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TEST REPORT 12591/A/24

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-288
TEST STANDARDS	ANSI C29.19-2020, ANSI C29.11-2020 NEMA HV 80036-2016, IEEE Std 4:2013
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TEST REPORT 12591/A/24

TEST OBJECT	Composite post insulator
TYPE SPECIFICATION	TR-288
DRAWING No.	24SM280706-TR288
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	2024-09-29
DATE OF TESTS	2024-11-07
ORDER No.	4524080701
TESTS WITNESSED BY	N/A
ANNEX	N/A

TABLE OF CONTENTS

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.

A customer guarantees a test object being made according to submitted product drawings and documents, see Table 1.

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 1 Drawings/documents submitted, and included in this test report

Document No.	Title	See
24SM280706-TR288	Composite post insulator type TR-288	Figure 1

2 TEST SUMMARY

Test title	Test standard	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

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 Table 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 50 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. 02910318
- digital stopwatch PM-300

4.1.2 Test results

Table 2 Results of the radio-influence voltage test

Date of the test: 2024-11-07	
Atm. conditions	
pressure (inHg)	28,88
temperature (°F)	63,3
rel. humidity (%)	53,8
Test voltage (kV)	**Radio-influence voltage (µV)**
115	10
106	6
97	6
88	**6**
74	6
70	6
61	6
⋮	
0	6
Measuring frequency: 1,0 MHz	
Circuit RIV factor (P): 0,49	
Specified value: RIV at 88 kV ≤ 200 µV Maximum voltage for equipment U_m = 138 kV	

Evaluation:

The radio-influence voltage (RIV) measured at the test voltage of 88 kV is lower than the specified value of 200 µV.

Statement of conformity:

Composite post insulator, type TR-288, drawing No. 24SM280706-TR288 passed the test according to requirements given in ANSI C29.19, clause 8.4.

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 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 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 TuR Dresden 3000 kV, 100 kJ, serial No. 1543
- capacitive divider TuR Dresden, type KOIS-3-500, serial No. 32373
- measuring system Haefely, type DiAS 733, serial No. 173990
- measuring system for atmospheric condition COMET, serial No. 02910318
- tape measure, type 5 m, Assist, PM-291

4.2.2 Test results

Table 3 Results of the critical impulse flashover tests

Date of the test: 2024-11-07		
Atm. Conditions		
pressure (inHg)		28,88
temperature (°F)		63,7
rel. humidity (%)		51,8
Impulse polarity	**+**	**-**
Correction factors		
k_d air density correction	0,990	0,990
k_h humidity correction	1,061	1,054
min arcing distance (m)	1,230	1,230
Critical impulse flashover voltage	**744**	**931**
Specified value: critical impulse flashover voltage, positive polarity: 710 kV, negative polarity: n/a		

Evaluation:

Measured critical impulse flashover voltage of both polarities is greater than 92% of the rated critical impulse flashover voltage (710 kV), i.e. 653 kV.

Statement of conformity:

Composite post insulator type TR-288, drawing No. 24SM280706-TR288 passed the test according to requirements given in ANSI C29.19, clause 8.3.

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 TuR Dresden 3000 kV, 100 kJ, serial No. 1543
- capacitive divider TuR Dresden, type KOIS-3-500, serial No. 32373
- measuring system Haefely, type DiAS 733, serial No. 173990
- measuring system for atmospheric condition COMET, serial No. 02910318
- tape measure, type 5 m, Assist, PM-291

4.3.2 Test results

Table 4 Results of the impulse withstand test

Date of the test: 2024-11-07		
Atm. Conditions		
pressure (inHg)		28,88
temperature (°F)		63,7
rel. humidity (%)		51,8
Impulse polarity	**+**	**-**
Correction factors		
k_d air density correction	0,990	0,990
k_h humidity correction	1,061	1,054
min arcing distance (m)	1,230	1,230
Impulse voltage withstand voltage		
U_{LI} (kV)	**650**	**650**
$U_{LI\ cor}$ (kV)	606	610
number of impulses	3	3
number of flashovers	0	0
Specified impulse withstand voltage: 650 kV		

Evaluation:

No flashover occurred during the impulse withstand test with three impulses of both polarities at the rated impulse withstand voltage of 650 kV.

Statement of conformity:

Composite post insulator type TR-288, drawing No. 24SM280706-TR288 passed the test according to requirements given in ANSI C29.19, clause 8.2.

