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ACCREDITED LABORATORY TEST REPORT

12591/C/24

Revision 0

CUSTOMER	Jiangsu Shemar Electric Co., Ltd. No.66, Haiwei Road, Sutong science and Technology Industrial Park, 226 017 Nantong City, Jiangsu Province China
TEST OBJECT	Composite post insulator
TYPE SPECIFICATION	TR-291
TEST STANDARDS	ANSI C29.19-2020, ANSI C29.11-2020 NEMA HV 80036-2016, IEEE Std 4:2013
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ACCREDITED TESTING LABORATORY EGU HV Laboratory EGU HV LABORATORY No. 1029 CZECH REPUBLIC

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REAL INDEPENDENT TESTING

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TESTING DETAILS

TEST OBJECT	Composite post insulator
TYPE SPECIFICATION	TR-291
DRAWING No.	24SM280707-TR291
MANUFACTURER	Jiangsu Shemar Electric Co., Ltd. No.66, Haiwei Road, Sutong science and Technology Industrial Park, 226 017 Nantong City, Jiangsu Province China
DATE OF DELIVERY	2025-02-14
DATE OF TESTS	From 2025-05-23 to 2025-05-30
ORDER No.	4524080701
TESTS WITNESSED BY	N/A
ANNEX	N/A
REVISION OVERVIEW	Rev.0 – First issue

The edition with the highest revision number always replaces the earlier issued editions.

The ACCREDITED LABORATORY TEST REPORT covers test procedures within the scope of EGU HV LABORATORY accreditation which is an integral part of the Certificate of Accreditation. Test procedures are at international, regional or national standards level. Any deviations from test procedures are clearly marked.

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1 TEST OBJECT IDENTIFICATION

The results presented in this test report apply only to test objects subjected to the testing. Responsibility for conformity of any objects having the same designation as the test object fully rests with the Manufacturer.

EGU HV LABORATORY is not responsible for the sampling. Samples are provided by a customer. Test results apply only to tested samples as received.

1.1 RATINGS/CHARACTERISTICS ASSIGNED BY THE MANUFACTURER

Table 1 Ratings/characteristics of a test object

Dimensions	
Creepage distance (mm)	5059
Arcing distance (mm)	1424
Length (mm)	1574,8
Number of large/small sheds	26/25
Approx. nett weight (kg)	38,5
Electrical data	
Rated voltage (kV)	161
Impulse withstand voltage (kV)	750
Critical impulse flashover, positive (kV)	810
Low frequency wet withstand (kV)	315
Mechanical data	
Specified cantilever load (kN)	23,6
Specified tensile load (kN)	121
Material description	
Corona ring	None
End fittings	Galv. Steel
Weathersheds	HTV silicone rubber
Core	E-CR FRP
Color of sheds	Gray, same as RAL7047

1.2 LIST OF DRAWINGS

A customer guarantees a test object being made according to submitted product drawings and documents, see Table 2.

EGU HV LABORATORY confirms product drawings submitted by a customer fully represent in technical aspects (shape, dimensions etc.) a given test object and markings/nameplates on a test object conform with drawings.

Table 2 Drawings/documents submitted, and included in this test report

Document No.	Title	See
24SM280707-TR291	Composite post insulator type TR-291	Figure 1

2 TEST SUMMARY

Test title	Test procedure	Result
Radio-Influence Voltage	ANSI C29.19, clause 8.4	Passed
Critical Impulse Flashover Tests	ANSI C29.19, clause 8.3	Passed
Impulse Withstand Test	ANSI C29.19, clause 8.2	Passed
Low-Frequency Wet Withstand Test	ANSI C29.19, clause 8.1	Passed

EGU - HV Laboratory applies a binary decision rule to the test results which reports two statements: PASSED – results are within limits or meet a given specification, FAILED – results are out of limits or fail a given specification.

