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L 1029

EGU HV LABORATORY

Accredited testing laboratory No.: 1029
Accredited by Czech Accreditation Institute
according to ČSN EN ISO/IEC 17025:2018

TEST REPORT No.: 11788/V/21

CUSTOMER:	Jiangsu Shemar Electric Co., Ltd. 66 Haiwei Road 226 017 Nantong, Jiangsu China
TEST OBJECT:	138 kV Composite insulator
TYPE SPECIFICATION:	SML 222 kN
TEST STANDARDS:	ANSI C29.12-2020, ANSI C29.11-2020

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TEST REPORT	No.: 11788/V/21
TEST OBJECT:	138 kV Composite insulator
TYPE SPECIFICATION:	SML 222 kN
DRAWING No.:	21SM510756 Rev. A
MANUFACTURER:	Jiangsu Shemar Electric Co., Ltd.
DATE OF DELIVERY:	2021-12-09
DATE OF TESTS:	From 2021-12-16 till 2022-03-15
ORDER No.:	Contract 23/21
TESTS WITNESSED BY:	N/A
ANNEX:	Testpolymer EU, test report 59/2022/EN

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1 TEST SUMMARY

Test title	Test standard	Test result
Tests of interface and connection of fittings	ANSI C29.12, clause 8.1 ANSI C29.11, clause 7.1	Passed
Visual inspection and dimensional check	ANSI C29.11, clause 7.1.1.1	Passed
Sudden load release	ANSI C29.11, clause 7.1.3	Passed
Thermal mechanical test	ANSI C29.11, clause 7.1.4.1	Passed
Water penetration test	ANSI C29.11, clause 7.1.5	Passed
Verification test	ANSI C29.11, clause 7.1.6	Passed
Linearly rising front chopped impulse voltage test	ANSI C29.11, clause 7.1.6.2	Passed
Low-frequency dry flashover test	ANSI C29.11, clause 7.1.6.3	Passed
Core time-load test	ANSI C29.12, clause 8.2 ANSI C29.11, clause 7.2	Passed
Determination of the average failing load of the core	ANSI C29.11, clause 7.2.1.2	Passed
Core time – load test	ANSI C29.11, clause 7.2.1.3	Passed
Tests on the core material	ANSI C29.12, clause 8.4	Passed
Dye penetration test	ANSI C29.12, clause 8.4.1 ANSI C29.11, clause 7.4.1	Passed
Water diffusion test	ANSI C29.12, clause 8.4.2 ANSI C29.11, clause 7.4.2	Passed
Housing tracking and erosion test	ANSI C29.12, clause 8.3 ANSI C29.11, clause 7.3	Passed
Flammability test [3)] (see Testpolymer EU test report 59/2022/EN)	ANSI C29.12, clause 8.5 ANSI C29.11, clause 7.5	Passed

Note:

[3)] The test was done in an external accredited laboratory.

Prototype tests are required to verify the suitability of the prototype design, materials and method of manufacture for a class of composite insulators. A class of insulators is defined by the following characteristics: same shed material, same housing material, same core material, same core diameter, same metal fitting material, same metal fitting connection zone design, same core-metal-housing zone design, same metal fitting method od attachment to core.

Composite insulator 138 kV / 222 kN drawing 21SM510756, Rev. A is class insulator for given design, see ANSI C29.12, clause 8 and Table 1.

Following insulators belong to same class:
161 kV / 222 kN, drawing No. 21SM510757, Rev. A (see Figure 2)
230 kV / 222 kN, drawing No. 21SM510758, Rev. A (see Figure 3)
345 kV / 222 kN, drawing No. 21SM510759, Rev. A (see Figure 4)
500 kV / 222 kN, drawing No. 21SM510760, Rev. A (see Figure 5)

2 TESTS PERFORMED

2.1 Tests on interfaces and connections of end fittings

The test was carried out according to ANSI C29.12, clause 8.1 & ANSI C29.11, clause 7.1.

2.1.1 Visual inspection and dimensional check

Test specimens

Test was carried out according to ANSI C29.11, clause 7.1.1. The test was performed on composite insulator samples No.: 1, 2, 3 and 4 REF.
No. 1, serial No. 2111150033,
No. 2, serial No. 2111150008,
No. 3, serial No. 2111150018.
No. 4 REF, serial No. 2111150013.

The insulators were examined visually and their dimensions were checked against the manufacturer's drawing (see Figure 1).

Testing and measuring equipment

tape measure 5 m, CXS, PM-241
slide gauge 300 mm, Kinex CZ, serial No. 2441/05

Evaluation:

Insulators were without damage and dimensions conform to the drawing.

2.1.2 Sudden load release

Test date: 2022-03-03

Tests were carried out according to ANSI C29.11, clause 7.1.3.

This test was performed on insulators No. 1, 2 and 3 at temperatures of –20 °C to –25 °C. Each of tested insulators was subjected to five sudden load releases from a tensile load of 66,6 kN (30 % of SML, SML=222 kN) and held for minimum 15 seconds.

Testing and measuring equipment

thermal mechanical chamber Horkan Klima, inventory No. 2237
digital thermometer - datalogger, Comet system, serial No. 18931701

2.1.3 Thermal-mechanical pre-stress

Date of test: from 2022-03-03 till 2022-03-11

Tests were carried out according to ANSI C29.11, clause 7.1.4.1.

Three insulators No. 1, 2 and 3 were subjected to a mechanical load of 6,7 kN (5 % of SML, SML=222 kN) for the duration one minute, the reference total length was measured. Measured values are show in Table 1.

Three insulators No. 1, 2 and 3 were subjected to a mechanical load of 111 kN (100 % of RTL). Each insulator was subjected to four 24-hour cycles with one cooling period of -35 °C ± 5 °C, followed by one heating period of +50 °C ± 5 °C.

Records of measured temperatures and mechanical tension during the thermal-mechanical testing are given in Graphs 2, 3, 4 and 5. The test arrangement during the thermal-mechanical test on the insulator is shown in Figure 6.

Testing and measuring equipment:

thermal mechanical chamber LaborTech,type Creep test 6.500.C3, serial No. ZA/2018/51
digital thermometer - datalogger, Comet system, serial No. 18931701
thermal mechanical chamber Horkan Klima, inventory No. 2237
loading measuring system Format 1, type EGU – 1V, serial No. Z201128287
digital thermometer - datalogger, Comet system, serial No. 19270819
tape measure 5 m, CXS, PM-241

Table 1

Insulator No.	**1**	**2**	**3**
Reference length at both places before test (mm)	1415	1418	1417
Reference length at both places after test (mm)	1415	1418	1418

2.1.4 Water penetration test

Test date: from 2022-03-11 till 2022-03-13

Three tested insulators No. 1, 2, 3 were immersed according to ANSI C29.11, clause 7.1.5 for 42 hours in boiling deionized water with 0,1 % by weight of NaCl (see Figure 7).

At the end of boiling, the insulators remained immersed until the water cooled to approx. 50 °C and maintained at this temperature until the verification tests started.

Testing and measuring equipment

Heating water vessel AKV2, inventory No. 2420

2.1.5 Verification tests

Test date: 2022-03-14

Tests were carried out according to ANSI C29.11, clause 7.1.6.

2.1.5.1 Visual examination

Insulators were inspected visually.

Evaluation:

No cracks were observed.

2.1.5.2 Lineary rising front chopped impulse voltage test

Test was carried out according to ANSI C29.11, clause 7.1.6.2.

Atmospheric conditions:

air pressure	99,5 kPa (29,68 inHg)
air temperature	11,5 °C (52,7 °F)
relative humidity	39,2 %

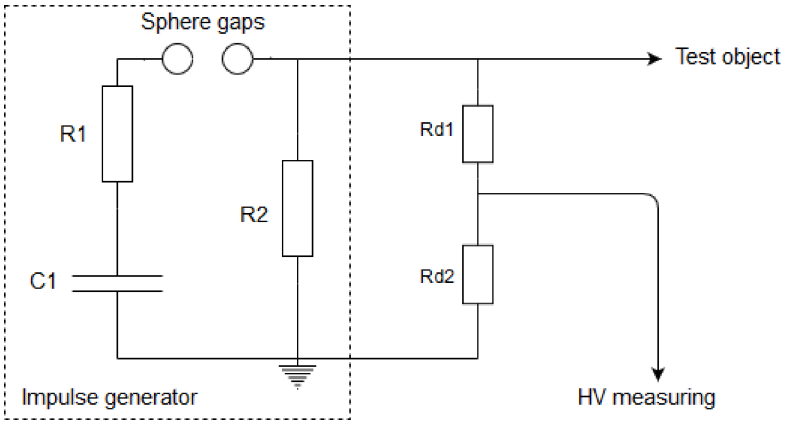
Insulators No. 1, 2, 3 were tested. Insulators were divided by electrode on sections. 25 impulses of both polarities with a steepness of at least 1000 kV/µs were applied on each section:

- the original upper metal fitting and an electrode made of a copper strip 20 mm wide and less than 1 mm thick (upper section),
- electrode made of a copper strip 20 mm wide and less than 1 mm thick (middle section),
- electrode made of a copper strip 20 mm wide and less than 1 mm thick and an original bottom metal fitting (bottom section).

The test arrangement and the flashover on the insulator are shown in Figure 8.

The wave shape of the test impulse is given in Graph 1.

Testing and measuring equipment



impulse generator TuR Dresden 750 kV, 30 kJ
R_{d1}/R_{d2} - resistive divider Haefely, 800 kV, serial No. 554333
measuring system Haefely Trench, type HiAS 743, serial No. 175247
measuring system for atmospheric conditions Comet, serial No. 10910247
tape measure 5 m, CSX, PM-241

Evaluation:

No punctures of the sheds or the core occured.

2.1.5.3 Low-frequency dry flashover voltage test

Atmospheric conditions:

air pressure	99,6 kPa (27,41 inHg)
air temperature	15,9 °C (60,6 °F)
relative humidity	25,9 %

Testing and measuring equipment

Resonant AC source Evergreen, MSR600-1200, serial No. 2001042-EGU
Capacitive divider Evergreen, HCC600-2, serial No. 200104-EGU
universal voltmeter Haefely DMI 551, serial No. 188856
digital stop-watch Fastime, PM-251
measuring system for atmospheric conditions COMET, serial No. 10910247
digital thermometer Fluke 52II, serial No. 3910029WS + probe 80PK-27
tape measure 7,5 m, Assist, PM-242

This test consisted of the following two tests:

a) Dry power frequency flashover test

Samples No. 1, 2, 3 and 4 REF (as a reference sample) were tested, see Figure 4. The average of five flashover voltages on each insulator was corrected to normal standard atmospheric conditions in accordance with ANSI C29.11, clause 8.2.1.5. The flashover voltage was obtained by increasing the voltage linearly from zero within one minute.

The test arrangement and the flashover of the insulator are shown in Figure 9.

The value of reference flashover voltage was obtained from insulator 4 REF.

The average value of the flashover voltages of insulators No. 1, 2, 3 shall be greater than or equal to 90 % of flashover voltage of the reference insulator 4 REF. Table 2 and 3 display the results of these measurements.

Table 2

Insulator No.	**Uncorrected flashover values (kV)**					**Uncorrected flashover average (kV)**	**Correction factors**	**Corrected reference flashover voltage (kV)**
4 REF	450	458	458	457	453	455	$K_d = 1{,}014$ $K_h = 1{,}148$	515
90 % of corrected reference flashover voltage = 464 kV								
80 % of uncorrected reference flashover voltage = 364 kV								

Table 3

Insulator No.	Uncorrected flashovers values (kV)					Uncorrected flashover average (kV)	Correction factors	Corrected flashover average (kV)
1	450	456	454	457	453	454	$K_d = 1{,}014$ $K_h = 1{,}148$	514
2	450	454	451	452	457	453	$K_d = 1{,}014$ $K_h = 1{,}148$	513
3	456	455	457	456	455	456	$K_d = 1{,}014$ $K_h = 1{,}148$	516

All measured voltages are corrected for the standard reference atmosphere according to ANSI C29.11, clause 8.2.1.5.

K_h humidity correction factor,
K_d air density correction factor.

Evaluation:

Average corrected flashover voltage values of insulators No. 1, 2, 3 exceed 90 % of the reference flashover voltage.

b) Dry power frequency withstand test

Each of tested insulators No. 1, 2, 3 and 4 REF were individually subjected for 30 minutes to 80 % of the average reference flashover voltage. The requirement is that during this test no puncture of the insulator shall occur. The temperature rise ΔT of the shank measured immediately after the test at five locations distributed approximately evenly along the length of the insulator shall be not more than 20 °C above ambient. The results are shown in Table 4.

Table 4

Insulator No.	Corrected test voltage (kV)	Result	ΔT (K)	Result
1	364	no puncture	< 10	passed
2	364	no puncture	< 10	passed
3	364	no puncture	< 10	passed
4 REF	364	no puncture	< 10	passed

Evaluation:

No puncture was occured and the temperature rise of the insulator shank was not more than 20 °C above the ambient temperature.

Statemens of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the the test according to requirements given in ANSI C29.12, clause 8.1 & ANSI C29.11, clause 7.1.

2.2 Core time-load test

2.2.1 Test specimens

Test was carried out according to ANSI C29.12, clause 8.2 & ANSI C29.11, clause 7.2. The six insulators were examined visually. The tests were performed on composite tension insulators samples No. 1, 2, 3, 4, 5 and 6.

No. 1, serial No. 2111150015,
No. 2, serial No. 2111150022,
No. 3, serial No. 2111150012.
No. 4, serial No. 2111150025,
No. 5, serial No. 2111150035,
No. 6, serial No. 2111150036.

Testing and measuring equipment:
slide gauge 300 mm, Kinex CZ, serial No. 2441/05
tape measure 5 m, CXS, PM-241

Evaluation:

Insulators were without damage and dimensions conform to the drawing.

2.2.2 Determination of the average failing load of the core

Test date: from 2022-03-03

Test was carried out according to ANSI C29.11, clause 7.2.1.2. Three insulators No. 1, 2 and 3 were subjected to tensile load applied between couplings. The tensile load was increased rapidly but smoothly from zero to approximately 167 kN (75 % SML) and then gradually increased in a time between 30 s to 90 s until breakage of the core or complete pull-out occurs (see Figure 10, 11 and 12). The average value of the three failing loads was calculated.

Records of measured mechanical loading during the mechanical failing test are given in Graphs 6, 7 and 8.

The samples after mechanical failing load test are shown in Figure 10, 11, 12 and 13.

Testing and measuring equipment

Hydraulic loading machine LabTest 5.600SP1, serial No. 15/12

Test results

The results are shown in Table 5.

Table 5

Test sample No.	Type of failure	Composite insulator failing load (kN)
1	Pull out of the core from the end fitting	296,9
2	Pull out of the core from the end fitting	309,8
3	Pull out of the core from the end fitting	263,0
	Average value of the failing load	289,9
	60 % of average value of failing load	173,9

2.2.3 Verification of the 96 hours withstand load

Test date: from 2022-03-11 till 2022-03-15

Test was carried out according to ANSI C29.11, clause 7.2.1.3. Three insulators No. 4, 5 and 6 were subjected to a tensile load applied between couplings. The tensile load was increased rapidly but smoothly, from zero up to 173,9 kN (60 % of average failing load) and then maintained at this value for 96 hours.

Record of mechanical loading applied during mechanical 96 hours tests is given in Graph 9.

Test samples during the mechanical 96 hours load test are shown in Figure 14.

Testing and measuring equipment

Hydraulic loading machine LabTest 5.600SP1, serial No. 15/12

Evaluation:

No failure (breakage or complete pull-out of the core or fracture of the metal fittings) occurred during 96 h test on insulators No. 4, 5 and 6.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 8.2 & ANSI C29.11, clause 7.2.

2.3 Tests on the core material

2.3.1 Dye penetration test

Test date: 2022-01-03

The test was carried out according ANSI C29.12, clause 8.4.1 & ANSI C29.11, clause 7.4.1.

Test specimens

Ten test samples of core rod diameter Ø24 mm, 10 mm in length were prepared and delivered by customer.

Test procedure

Test specimens were placed (with fibres in vertical position) on a layer of glass balls (diameter 2 mm) in a glass vessel. A dye (1 % methyl alcohol solution of Astrazon BR 200) was poured into the vessel, with its level 2,5 mm above the glass balls, see Figure 15. The time taken for the dye to rise (by capillary action) through the specimens was measured.

Testing and measuring equipment:
digital stop-watch Olympia PM-172
slide gauge 150 mm, Kinex CZ, serial No. KN2038

Evaluation:

There were no traces of dye penetration through the insulator core recorded during 15 minutes.

Statement of conformity:

Core rod diameter Ø24 mm, passed the test according to requirements given in ANSI C29.12, clause 8.4.1 & ANSI C29.11, clause 7.4.1.

2.3.2 Water diffusion test

Test date: from 2022-01-03 till 2022-01-07.

The test was carried out according to ANSI C29.12, clause 8.4.2 and ANSI C29.11, clause 7.4.2.

Test specimens

Six test samples of core rod diameter Ø24 mm, 30 mm in length were prepared and delivered by customer.

Pre-stressing

The surfaces of the specimens were cleaned with isopropyl-alcohol and filter-paper immediately before the boiling. The specimens were boiled in a glass container for 100 hours in deionised water with 0,1 % by weight of NaCl.

After boiling, the specimens were removed from the glass container and placed in another glass container filled with tap water at ambient temperature for 15 minutes. The voltage test described in the following clause was carried out within the next three hours.

Voltage test

Immediately before the voltage test the specimens were removed from the glass container and their surfaces dried with filter paper.

Each specimen was placed between the test electrodes. The test voltage was increased at rate of approximately 1 kV/sec up to 12 kV, kept at this level for one minute and then decreased to zero, see Figures 16 and 17.

