

**Type Test Report**  
**Electrical Accessories and Hardware Reference Laboratory**

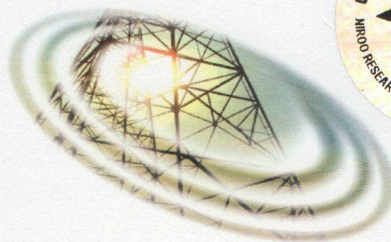
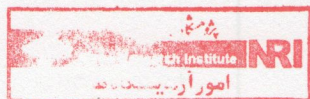
**Tension Clamp for 20 kV Medium Voltage Covered Conductor of 70 mm<sup>2</sup>  
Cross Section  
TE0101**

**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: EN 50397-2 (2009), EN 50483-6 (2009)**

**Niroo Research Institute**



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**Tension Clamp for 20 kV Medium Voltage Covered Conductor of 70 mm<sup>2</sup> Cross Section  
TE0101**

Serial number: -

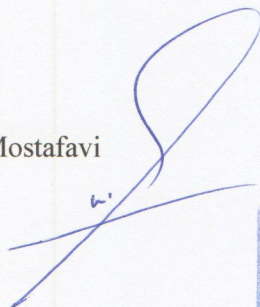
Reference Standards: EN 50397-2 (2009), EN 50483-6 (2009)

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Date of issue: 2025/05/03

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Niroo Research Institute

Reviewed by: H. Mostafavi



Approved by: F. Naghdi





**Tension Clamp for 20 kV Medium Voltage Covered Conductor of 70 mm<sup>2</sup> Cross Section  
TE0101**

Serial number: -

Reference Standards: EN 50397-2, EN 50483-6

Tested by: M. Soltanloo

Approved by: A. Bajgholi

Tests witnessed by:

Date of issue: 2020/12/05

Laboratory: Electrical Accessories and Hardware Reference Laboratory

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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: 99/27500/3170

Request date: 2020/07/18

Sampling date: 2020/08/24

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

Report number: CH99131

Sample code: SCH99117

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Tested by: M. Soltanloo

Approved by: A. Bajgholi



## Contents

1. Summary of test results.....	5
2. Product Specifications .....	6
3. Technical Specifications .....	6
4. General Considerations.....	6
5. Test Methods and Results .....	7
5.1. Visual examination .....	7
5.2. Dimensional and material verification.....	7
5.3. Damage and failure load test.....	7
5.4. Tensile test at ambient temperature .....	8
5.5. Tensile test at low temperature .....	9
5.6. Tensile test at high temperature .....	10
5.7. Clamp bolt tightening test.....	11
5.8. Low temperature assembly test.....	12
5.9. Water tightness test.....	13
5.10. Short-circuit test.....	13
5.11. Corrosion test.....	14
5.12. Test for permanent marking.....	15
Appendix .....	16



## 1. Summary of test results

Test	Test Type	Standard/Clause	Result
Visual examination and dimensional and material verification	Type test	EN 50397-2 7.1, 7.2	Passed
Damage and failure load test	Type test	EN 50397-2 7.4.1	Passed
Tensile test at ambient temperature	Type test	EN 50397-2 7.4.7	Passed
Tensile test at low temperature	Type test	EN 50397-2 7.4.8	Passed
Tensile test at high temperature	Type test	EN 50397-2 7.4.9	Passed
Clamp bolt tightening test	Type test	EN 50397-2 7.4.10.1	Passed
Low temperature assembly test	Type test	EN 50397-2 7.4.14	Passed
Water tightness test	Type test	EN 50397-2 7.6	Passed
Short-circuit test	Type test	EN 50397-2 7.8	Passed
Corrosion test	Type test	EN 50483-6 8.4.2.2	Passed
Test for permanent marking	Type test	EN 50397-2 7.3	Passed