3 LIST OF SYMBOLS

Symbol	Description
U_{pk}	The maximum voltage of impulse wave (kV)
$U_{W\ cor}$	Low-frequency wet withstand voltage (kV), corresponding to actual reference atmosphere
U_W	Low-frequency wet withstand voltage (kV), corresponding to standard reference atmosphere
$U_{LI\ cor}$	Impulse withstand voltage (kV), corresponding to actual reference atmosphere
U_{LI}	Impulse withstand voltage (kV), corresponding to standard reference atmosphere
T_1	Front time of impulse wave (μs)
T_2	Time to half-value of impulse wave (μs)

4 TESTS PERFORMED

4.1 RADIO – INFLUENCE VOLTAGE TEST

4.1.1 Test procedure

The radio influence voltage test was carried out one post insulator according to ANSI C29.19, clause 8.4 and ANSI C29.11, clause 8.2.8 and customer requirements.

Influence voltage RIV was measured according to NEMA HV 80036-2016 in compliance with the circuit diagram in Figure 3-3a of NEMA HV 80036-2016. The test circuit was calibrated according to NEMA HV 80036-2016, clause 3.2. Measured RIV values and circuit RIV factor (P) are shown in 4.1.2.

The test arrangement was set up according to ANSI C29.11, clause 8.2.8.1 and clause 8.1.3 (see Figure 3).

Testing and measuring equipment:

- test transformer TuR Dresden, type WMC 160/1200, serial No. 884469
- inductive regulator ČKD Praha 250 kVA, type 6/0 – 3 kV, serial No.1130316
- divider TuR, type WMC, serial No. 884470
- universal voltmeter Haefely Trench DMI 551, serial No. 150505
- measuring impedance Power Diagnostix, NEMA 150 Ω, type CIT4M/V8µ0/RIV, serial No. 12533
- RIV meter - 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 stopwatch PM-300

4.1.2 Test results

Acceptance criteria:

The radio-influence voltage (RIV) measured at the test voltage of 103 kV must be lower than the specified value of 500 µV.

Table 3 Results of the radio-influence voltage test

Date of the test: 2025-05-30	
Atm. conditions	
pressure (inHg)	29,26
temperature (°F)	64,80
rel. humidity (%)	68,10
Test voltage (kV)	**Radio-influence voltage (µV)**
133	25
123	25
103	**25**
93	25
83	25
73	25
63	25
53	25
|	
0	25
Measuring frequency: 1,0 MHz	
Circuit RIV factor (P): 0,41	
Specified value: RIV at 103 kV ≤ 500 µV Maximum voltage for equipment U_m = 161 kV	

Conclusion:

The test object passed the test.

4.2 CRITICAL IMPULSE FLASHOVER TESTS

4.2.1 Test procedure

The test was carried out according to ANSI C29.19, clause 8.3 and ANSI C29.11, clause 8.2.6.

The critical impulse voltage of positive and negative polarity was determined by the up and down method with 20 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 example of wave shape of lightning-impulse 1,2/50 μs is given in Figure 2.

The test arrangement was set up according to ANSI C29.11, clause 8.2.6.2 and 8.1.3 (see Figure 4).

Testing and measuring equipment:

- impulse generator HighVolt IGL 180/1800G, serial No. IGG2295141
- capacitive divider HighVolt, type MCR 04/2000-1000/1000/H391-41, serial No. MCR2295141/103732
- measuring system HiRES, serial No. HIGG2295141
- measuring system for atmospheric condition COMET, serial No. 19910190
- tape measure, type 5 m, Assist, PM-291

4.2.2 Test results

Acceptance criteria:

Measured critical impulse flashover voltage of both polarities must be greater than 92% of the rated critical impulse flashover voltage (810 kV), i.e. 745 kV.

Table 4 Results of the critical impulse flashover tests

Date of the test: 2025-05-23		
Atm. Conditions		
pressure (inHg)		29,06
temperature (°F)		66,6
rel. humidity (%)		54,2
Impulse polarity	**+**	**-**
Correction factors		
k_d air density correction	0,990	0,990
k_h humidity correction	1,051	1,045
Critical impulse flashover voltage	**858**	**1091**
Specified value: critical impulse flashover voltage, positive polarity: 810 kV, negative polarity: n/a		

Conclusion:

The test object passed the test.