Testing and measuring equipment

voltage source HVI 30 kV, type HPA-305FC1, serial No. 006 + Analog panel meters model 553
slide gauge 150 mm, Kinex CZ, serial No. KN2038
Multimeter UT60E, serial No. 110055936 + shunt PM-160
Digital stop-watch Fastime, PM-251
Measuring cylinder, type 1000 ml, i.n. 2/044/11
Heating water vessel, type LTHS 4000, serial No. 18102
Weight Sartorius, type S210P, serial No. 39010002

Table 6 The results of the leakage current measurements

Specimen No.	Test voltage (kV)	Leakage current (µA)	Test duration (sec)	Result
1	12,0	30,2	60	passed
2	12,0	31,1	60	passed
3	12,0	30,4	60	passed
4	12,0	30,3	60	passed
5	12,0	30,0	60	passed
6	12,0	30,5	60	passed

Evaluation:

No puncture or external flashover occured. The leakage current did not exceed maximum allowable current of 1 mA (r.m.s.).

Statement of conformity:

Core rod diameter Ø24 mm, passed the test according to requirements given in ANSI C29.12, clause 8.4.2 & ANSI C29.11, clause 7.4.2.

2.4 Tests on shed and housing material

Specification of silicone rubber

Manufacturer: Jiangsu Shemar Electric Co., Ltd.

Address: No. 66, Haiwei Road, Sutong Science and Technology Industrial Park, Nantong City, Jiangsu 226017, China

Type: HTV silicone rubber

Color: Light gray

Butch number: N/A

The silicone rubber specification was provided by the customer.

2.4.1 Test procedure

Test was carried out according to ANSI C29.12, clause 8.3 and ANSI C29.11, clause 7.3.

Test specimens

Two samples of a composite insulator 138 kV with reduced length, were subjected to a salt fog test in accordance with ANSI C29.11, clause 7.3.1. The test was performed on the insulator in horizontal position (Sample No. 2) and vertical position (Sample No. 1).

Table 7

Composite insulator	Type	138 kV
	Manufacturer	Jiangsu Shemar Electric Co., Ltd
	Measured creepage distance	631 mm
	Measured arcing distance	276 mm
	Diameter of the shank	35 mm
	Test sample No.1	Serial No. 211115009
	Test sample No.2	Serial No. 211115021

Table 8

Test voltage:	18,2 kV (measured creepage distance 631 mm divided by 34,6)
Beginning of the test:	2021-12-16
End of the test:	2022-01-27
Starting salinity:	8 ± 0,4 kg/m^3
Finishing salinity:	8 ± 0,4 kg/m^3
Intensity of the precipitation of the salt fog test:	between 1,5 and 2,0 ml/h
Test duration:	1015,5 hours
Temperature:	20 °C ±5 K
The average collect of precipitation	1,84 ml/h
The ambient temperature	20 °C ±5 K

Test chamber

The test chamber was prepared according to ANSI C29.11, clause 7.3.2.

Test was performed in a moisture-sealed corrosion-proof chamber not exceeding 15 m^3 (530 ft^3). The two sprayer of constant spraying capacity were mounted close to the bottom of the test chamber and spray upwards towards to the roof of the test chamber. A solution of NaCl and de-ionized water was supplied to the sprayer.

Sample mounting

Test specimens were cleaned with de-ionized water before starting the test. One test specimen was tested mounted horizontally and the second test specimen was mounted vertically. There was a clearance of at least 200 mm between the roof of the chamber and a test specimen a clearance of at least 100 mm between the side walls of the chamber and a test specimen and at least 400 mm between parallel test specimens.

Fog calibration

The fog calibration was done according to ANSI C29.11, clause 7.3.2.2.
Before commencing the test two collecting receptacles with a collection area of 7085 mm^2 and a height of 100 mm were placed close to the position of the ends of the test objects. They collected between 1,5 ml and 2,0 ml of precipitation per hour (corrected to 8000 mm^2 collecting area) averaged over a minimum period of 16 hours. The flow rate was checked at least every 100 hours. Interruption times are not to be counted as test time.

Test voltage

The test voltage was adjusted according to ANSI C29.11, clause 7.3.3.3.1.
The test circuit when loaded with a continuous resistive current of 250 mA (r.m.s.) during 1 sec on the high voltage side shall experience a maximum voltage drop of 5 %.
The protection level of the tripping device was set at 1 A (r.m.s.).

Test conditions

The test conditions were adjusted according to ANSI C29.11, clause 7.3.3 Duration of the test: 1015,5 h. Weekly interruptions of the test for inspection purposes did not exceed 1 h. Numbers of flashovers and trip outs, when occurred, were recorded.

Temperature

The ambiente temperature within the chamber was 20 °C ±5 K.

Testing and measuring equipment

Test transformer Třebíč,, serial No. 6022
Voltage divider ABB, type TDC7, 35/0,1 kV, serial No. VLT52111022698
Measuring system Dewe-rack + USB converter 6341, serial No. 52150637/1890C82
Conductivity meter, WTW Cond 3310, serial No. 10410891
Measuring system for atmospheric conditions COMET, serial No. 16910046
Measuring cylinder 250 ml, PM-256
Stop watch Olympia, PM-172
Tape measure, CXS 5 m, PM-241
slide gauge 150 mm, Kinex, serial No. KN2038
measuring system for atmospheric conditions Comet, serial No. 16910046

2.4.2 Test results

Table 9

Sample No.	Position	Number of flashovers	Visual examination
2	horizontal	0	no erosion occurred, no tracking occurred no puncture of shed, housing or interface occurred
1	vertical	0	no erosion occurred, no tracking occurred no puncture of shed, housing or interface occurred

The pictures of test samples before starting and after end of the test are given in Figure 18, 19, 20, 21 and 22.

Table 10 Test dates of collected precipitation

Date of inspection	Time of period (h)	Average collect (ml/h)	Interrupt time for checked of precipitation rate (min)
16.12	Start		
20.12.	96	1,85	15
23.12.	72,75	1,82	15
27.12.	97,75	1,89	15
31.12.	92,75	1,83	15
3.1.	73,75	1,88	15
7.1.	95,75	1,85	15
10.1.	71	1,91	15
14.1.	95	1,84	15
17.1.	73,25	1,81	15
21.1.	98,5	1,83	15
24.1.	67,75	1,79	15
27.1.	79	1,79	End of the tst

Evaluation:

No erosion, no tracking and puncture of shed, housing or interface occured on horizontal and vertical composite insulator.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 8.3 & ANSI C29.11, clause 7.3.

2.5 Flammability test [3)]

The test was performed according to ANSI C29.12, clause 8.5 & ANSI C29.11, clause 7.5.

The test was performed by accredited test Testpolymer EU as per report No. 59/2022/EN.

The silicone rubber samples of required dimensions were provided by the customer.

Evaluation:

The silicone material HTV, passed specification V0 and HB.

Statement of conformity:

Test specimens of HTV silicone rubber passed the test according to requirements given in ANSI C29.12, clause 8.5 & ANSI C29.11, clause 7.5.

3 UNCERTAINTY OF MEASUREMENTS

QUANTITY	UNCERTAINTY (k=2)	
Steep front impulse voltage	U_m T_1	2,2 % 6,5 %
Power-frequency voltage	1,2 %	
Power-frequency voltage (water diffusion test)	0,3 kV	
Power-frequency voltage (salt fog)	1,0 %	
Mechanical load (CreepTest)	1,0 %	
Mechanical load (LabTest)	1,0 %	
Mechanical load (Horkan Klima)	1,3 %	
Temperature (thermal-mechanical chamber)	3,0 %	
Temperature (Fluke)	7,5 %	
Length (2-150 mm)	0,4 %	
Length (2-300 mm)	0,5 %	
Length (10-5 000 mm)	1,6 %	
Length (10-7 500 mm)	1,6 %	
Temperature	4,0 %	
Air pressure	0,5 %	
Relative humidity	6,3 %	
Time	0,7 %	
Body of water (20 – 250 ml)	1,0 ml	
Body of water (200 – 1000 ml)	10,0 ml	
Weight	0,9 %	
Conductivity (0,1 µS/cm – 1000 mS/cm)	5,0 %	
Power-frequency leakage current (water diffusion test)	1,3 %	

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a Normal (Gaussian) distribution corresponds to a coverage probability of approximately 95 %. Details related to the statement of conformity when applied are given in a price quotation submitted to a customer before the testing and on the website of the laboratory.

