گواهینامه تایید صلاحیت آزمایشگاه
Laboratory Accreditation Certificate

سامانه های نوین افرا
AFRA MODERN SYSTEMS

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TEST REPORT

Sample: 24 kV silicone rubber pin insulator (DP-280645)

Manufacturer: Afra Modern Systems (Samanehaye Novin Afra) Company

Rated voltage: 24 kV

Number of sheds: 6

Creepage distance: 645 mm

Insulator material: Silicone Rubber

Test according to: IEC 62217 (2012), IEC 61952 (2008), ISO 868 (2003), IEC 60587 (2007), IEC TS 62073 (2016), IEC 60695-11-10 (2013), IEC 60060-1 (2010), IEC 60383-1(1993), IEC 60383-2 (1993).

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performer		Confirmed by
Nazanin Mostafavi	Fateme Homayooni	Raziye Namaki
Nazanin Mostafavi	Fatemeh Homayooni	Raziye Namaki

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1. General Information

1.1. Product Information

Equipment under test : Silicon rubber pin insulator

Manufacturer : Afra Modern Systems (Samanehaye Novin Afra) Company

Manufacturer's address : Block E2-79, Shiraz Especial Economic Zone (SEEZ), Fars, Iran

Silicone compound manufacturer : Afra Modern Systems (Samanehaye Novin Afra) Company

Silicone manufacturer : Wynca Company

The diameter of the core used : 28 mm

MDCL : 3 kN

SCL : 6 kN

Compression Loads : 2.5 kN

Number of sheds : 6

Rated voltage : 24 kV

STL :15 kN

Creepage distance : 645 mm

Bottom Fitting : Galvanized Steel

Top Fitting : Aluminum

1.2. Performed Tests

No.	Test Title	Related Standard	Test Result
1.	Verification of Dimensions	IEC 62217 (clause 8)	passed
	Design tests		
2.	Hardness test	IEC 62217 (subclause 9.3.1), ISO 868	passed
3.	Accelerated Weathering Test (UV)	IEC 62217 (subclause 9.3.2), ISO 4892	passed
4.	Tracking and Erosion Test – 1000 h Salt Fog Test	IEC 62217 (subclause 9.3.3)	passed
5.	Flammability test	IEC 62217 (subclause 9.3.4), IEC 60695-11-10	passed
6.	Porosity test (Dye Penetration)	IEC 62217 (subclause 9.4.1)	passed
7.	Water Diffusion	IEC 62217 (subclause 9.4.2)	passed
8.	Test for the Verification of the Maximum Design Cantilever Load (MDCL)	IEC 61952 (subclause 10.4.1)	passed
9.	Tensile load test	IEC 61952 (subclause 10.4.2)	passed
	Type tests		
10.	Dry Lightning Impulse Test	IEC 61952 (subclause 11.1), IEC 60060-1	passed
11.	Wet Power-Frequency Test	IEC 61952 (subclause 11.1), IEC 60060-1	passed
12.	Cantilever Failing Load Test	IEC 61952 (subclause 11.2.1)	passed
	Sample tests		
13.	Verification of Dimensions (fitting)	IEC 61952 (subclause 12.2)	passed
14.	Galvanizing Test	IEC 61952 (subclause 12.3), IEC 60383-1	passed
15.	Verification of the SCL test	IEC 61952 (subclause 12.4)	passed
16.	Verification of Compression Loads	IEC 61952	passed
	Routine tests		
17.	Tensile load test (routine)	IEC 61952 (subclause 13.1)	passed
18.	Visual Examination	IEC 61952 (subclause 13.2)	passed
	Other tests		
19.	Dry Power Frequency Test	IEC 62217 (subclause 9.2.4), IEC 60060-1	passed
20.	Water immersion pre-stressing	IEC 62217 (subclause 9.2.6)	passed
21.	Tracking and erosion test –Inclined Plane Test	IEC 60587	passed
22.	Hydrophobicity test Method C & A	IEC TS 62073	passed

2. Performance and Results of Tests

2.1. Verification of Dimensions

- According to IEC 62217 clause 8

Arcing distance, creepage distance and insulator length were measured using glue tape and ruler.