4.3 IMPULSE WITHSTAND TEST

4.3.1 Test procedure

The test was carried out on one insulator according to ANSI C29.19, clause 8.2 and according to ANSI C29.11, clause 8.2.7.

Three consecutive impulses of both polarities were applied to the post insulator according to ANSI C29.11, clause 8.2.7.4.

All measured voltages were corrected to the standard reference atmospheric conditions according to ANSI C29.11, clause 8.2.7.3 and clause 8.2.1.5.

The test arrangement was set up according to ANSI C29.11, clause 8.2.7.2 and 8.1.3.

Testing and measuring equipment:

- impulse generator HighVolt IGL 180/1800G, serial No. IGG2295141
- capacitive divider HighVolt, type MCR 04/2000-1000/1000/H391-41, serial No. MCR2295141/103732
- measuring system HiRES, serial No. HIGG2295141
- measuring system for atmospheric condition COMET, serial No. 19910190
- tape measure, type 5 m, Assist, PM-291

4.3.2 Test results

Acceptance criteria:

No flashover occurred during the impulse withstand test with three impulses of both polarities at the rated impulse withstand voltage of 750 kV.

Table 5 Results of the impulse withstand test

Date of the test: 2025-05-23		
Atm. Conditions		
pressure (inHg)		29,06
temperature (°F)		66,6
rel. humidity (%)		54,2
Impulse polarity	**+**	**-**
Correction factors		
k_d air density correction	0,990	0,990
k_h humidity correction	1,051	1,045
Impulse voltage withstand voltage		
U_{LI} (kV)	**750**	**750**
$U_{LI\ cor}$ (kV)	707	710
number of impulses	3	3
number of flashovers	0	0
Specified impulse withstand voltage: 750 kV		

Conclusion:

The test object passed the test.

4.4 LOW-FREQUENCY WET WITHSTAND TEST

4.4.1 Test procedure

The test was carried out on one post insulator according to ANSI C29.19, clause 8.1 and according to ANSI C29.11, cl. 8.2.4.

The rated wet withstand voltage was applied to the post insulator according to ANSI C29.11, clause 8.2.4.5. Precipitation was performed in compliance with Table 3 given in ANSI C29.11.

All measured voltages were corrected to the standard reference atmospheric conditions according to ANSI C29.11, clause 8.2.4.6.

The test arrangement was set up in compliance with ANSI C29.11, clause 8.2.4.1 and 8.1.3 (see Figure 5).

Testing and measuring equipment:

- synchronous generator BEZ Bratislava 6 kV, 1 300 kVA, 50 Hz, serial No. BRA20980
- test transformer TuR Dresden, type WMC 160/1200, serial No. 884469
- voltage divider type WMC, serial No. 884470
- universal voltmeter Haefely Trench, type DMI 551, serial No. 150505
- measuring system for atmospheric conditions Comet, serial No. 16910046
- plastic measuring cylinder 50ml, identification No. 1/153/14 & 2/153/14
- conductivity meter WTW Cond 3310, serial No. 22170009
- digital stopwatch PM-172
- tape measure 5 m, Assist, PM-291

4.4.2 Test results

Acceptance criteria:

No flashover should occur during the 12 second with low-frequency wet withstand voltage 315 kV.

Table 6 Results of the low-frequency wet withstand test

Date of the test: 2025-05-30	
Atm. conditions	
pressure (inHg)	29,26
temperature (°F)	64,8
rel. humidity (%)	68,1
Rain parameters	
rainfall intensity (mm/min)	5,0
water resistivity (Ω.m)	170
Correction factors	
K_d air density correction	1,001
K_h humidity correction	1,000
Low-frequency voltage wet withstand voltage	
U_W (kV)	**315**
$U_{W\,cor}$ (kV)	315
duration of test (s) *)	12
Specified low-frequency wet withstand voltage: 315 kV	

*) the withstand time was prolonged 2 seconds because of 50 Hz frequency applying

Conclusion:

The test object passed the test.