4 PRODUCT DRAWINGS

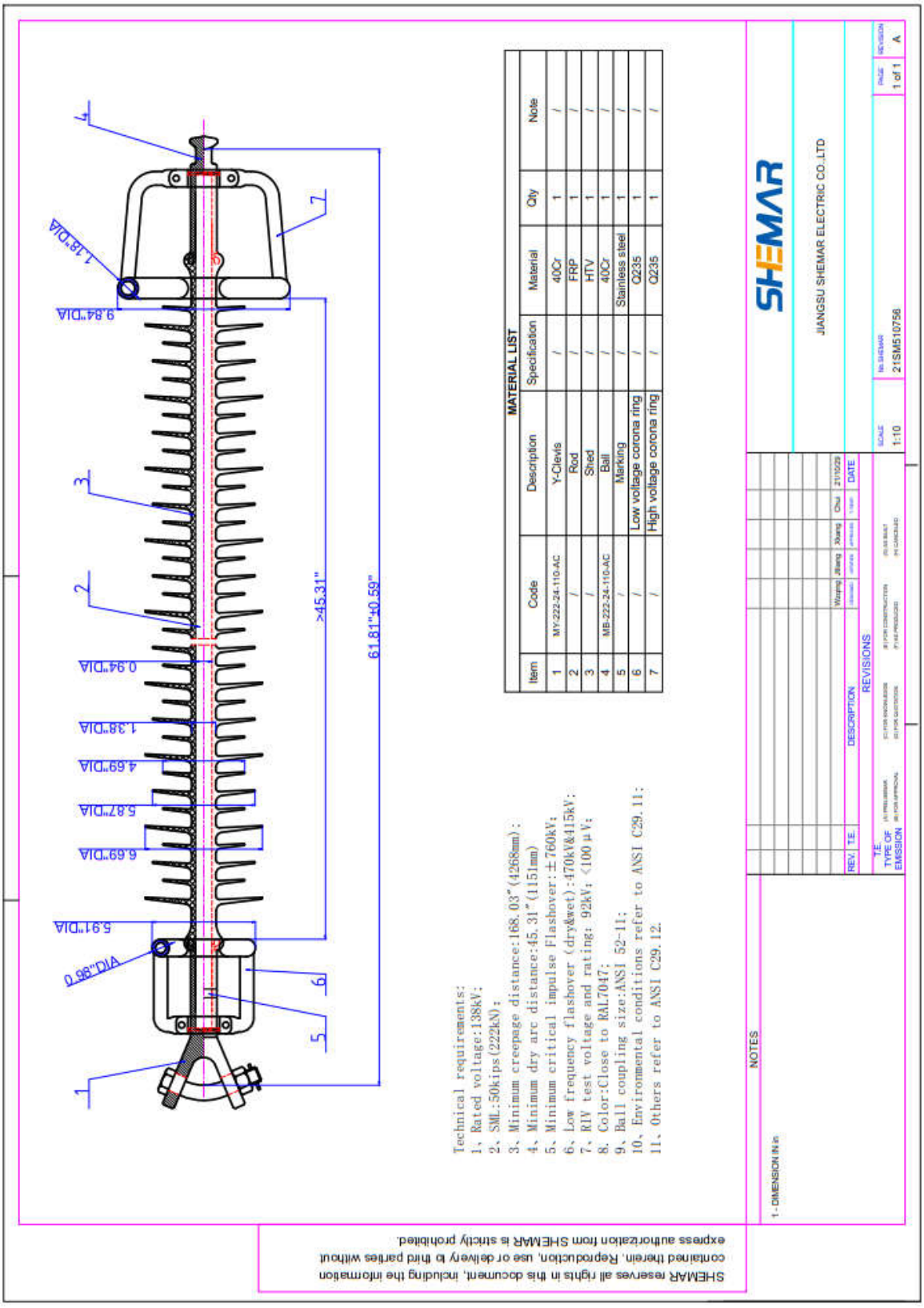


Figure 1
138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A

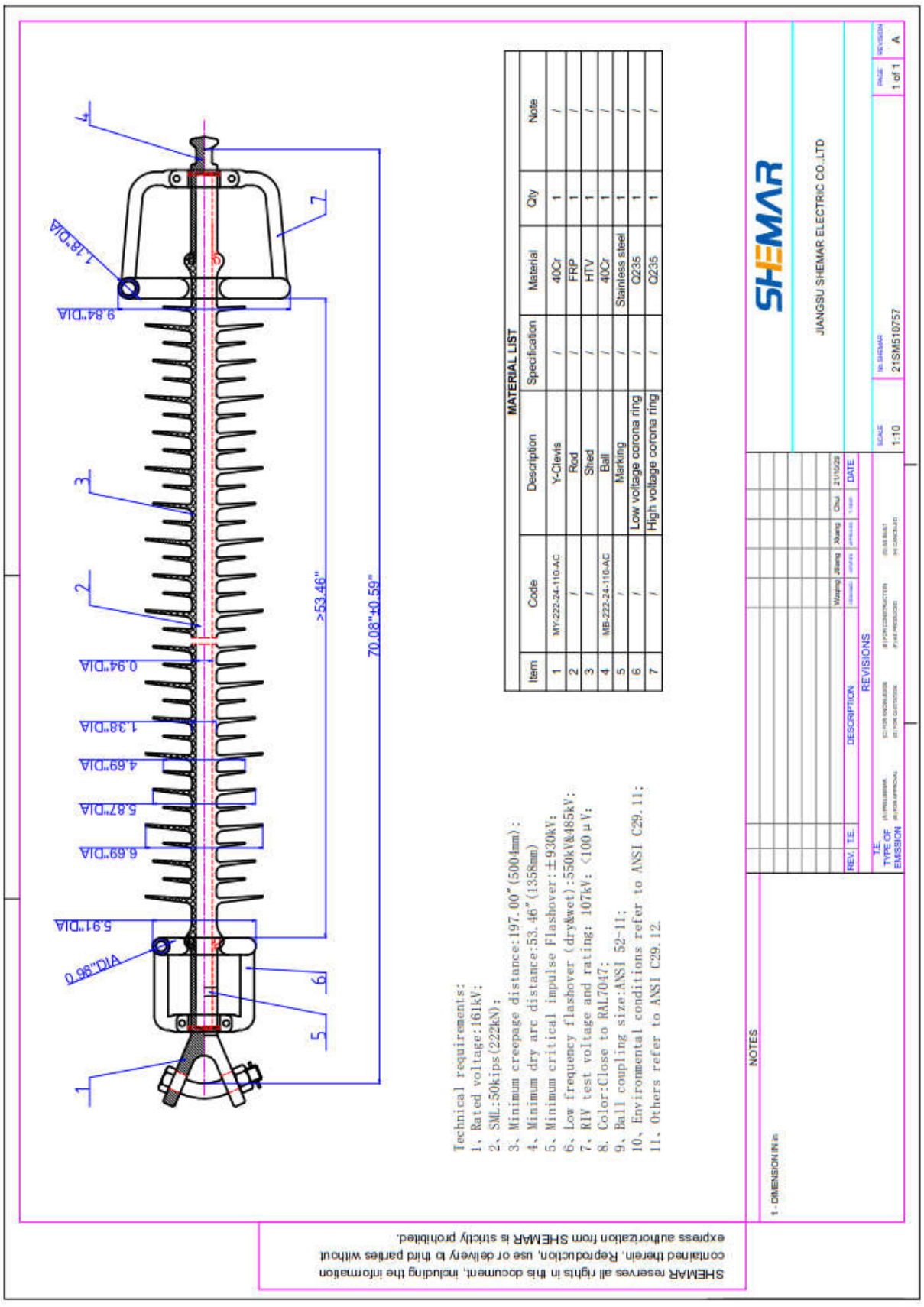


Figure 2
161 kV Composite insulator, SML 222 kN, drawing No. 21SM510757 Rev. A

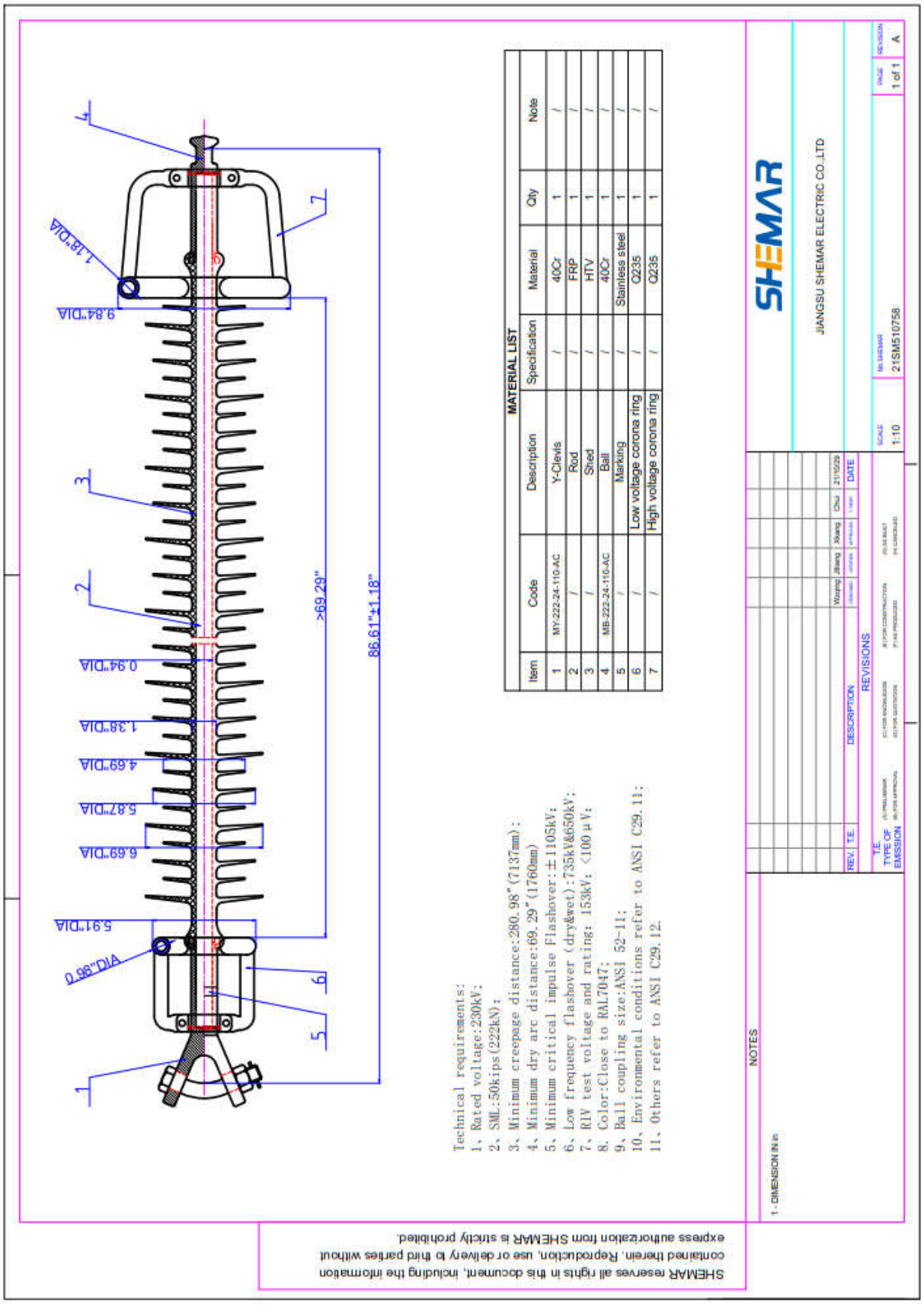


Figure 3
230 kV Composite insulator, SML 222 kN, drawing No. 21SM510758 Rev. A

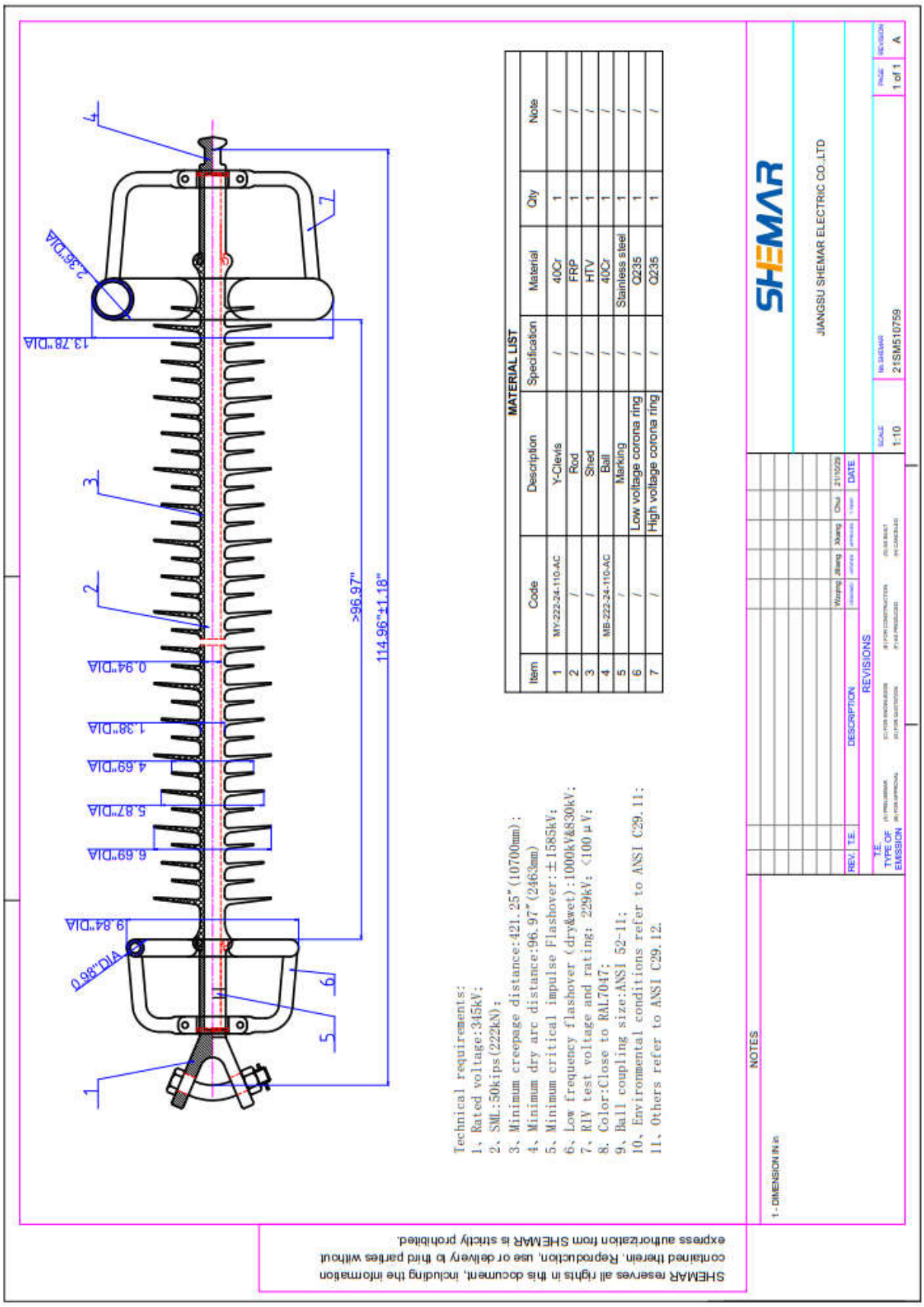


Figure 4
345 kV Composite insulator, SML 222 kN, drawing No. 21SM510759 Rev. A

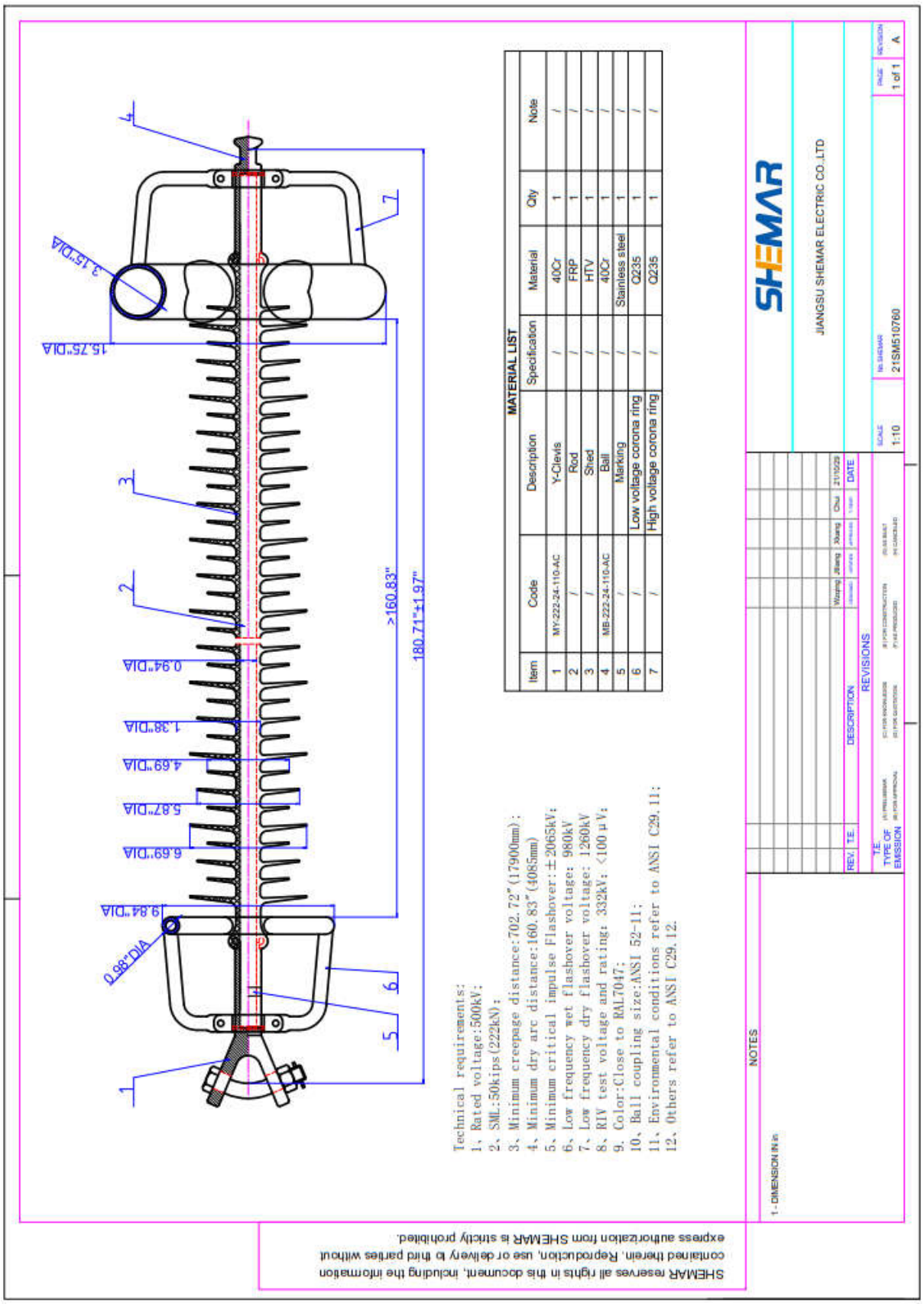
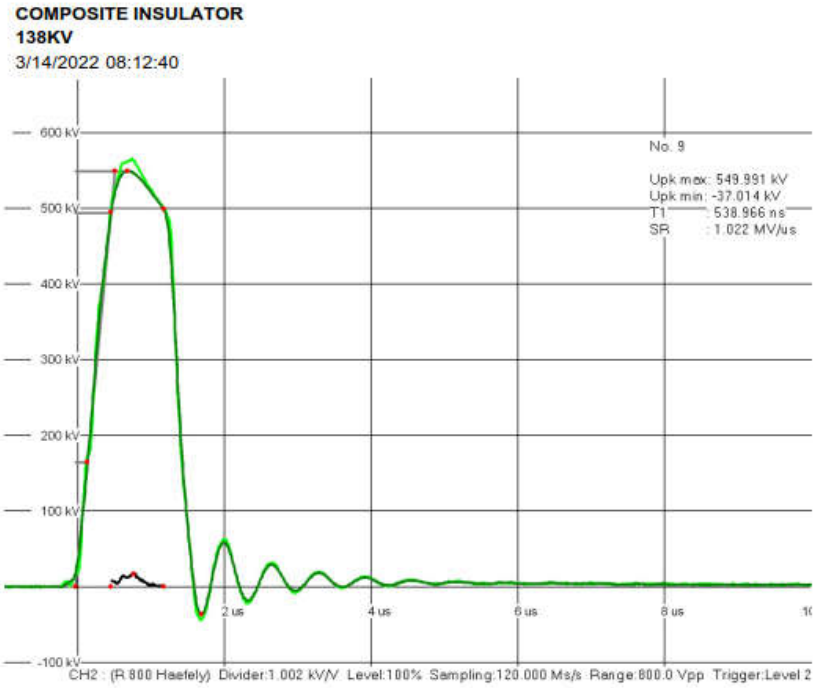
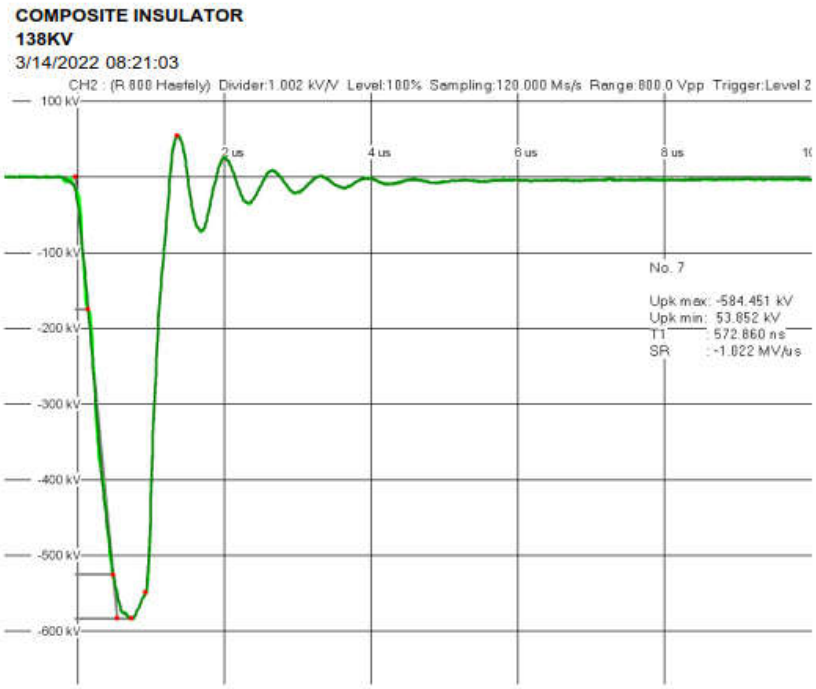