Acceptance Criteria: The insulator passed the test if the allowable tolerances for different dimensions of the insulator are as follows:

$\pm (0.04 \times d + 1.5)$ mm when $d \leq 300$ mm,

$\pm (0.025 \times d + 6)$ mm when $d > 300$ mm with a maximum tolerance of ± 50 mm,

Result of Test (Date: 25-November-2024):

Properties	Sample	Measuring value (mm)	Acceptable tolerances (mm)
Creepage distance	DP-280645	647	622.8-667.1
Arcing distance		242	228.8-251.1
Big shed diameter		132	125.2-138.8
Small shed diameter		98	92.6-103.4

2.2. Design tests

2.2.1. Hardness test

- According to IEC 62217 subclause 9.3.1 & ISO 868

Two specimens of the insulator housing material with thickness of 4 mm were taken from the housing of two insulators. Hardness of the mentioned samples was measured with Shore A durometer at ambient temperature. After that, the samples were kept immersed in boiling deionized water with 0.1 % by weight of NaCl for 42 h. At the end of the boiling period, the samples were allowed to cool and, within 3 h, their hardness was measured again at the same temperature as that of the pre-boiling measurements ± 5 K.

Acceptance Criteria: The hardness of each specimen shall not change from the pre-boiled value by more than ± 20 %.

Result of Test (Date: 10-December-2024): According to table 1, hardness test was passed.

Table 1: Hardness Results

Sample	Pre-Boiled Hardness	After-boiled Hardness	Difference of Change	Result
1	66	67	1.51%	Passed
2	65	66	1.53%	Passed

2.2.2. Accelerated Weathering Test (UV)

- According to IEC 62217 subclause 9.3.2 & ISO 4892

Three specimens of insulator housing (markings on the housing) were subjected xenon (UV lamp) irradiation for 1000 hours. At the end of the test, visual inspection and surface roughness test were performed.

Acceptance Criteria: After the test, marking on shed or housing material shall be legible. Surface degradations such as cracks and raised areas are not permitted.

Result of Test (Date: 14-December-2024): The insulator has passed this test and surface degradations such as cracks and raised areas was not occurred. Also, the R_z = 13.63

2.2.3. Tracking and Erosion Test – 1000 h Salt Fog Test

- According to IEC 62217 subclause 9.3.3

Two insulators were cleaned and installed at a suitable distance from each other in the test chamber. The voltage of test was calculated and applied based on creepage distance. The test was applied for 1000 h on the insulators.

Test voltage = 21 kV

NaCl content of water = 8 ± 0.4 kg/m^3

Ambient temperature =20°C ± 5K

Acceptance Criteria: The insulators have passed this test if no tracking and erosion occurs on insulator surface. Erosion depth is less than 3 mm and does not reach the insulator core. No shed, housing or interface is punctured.

Result of Test (Date: 14-December-2024): The insulator has passed this test. The shed and housing were not punctured and the erosion depth was not observed.

2.2.4. Flammability test

- According to IEC 62217 subclause 9.3.4 & IEC 60695-11-10

This test can be conducted in two ways as follows:

In two variations of this test, a rectangular bar-shaped test specimen is supported horizontally or vertically by one end and the free end is exposed to a specified test flame. The burning behavior of the horizontally supported bar under specific test conditions is assessed by measuring the linear burning rate. The burning behavior of the vertically supported bar under specific test conditions is assessed by measuring the after flame and afterglow times (observing whether the material is self-extinguished), the extent of burning and the dripping of flaming particles.

2.2.4.1. Horizontal Flammability test

Three bar specimens with the dimensions of 125 mm ± 5 mm long by 13,0 mm ± 0,5 mm wide, and 3 mm thickness were tested. Each test specimen was marked with two lines perpendicular

to the longitudinal axis of the bar, 25 mm ± 1 mm and 100 mm ± 1 mm from the end that was exposed to the test flame. The test specimen was clamped at the end furthest from the 25 mm mark, with its longitudinal axis approximately horizontal and its transverse axis inclined at 45° ± 2°.

