

Type Test Report
Electrical Accessories and Hardware Reference Laboratory

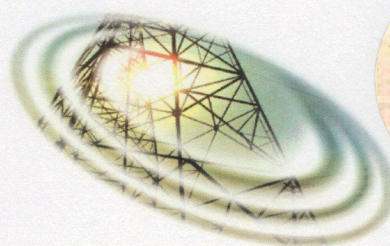
**Bimetallic Parallel Groove Connector Al/Cu 16-120 mm² / Al/Cu 16-120 mm²
CO1047**

**Client: Council for Assessment and Compliance with Electrical Industry Equipment
Production Standards, Power Generation, Transmission & Distribution Company**

Manufacturer: Electro Niroo Taban Control Company (NETCO).

Test Standard: BS 3288-1 (2014), IEC 61238-1-3 (2018), EN 50483-6 (2009)

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Reviewed by: H. Mostafavi



Approved by: F. Naghdi

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CO1047**

Serial number: -

Reference Standards: BS 3288, IEC 61238, EN 50483-6

Tested by: M. Soltanloo

Approved by: A. Bajgholi

Tests witnessed by:

Date of issue: 2021/05/24

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Client: Council for Assessment and Compliance with Electrical Industry Equipment Production
Standards, Power Generation, Transmission & Distribution Company

Manufacturer: Electro Niroo Taban Control Company (NETCO)

Request number: 99/27500/1628

Request date: 2020/05/27

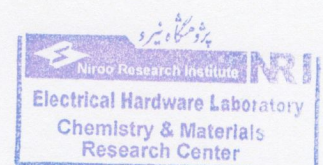
Sampling date: 2020/09/10

Sampling location: No. 10, Kamalzadeh St., End of Robat Mashin St., Shora Bly., Kamalshahr, Karaj

Report number: CH140024

Sample code: SCH140021

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Tested by: M. Soltanloo

Approved by: A. Bajgholi

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1. Summary of test results

Test	Test Type	Standard/Clause	Result
Visual and dimensional examination	Type test	BS 3288	Passed
Slip test	Type test	IEC 61238	Passed
Connector bolt tightening test	Type test	IEC 61238	Passed
Electrical ageing test	Type test	IEC 61238	Passed
Corrosion test	Type test	EN 50483-6	Passed

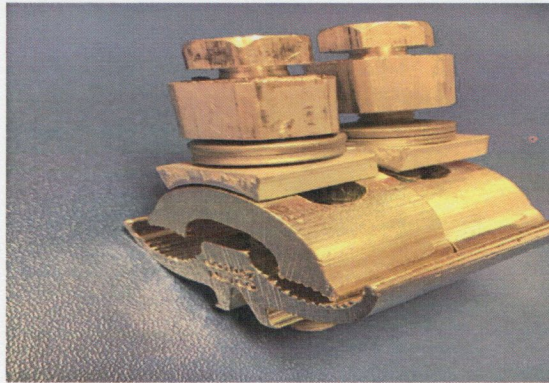
Bimetallic Parallel Groove Connector Al/Cu 16-120 mm² /Al/Cu 16-120 mm² CO1047 of Electro Niroo Taban Control Company (NETCO) is approved according to BS 3288, IEC 61238, and EN 50483-6 standards.

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2. Product Specifications

Name: Bimetallic Parallel Groove Connector Al 16-120 mm² / Al 16-120 mm²

Model: CO1047



3. Technical Specifications

Branch Conductor Range: Al/Cu 16-120 mm²

Main Conductor Range: Al/Cu 16-120 mm²

Features:

4 × Belleville washer with dacromat coating

2 × M10 bolt with dacromat coating and 2 × Al shear heads

Weight:

Installation Torque: 20 N.m

Markings:

4. General Considerations

The customer has the right to officially announce their written objection to the test results or procedure within one month after the test report is issued. The tested samples will be stored at the laboratory for up to 6 months after testing.

Sampling was conducted by representatives of the Niroo Research Institute.

5. Test Methods and Results

5.1. Visual and dimensional examination

The fitting was visually and dimensionally inspected in order to make sure that it is within standard tolerances.

Acceptance Criteria:

It shall be verified that the test samples are in accordance with the drawing provided by the manufacturer. Manufacturer's name shall be engraved on the sample.

Results:

The test samples were in accordance with the manufacturer's specifications. Manufacturer's name was engraved on the sample. The connector has 4 Belleville washers with 2.0 mm thickness and 2 bolts of size M10 with dacromat coating and 2 Al shear heads.

Conclusion:

The connector passed the test.

5.2. Mechanical tests

5.2.1. Slip test

Cu conductors with 120-120 mm² and 16-16 mm² were used in the test. The tensile force was $60 \times A$, where A was the conductor nominal cross section area in mm².

Acceptance Criteria:

The conductor shall maintain the test load for 60 s without breaking or any damage that would prevent the correct function of the cable.

Sample	Conductor (mm ²)	Standard load (N)	Slip load (N)
1	Cu 120-120	7200	76520
2			77130
3	Cu 16-16	960	1540
4			1610

Results:

The connector and the conductors withstood the applied loads and no slip, damage or failure were observed.

Conclusion:

The connector passed the test.

5.2.2. Shear head function test

To ensure that the shear head mechanism functions correctly within the specified torque range, four samples were tested at each of the minimum temperature of -10 °C and the maximum temperature of 50 °C using the following conductor cross section combinations.