Figure 5
500 kV Composite insulator, SML 222 kN, drawing No. 21SM510760 Rev. A

5 GRAPHS AND RECORDS

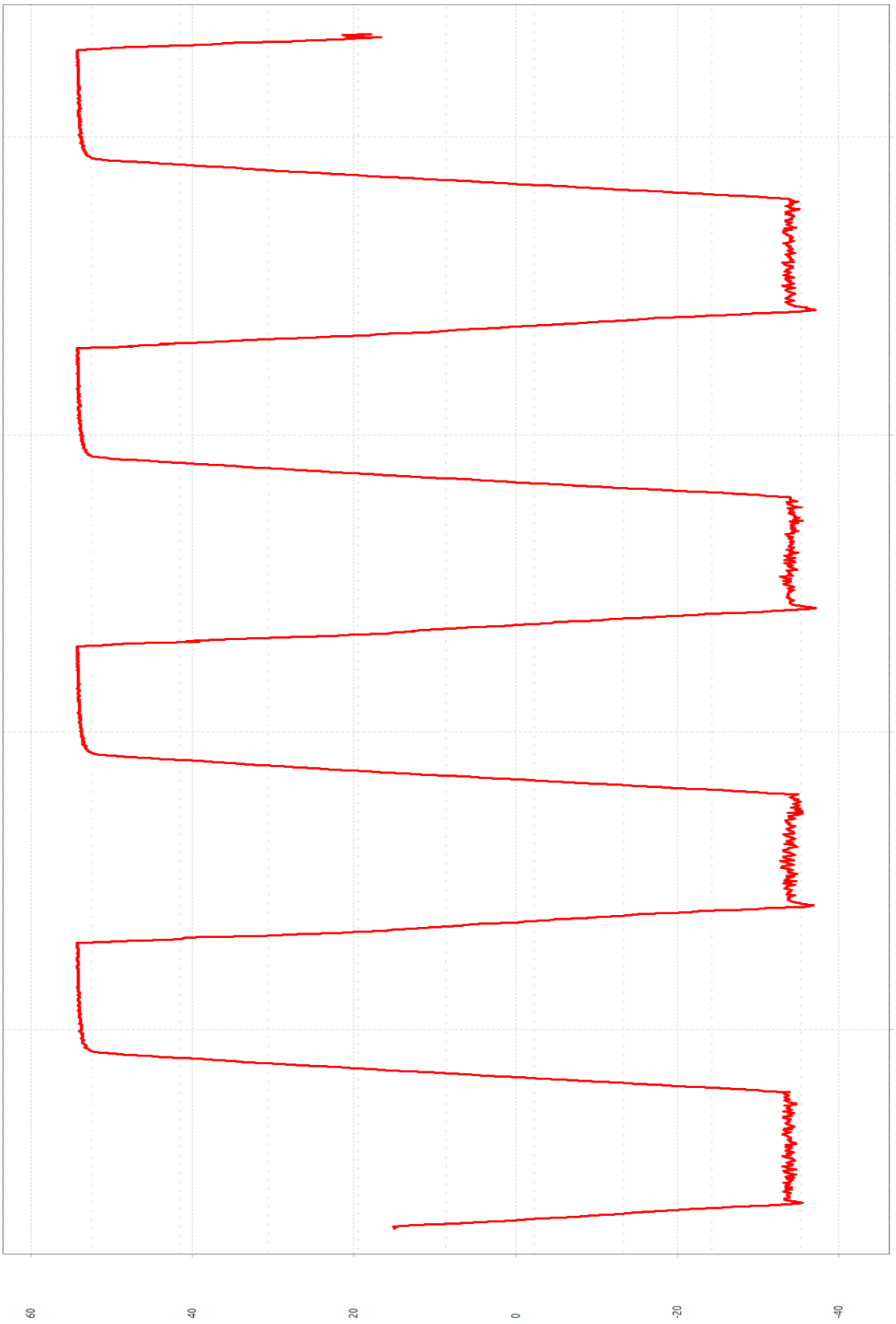


No. 9
Upk max: 549.991 kV
Upk min: -37.014 kV
T1 : 538.966 ns
SR : 1.022 MV/us

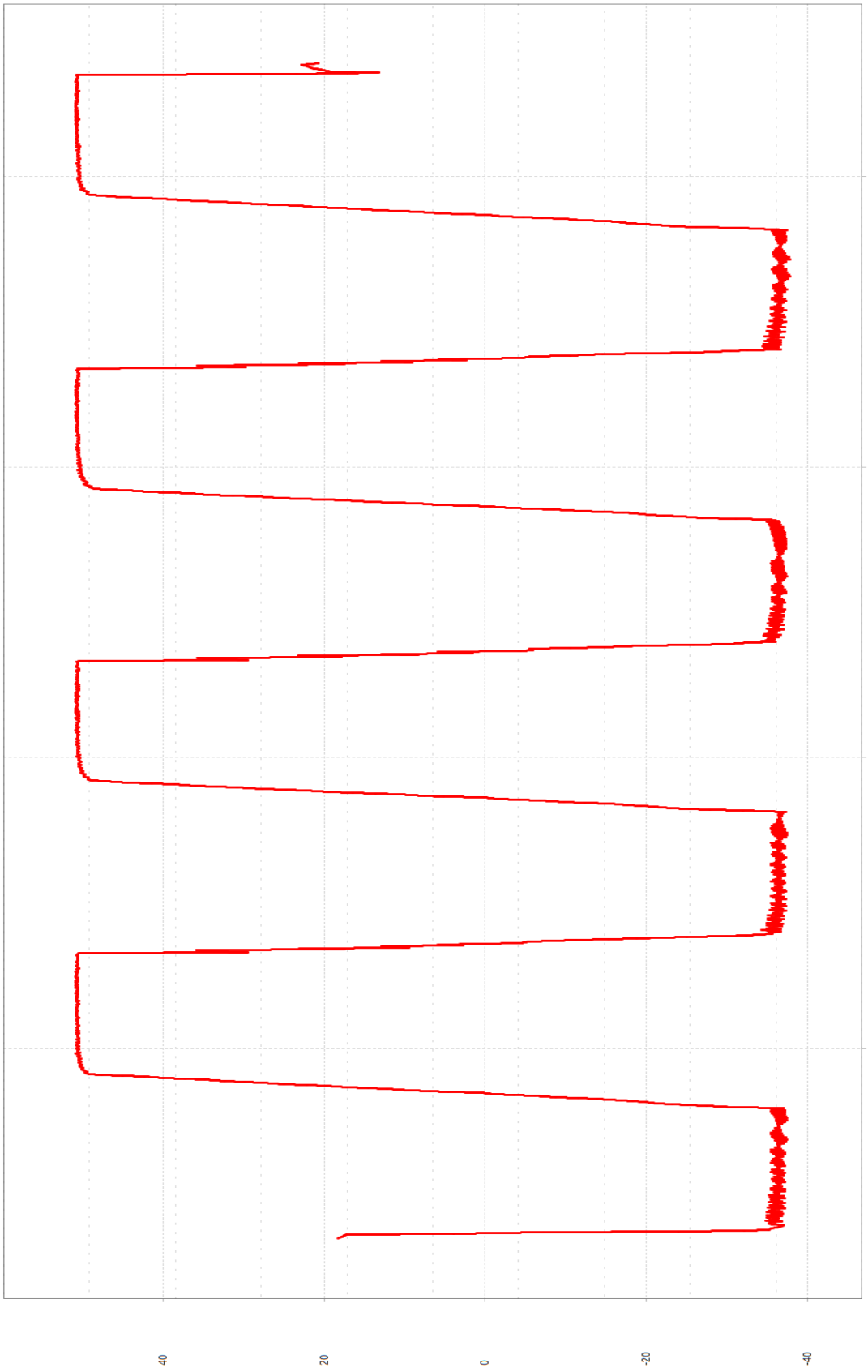


No. 7
Upk max: -584.451 kV
Upk min: 53.852 kV
T1 : 572.860 ns
SR : -1.022 MV/us

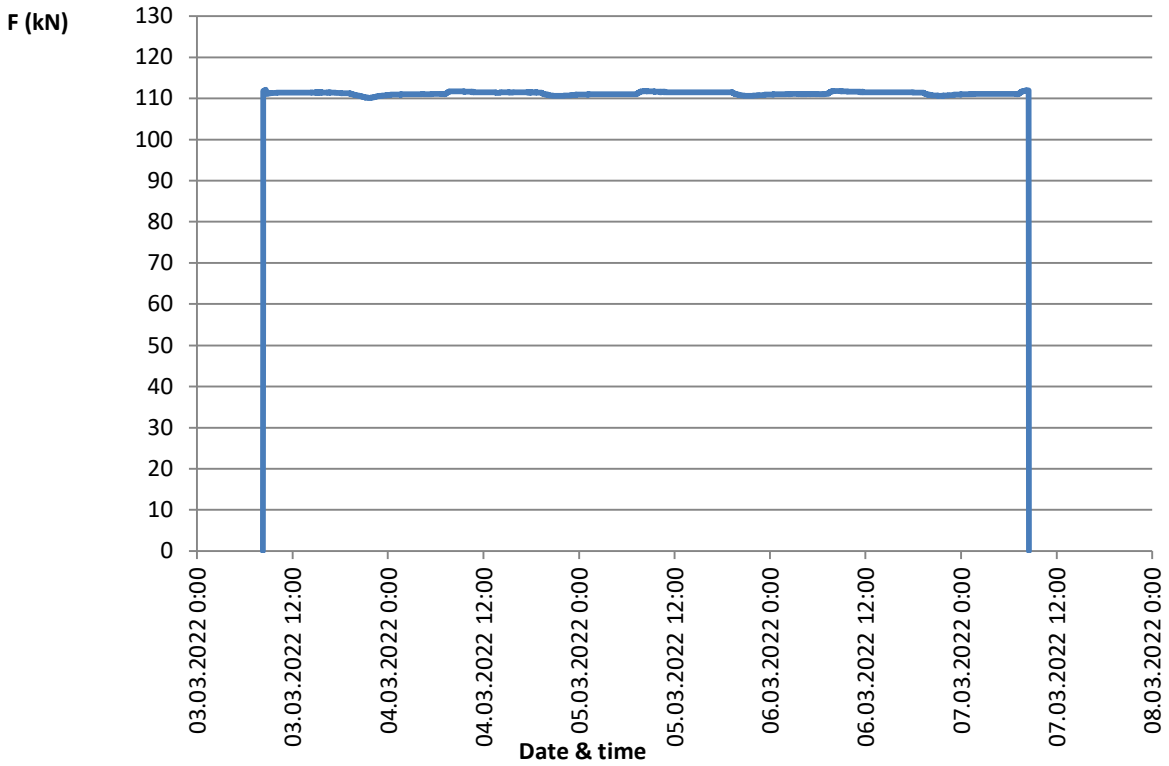
Graph 1
Representative wave shape of steep front impulse



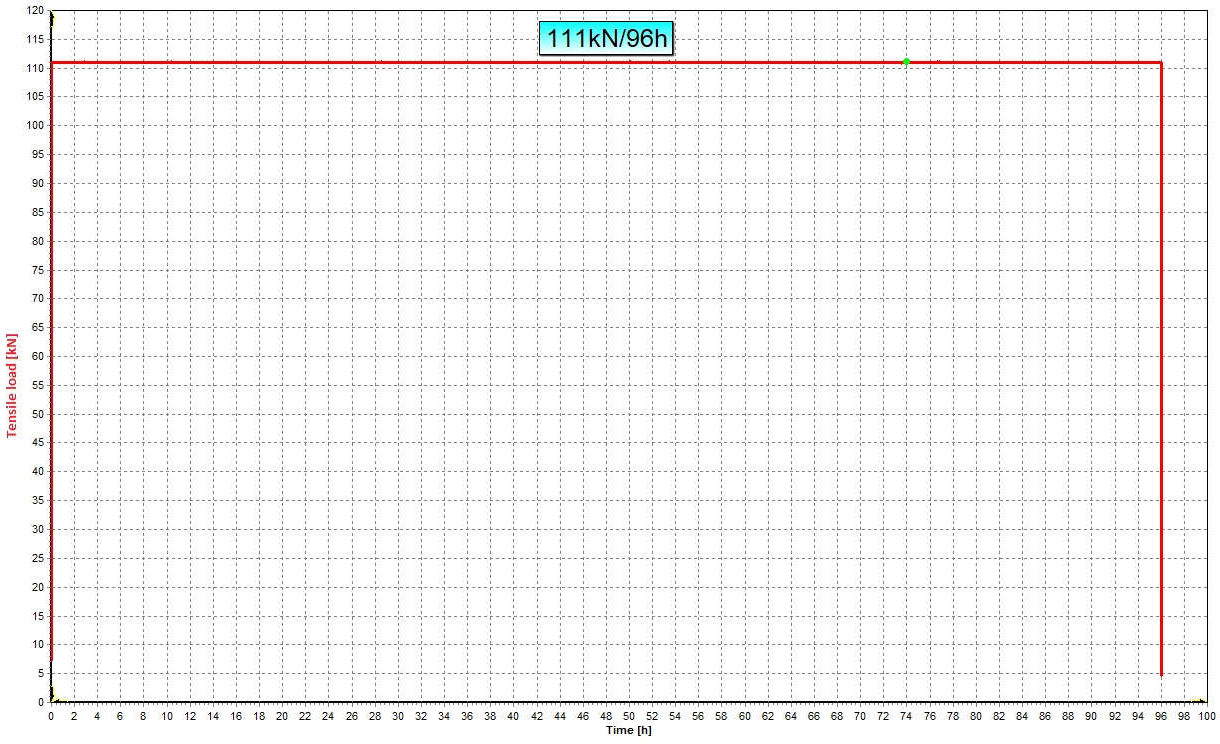
Graph 2
Record of temperature during thermal-mechanical cycles, test sample No. 1



Graph 3
Record of temperature during thermal-mechanical cycles, test samples No. 2 and 3

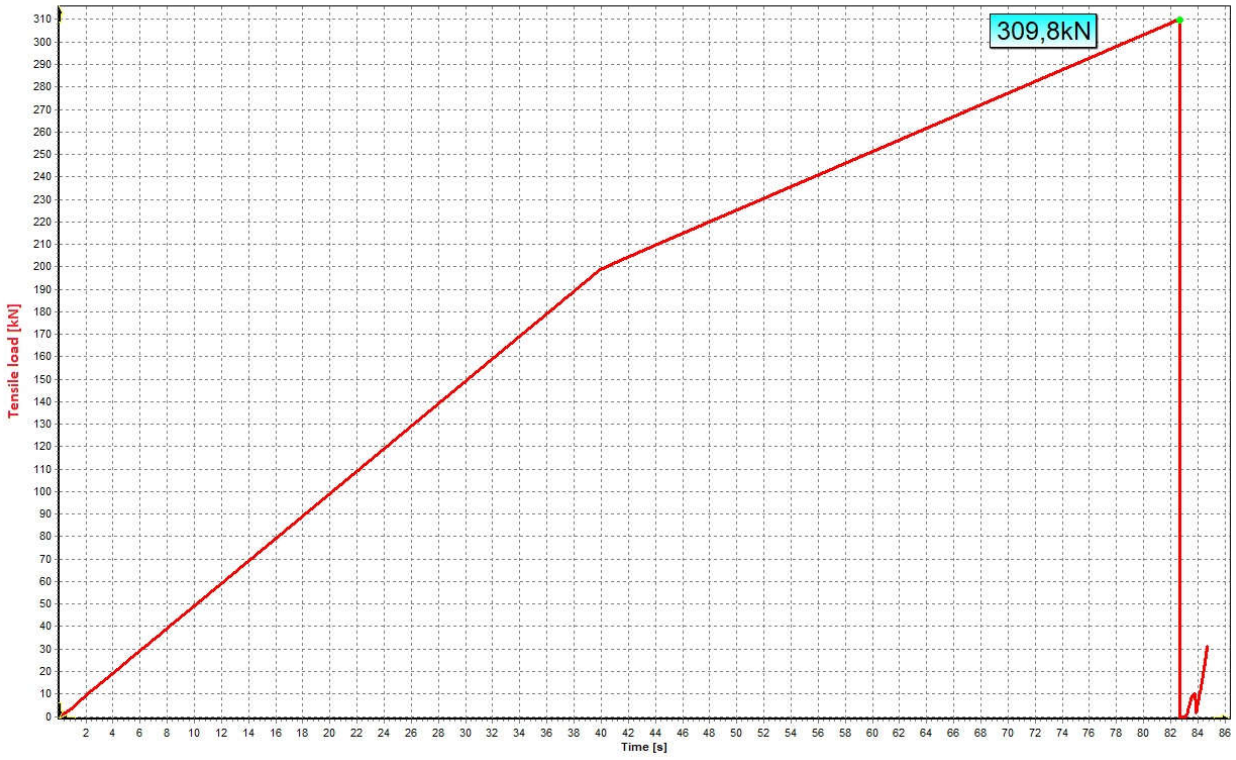


Graph 4
Record of tensile laod during thermal-mechanical cycles, test sample No. 1



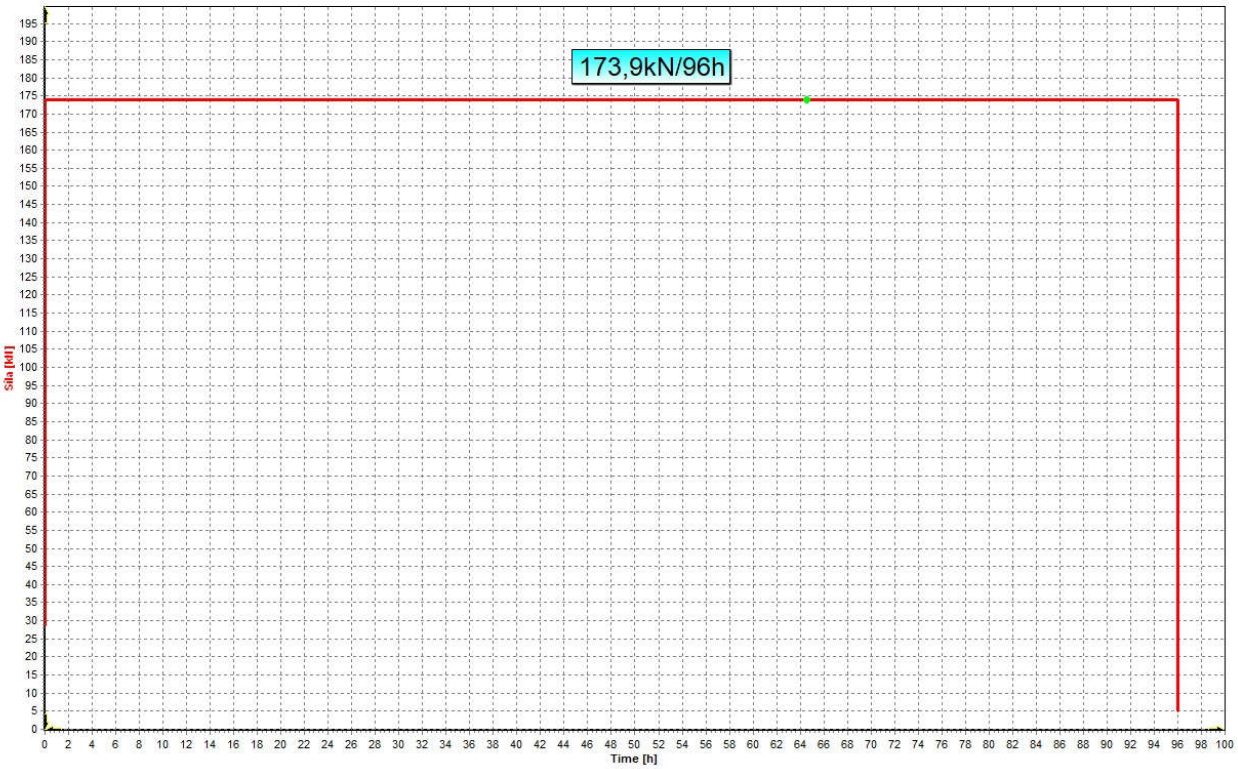
Graph 5
Record of tensile laod during thermal-mechanical cycles, test samples No. 2 and 3

Graph 6
Record of mechanical loading test, sample No. 1



Graph 7
Record of mechanical loading test, sample No. 2

Graph 8
Record of mechanical loading test, sample No. 3



Graph 9
Record of 96 hours mechanical loading test, samples No. 4, 5 and 6

6 TEST OBJECT AND TEST SETUP PHOTOS

Figure 6
Test samples No. 1, 2 and 3, during thermal – mechanical test

Figure 7
Test samples No. 1, 2 and 3, before watter watter penetration test

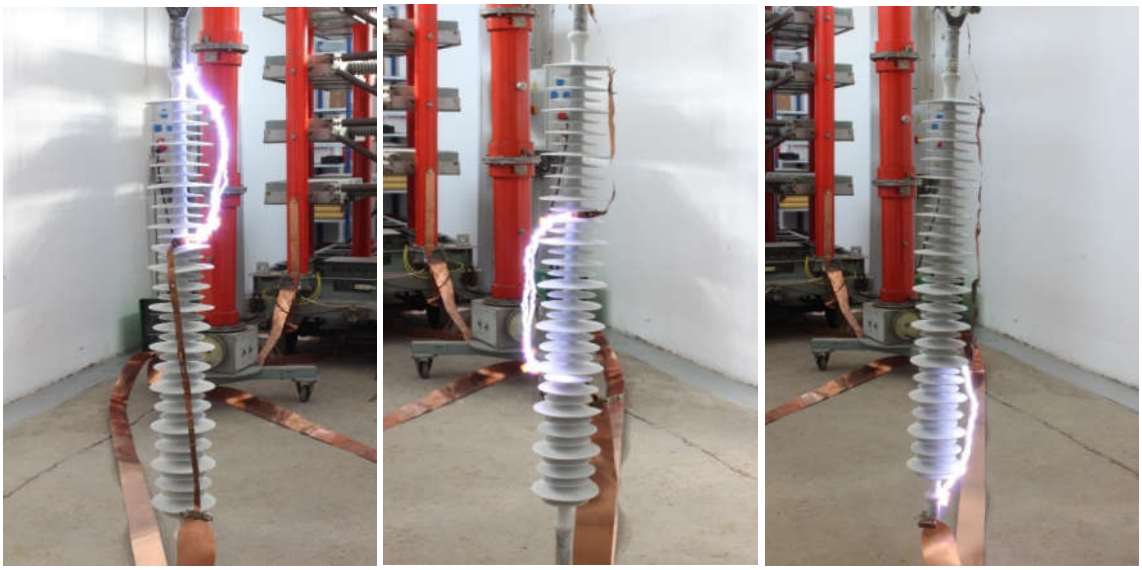


Figure 8
Test sample, during the lineary rising front chopped impulse voltage test