5 UNCERTAINTY OF MEASUREMENTS

Quantity		Uncertainty (k = 2)
Lightning impulse voltage	U_{pk}	1,7 %
	T_1	8,0 %
	T_2	3,1 %
Power-frequency voltage		1,7 %
Radio interference voltage		1,0 dB
Length (tape measure 5 m)		1,6 %
Temperature		4,0 %
Air pressure		0,5 %
Relative humidity		6,3 %
Time		0,7 %
Conductivity		5,0 %
Rainfall intensity		10,0 %

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%.

Calculated uncertainties of measurements are informative only.

6 PRODUCT DRAWING

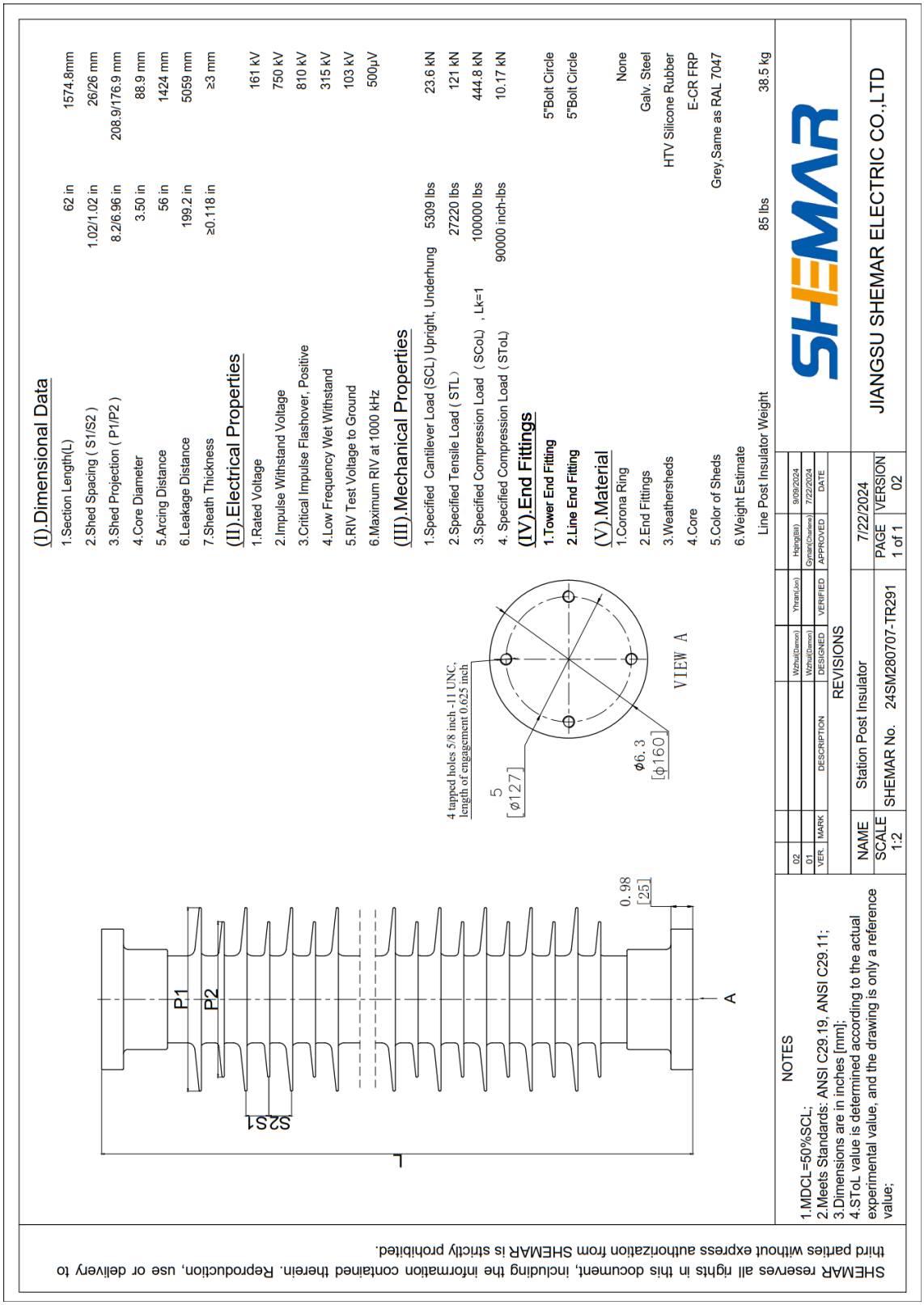
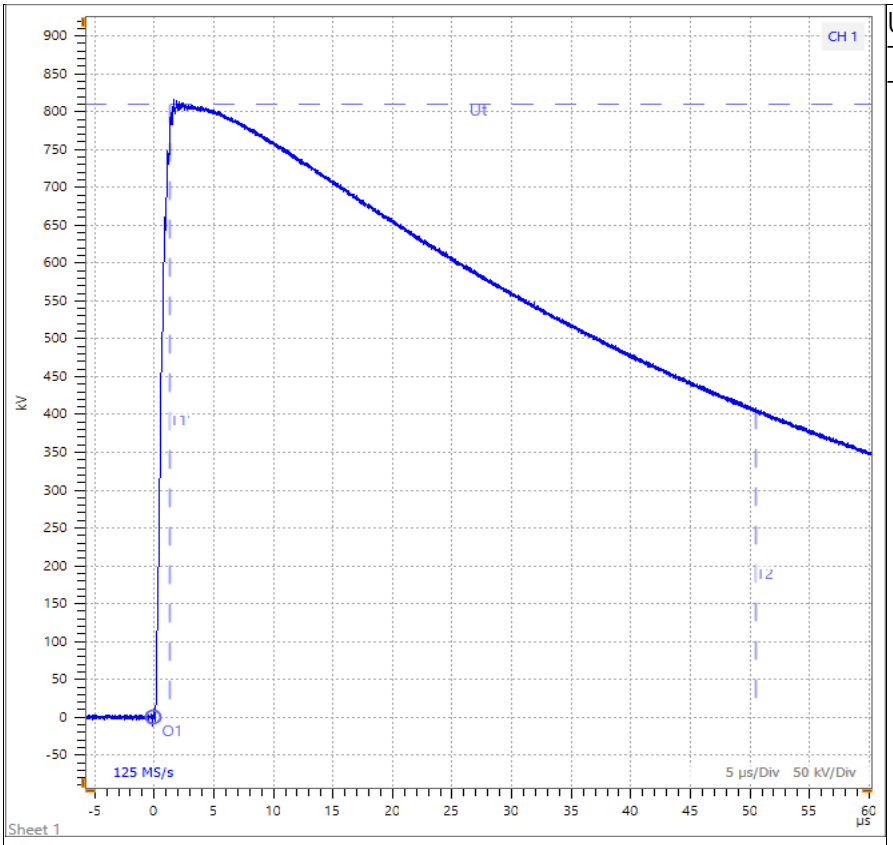
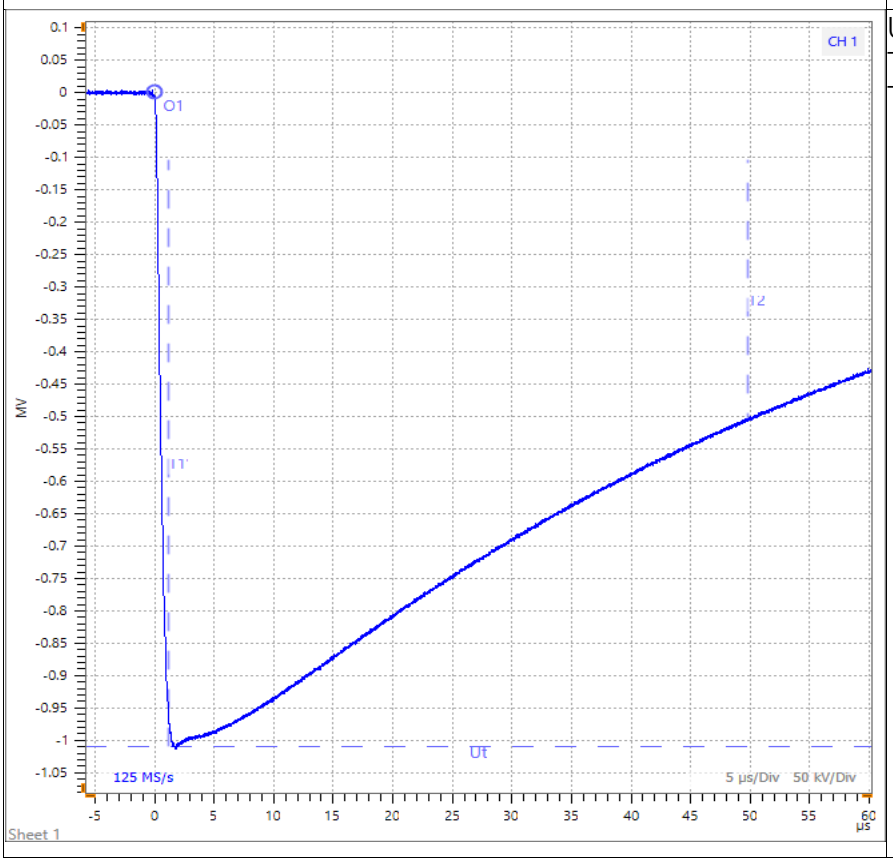