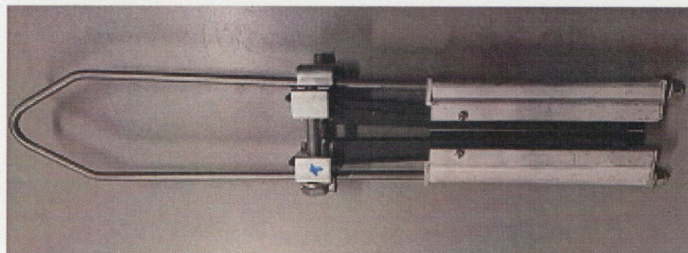
Tension Clamp for 20 kV Medium Voltage Covered Conductor of 70 mm<sup>2</sup> Cross Section TE0101 of Electro Niroo Taban Control Company (NETCO) is approved according to EN 50397-2 and EN 50483-6 standards.



## 2. Product Specifications

Name: Tension Clamp for 20 kV Medium Voltage Covered Conductor of 70 mm<sup>2</sup> Cross Section

Model: TE0101



## 3. Technical Specifications

Covered conductor cross section: 70 mm<sup>2</sup>

Features:

5 × Belleville washer made of dacromat coated steel

2 × M10 bolt

Weight:

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 examination

The test was performed according to EN 50397-2, clause 7.1 and 7.2.

#### Acceptance Criteria:

All the items mentioned in the standard including conductor cross section area and manufacturer's name should be marked on the sample.

#### Results:

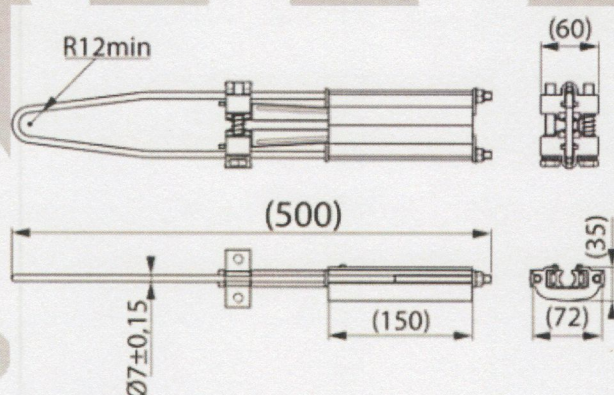
The sample fulfilled acceptance criteria.

#### Conclusion:

The clamp passed the test.

### 5.2. Dimensional and material verification

The test was performed according to EN 50397-2, clause 7.1 and 7.2. The measured dimensions of the samples must be in accordance with the drawing provided by the manufacturer as seen in the following image.



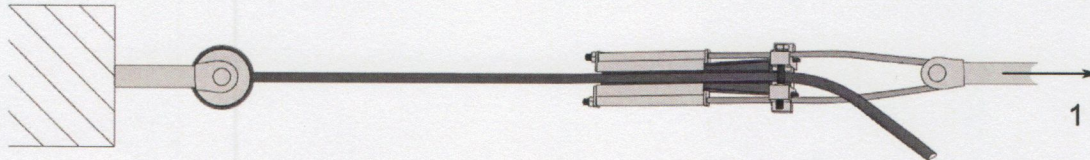
Dimension	Measured value (mm)
Clamp body height	33
Clamp body width	65
Clamp body length	150
Clamp width	65
Bail diameter	7

### 5.3. Damage and failure load test

The test was performed according to EN 50397-2, clause 7.4.1. The fitting shall be held in a tensile testing machine and the load shall be gradually increased until it reaches the specified minimum damage load. This load shall be kept constant for 60 s. It shall then be removed and the measurement of the permanent



deformation of the fitting carried out. Then the load shall be gradually increased until it reaches the specified minimum failure load at which it shall be kept constant for 60 s. Then the load shall be increased until the failure of the fitting occurs. The tensile load was applied to the sample according to standard procedure in a direction shown in the following figure.



#### Acceptance Criteria:

No permanent deformation, which can affect the proper function of the fitting, must occur at or below the specified mechanical minimum damage load.

The clamp shall withstand the applied specified minimum failure load for 60 s without any failure.

#### Results:

No permanent deformation was observed at or below the specified mechanical minimum damage load.