Figure 9
Test sample, during the low-frequency dry flashover voltage test

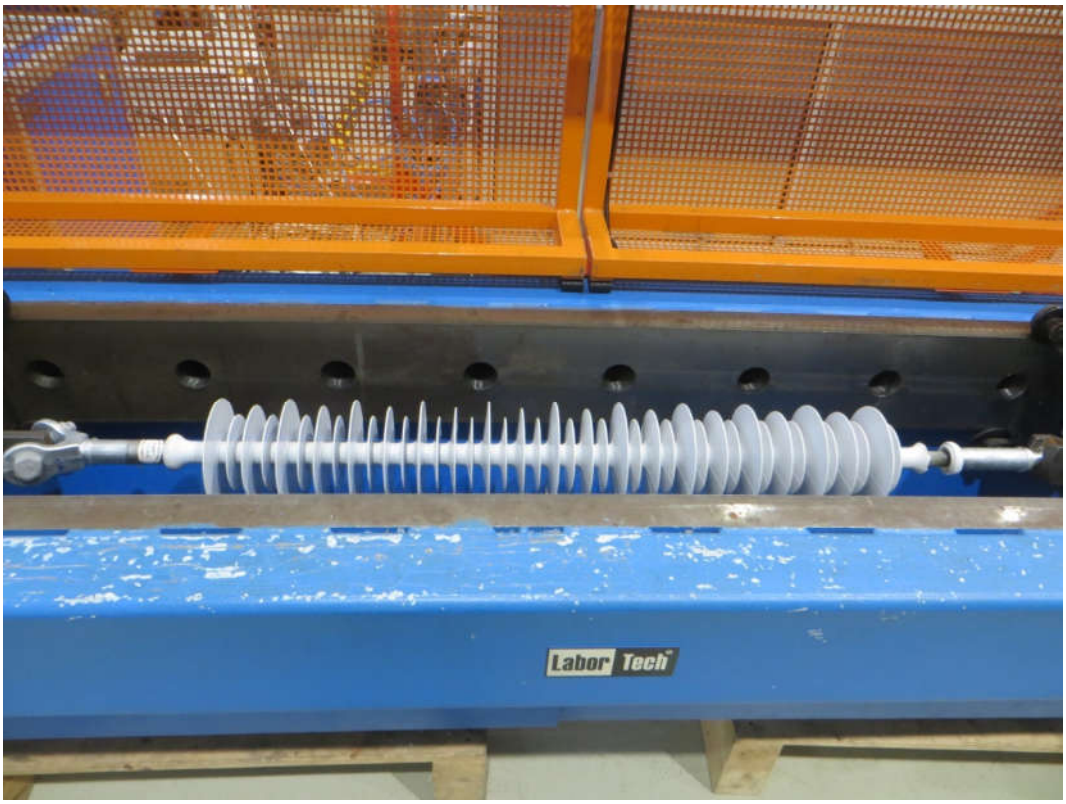


Figure 10
Test sample No. 1, after the mechanical failing load test

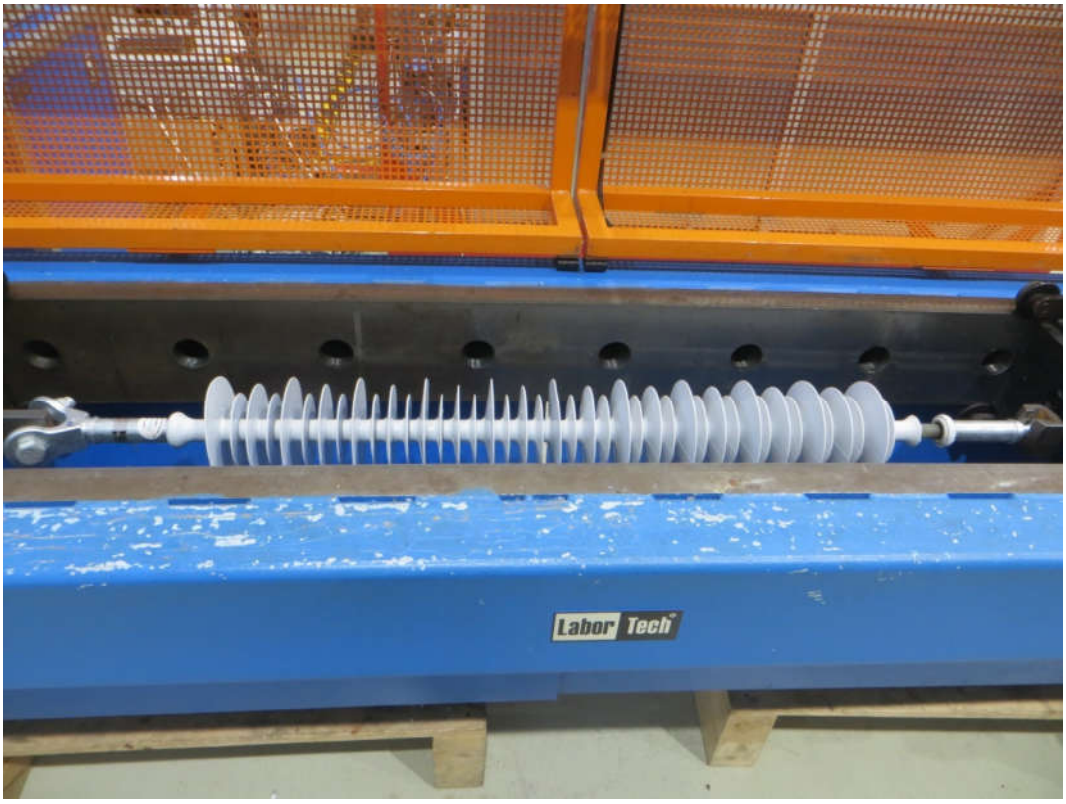


Figure 11
Test sample No. 2, after the mechanical failing load test

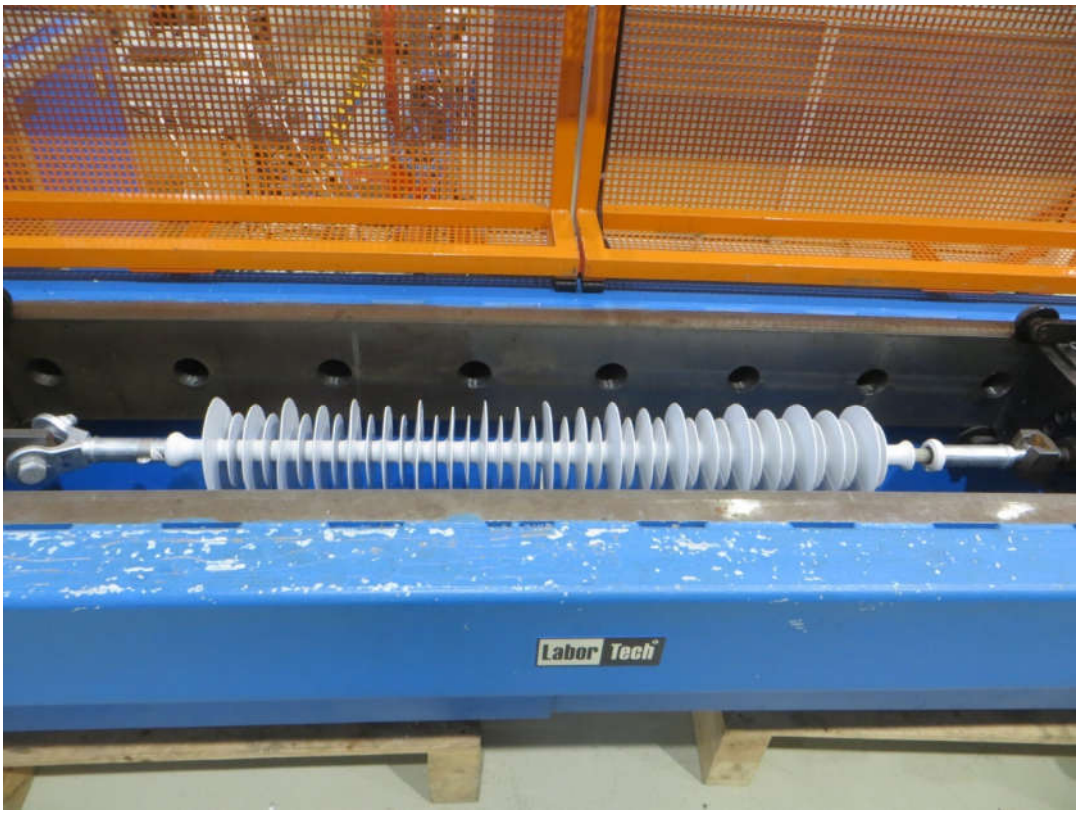


Figure 12
Test sample No. 3, after the mechanical failing load test

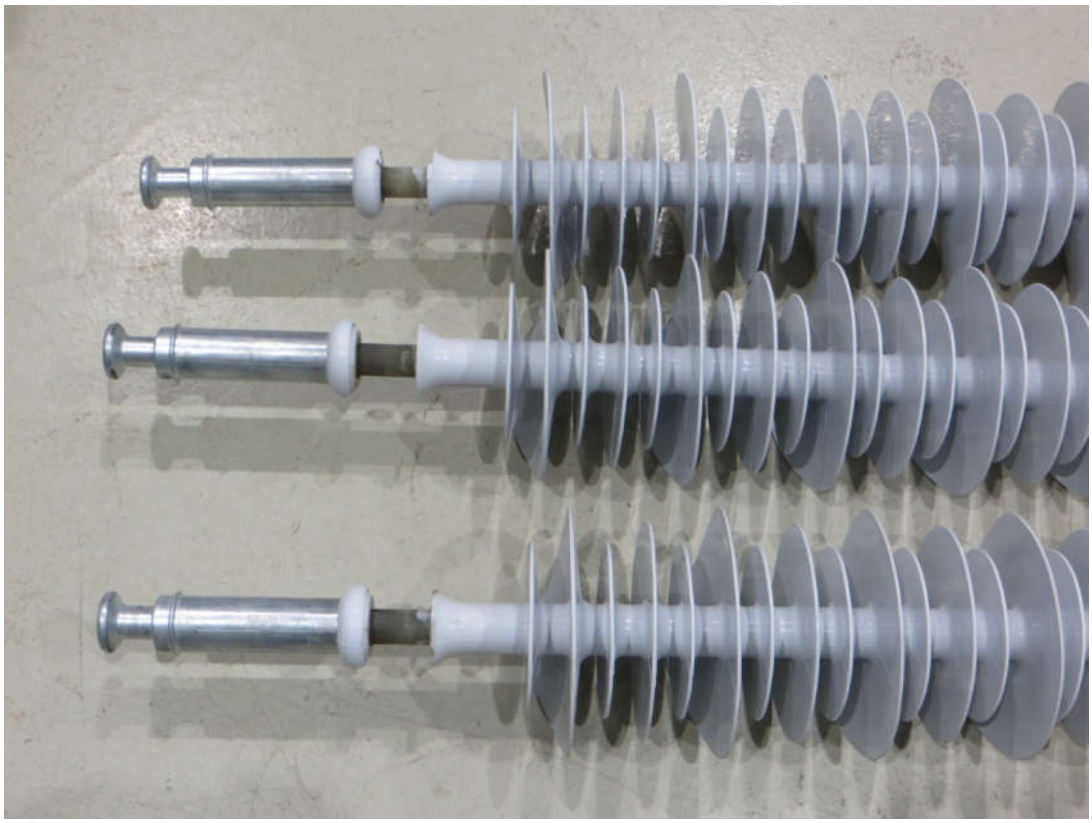


Figure 13
Test samples No. 1, 2 and 3, after the mechanical failing load test

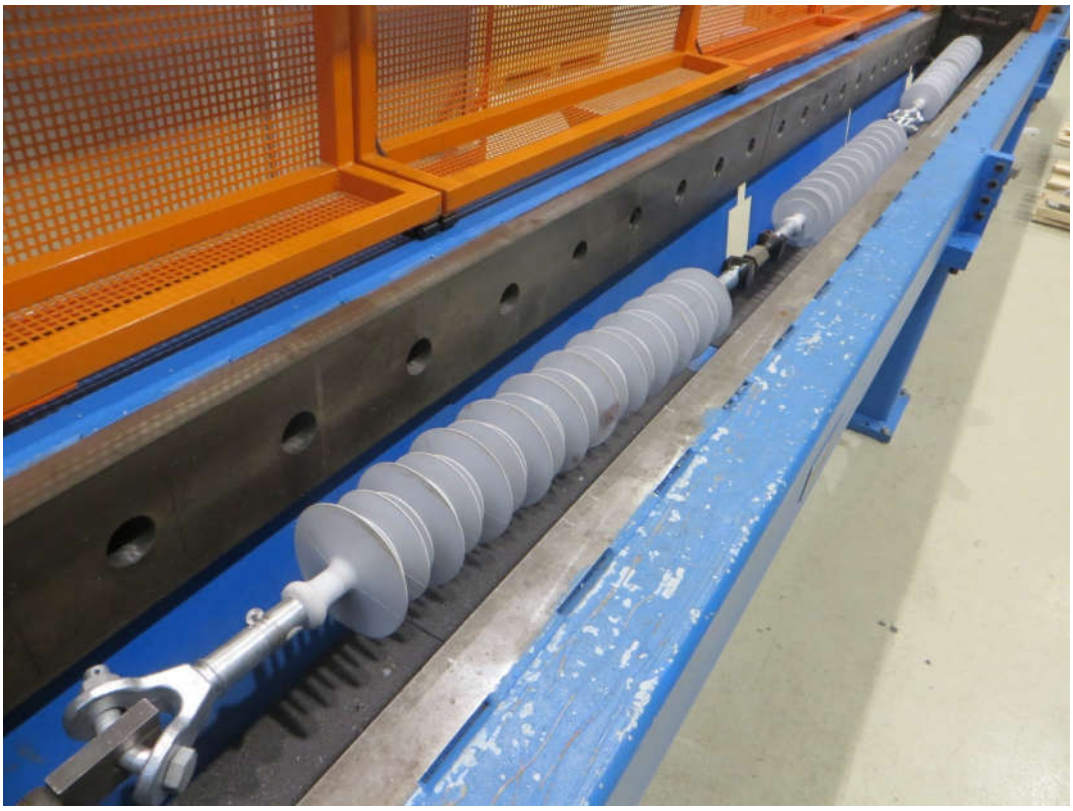


Figure 14
Test samples No. 4, 5 and 6, during the verification of the 96 hours mechanical load test, test