The test flame was applied without changing its position for 30 s ± 1 s or was removed as soon as the flame front on the test specimen reaches the 25 mm mark if within less than 30 s. The timing device was restarted when the flame front reaches the 25 mm mark.

Acceptance Criteria: The materials were classified HB, HB40 or HB75 (HB = horizontal burning) in accordance with IEC 60695-11-10, with the following sub-classes:

a) If it does not burn with a flame after the ignition source is removed;

b) If the test specimens continue to burn with a flame after removal of the ignition source, and the flame front does not pass the 100 mm mark;

c) If the flame front passes the 100 mm mark and it does not have a linear burning rate exceeding 40 mm/min.

Result of Test (Date: 25-November-2024): Three specimens did not burn after the ignition source was removed, so this material can be classified as **HB 40** (clause A).

2.2.4.2. Vertical Flammability test

Five bar specimens with the dimensions of 125 mm ± 5 mm long by 13,0 mm ± 0,5 mm wide, and 3 mm thickness were tested. The test specimen was clamped using the upper 6 mm of its length with the longitudinal axis vertical. The lower end of the test specimen was 300 mm ± 10 mm above the horizontal cotton pad.

The central axis of the burner tube was maintained in the vertical position, approached the test specimen horizontally towards the wide face. The flame was applied centrally to the middle point of the bottom edge of the test specimen so that the top of the burner was 10 mm ± 1 mm below that point. The burner was maintained at that distance for 10 s ± 0,5 s and moved in the vertical plane in response to any changes in the length or position of the test specimen.

After that, the burner was withdrawn immediately and the timing device was used to commence measurement of the after flame time t_1. After that the flame was applied again and the after flame time t_2, and the afterglow time t_3 of the test specimen were recorded. This procedure was repeated for all of the five specimens.

Acceptance Criteria: The specimens can be classified according the following table:

Criteria	Materials Classification		
	V-0	V-1	V-2
Individual test specimen afterflame times (t_1, t_2)	≤ 10 s	≤ 30 s	≤ 30 s
Total afterflame time t_f for any conditioned set of five specimens	≤ 50 s	≤ 250 s	≤ 250 s
Individual test specimen afterflame time plus afterglow time after the second flame application ($t_2 + t_3$)	≤ 30 s	≤ 60 s	≤ 60 s
Afterflame and/or afterglow of any specimen burned to the holding clamp	No	No	No
Cotton indicator pad ignited by flaming particles or drops	No	No	Yes

Result of Test (Date: 25-November-2024): Regarding table 2, specimens were classified as **V-0:**

Table 2: Vertical Flammability Results

Sample	t_1	t_2	t_3	t_2+t_3	Result
1	0	1	0	1	Passed
2	0	1	0	1	Passed
3	0	0	0	0	Passed
4	0	2	0	2	Passed
5	0	0	0	0	Passed

2.2.5. Dye Penetration

- According to IEC 62217 subclause 9.4.1

Ten samples, with the length of 10 mm ± 0.5 mm, were cut from the insulator with a diamond-coated circular saw blade under running cold water. The cut surfaces were smoothed by means of fine abrasive cloth (grain size 180). The specimens were placed on a layer of steel balls of same diameter in a tray. A solution of 1 % (by weight) of Astrazon BR 200 in methanol was poured into the tray, its level being 2 mm or 3 mm higher than the level of the balls. The specimens were observed for 15 minutes.

Acceptance Criteria: No dye shall rise through the specimens before the 15 minutes have elapsed.

Result of Test (Date: 25-November-2024): according to figure 1, no dye rise through the specimens before the 15 minutes have elapsed.

Figure 1: Schematic View of Dye Penetration Test

2.2.6. Water diffusion

- According to IEC 62217 subclause 9.4.2

Six cylindrical samples with 30 mm ± 0.5 mm height were cut from the insulator making the cut approximately 90° to the long axis of the insulator. The specimens were boiled in a suitable container for 100 h ± 0.5 h in deionized water with 0.1 % by weight of NaCl.