Main Conductor (mm ²)	Branch Conductor (mm ²)	Shearing-off torque at the minimum temperature (N.m)	Shearing-off torque at the maximum temperature (N.m)
120 Cu (Max.)	120 Cu (Max.)	20.0 – 21.3 – 21.0 – 20.5	21.4 – 20.9 – 22.0 – 21.3
16 Cu (Min.)	16 Cu (Min.)	21.8 – 21.2 – 21.1 – 20.6	21.0 – 20.4 – 20.8 – 21.1

Acceptance Criteria:

For each of the test temperatures and cross section combination, the torque at which the shear head shears, shall be within the tolerances of the manufacturer's specified torque.

Results:

The shearing-off was taken place within the torque range of 20-22 N.m at -10 and 50 °C on the maximum and minimum conductor cross section combinations.

Conclusion:

The connector passed the test.

5.2.3. Connector bolt tightening test

The connector shall be installed on a conductor or cable with a diameter equal to that for which the connector is intended to be used. The bolts and/or nuts shall be tightened with the installation torque specified by the supplier (20 N.m). The torque shall be increased to the specified installation value by a factor of 1,1 (22 N.m). 10 installations and removals shall be completed. Finally, the torque shall be increased to either twice the specified installation value or the maximum torque value recommended by the bolt supplier; whichever is the lower.

Acceptance Criteria:

The threads must be usable for any number of subsequent tightening and loosening operations and all parts of the connector must remain intact. There must be no unacceptable damage to the conductor inside the connector.

Results:

The Al nuts were removed from the bolts at torques of 27.9, 28.4, 28.6 and 30.2 N.m.

Conclusion:

The connector passed the test.

5.3. Electrical ageing test

A test loop consisting of 6 connectors was prepared according to standard and subjected to 1000 heating and cooling cycles. The test was performed using a 120-120 mm² conductor. The resistance was measured 12 times during the test; first measurement was taken before heating/cooling cycles, the second one after first 250th cycle, and the remaining measurements after every 75 cycles thereafter.

Acceptance Criteria:

Maximum standard values for the test parameters are shown in the following table.

Parameter	Maximum value
Initial scatter, δ	0.3
Mean scatter, β	0.3
Assessment of resistance stability	15 %
Resistance factor ratio, λ	2.0
Temperature stability $\Delta\theta_j$	$\Delta\theta_j - 10 \leq \Delta\theta_j \leq \Delta\theta_j + 10$
Maximum temperature θ_j of each connector	θ_R

Results:

Results are shown in the following table.
All samples fulfilled standard requirements.

Conclusion:

The connector passed the test.

Parameter	Maximum Standard Value	Connector 1		Connector 2		Connector 3		Connector 4		Connector 5		Connector 6	
Initial scatter, δ	0.3	0.22											
Mean scatter, β	0.3	0.22											
Assessment of resistance stability	0.15	0.15 [*]		0.15 [*]		0.148 [*]		0.15 [*]		0.149 [*]		0.15 [*]	
Maximum temperature θ_j of each connector (°C)	120	108		109		108		102		110		108	
Resistance factor ratio, λ	1.5	1.045		1.09		1.027		1.048		1.09		1.01	
Primary torque (N.m)	-	18											
Secondary torque (N,m)	-	10.6	9.8	11.0	10.4	10.6	11.0	11.3	10.9	10.2	9.7	10.3	10.7
Torque drop (%)	-	41	45	39	42	41	39	37	39	43	46	43	41

* Borderline

5.4. Corrosion test

According to EN 50483-6, clause 8.4., the samples exposed to 500 cycles of 2 h (1000 h) in an environment created by the solution consisting of 0.05 % sodium chloride (NaCl) and 0.35 % ammonium sulphate ((NH₄)₂SO₄) by mass. After the test, the samples were subjected to visual inspection.

Acceptance Criteria:

Visual inspection shall be carried out and there shall be no significant trace of red rust. The amount of corroded area should not be more than 10 % of the exposed surface area of the metallic parts.

The sample's identification marking shall be legible when examined with normal or corrected vision, without magnification.

No deterioration of the connector occur which would impair their normal function.

Results:

No trace of red rust was observed.

The connector's identification marking was legible when examined with normal vision.

The sample fulfilled standard requirements.

Conclusion:

The connector passed the test.

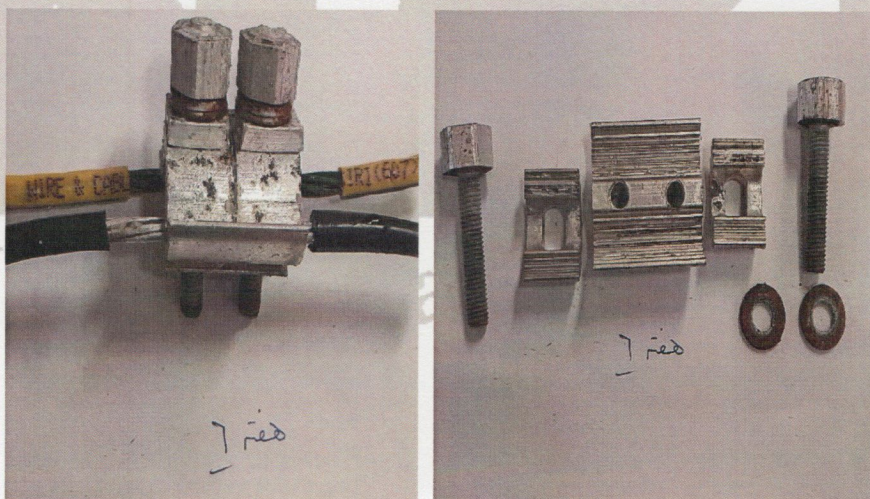


Figure 1. Sample after 6 weeks in the corrosion chamber.

Appendix