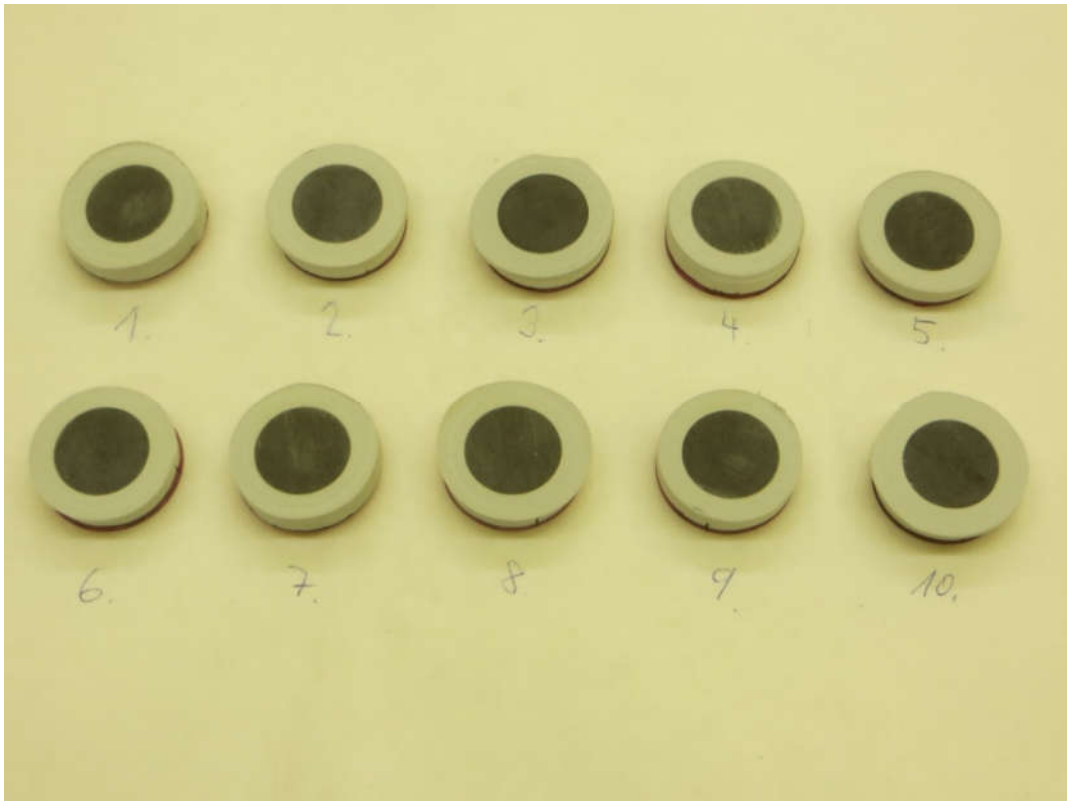


Figure 15
Test specimens after the dye penetration test

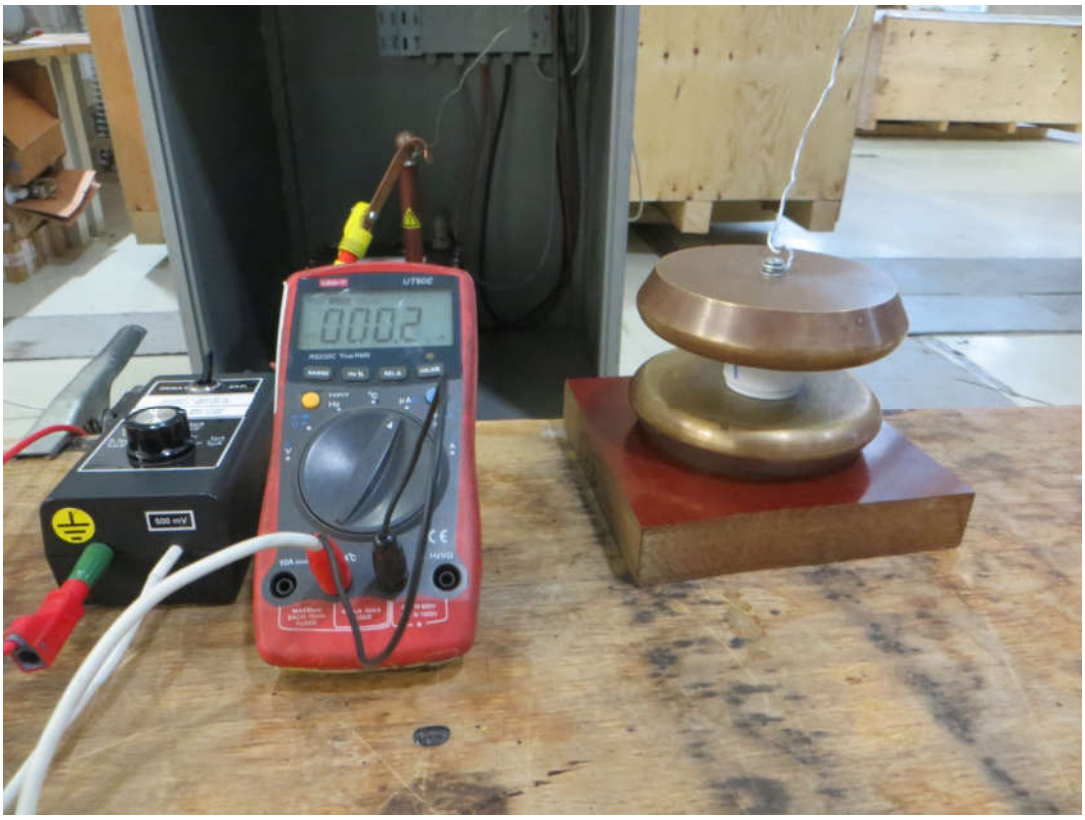


Figure 16
Test specimens during the voltage test – water diffusion test

Figure 17
Test specimens after the voltage test – water diffusion test

Figure 18
Test sample No. 2, horizontal position, housing tracking and erosion test

Figure 19
Test sample No. 2, horizontal position, after the housing tracking and erosion test

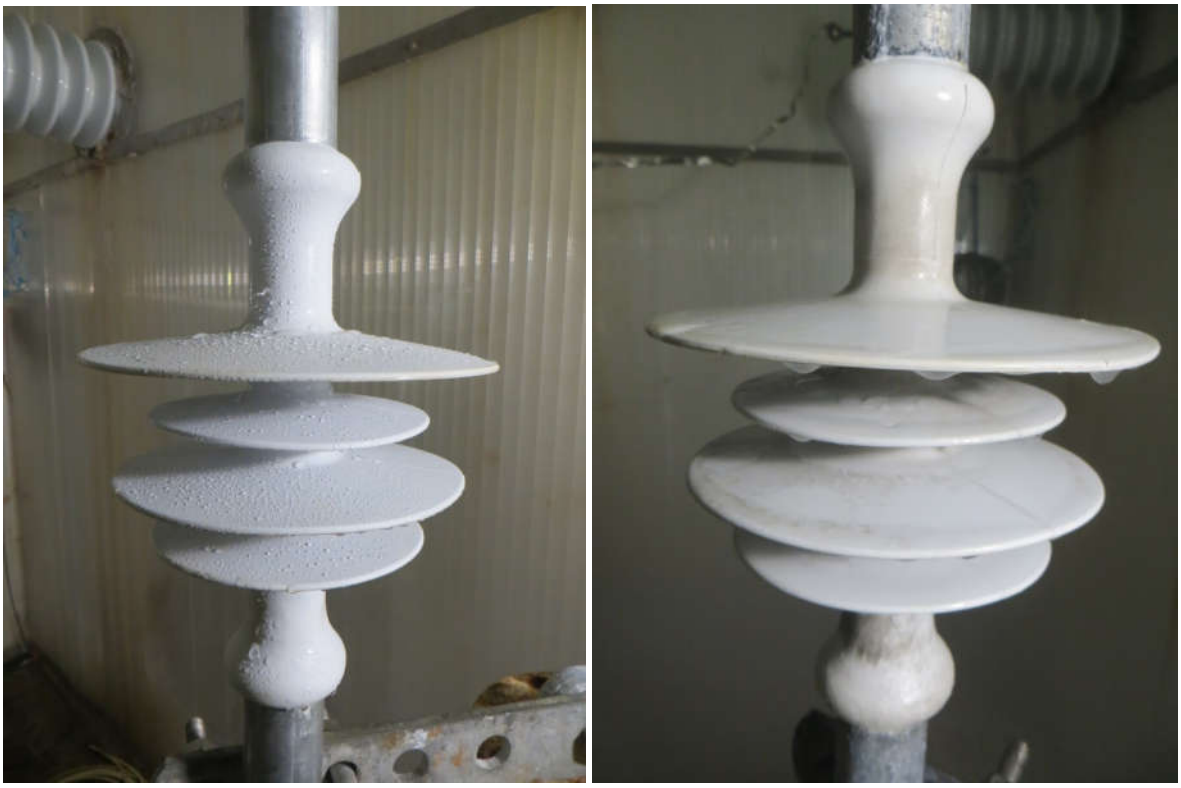


Figure 20
Test sample No.1, vertical position, before and after the housing tracking and erosion test

Figure 21
Test sample No. 1, vertical sample after the housing tracking and erosion test

Figure 22
Test sample No. 2, horizontal sample after the housing tracking and erosion test

- end of test report -

EGU HV Laboratory a.s.
E G U - H V Laboratory a. s.
EGU HV LABORATORY, Podnikatelská 267, 190 11 Praha 9 - Běchovice

EGU HV LABORATORY

Accredited testing laboratory No.: 1029
Accredited by Czech Accreditation Institute
according to ČSN EN ISO/IEC 17025:2018

L 1029

TEST REPORT No.: 11788/N/21

CUSTOMER:	Jiangsu Shemar Electric Co., Ltd. 66 Haiwei Road 226 017 Nantong, Jiangsu China
TEST OBJECT:	138 kV Composite insulator
TYPE SPECIFICATION:	SML 222 kN
TEST STANDARDS:	ANSI C29.12-2020, ANSI C29.11-2020, NEMA 107:2016, IEEE Std 4:2013

Michal Novotný **Test engineer**	Marek Brosch **Head of EGU HV LABORATORY**	Jan Lachman, Ph.D. **Director of EGU - HV Laboratory a. s.**

TEST REPORT No.: 11788/N/21

TEST OBJECT:	138 kV Composite insulator
TYPE SPECIFICATION:	SML 222 kN
DRAWING No.:	21SM510756 Rev. A
MANUFACTURER:	Jiangsu Shemar Electric Co., Ltd.
DATE OF DELIVERY:	2021-12-09
DATE OF TESTS:	From 2022-02-28 till 2022-03-07
ORDER No.:	Contract 23/21
TESTS WITNESSED BY:	N/A

TABLE OF CONTENTS

1 TEST SUMMARY

Test title	Test standards	Test result
Radio-Influence Voltage (RIV)	ANSI C29.12, clause 9.4	Passed
Critical Impulse Flashover Tests – Positive and Negative	ANSI C29.12, clause 9.3	Passed
Low-Frequency Wet Flashover test	ANSI C29.12, clause 9.2	Passed
Low-Frequency Dry Flashover test	ANSI C29.12, clause 9.1	Passed

2 TESTS PERFORMED

2.1 Radio-Influence Voltage (RIV)

2.1.1 Test procedure

Date of test: 2022-02-28

The test was carried out according to ANSI C29.12, clause 9.4, ANSI C29.11, clause 8.2.8 and customer requirements. The test was performed on one composite insulator assembly, including grading ring, serial No. 2111150026.

Radio influence voltage RIV was measured according to NEMA 107. RIV (expressed in decibels relative to 1 µV across 150 Ω) was measured at the frequency of 1,0 MHz in compliance with the circuit diagram in Figure 3-3a of NEMA 107, Section 3.

The circuit RIV factor was 0,42.

Measured RIV values are shown in Table 1.

The test arrangement was set up according to ANSI C29.11, clause 8.2.8.1 and customer requirements (see Figure 2). The single conductor was simulated using an aluminium tube of 14 m length and 30 mm diameter. Both ends of the tube were terminated with corona shielding spheres (screening electrode) with a diameter of 300 mm. Conductor was at a height of 4,15 m above the ground.

Testing and measuring equipment:

coupling capacitance, 1 000 pF, 800 kV, serial No. 11100108.10.1
measuring impedance Power Diagnostix, NEMA 150 Ω, type CIT4M/V8µ0/RIV, serial No. 12533
test transformer TuR Dresden 5,7/1 200 kV, 1 500 kVA
inductive regulator ČKD Praha 6/ 0 - 3 kV, 50 kVA
capacitive divider TuR Dresden 1 200 kV, 150 pF, type WMC 160/1200, serial No. 884470
universal voltmeter Haefely Trench, type DMI 551, serial No. 150505
RIV meter - measuring receiver Power Diagnostix, type RIV meter, serial No. 035
calibrator Power Diagnostix, type CAL3B, serial No. 3014
measuring system for atmospheric condition COMET, serial No. 10910247
digital stop-watch Kalenji, PM-259
measuring telescopic stick 5m, type BMI, serial No. 102

2.1.2 Test results

Table 1 Test results of the RIV test

Rated voltage (kV)	**138**		
Atm. conditions b (in Hg) t (°F) RH (%)	 29,68 60,4 33,1		
Test voltage (kV)	**RIV ↓ (µV)**	**RIV ↑ (µV)**	**RIV ↓ (µV)**
178	31 623	31 623	31 623
162	25 119	25 119	25 119
147	7 080	2 512	3 548
134	22	22	22
122	22	22	22
111	22	22	22
101	22	22	22
92	**22**	**22**	**22**
83	22	22	22
74	22	22	22
65	22	22	22
|	|	|	|
0	22	22	22

Evaluation:

Measured RIV at 92 kV (115 % of nominal line – to – ground voltage, 1,15 × 138/√3 =92 kV) is lower than the specified value of 100 µV.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 9.4.

2.2 Critical Impulse Flashover Tests-Positive and Negative

2.2.1 Test procedure

Date of test: 2022-03-01

The test was carried out according to ANSI C29.12, clause 9.3 and ANSI C29.11, clause 8.2.6.

The test was performed on one composite insulator assembly, including grading ring, serial No. 2111150026.

The critical impulse voltage of positive and negative polarity was determined by the up and down method with 30 impulses according to ANSI C29.11, clause 8.2.6.4 and IEEE Std 4, clause 8.

All measured voltages were corrected to the standard reference atmospheric conditions according to ANSI C29.11, clause 8.2.6.6

The representative wave shape of the lightning impulse 1,2/50 µs is given Graph 1.

The test arrangement was set up in compliance with ANSI C29.11, clause 8.2.6.2 and 8.1 (see Figure 4).

Testing and measuring devices:

impulse generator HighVolt IGL 180/1800G, serial No. IGG2295141
capacitive/resistive divider HighVolt, type MCR 0,4/2000-1000/1000 H391-41, serial No. MCR2295141/103732
measuring system High Volt, type HiRES S4D, serial No. HIGG2295141
tape measure 7,5 m, Assist, PM-242
measuring system for atmospheric condition COMET, serial No. 14900363

2.2.2 Test results

Table 2 Test results of the critical impulse flashover test – positive and negative

Impulse polarity	+	–
Atm. conditions:		
barometric pressure (in Hg)	29,53	29,53
temperature of air (°F)	62,6	62,6
relative humidity (%)	28,1	28,1
Correction factors:		
air density correction factor K_d	1,014	1,014
humidity correction factor K_h	1,112	1,096
Critical impulse flashover voltage (kV)	**771**	**808**
Measured arcing distance: 1 151 mm		
Drawing specified critical impulse flashover voltage: 760 kV		

Evaluation:

Critical impulse flashover value of positive and negative polarity was equal to or exceed 92% of the rated critical impulse flashover voltage specified by drawing 760 kV, i.e. 699 kV.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 9.3.

2.3 Low-Frequency Wet Flashover Test

2.3.1 Test procedure

Date of test: 2022-03-07

The test was carried out according to ANSI C29.12, clause 9.2 and ANSI C29.11, clause 8.2.2.

The test was performed on one composite insulator assembly, including grading ring, serial No. 2111150026.

Characteristics of the artificial rain and precipitation method was in accordance with the ANSI C29.11, clause 8.2.2.2.

The low-frequency wet flashover test was performed according to ANSI C29.11, clause 8.2.2.4 and 8.2.2.5. The flashover voltage was obtained by increasing the voltage continuously from zero up to flashover. The average of five flashovers was calculated.

All measured voltages were corrected to the standard reference atmospheric conditions according to ANSI C29.11, clause 8.2.2.6.

The test arrangement was set up in compliance with ANSI C29.11, clause 8.2.2.1 and 8.1 (see Figure 5).

Testing and measuring equipment:

synchronous generator BEZ Bratislava 6 kV, 1 300 kVA
test transformer TuR Dresden 5,7/1200 kV, 1500 kVA, serial No. 884469
capacitive divider TuR Dresden 1200 kV, 150 pF, type WMC 160/1200, serial No. 884470
universal voltmeter Haefely Trench, type DMI 551, serial No. 150505
measuring system for atmospheric conditions Comet, serial No. 10910247
tape measure 5 m, CXS, PM-241
digital stop-watch Kalenji PM-259
conductivity meter WTW Cond 3310, serial No. 10410891
plastic measuring cylinder 50ml, identification No. 1/153/14 & 2/153/14

2.3.2 Test results

Table 3 Test results of the low-frequency wet flashover test

Atm. conditions:	
barometric pressure (in Hg)	29,29
temperature of air (°F)	60,8
relative humidity (%)	41,9
Rain parameters:	
r. i. (mm/min)	4,7
conductivity (µS/cm)	192
Correction factors:	
humidity correction factor K_h	1,000
air density correction factor K_d	1,010
Flashover voltage	**378 kV**
Measured arcing distance: 1 151 mm	
Drawing specified low-frequency wet flashover voltage: 415 kV	

Evaluation:

Low-frequency wet flashover value was equal to or exceed 90% of the rated wet flashover value specified by drawing 415 kV, i.e. 374kV.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 9.2.

2.4 Low-Frequency Dry Flashover Test

2.4.1 Test procedure

Date of test: 2022-03-07

The test was carried out according to ANSI C29.12, clause 9.1 and ANSI C29.11, clause 8.2.1.

The test was performed on one composite insulator assembly, including grading ring, serial No. 2111150026.

The low-frequency dry flashover test was performed according to ANSI C29.11, clause 8.2.1.3 and 8.2.1.4. The flashover voltage was obtained by increasing the voltage continuously from zero up to flashover. The average of five flashovers was calculated.

All measured voltages were corrected to the standard reference atmospheric conditions according to ANSI C29.11, clause 8.2.1.5.

The test arrangement was set up in compliance with ANSI C29.11, clause 8.2.1.2 and 8.1 (see Figure 6).

Testing and measuring equipment:

synchronous generator BEZ Bratislava 6 kV, 1 300 kVA
test transformer TuR Dresden 5,7/1200 kV, 1500 kVA, serial No. 884469
capacitive divider TuR Dresden 1200 kV, 150 pF, type WMC 160/1200, serial No. 884470
universal voltmeter Haefely Trench, type DMI 551, serial No. 150505
measuring system for atmospheric conditions Comet, serial No. 10910247
tape measure 5 m, CXS, PM-241
digital stop-watch Kalenji PM-259

2.4.2 Test results

Table 4 Test results of the low-frequency dry flashover test

Atm. conditions:	
barometric pressure (in Hg)	29,29
temperature of air (°F)	59,9
relative humidity (%)	37,1
Correction factors:	
humidity correction factor K_h	1,130
air density correction factor K_d	1,011
Flashover voltage	**450 kV**
Measured arcing distance: 1 151 mm	
Drawing specified low-frequency dry flashover voltage: 470 kV	

Evaluation:

Low-frequency dry flashover value was equal to or exceed 95% of the rated dry flashover value specified by drawing 470 kV, i.e. 447 kV.

Statement of conformity:

138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A, passed the test according to requirements given in ANSI C29.12, clause 9.1.

3 LIST OF SYMBOLS

RIV	radio influence voltage (µV)
b	barometric pressure (in Hg)
t	temperature of air (°F)
RH	relative humidity (%)
K_h	humidity correction factor
K_d	air density correction factor
U_{pk}	maximum voltage of recorded curve (kV)
β'	relative overshoot (%)
T_1	front time of recorded curve (µs)
T_2	time to half-value of recorded curve (µs)
r.i.	average value of measured rainfall intensity – vertical component (mm/min)
conductivity	water conductivity (µS/cm)

4 UNCERTAINTY OF MEASUREMENTS

QUANTITY	UNCERTAINTY (k=2)	
Lightning impulse voltage	U_{pk} T_1 T_2	1,7 % 8,0 % 3,1 %
Radio interference voltage	1,0 dB	
Power-frequency voltage	1,7 %	
Barometric pressure	0,5 %	
Temperature of air	4,0 %	
Relative humidity	6,3 %	
Time	0,7 %	
Telescopic stick	0,8 %	
Length (tape measure)	1,6 %	
Rainfall intensity	10 %	
Conductivity	5,0 %	

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a Normal (Gaussian) distribution corresponds to a coverage probability of approximately 95 %. Details related to the statement of conformity when applied are given in a price quotation submitted to a customer before the testing and on the website of the laboratory.