No failure was occurred at or below the specified mechanical minimum failure load.

#### Conclusion:

The clamp passed the test.

Sample	Conductor cross section (mm <sup>2</sup> )	SMDL (kN)	SMFL (kN)	SMDL for 60 s	SMDL for 60 s	Failure load (kN)	Result
1	70	14.0	16.1	No deformation	No failure	34.9	OK
2	70	14.0	16.1	No deformation	No failure	36.6	OK
3	70	14.0	16.1	No deformation	No failure	38.0	OK

#### 5.4. Tensile test at ambient temperature

The test was performed according to EN 50397-2, clause 7.4.7. Two tension clamps shall be assembled on to the covered conductor upon the covering in accordance with the manufacturing instructions and fitted into a tensile test machine. The length of the tails on the unloaded side of the clamp shall be at minimum of 500 mm. The distance between the two clamps shall be at minimum of  $100 \times d$ , where  $d$  is the diameter of the covered conductor including covering. The load shall be increased to 20 % of the SMFL. Then, the conductor shall be marked where it exits from the clamps. The load shall be gradually increased until it reaches 60 % of the SMFL of the assembly. The load shall be maintained to this value for a time of 60 s. Without any subsequent adjustment of the fitting, the load shall be steadily increased in not less than 30 s until the SMFL is reached.



Such load shall be kept constant for 60 s at least. Without any subsequent adjustments of the fitting, the load shall be steadily increased until failure occurs. The failure load shall be recorded.

#### Acceptance Criteria:

The movement of the conductor relative to the clamp shall be less than 3 mm and no failure of the clamp or covered conductor shall occur below the SMFL, where  $SMFL = 0.80 \times MBL$ .

#### Results:

No slippage or failure was observed in the clamp or conductor. Failure loads are reported in the following table.

#### Conclusion:

The clamp passed the test.

Sample	Conductor cross section (mm <sup>2</sup> )	MBL (kN)	20% SMFL (kN)	60% SMFL (kN)	SMFL (kN)	Failure load (kN)	Result
1	70	20.0	3.2	9.7	16	18.2	OK
2	70	20.0	3.2	9.7	16	19.3	OK
3	70	20.0	3.2	9.7	16	18.9	OK

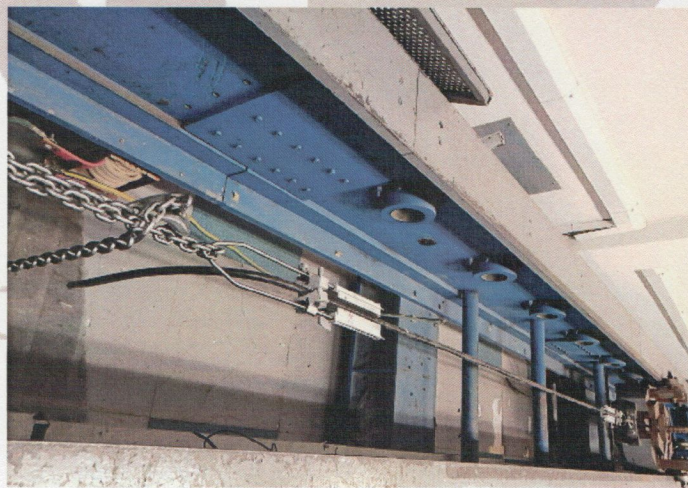


Figure 1. Set up for tensile test at ambient temperature.

