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Test report

Electrical Tests on Abiko KRF 150-12, 2014510 Cable Lug Mounted on 150 mm^2 Class 2 Copper Conductors with Novopress HP-series Crimping Tool

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TEST OBJECT
Abiko KRF 150-12, 2014510

TEST OBJECT RECEIVED
2010

TEST PROGRAM
Electrical tests according to IEC61238-1, Ed.2

TEST LOCATION
SINTEF Energy Research

DATE OF TEST
2011/2012

ABSTRACT

The cable lug Abiko KRF 150-12, 2014510, compressed with a dieless deep indent crimp, using a Novopress HP - Series crimping tool on a stranded copper conductor (class 2), has been tested according to the electric part of the IEC 61238-1 standard. The tested set of cable lugs passed all criteria of the test.

The test results relate only to the items tested

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1 TEST OBJECT

The tested cable lug was an Abiko KRF 150-12, 2014510 compressed with a dieless deep indent crimp, using a Novopress HP - Series crimping tool. The cable lug is of class A. Figure 1 shows the cable lug after the test. Six specimens of this cable lug were used in the test. The crimping sequence was for cable lug specimens 1, 3 and 5 first close to the bolt, second close to the cable, and for cable lug specimens 2, 4 and 6 vice versa.

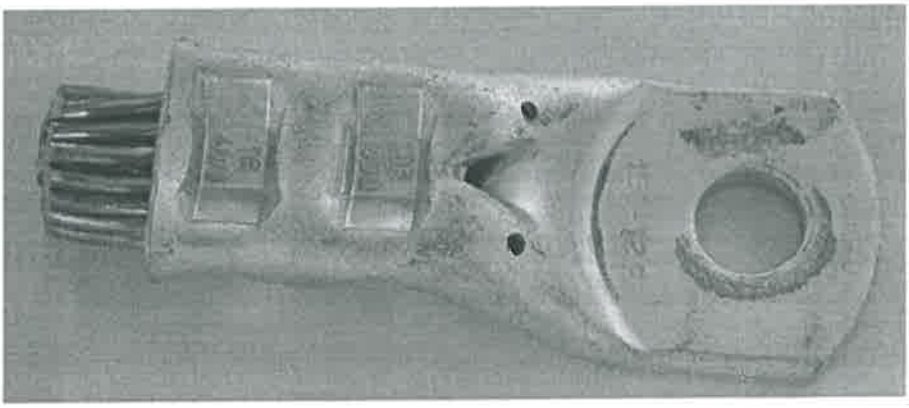

Figure 1: Tested cable lug.

2 INSTALLATION

2.1 Conductor used

The conductor used was a stripped, class 2, stranded copper conductor consisting of 37 strands. The nominal cross-section area was 150 mm^2. The cross-section of the copper bus bar bolted to the cable lug was 5 mm x 30 mm.

2.2 Mounting procedure

The six specimens of the cable lug were mounted on the bare conductor. In the other end, the cable lugs were bolted to the bus bar. Two holes, a few millimetres deep and about 2 mm in diameter, were drilled in the middle of each cable lug. The holes were used to fasten (with small screws) one thermocouple and one voltage tap on each cable lug. Equalizer points for resistance measurements were soldered on the conductor.

3 TEST PROCEDURES

3.1 Temperature cycling

The temperature on the reference conductor was cycled 1000 times between 35°C and about 120°C. The heating period was 53 minutes and the subsequent cool down time was about 37 minutes. The current in the test loop was generated by a constant voltage source (reg. No. B01-0597 and B01-0663). The current at the start of the heating period was 688 A, whereas the current at equilibrium was 641 A. No forced cooling was used.

Resistance measurements were made by passing a DC current of 50 A through the test circuit (from DC power supply with reg. No. B2-340).

Temperatures and voltage drops were recorded by a data logger (reg. No. G05-0172).

3.2 Short-circuit tests

After 200 heat cycles, six short-circuits were applied with currents and durations according to Table I.

Table I: Short circuit tests.

No.	Specimens 1,2		Specimens 3,4,5,6	
	I_{rms} (kA)	Time (s)	I_{rms} (kA)	Time (s)
1	23.9	1.14	23.1	1.21
2	24.0	1.25	22.8	1.25
3	23.5	1.16	22.9	1.29
4	24.0	1.28	22.8	1.28
5	24.0	1.16	23.1	1.29
6	24.0	1.16	22.8	1.25

The short-circuit tests were performed in the same test rig. Four conductors arranged concentrically around the tested cable lugs were used for the return current.