After boiling, the specimens were removed from the boiling container and placed in another container filled with tap water at ambient temperature for 15 min. Immediately before the voltage test, the specimens were removed from the container and their surfaces dried with filter paper.

For voltage test, each specimen was put between the electrodes. The test voltage was increased at approximately 1 kV per second up to 12 kV. The voltage was kept constant at 12 kV for 1 min and then decreased to zero.

Acceptance Criteria: During the test no puncture or surface flashover shall occur. The current during the whole test shall not exceed 1 mA (r.m.s.).

Result of Test (Date: 02-December-2024): According to table 3, all specimens passed the test.

Table 3: Water Diffusion Test Results

Sample	Duration (min)	Voltage (kV)	Ultimate current (µA)	Result
1	1	12.0	13	Passed
2	1	12.0	16	Passed
3	1	12.1	20	Passed
4	1	12.0	10	Passed
5	1	12.1	25	Passed
6	1	12.1	18	Passed

2.2.7. Test for the Verification of the Maximum Design Cantilever Load (MDCL)

- According to IEC 61952 subclause 10.4.1

The insulator gradually loaded to 1.1 times the MDCL at a temperature of (20±10) ˚C. This load was maintained for 96 h. The load was applied to the insulator at the conductor position, in the direction appropriate for the end fittings, and initially perpendicular to the core of the insulator. Visually inspect was performed during this process.

Then the insulator fitting was cut and after visually inspect, the presence of cracks was checked using dye penetration test.

Acceptance Criteria: The insulators have passed this test if no failure (cracks or permanent deformation in the base end fitting, unusable threads, or the presence of cracks or delamination in the rod) occurs.

Result of Test (Date: 02-December-2024): The insulator passed the test and the MDCL value was 3 kN. The dye penetration test was performed and no crack was observed.

2.2.8. Tensile load test

- According to IEC 61952 subclause 10.4.2

The tensile load was applied in line with the axis of the core of the insulator, at or near the intended service attachment point. The load was increased rapidly but smoothly from zero to approximately 75% of the STL. Then the load was gradually increased in a time between 30 s and 90 s until the STL is reached.

Acceptance Criteria: The insulators have passed this test if no pull-out of the core from the end fitting and no breakage of the end fitting.

Result of Test (Date: 25-November-2024): The insulator has passed this test at 15 kN.

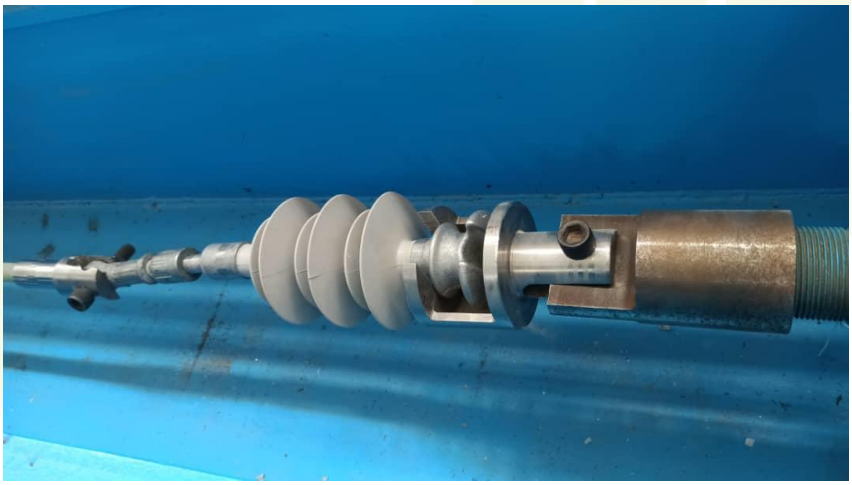


Figure 2: Picture of the insulator after the application of the mechanical force STL

2.3. Type tests

2.3.1. Dry Lightning Impulse Test

- According to IEC 61952 subclause 11.1 & IEC 60060-1

The standard 1.2µs/50µs lightning-impulse voltage with a front time less than 20 s was used. 15 impulses of positive and 15 impulses of negative polarity were applied to the sample. Minimum time interval between pulses was 3 s. The insulator should withstand 15 impulses and then the voltage was increased additionally which arcing of the insulator occurred.
It should be noted that the test voltage was corrected according to the atmosphere correction factor. According to the following ambient conditions, the atmosphere correction factor was 0.800.