5 PRODUCT DRAWING

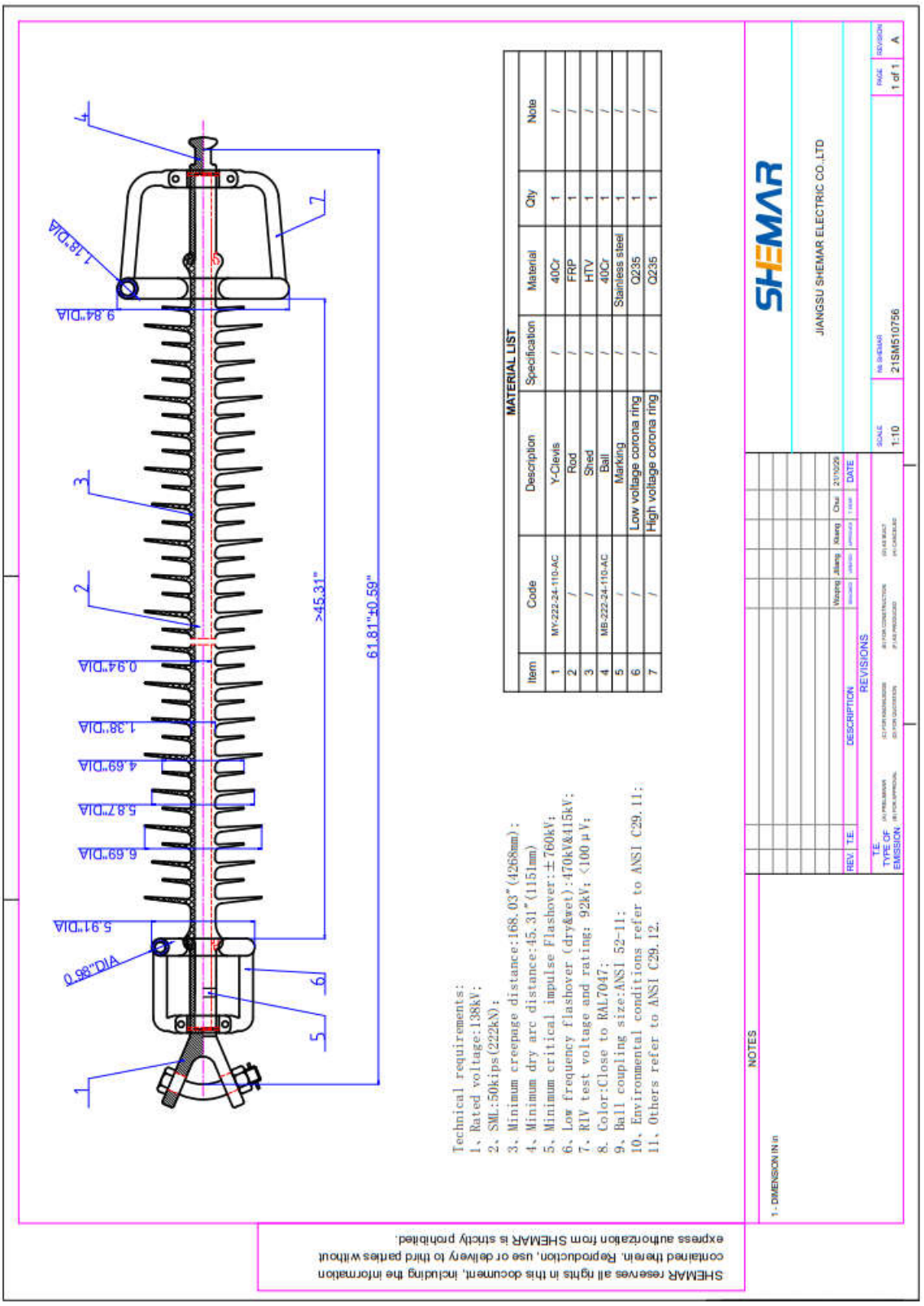


Figure 1
138 kV Composite insulator, SML 222 kN, drawing No. 21SM510756 Rev. A

6 TEST SETUP PHOTOS

Figure 2
Test arrangement for RIV and corona tests

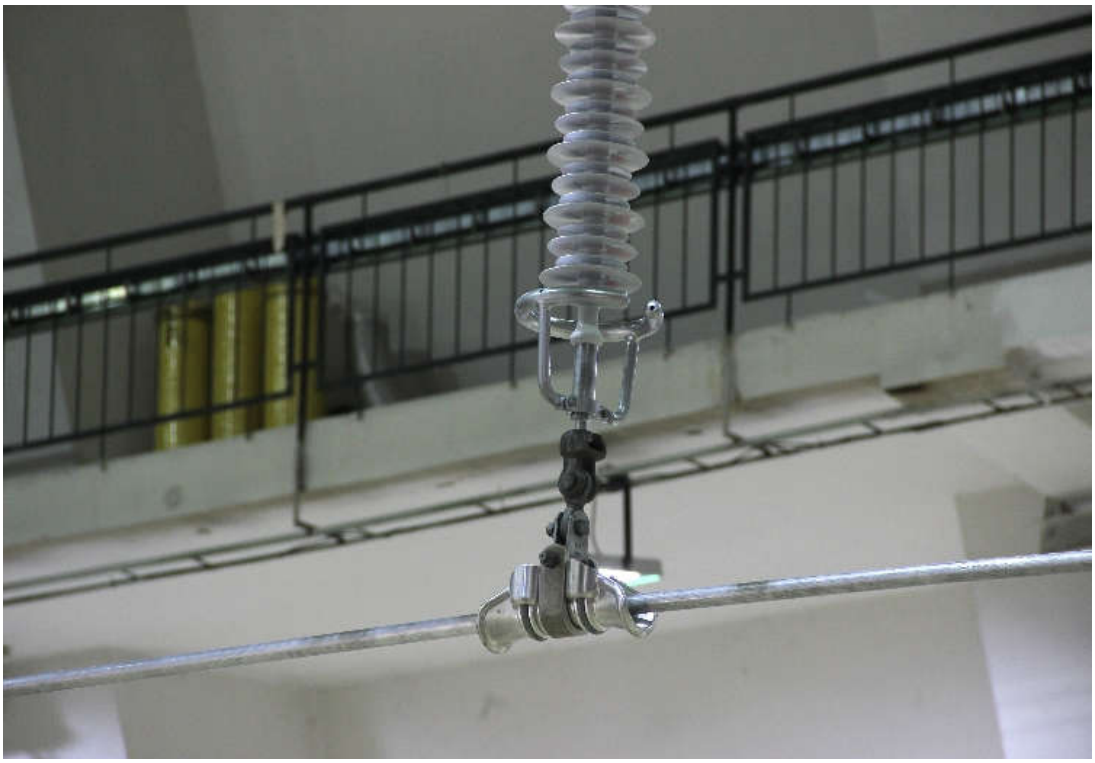


Figure 3
Test arrangement for RIV and corona tests

Figure 4
Test arrangement and flashover under the critical impulse flashover test

Figure 5
Test arrangement and flashover under the low-frequency wet flashover test

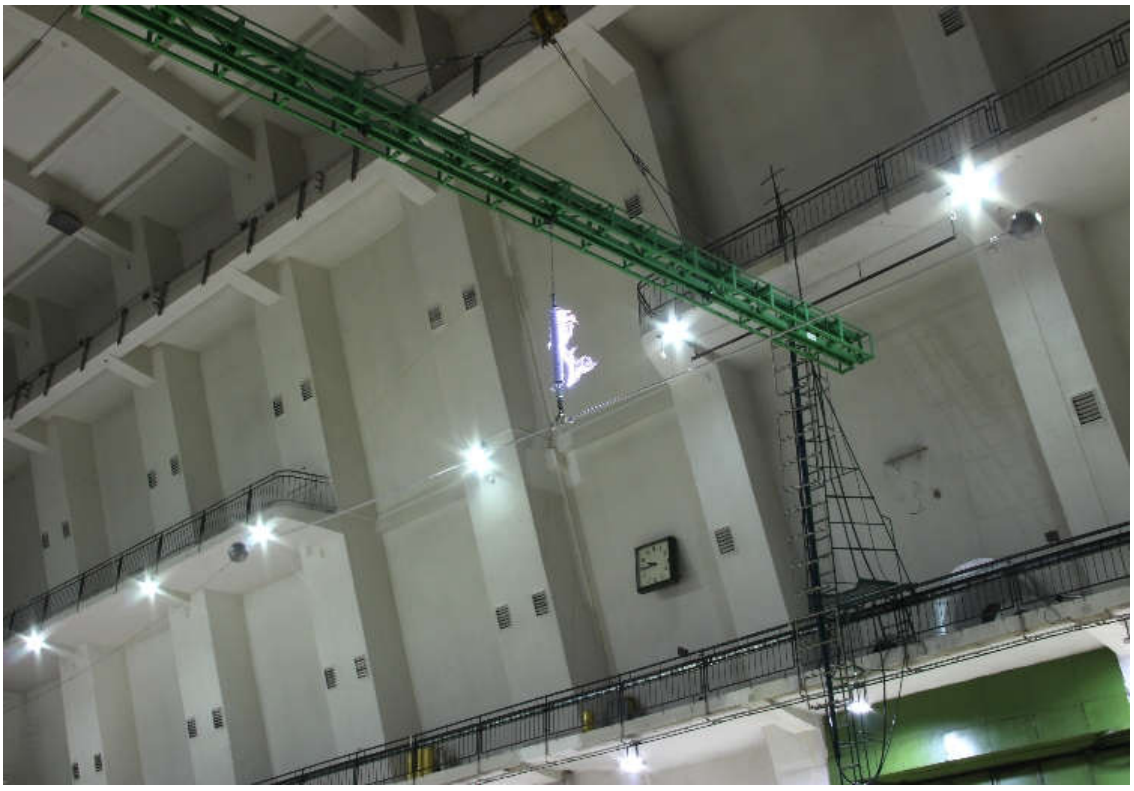
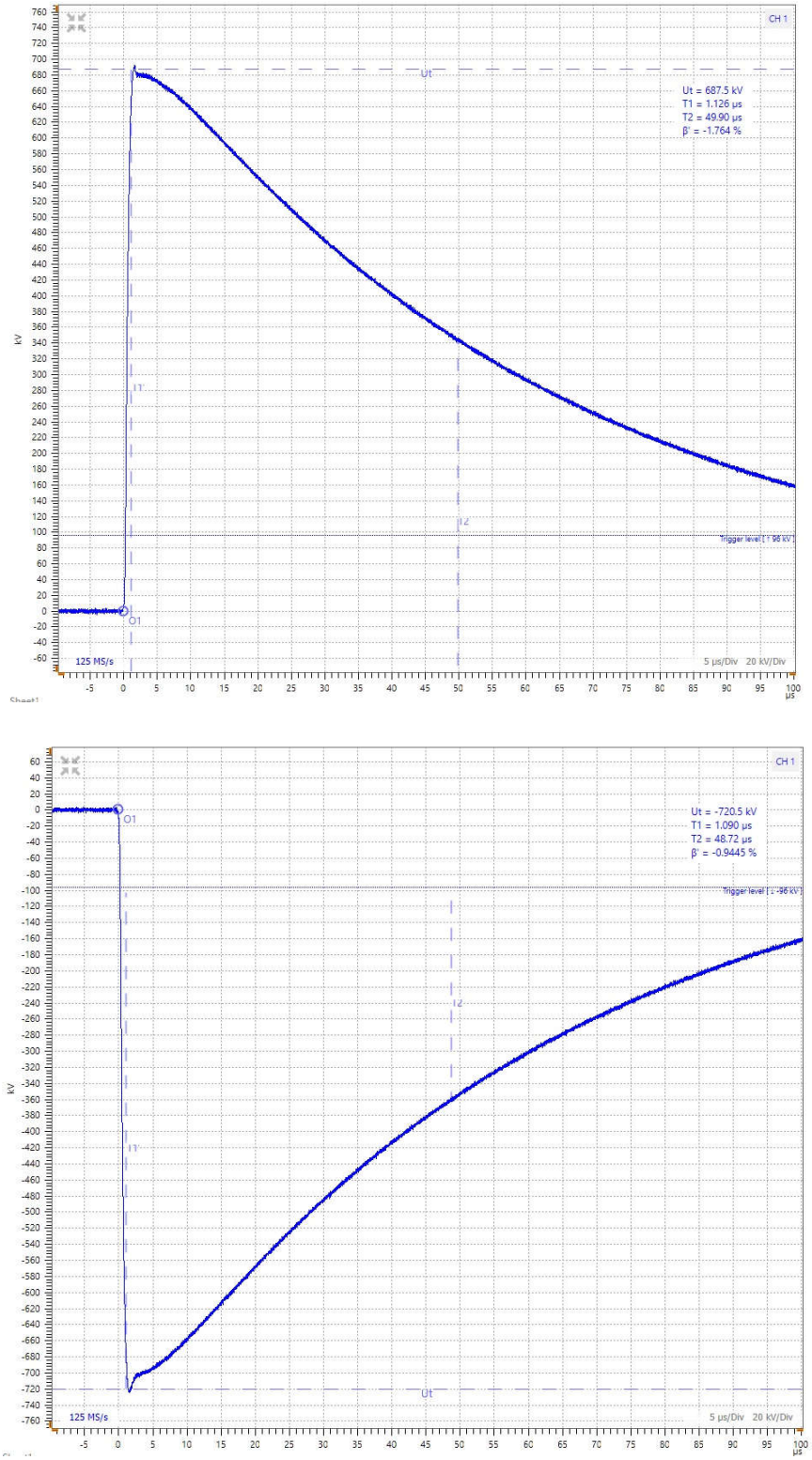


Figure 6
Test arrangement and flashover under the low-frequency dry flashover test

7 GRAPHS



Graph 1
Representative wave shape of the lightning impulse 1,2/50 µs

- end of test report -

Testpolymer EU s.r.o.

Testing laboratory No. 1595
accredited by ČIA
according to ČSN EN ISO/IEC 17025: 2018

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Test report No. 59/2022/EN

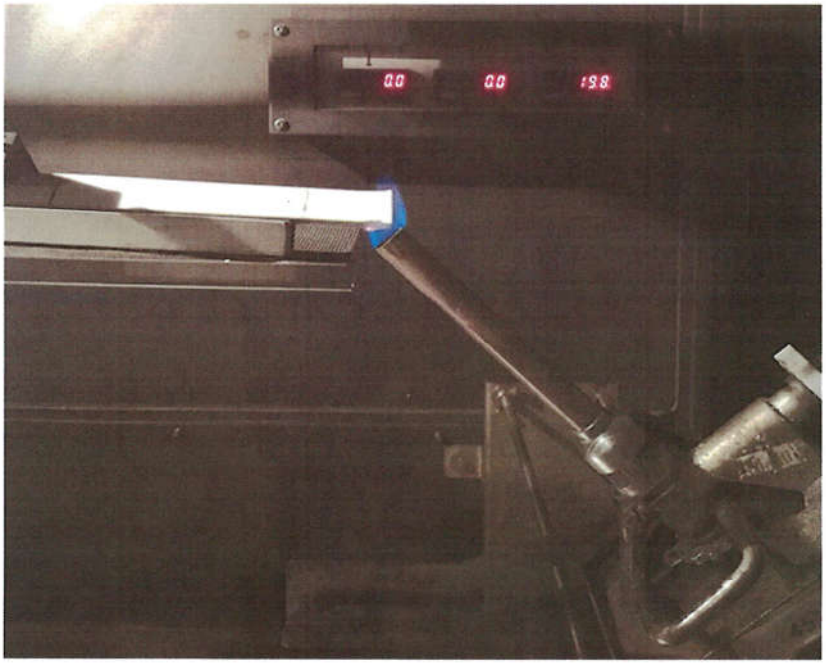
Customer:	**EGU - HV Laboratory a.s., Podnikatelská 267, 190 11 Praha 9, Běchovice**
	Company ID: 25634330, Tax ID: CZ25634330
Customer´s order:	**6/11788/2022**
Application form:	**2200223**
Tested material:	**HTV silicone material**
Detailed description:	**Manufacturer: Jiangsu Shemar Electric Co., Ltd.**
Form of material:	test specimens - sampled and delivered by customer
Preparation of samples:	test specimens supplied by customer
Date of receipt of the sample:	10.1.2022

Tests	Test specifications
Fire hazard testing - horizontal and vertical flame tests	UL 94: 2013 revision 05/2021 ČSN EN 60695-11-10 ed.2: 2014

These tests were performed in accordance with the standard ČSN EN 62217 ed.2: 2013, article 9.3.4.