### 5.5. Tensile test at low temperature

The test was performed according to EN 50397-2, clause 7.4.8. Two tension clamps shall be assembled on to the covered conductor upon the covering in accordance with the manufacturing instructions and fitted into a tensile testing machine. The fitting shall be installed in a cold temperature zone (-25 °C). The length of the tails on the unloaded side of the clamp shall be at minimum of 500 mm. The distance between the two clamps shall be at minimum of  $100 \times d$ , where  $d$  is the diameter of the covered conductor including covering. The test shall be carried out with a static load of  $0.7 \times MBL$ . At least one tension clamp and a 300 mm section of the



conductor shall be cooled to  $(-25 \pm 3) ^\circ\text{C}$  for 1 h during which time a tensile load is maintained at  $\pm 10 \%$ . Before starting the 24 h period, the conductor shall be marked at the point where it exits the tension clamp. These marks shall be used for reference purposes to measure slippage. Marking shall be applied of a load to 20 % of the specified minimum slip load. After assembling of the covered conductor section between the extremities of a tension machine, the conductor shall be subjected to a load, which is agreed between purchaser and supplier. To assemble the clamp on the covered conductor, the nuts or bolts shall be tightened with the torque specified by the supplier (40 N.m). The tension clamp shall be maintained at the specified minimum slip load agreed between the purchaser and supplier for 24 h at  $(-25 \pm 3) ^\circ\text{C}$ .

#### Acceptance Criteria:

No slippage more than 3 mm shall occur at or below the specified minimum slip load. No damage shall occur which could affect the correct function of the tension clamp.

#### Results:

The clamp withstood the applied specified minimum slip load without any slippage or damage.

#### Conclusion:

The clamp passed the test.

Sample	Conductor cross section (mm <sup>2</sup> )	MBL (kN)	70% MBL (kN)	20% SMSL (kN)	SMSL (kN)	Result
1	70	20.0	14.5	2.7	12.9	OK

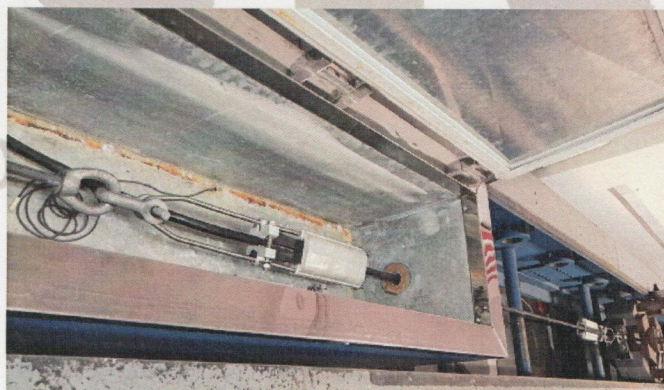


Figure 2. Set up for tensile test at low temperature.

### 5.6. Tensile test at high temperature

The test was performed according to EN 50397-2, clause 7.4.9. Two tension clamps shall be tested. The covered conductor used in the test shall be the one for which the clamp is intended. The clamp shall be installed in a test rig, and a constant mechanical load shall be maintained on the clamps throughout the test. This load shall be agreed between purchaser and supplier. Tails approximately 500 mm long shall remain outside the two clamps for connection to a current source. The load (15% MBL) shall be maintained for a period of at least 6 h



at ambient temperature. Then, the test assembly shall undergo 100 heat cycles at a rate of maximum four cycles per day. The load shall be maintained for the duration of the test. The conditions for each temperature cycle shall be as follows: an initial temperature at ambient; the conductor temperature gradually increased to the maximum normal operating temperature of the conductor  $\pm 5$  K, in less than 2 h; this high temperature maintained for 4 h; the conductor and the tension clamp allowed to cool naturally to ambient temperature before the next cycle begins.

#### Acceptance criteria

If any, the slippage of the covering shall be less than 20 mm. No damage shall occur which could affect the correct function of the tension clamp or the conductor. No damage shall occur on the covering.

#### Results:

No slippage of the covering was observed. No damage was observed in the clamp and conductor covering.

#### Conclusion:

The clamp passed the test.