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. 02910318
- plastic measuring cylinder 50ml, identification No. 1/63/16 & 2/63/16
- conductivity meter WTW Cond 3310, serial No. 12240282
- digital stopwatch PM-300
- tape measure 5 m, Assist, PM-291

4.4.2 Test results

Table 5 Results of the low-frequency wet withstand test

Date of the test: 2024-11-07	
Atm. conditions	
pressure (inHg)	28,91
temperature (°F)	63,3
rel. humidity (%)	54,3
Rain parameters	
rainfall intensity (mm/min)	4,9
water resistivity (Ω.m)	175
Correction factors	
K_d air density correction	0,992
K_h humidity correction	1,000
min. arcing distance (m)	1,230
Low-frequency voltage wet withstand voltage	
U_W (kV)	**275**
$U_{W\,cor}$ (kV)	273
duration of test (s) *)	12
Specified low-frequency wet withstand voltage: 275 kV	

*) the withstand time was prolonged by 2 seconds due to test voltage frequency of 50 Hz

Evaluation:

No flashover occurred during 12 seconds of low-frequency wet withstand voltage application of 275 kV.

Statement of conformity:

Composite post insulator type TR-288, drawing No. 24SM280706-TR288 passed the test according to requirements given in ANSI C29.19, clause 8.1.

5 UNCERTAINTY OF MEASUREMENTS

Quantity		Uncertainty (k = 2)
Lightning impulse voltage	U_t	2,2 %
	T_1	6,5 %
	T_2	4,2 %
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%.

EGU - HV Laboratory applies a binary decision rule to the statement of conformity 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. Calculated uncertainty of measurements are only informative with regards to the statement of conformity application.

6 PRODUCT DRAWING

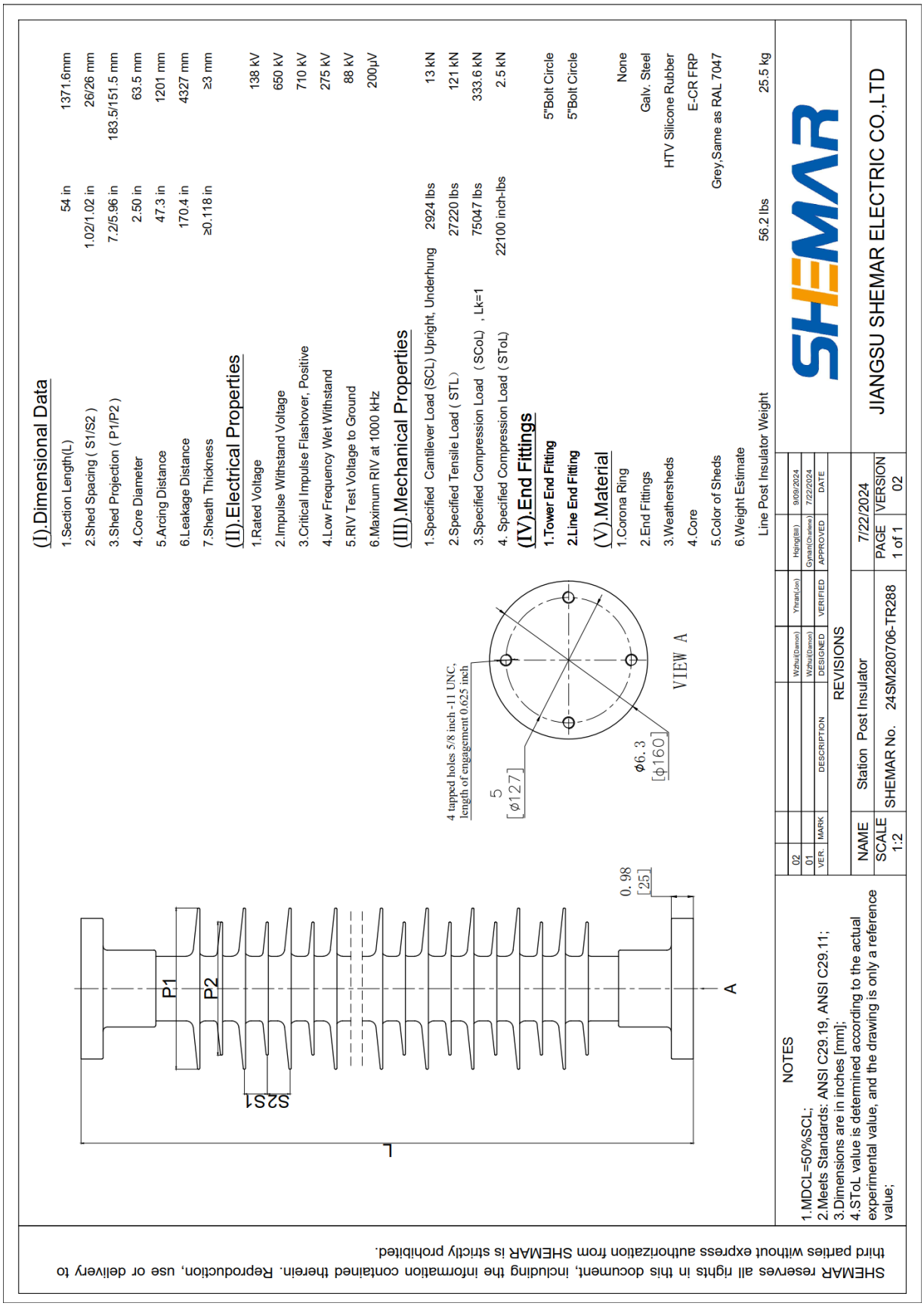
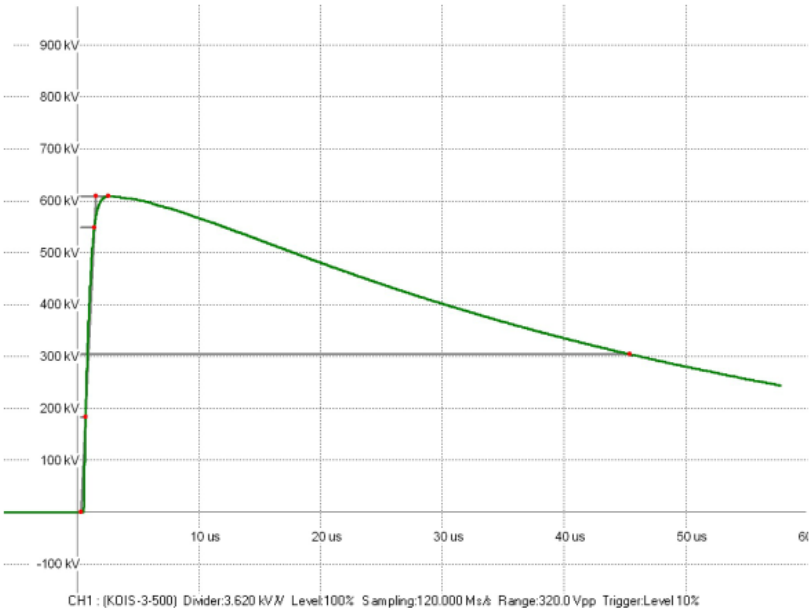