Figure 1 Composite post insulator type TR-291, drawing No. 24SM280707-TR291

7 GRAPHS AND RECORDS



Ut = 809.8 kV
T1 = 1.270 µs
T2 = 50.50 µs



Ut = -1010 kV
T1 = 1.160 µs
T2 = 49.76 µs

Figure 2 The wave shape of the lightning impulse voltage 1,2/50 µs

8 TEST OBJECT AND TEST SETUP PHOTOS

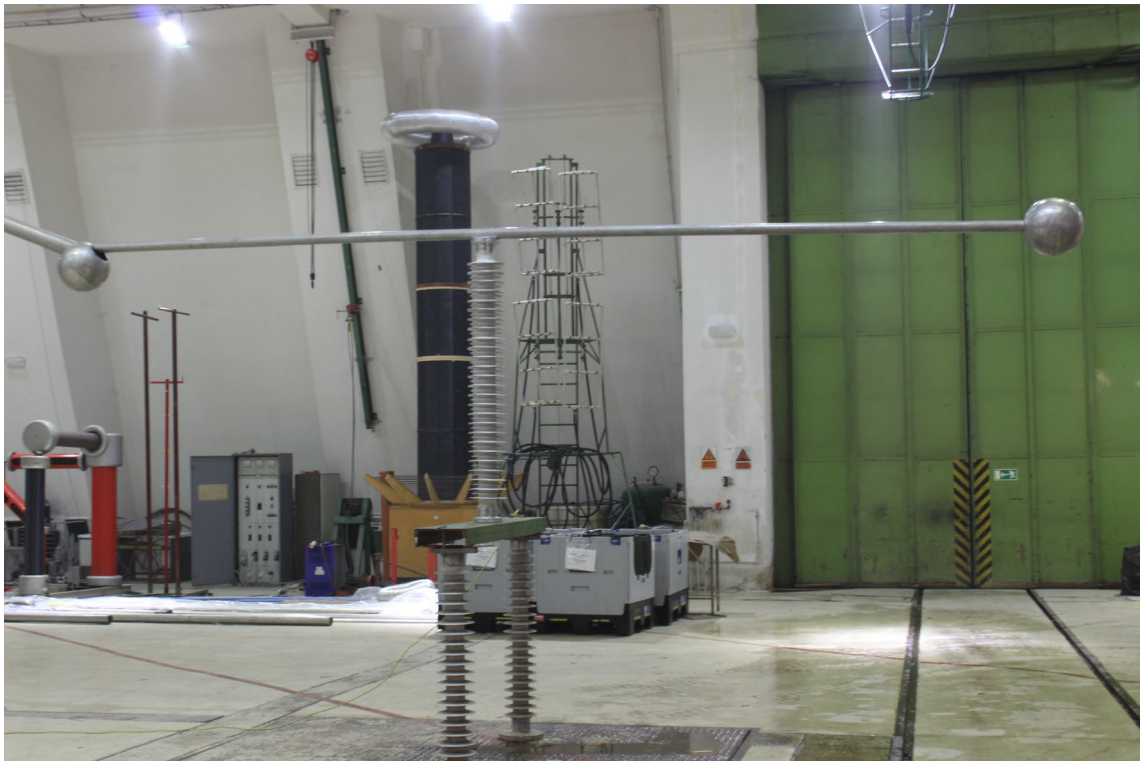


Figure 3 Test arrangement during the radio-influence voltage test

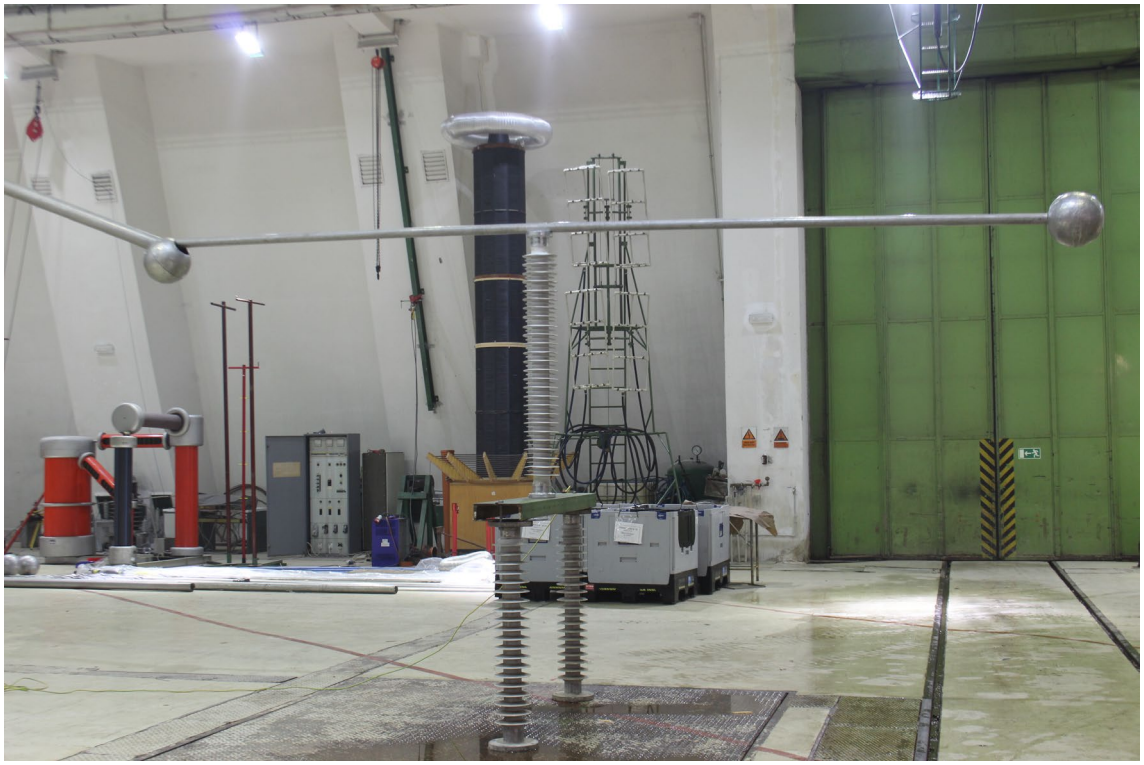


Figure 4 Test arrangement during the critical impulse flashover tests

Figure 5 Test arrangement during the low-frequency voltage wet withstand test

– end of the test report –