Pressure: 844 hPa
Ambient temperature: 31.9 ˚C
Relative humidity: 18.8%

Acceptance Criteria: The insulator shall be considered to have passed the test if no flashover or puncture occurs. Additionally, regarding 24kV insulator, the dry lightning impulse withstand voltage should be equal or higher than 125 kV in both positive and negative polarities.

Result of Test (Date: 26-November-2024): Corrected withstand and breakdown voltage (V_{actual}) of the insulator were measured as following which demonstrate that the insulator has passed the test.

Positive Withstand voltage: 145.0 kV Negative Withstand voltage: 160.1 kV

2.3.2. Wet power-frequency Test

- According to IEC 61952 subclause 11.1 & IEC 60060-1

The wet test procedure was intended to simulate the effect of natural rain on external insulation. The insulator was sprayed with water falling on it as droplets and directed so that the vertical and horizontal components of the spray intensity were approximately equal. The insulator was pre-wetted initially for at least 15 min. then, the insulator was put in high potential circuit and test voltage was applied between fittings. The test voltage was linearly raised to the withstand value and maintained for 1 min. Then the voltage was increased additionally which arcing of the insulator occurred. It should be noted that the test voltage was corrected according to the

atmosphere correction factor. According to the following ambient conditions, the atmosphere correction factor was 0.900.

Pressure: 843.6 hPa
Ambient temperature: 32.3 °C

Acceptance Criteria: The insulator shall be considered to have passed the test if no flashover or puncture occurs. Additionally, regarding 24kV insulator, the wet power frequency withstand voltage should be equal or higher than 50 kV.

Result of Test (Date: 26-November-2024): Corrected withstand and breakdown voltage (V_{actual}) of the insulator were measured as following which demonstrate that the insulator has passed the test.

Withstand voltage: 62 kV

2.3.3. Cantilever failing load Test

- According to IEC 61952 subclause 11.2.1

The cantilever load was increased rapidly but smoothly from zero to approximately 75% of SCL. Then the load was gradually increased in a time between 30 s and 300 s until breakage of either the core or the end fitting occurs.

Acceptance Criteria: The insulators have passed this test if the three failing load values were greater than the SCL.

Result of Test (Date: 25-November-2024): The insulators have passed this test at 14.3 KN.

2.4. Sample tests

2.4.1. Verification of Dimensions

- According to IEC 61952 subclause 12.2

Arcing distance, creep distance and insulator length were measured using glue tape and ruler.

Acceptance Criteria: The insulator passed the test if the allowable tolerances for different dimensions of the insulator are as follows:

$\pm$ (0.04 × d + 1,5) mm when d $\leq$ 300 mm,

$\pm$ (0.025 × d + 6) mm when d > 300 mm with a maximum tolerance of $\pm$ 50 mm,

Result of Test (Date: 25-November-2024):

Table 4- Verification of Dimensions result

Properties	Sample	Measuring value (mm)	Acceptable tolerances (mm)
Creepage distance	DP-280645	647	622.8-667.1
Arcing distance		242	228.8-251.1
Big shed diameter		132	125.2-138.8
Small shed diameter		98	92.6-103.4

2.4.2. Galvanizing Test

- According to IEC 61952 subclause 12.3 & IEC 60383-1

The coating thickness of the ferrous fittings of insulator was determined by coating thickness instrument (Elcometer). On the test sample, three to ten randomly distributed measurements were carried out according to its dimensions.

Acceptance Criteria: The coating shall be continuous, as uniform and as smooth as possible and free from anything that is determined to the stated use of the coated object. The mean coating thickness of specimen shall be not less than 85 µm.

Result of Test (Date: 25-November-2024): Mean coating thickness of fitting was 125.0 µm.