Figure 1 Composite post insulator type TR-288, drawing No. 24SM280706-TR288

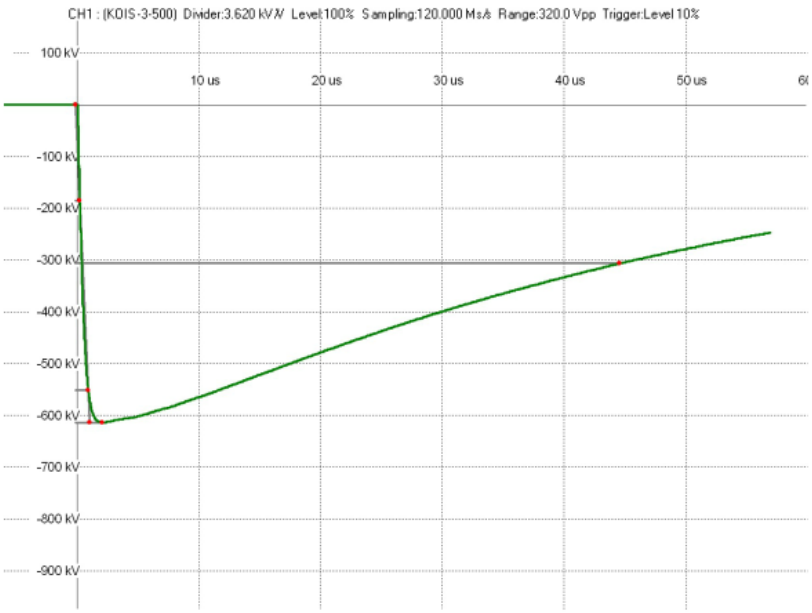
7 GRAPHS AND RECORDS

COMP. POST. INS.
24SM28070C-TR288



No. 1
LI full
Upk : 605.800 kV
T1 : 1.188 us
T2 : 45.031 us

COMP. POST. INS.
24SM28070C-TR288



No. 3
LI full
Upk : -610.325 kV
T1 : 1.160 us
T2 : 44.692 us

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 –