Sample	Conductor cross section (mm <sup>2</sup> )	MBL (kN)	15% MBL (kN)	Result
1	70	20.0	3.0	OK

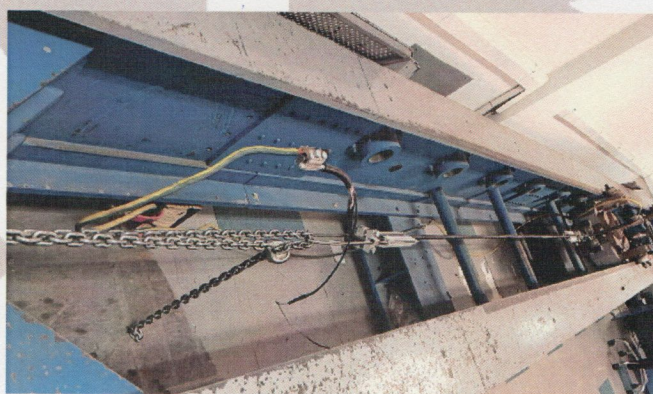


Figure 3. Set up for tensile test at high temperature.

### 5.7. Clamp bolt tightening test

The test was performed according to EN 50397-2, clause 7.4.10.1. Two clamps shall be tested. The clamp shall be installed on to the covered conductor for which the clamp is designed. The bolts and/or nuts shall be tightened to the installation torque specified by the manufacturer. The torque shall be increased to  $1.1 \times$  the specified installation torque value. The bolts and/or nuts shall then be slackened until they exert no pressure on the conductor bundle and the clamp becomes loose enough to remove. The tightening and loosening process shall be completed 10 times. The torque shall then be increased until damage occurs. Tightening torque and damage shall be recorded.



**Acceptance Criteria:**

No damage shall occur, during the tightening and loosening process which could affect the correct function of the clamp or its nuts.

**Results:**

No damage occurred during tightening and loosening process and the correct function of the clamp or its nuts were not affected.

**Conclusion:**

The clamp passed the test.

Sample	Conductor cross section (mm <sup>2</sup> )	Installation torque (N.m)	Result
1	70	40	OK

**5.8. Low temperature assembly test**

The test was performed according to EN 50397-2, clause 7.4.14. Two samples shall be tested. The connectors and conductor shall be further pre-conditioned until they reach the test temperature of  $(-25 \pm 3) ^\circ\text{C}$ , before they are assembled. Then, the tightening shall be carried out at a rate of approximately 1 full turn in 8 s inside or outside of the chamber, and electrical continuity shall be measured between the main and branch cables.

**Acceptance Criteria:**

Electrical continuity shall be achieved at a torque value less, or equal to, 70 % of the manufacturer's specified minimum installation torque.

**Results:**

Electrical continuity was achieved at a torque value less than 70 % of the manufacturer's specified minimum installation torque.

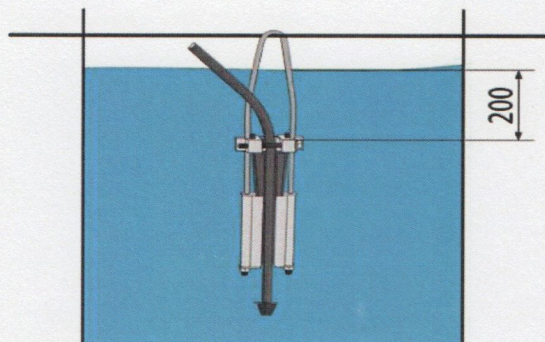
**Conclusion:**

The clamp passed the test.



### 5.9. Water tightness test

The test was performed according to EN 50397-2, clause 7.6. The clamp shall be assembled on the covered conductor according to the supplier's instruction and immersed in water. The conductor and the mounted fitting shall be immersed in water for 48 h.



#### Acceptance Criteria:

No water shall penetrate the conductor and shall move through the conductor.

#### Results:

No trace of water was observed at the end of the core.

#### Conclusion:

The clamp passed the test.

### 5.10. Short-circuit test

The test was performed according to EN 50397-2, clause 7.8. The test arrangement shall be subjected to one pulse of over-current for 1 s. Two devices equipped of the test piece are tightened on a cable having the maximum cross-section for which the connectors are designed. The electric resistances are measured before and after over-current.

#### Acceptance Criteria:

The change of resistance before and after short circuit shall be less than 50 %. No visible damage shall be observed on the connector or on the cable.