Test No. 15	**Fire hazard testing - Horizontal and vertical flame tests - method A - horizontal burning test**

Photo of the position of the test specimen during the test:



Test report No. 59/2022/EN

Test standard:	ČSN EN 60695-11-10 ed. 2: 2014	
Test equipment:	Chamber Atlas HVUL2	
Ignition source:	Burner with an inner diameter 9.5 mm	
	The gas used: Methane 2.5	
Test conditions:	Blue flame height 20 mm, the exposure time 30s	
	No forced ventilation was used during the test	
	Temperature: 22,0 - 23,0°C	Humidity: 48,0 - 49,0%
Description of the sample (sample type, the color, the location in the product, the number of samples tested):	Test specimens of grey color 125x13x3mm, 3 pieces	
Conditioning of samples:	48 hours at 23±2°C and 50±5% relative humidity	
Conditioning of cotton indicator:	24 hours in desiccator 23±2°C	
Deviations from the standard:	no	
Test progress:	After removing the ignition flame, the test specimens do not burn. The flame did not exceed the 25 mm mark. A support fixture was used during the test due to the bending of the test specimens.	
Test specimen No.1	burning stopped before 25 mm	
Test specimen No.2	burning stopped before 25 mm	
Test specimen No.3	burning stopped before 25 mm	

No. of test specimen	Damaged length L (mm)	Burning time t (s)	Linear burn rate (mm/min)	**Linear burn rate average value (mm/min)**	Sample standard deviation (mm/min)
1	0	0	0	**0**	0
2	0	0	0		
3	0	0	0		

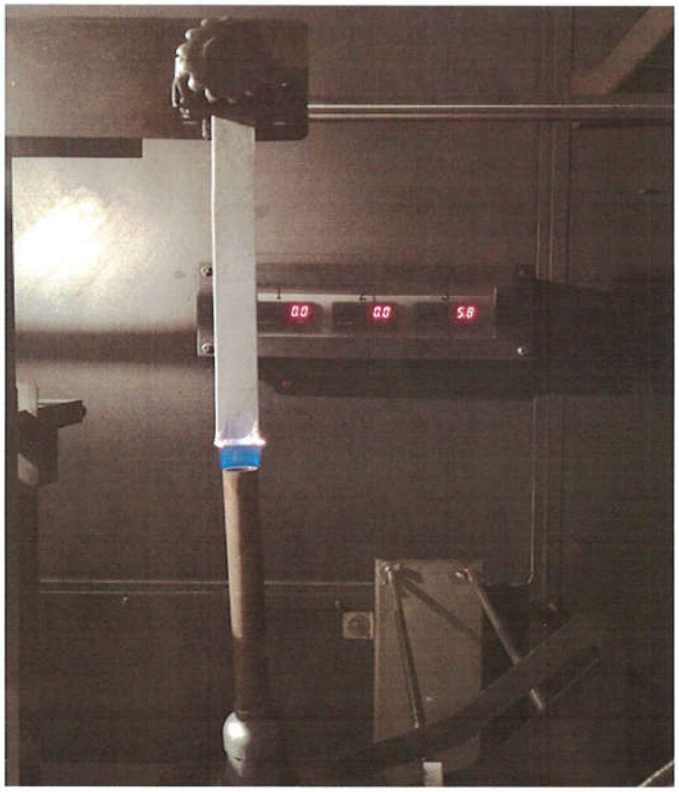
Statement of conformity to specifications - classification	Measured results (burning rate, damaged length) on tested three samples meet all requirements for classification **HB** according to article 8.4 ČSN EN 60695-11-10 ed.2 This statement of conformity to specifications is given in the sense of the shared risk decision rule; without including measurement uncertainty.

Tested and evaluated by:	Ing. Lukáš Navrátil	Date:	13.1.2022

Test report No. 59/2022/EN

Test No. 15	**Fire hazard testing - horizontal and vertical flame tests - method B - vertical burning test**

Photo of the position of the test specimen during the test:



Test standard:	ČSN EN 60695-11-10 ed. 2: 2014	
Test equipment:	Chamber Atlas HVUL2	
Ignition source:	Burner with an inner diameter 9.5 mm	
	The gas used: Methane 2.5	
Test conditions:	Blue flame height 20 mm, the exposure time 2 x 10s	
	No forced ventilation was used during the test	
	Temperature: 22,0 - 23,0°C	Humidity: 48,0 - 49,0%
Description of the sample (sample type, the color, the location in the product, the number of samples tested):	Test specimens of grey color 125x13x3mm, 10 pieces	
Conditioning of samples:	5 pieces - 48 hours in the climate chamber at 23±2°C and 50±5% relative humidity; 5 pieces -168 ±2 hours in the hot air oven at 70±2°C and cooled in desiccator min. 4 hours at room temperature	
Conditioning of cotton indicator:	24 hours in desiccator 23±2°C	
Deviations from the standard:	Not detected	
Test progress:	The test specimens do not burn after the first or after the second application of the flame. The material does not drip or ignite absorbent cotton.	

Test report No. 59/2022/EN

No. of test specimen:	Afterflame time after the first flame application t_1 (s)	Afterflame time after the second flame application t_2 (s)	Afterflame plus afterglow time after the second flame application t_2+t_3 (s)	Afterflame up to the holding clamp: YES - NO	Flaming particles or drops: YES - NO	Cotton indicator ignited by flaming particles or drops: YES - NO
Specimens conditioned in climate chamber						
1	0	0	0	NO	NO	NO
2	0	0	0	NO	NO	NO
3	0	0	0	NO	NO	NO
4	0	0	0	NO	NO	NO
5	0	0	0	NO	NO	NO
Specimens conditioned in hot air oven						
1	0	0	0	NO	NO	NO
2	0	0	0	NO	NO	NO
3	0	0	0	NO	NO	NO
4	0	0	0	NO	NO	NO
5	0	0	0	NO	NO	NO

Statement of conformity to specifications - classification	The measured results (burning and afterglow times and the condition of the cotton indicators) on the ten samples tested meet all the requirements for classification **V-0** according to article 9.4 ČSN EN 60695-11-10 ed. 2. This statement of conformity to specifications is given in the sense of the shared risk decision rule; without including measurement uncertainty.

Tested and evaluated by:	Ing. Lukáš Navrátil	Date:	13.1.2022, 18.1.2022

Declaration:

Test results relates only to the test subject and refer to the sample as received
Laboratory is not responsible for sampling and specimen preparations done by customer.
Without the written consent of the Head of Laboratory, the protocol cannot be reproduced other than the entire.
All results are metrologically traceable.

Test report was created by:

Jana Trbušková
Chief laboratory technician

AKREDITOVANÁ ZKUŠEBNÍ LABORATOŘ Testpolymer EU s.r.o. č. 1595

Test report was approved by:

Eva Kovářová
Laboratory manager

In Bohuslavice: 19.1.2022

End of test report

SYNPO, akciová společnost
S. K. Neumanna 1316
532 07 Pardubice - Zelené Předměstí
The Czech Republic

Department of Evaluation and Testing
Testing Laboratory No. 1105.2 accredited by CAI according to ČSN EN ISO/IEC 17025:2018

TEST REPORT
T 375/005

Name and contact information of the customer	**EGU – HV Laboratory a.s.** Podnikatelská 267, 190 11 Praha 9 – Běchovice The Czech Republic
Test item(s)	**Manufacturer: Jiangsu Shemar Electric Co., Ltd.** **Address : No. 66, Haiwei Road, Sutong Science and Technology Industrial Park, Nantong City, Jiangsu 226017, China** **Type : HTV**
Test procedure/method	Test No. 35: **Exposure to laboratory light – Xenon - arc lamps -** *ČSN EN ISO 4892-2* Test No. 1 : **Determination of the degree of degradation of coatings** APP 1 (*ČSN EN ISO 4628 -1, 4, 5)* Test No. 33 : **Surface roughness measurement (Ra, Rz, Ry, Rq)** (*ČSN EN ISO 4287, ČSN EN ISO 4288)*
Date of receipt of item(s)	January 7, 2022
Internal laboratory number	22 0065
Date of the test	January 7, 2022– February 22, 2022
Tested by	Gabriela Štěpánková
The report made by	Gabriela Štěpánková, Ondřej Janča

This report contains 6 pages and 1 annex.

Digitálně podepsal Ing. Vladimír Špaček, CSc.

In Pardubice on March 29, 2022

Dr. Vladimír Špaček
Head of testing laboratory

TEST REPORT T 375/005
Page/Total pages: 2/6
Annexes: 1

DESCRRIPTION OF THE TEST ITEM

Test item:	**Manufacturer: Jiangsu Shemar Electric Co., Ltd.** **Address : No. 66, Haiwei Road, Sutong Science and Technology Industrial Park, Nantong City, Jiangsu 226017, China** **Type : HTV**
Data delivered by the customer[1] :	-
Internal lab number:	**22 0065**

[1]The laboratory is not responsible for the data delivered by customer.

FURTHER SPECIFICATION OF THE TEST PERFORMANCE

The samples of testing were received from the contractor and submitted to the test without any treatment of surface protection or heat storage.

Test No. 35: Exposure to laboratory light – Xenon - arc lamps

Testing device: Q-SUN Xe-3HS (Q-Lab, GB), Xenon lamps with irradiation energy 0,51 W/m^2/nm at 340 nm (60 W/m^2/nm for TUV). Filtres used – Q-Daylight. Used IBP placed horizontally at the site of sample exposure was fasten by anticorrosion screw. Irradiation intensity was calibrated by radiometer with zone detector of 340 nm (or TUV).
Description of exposure cycle:
Exposure cycle A1: 102 min of irradiance phase with BP temperature (65 ± 3) °C, chamber temperature (38 ± 3) °C with RH (50 ± 10) %. Spray phase (front spraying) of 18 min. (according to the requirements of article 9. 3. 2 of IEC 62217 (2012) - cycle 1 with 8 hours dark period). Both phases with irradiation energy 0,51 W/m^2/nm at 340 nm (60 W/m^2/nm for TUV). Pause: 4.2. – 8.2.2022. The test samples were putted in testing area and the position of samples during the test was not changed.

Test No. 33: Surface roughness measurement

Test was performed according to ČSN EN ISO 4288 - Geometrical product specifications (GPS) - Surface texture: Profile method – Rules and procedures for the assessment of surface texture. Parameters of surface texture were measured according to *ČSN EN ISO* 4287- Geometrical product specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters.

Testing device: SURFTEST SJ-201 (Mitutoyo, Ltd., Japan).
Ra - arithmetical mean deviation of the assessed profile (roughness)
Rz - maximum height of profile (roughness).

Measurements were performed six times on each sample.

Measurement conditions: basic roughness length 0,8mm

TEST REPORT T 375/005
Page/Total pages: 3/6
Annexes: 1

DESCRRIPTION OF THE TEST ITEM

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Data delivered by the customer[1] :	-
Internal lab number:	**22 0065**

[1]The laboratory is not responsible for the data delivered by customer.

APP 1 - Determination of the degree of degradation of coatings

The evaluation of surface failure (defects) was performed according standard ČSN EN ISO 4628 Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance; Part 1: General introduction and designation system; Part 4: Assessment of degree of cracking; Part 5: Assessment of degree of flaking

Lighting used in the evaluation of defect on the surface finish: the fluorescent tube, standard observation: the observation angle 0° / light incidence of angle 45°.

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TEST REPORT T 375/005

Annexes: 1

VISUAL EVALUATION OF SURFACE DEFFECTS ACCORDING TO ČSN EN ISO 4628 DURING THE EXPOSURE AFTER XENON TEST ACCORDING TO ČSN EN ISO 4892-2

(January 7, 2022 – February 22, 2022)

Sample name	Internal Lab Number	Surface failure	Cracking	Flaking
		ČSN EN ISO 4628-1	*ČSN EN ISO 4628-4*	*ČSN EN ISO 4628-5*
		degree + verbal	*degree*	*degree*
250 hours				
HTV	22 0065/1	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/2	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/3	**0, no visual changes**	**0 (S0)**	**0 (S0)**
500 hours				
HTV	22 0065/1	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/2	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/3	**0, no visual changes**	**0 (S0)**	**0 (S0)**
750 hours				
HTV	22 0065/1	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/2	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/3	**0, no visual changes**	**0 (S0)**	**0 (S0)**
1000 hours				
HTV	22 0065/1	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/2	**0, no visual changes**	**0 (S0)**	**0 (S0)**
	22 0065/3	**0, no visual changes**	**0 (S0)**	**0 (S0)**

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TEST REPORT T 375/005

Annexes: 1

MEASUREMENT OF SURFACE ROUGHNESS ACCORDING TO ČSN EN ISO 4287, 4288

(January 7, 2022 – February 22, 2022)

Sample name	Internal Lab Number	Arithmetical mean deviation of the assessed roughness Ra			Maximum height of profile (roughness) Rz		
		Measuring range [µm]			Measuring range [µm]		
		Mean	Max.	Min.	Mean	Max.	Min.
Before exposure							
HTV	22 0065/1	**0,70**	0,76	0,65	**5,00**	5,42	4,56
	22 0065/2	**0,72**	0,77	0,68	**5,35**	6,18	4,89
	22 0065/3	**0,71**	0,75	0,66	**5,20**	5,71	4,55
250 hours							
HTV	22 0065/1	**0,70**	0,77	0,65	**5,03**	5,47	4,57
	22 0065/2	**0,74**	0,77	0,70	**5,61**	6,23	5,04
	22 0065/3	**0,73**	0,79	0,70	**5,36**	5,78	5,04
500 hours							
HTV	22 0065/1	**0,73**	0,77	0,70	**5,26**	5,50	4,93
	22 0065/2	**0,76**	0,79	0,74	**5,35**	5,82	4,98
	22 0065/3	**0,77**	0,80	0,75	**5,34**	5,96	4,98
750 hours							
HTV	22 0065/1	**0,76**	0,80	0,74	**5,54**	6,15	5,23
	22 0065/2	**0,77**	0,79	0,75	**5,35**	5,63	5,11
	22 0065/3	**0,77**	0,80	0,74	**5,62**	5,96	5,32
1000 hours							
HTV	22 0065/1	**0,76**	0,78	0,74	**5,75**	6,20	5,11
	22 0065/2	**0,77**	0,80	0,74	**5,85**	6,23	5,36
	22 0065/3	**0,79**	0,82	0,75	**6,01**	6,56	5,59

TEST REPORT T 375/005
Page/Total pages: 6/6
Annexes: 1

DESCRRIPTION OF THE TEST ITEM

Test item:	**Manufacturer: Jiangsu Shemar Electric Co., Ltd.** **Address : No. 66, Haiwei Road, Sutong Science and Technology Industrial Park, Nantong City, Jiangsu 226017, China** **Type : HTV**
Data delivered by the customer[1] :	-
Internal lab number:	**22 0065**

[1]The laboratory is not responsible for the data delivered by customer.

Statement of conformity

The laboratory uses a binary decision rule according to ILAC-G08: 09/2019, article 4.2.1

Test items	**Prescribed test**	**Parameter** no cracks or raised parts result according to IEC 62217 (2012), clause 9.3.2	**Fulfillment of parameters**
HTV	ČSN EN ISO 4892 - 2	no cracks or raised parts	**Yes**

- End-

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TEST REPORT T 375/005
Annexes: 1/1

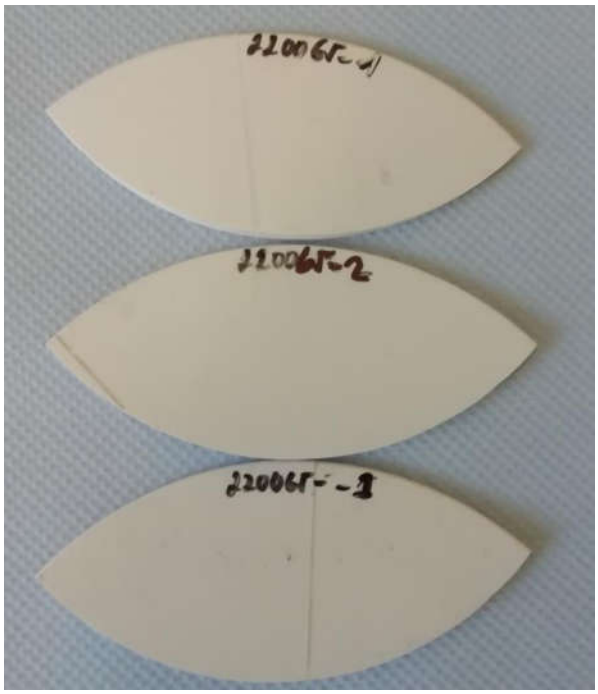
DESCRRIPTION OF THE TEST ITEM

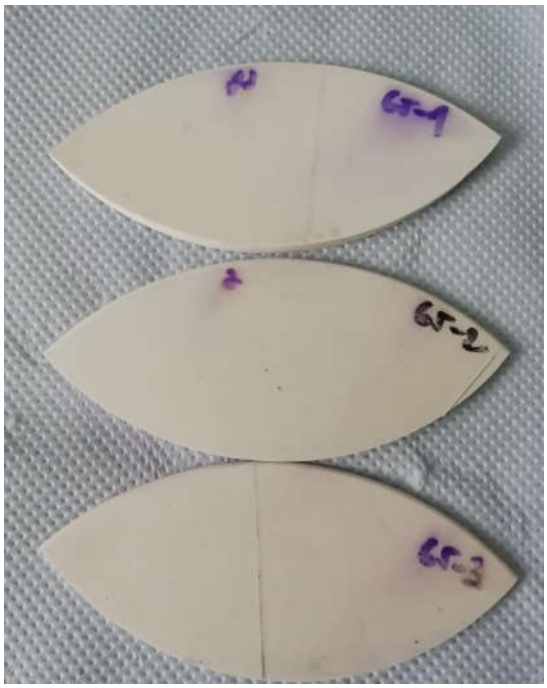
Test item:	**Manufacturer: Jiangsu Shemar Electric Co., Ltd.** **Address : No. 66, Haiwei Road, Sutong Science and Technology Industrial Park, Nantong City, Jiangsu 226017, China** **Type : HTV**
Data delivered by the customer[1] :	-
Internal lab number:	**22 0065**

[1]The laboratory is not responsible for the data delivered by customer.

THE PHOTOS OF TEST SAMPLES AFTER 1000 HOURS OF EXPOSURE UNDER XENON LAMPS ACCORDING TO ČSN EN ISO 4892-2

1 **2**





Pic 1 : Exposure after 1000hrs (top face)
Pic 2 : Exposure after 1000hrs (lower face)