4 RESULTS

4.1 Measured temperatures

The maximum temperatures for the cable lugs and for the reference conductor during cycling are given for certain cycles in Table II.

Table II: Maximum temperature (in °C) during cycling for the cable lugs and the reference conductor at different cycles.

Cycle	Cable lug 1	Cable lug 2	Cable lug 3	Cable lug 4	Cable lug 5	Cable lug 6	Reference conductor
1	101	105	106	104	101	103	118
200	106	110	112	107	107	106	122
250	105	109	112	106	108	100	114
325	107	115	118	112	108	104	119
400	106	116	118	112	108	100	117
475	104	115	118	110	109	102	120
550	104	115	118	110	105	102	119
625	103	113	116	109	107	102	120
700	105	114	117	111	107	101	120
775	109	117	118	112	107	102	121
850	108	117	119	113	106	101	119
925	101	112	115	109	100	98	115
1000	108	118	119	114	107	103	120

4.2 K-values

The k-values for the cable lugs are given in Table III and Figure 2.

Table III: k-values for the cable lugs.

Cycle	Cable lug 1	Cable lug 2	Cable lug 3	Cable lug 4	Cable lug 5	Cable lug 6
0	0.83	0.91	0.85	0.75	0.80	0.64
200-	0.83	0.92	0.86	0.75	0.80	0.64
200+	0.90	1.16	0.95	0.84	0.91	0.69
250	0.83	1.08	0.89	0.77	0.84	0.62
325	0.84	1.08	0.89	0.77	0.84	0.61
400	0.84	1.08	0.87	0.77	0.84	0.62
475	0.84	1.07	0.86	0.77	0.84	0.62
550	0.83	1.08	0.86	0.77	0.84	0.62
625	0.83	1.07	0.86	0.77	0.84	0.62
700	0.83	1.08	0.85	0.77	0.84	0.62
775	0.83	1.07	0.85	0.76	0.84	0.62
850	0.83	1.07	0.85	0.77	0.84	0.62
925	0.83	1.07	0.86	0.77	0.84	0.62
1000	0.83	1.07	0.85	0.77	0.84	0.62

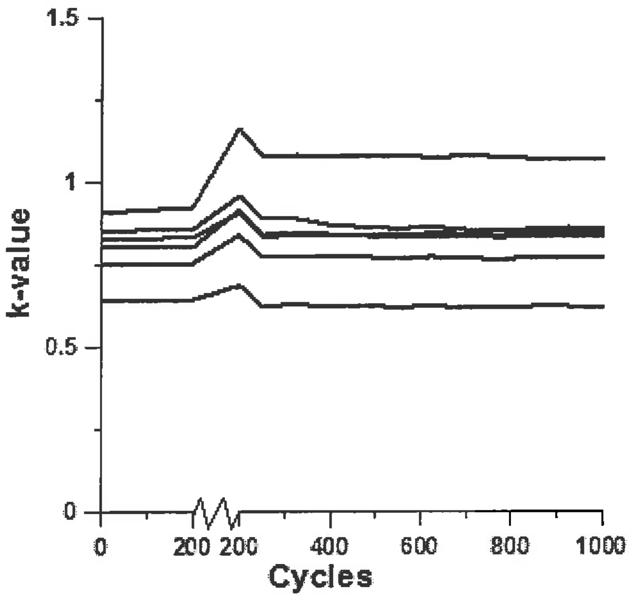

Figure 2: k-values as function of heat cycle for the six specimens.

4.3 IEC 61238-1 requirements

In Table IV the results of this test are compared to the requirements of the IEC 61238-1 standard.

Table IV: Obtained and maximum acceptable parameter values for the IEC 61238-1 standard.

Parameter	Designation	Result	Requirement
Initial scatter	δ	0.19	≤0.30
Mean scatter	β	0.29	≤0.30
Change in resistance factor	D	0.07	≤0.15
Resistance factor ratio	λ	1.28	≤2.0
Maximum temperature*	Θ_{max}	119 °C	≤120°C **

* Note that the cable lug temperature is influenced both by the tested cable lug-to-cable contact, and the cable lug-to-bus bar contact
** Temperature of the reference conductor

The tested set of cable lugs passed all criteria of the electrical part of the IEC 61238-1 standard.

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