08 AND 09/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 4

TEST EQUIPMENTS

- Connection and breaking on load bench
- Dynamometric equipment GRIN 15N.m and 70N.m

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.4.1 of the standard CEI 60947-3.

The Fuse Unit is linked to the connection and breaking on load bench by means of 2 copper cores. The Fuse Unit terminal blocks are tightened at a torque 2.5 N.m. A fuse link is installed on the Fuse Unit.

By means of a pneumatic jack, the fuse-carrier is operated at a speed of around 0,5m/s.

The first part of opening / closing cycle is made without power supply. The second part of the cycle is made on a closed circuit.

During test, no permanent flashover, neither exterior events which might be dangerous for operator should occur.

At the end of the test, the fuse carrier working shall be satisfactory.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	CONDUCTOR CROSS-SECTION AREA (in mm²)	TOTAL DURATION OF CYCLE (in s)	NUMBER OF CYCLE WITHOUT POWER SUPPLY	CYCLE WITH POWER SUPPLY				COMMENT		NEXT TEST
					NUMBER	TEST CURRENT (in A)	TEST VOLTAGE (in V)	COS φ	DURING TEST	AT THE END OF TEST	
4	/	35 Copper	30	1 700	300	100	500	0.95	Satisfactory	Satisfactory	8.3.3.4

TEST DESCRIPTION : **8.3.7.1 Overload test** | Page 1/1

DATE : ON 10/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 5

TEST EQUIPMENTS

- Dynamometric equipment GRIN 15N.m and 70N.m
- Temperature rise bench

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.3.7.1 of the standard CEI 60947-3.

1) Assembly

The Fuse Unit is installed as usual on a fixing bracket.

Each terminal is equipped with a 35 mm² copper core linked to the temperature rise bench terminals by means of compression lugs with deep necking. Screws are tightened at a torque 2.5 N.m.

A fuse link is installed in the sample.

FUSE LINK USED		
TYPE	**MANUFACTURER**	**RÉFÉRENCE**
22 x 58	LEGRAND	153 96

2) Test

An intensity current equal to 1,6 x I_e is flowed in the circuit (160A). The test is carried out for one hour until fusing of the fuse link.

Within the 3 minutes after the fuse link works or following an hour period of time, an opening / closing operation is performed. The opening / closing mechanism of the fuse link carrier should work normally.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	CONDUCTOR CROSS-SECTION AREA (in mm²)	TEST CURRENT (in A)	TEST DURATION (IN MINUTES)	COMMENTS	NEXT TEST
5	/	35 Copper	160	42	Satisfactory	8.3.3.4

TEST DESCRIPTION : **Verification of non-deterioration of the contacts and direct terminal clamps** — Page 1/2

DATE : ON 15/02/2011 UP TO 25/02/2011
PLACE : MICHAUD Test Laboratory

OPERATOR : JP. RAPY

N° OF SAMPLES : 7 up to 11

TEST EQUIPMENTS

- Temperature rise bench 300A
- Measure station SA 70 N1
- Dynamometric equipment GRIN 15N.m and 70N.m

PROCEDURES

Procedures and acceptance criteria are the ones of § 8.10 of the standard CEI 60269-2.

1) Assembly

The Fuse Units are installed as usual on a fixing bracket.

Each terminal is equipped with a 35 mm² copper core linked to the temperature rise bench terminals by means of compression lugs with deep necking. Screws are tightened at a torque 2.5 N.m.

Fuse links are installed in each sample. They dissipate a power lightly upper than the maximal power (9.5 W) of the 22 x 58 100A gG fuses.

FUSE LINK USED		CONDUCTOR CROSS-SECTION AREA (in mm²)
TYPE	POWER DISSIPATED	
22 x 58	10W under 100A	35

A thermocouple is installed on each jaw (TC 1 and TC 2) nearer the contact between the fuse link and the terminal block.

Two other thermocouples (TC 3 and TC 4) are installed on each terminal block.

2) Temperature rise test

An intensity current corresponding to the rated operational current (100 A) is flowed in the circuit. When the established value is reached, temperature rise values of the samples jaws and terminal blocks are recorded.

3) Test process

The Fuse Units shall withstand 250 overload cycles, process of one cycle being as follows:

LOAD PERIOD	DURATION	30 minutes
	CURRENT	125A
NO LOAD PERIOD (WITHOUT CURRENT)	DURATION	12 minutes
TOTAL DURATION OF ONE CYCLE		42 minutes

TEST DESCRIPTION: **Verification of non-deterioration of the contacts and direct terminal clamps**

4) Acceptance criteria

At the end of the 250 overload cycles, a temperature rise test is performed as indicated in § 2. The temperature rises measured after the 250 cycles shall not be 15 K higher than the ones measured at the beginning of the tests.

If this condition is not fulfilled, the samples shall withstand 750 additional overload cycles.

At the end of the 750 additional overload cycles, a temperature rise test is performed as indicated in § 2. The temperature rises measured after the 750 additional cycles shall not be 20 K higher than the ones measured at the beginning of the tests.

TEST RESULTS

N° OF SAMPLE	PREVIOUS TEST	I_e (in A)		TEMPERATURE RISE (in K)				COMMENTS	NEXT TEST
				JAWS		TERMINAL BLOCKS			
				TC1	TC2	TC3	TC4		
7	/	100	Beginning of the tests	54.3	57.2	52.9	54.2	Satisfactory	/
			After 250 cycles	60.8	64.3	58.4	60.7		
8	/	100	Beginning of the tests	56.1	55.7	54.8	54.1	Satisfactory	/
			After 250 cycles	64.3	62.8	61.7	60.6		
9	/	100	Beginning of the tests	55.0	56.6	53.2	53.9	Satisfactory	/
			After 250 cycles	61.9	63.6	59.5	59.2		
10	/	100	Beginning of the tests	57.5	55.0	54.8	53.0	Satisfactory	/
			After 250 cycles	65.5	61.4	60.8	58.2		
11	/	100	Beginning of the tests	57.1	56.9	53.5	54.0	Satisfactory	/
			After 250 cycles	63.3	63.4	59.6	60.9		
	Maximal difference authorized between temperature rises when sample is new and after 250 cycles (in K)			15					