#### Results:

The change of resistance before and after short circuit was less than 50 %. No visible damage was observed on the connector or on the cable.

#### Conclusion:

The clamp passed the test.



Sample	Length (mm)		Electrical resistance before short circuit ( $\mu\Omega$ )		Electrical resistance after short circuit ( $\mu\Omega$ )		Change of resistance (%)	Result
	Main conductor	Connector	Main conductor	Clamp	Main conductor	Clamp		
1	1000	480	0.0282	0.2894	0.0296	0.2999	3	OK



Figure 4. Short circuit test.

### 5.11. Corrosion test

The test was performed according to EN 50483-6, clause 8.4. The clamp shall be assembled on the covered conductor according to the supplier's instruction. The samples shall be exposed to 500 cycles of 2 h in an environment created by the solution consisting of 0.05 % sodium chloride (NaCl) and 0.35 % ammonium sulphate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>) by mass). After the test, the samples shall be subjected to visual inspection. Some samples were also exposed to saline environment (concentration of NaCl: 5 %) for 6 weeks and were visually examined afterwards.

#### Acceptance Criteria:

Visual inspection shall be carried out and there shall be no significant trace of red rust. Significant rusting would constitute more than 10% of the exposed surface area of the metallic parts.

The markings shall be legible when examined with normal or corrected vision, without magnification.

No deterioration of the clamps occur which would impair the normal function of the clamp.

Tension clamps shall meet the acceptance criteria of the damage and failure load test using 75% of the test load.

#### Results:

The amount of observed red rust in the metallic parts was about 10% in both environments.

The clamp' identification markings were legible when examined with normal vision.

Damage and failure load test was performed on the samples after corrosion test and the clamps withstood the applied load.

#### Conclusion:



The clamp passed the test.

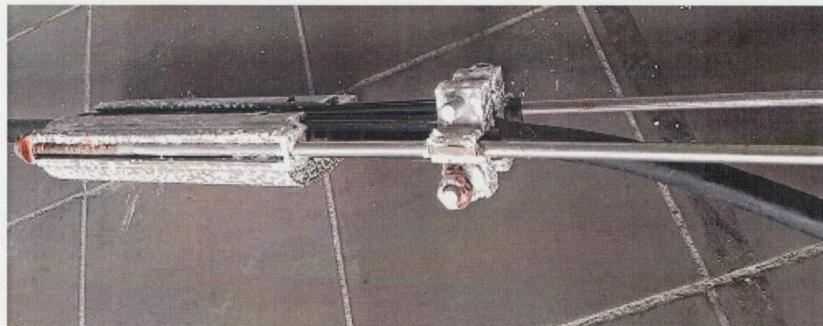


Figure 5. Sample after corrosion test.

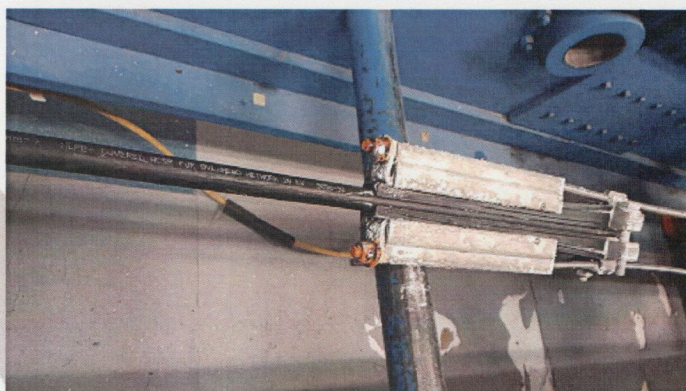


Figure 6. Sample under mechanical test after corrosion test.

### 5.12. Test for permanent marking

The test was performed according to EN 50397-2, clause 7.3. Three clamps shall be tested. The marking shall be rubbed by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

#### Acceptance Criteria:

The marking shall remain clear and allow the accessory to be easily identified.

#### Results:

The marking remained clear and eligible after the test.

#### Conclusion:

The clamp passed the test.



## Appendix