NO.	Thickness (µm) Bottom Fitting
1	108.6
2	125.6
3	137.8
4	130.5
5	110.6
6	136.9
Average	**125.0**

2.4.3. Verification of the SCL Test

- According to IEC 61952 subclause 12.4

The load was increased rapidly but smoothly from zero to approximately 75% of the SCL. Then the load was gradually increased in a time between 30 s and 90 s until the SCL is reached.

If the SCL is reached in less than 90 s, the load shall be maintained for the remainder of the 90 s.

Acceptance Criteria: The insulators have passed this test if the SCL can be maintained for the required time.

Result of Test (Date: 25-November-2024): The insulator tolerates 6 kN effectively and the test was passed.

2.4.4. Verification of Compression Loads

Line post insulators are rated according to their maximum design cantilever load MDCL. In service the cantilever load on a horizontal insulator may be the load resulting from the combination of a vertical load and a longitudinal load. In addition to this cantilever load an axial (compression or tension) load may also be present. The bending moment corresponding to the combination of these loads must not exceed the moment which corresponds to the MDCL.

Line post insulators are also often used with a tension brace in order to be able to support higher vertical loads. The line post insulator in this structure is usually angled upwards by a few degrees. In this case a vertical load creates compressive stresses in the line post insulator.

The following clauses give information on calculating the approximate equivalent bending moment when line post insulators are submitted to combined loads, either alone or when part of a braced structure.

The following notation is used:

C, T, V, L	applied compressive, tensile, vertical, longitudinal load, in newtons
Pp	resulting compressive load in the line post
Pb	resulting tensile load in the brace
MC	resulting moment in the post under compression
MT	resulting moment in the post under tension
d	distance from the point of application of the load to the top edge of the base fitting, in metres

E	longitudinal Young's modulus (Pa) or (N m–2)
I	moment of inertia of the rod, in metres, to the fourth power (for a solid round rod of diameter D: I = πD4/64).

Compression case

The sum of the vertical (V) and longitudinal (L) components of the loads applies a cantilever load to the insulator; the compression load (C) is taken as being applied to the head of the insulator toward its base. The moment resulting from the application of these three forces is given by:

MC = [(V2+L2)EI / C]1/2 tan [d (C / EI)1/2]

Tension case

The sum of the vertical (V) and longitudinal (L) components of the loads applies a cantilever load to the insulator; the tension load (T) is taken as being applied to the head of the insulator away from its base. The moment resulting from the application of these three forces is given by:

MT= [(V2+L2)EI / T]1/2 tanh [d (T / EI)1/2]

Result of Test (Date: 25-November-2024): The insulator tolerates 2.5 kN effectively and the test was passed.

2.5. Routine tests

2.5.1. Tensile Load Test (Routine)

- According to IEC 61952 subclause 13.1

The insulator was subjected, at ambient temperature, to a tensile load equal to or greater than either 50% of STL or 5 kN, whichever is the greater, for at least 10 s.

Acceptance Criteria: The insulators have passed this test if no failure (breakage or complete pull-out of the core, or fracture of the metal fitting) occurs.

Result of Test (Date: 25-November-2024): The insulator has passed the test at 7.5 KN.

2.5.2. Visual Exanimation Test

- According to IEC 61952 subclause 13.2

The mounting of the end fittings on the insulator were evaluated according to the drawings.

Acceptance Criteria: The insulator passed the test if the following defects are not permitted:

a) Superficial defects of an area greater than 25 mm^2 (the total defective area not to exceed 0.2% of the total insulator surface) or of depth greater than 1 mm.

b) Cracks at the root of the shed, notably next to the metal fitting.

c) Separation or lack of bonding at the housing to metal fitting joint (if applicable).

d) Separation or bonding defects at the shed to sheath interface.

e) Molding flashes protruding more than 1 mm above the housing surface.

Result of Test (Date: 25-November-2024): The insulator has passed this test.

2.6. Other Tests

2.6.1. Dry Power Frequency Test

- According to IEC 62217 subclause 9.2.4 & IEC 60060-1

The insulator was cleaned and put in high potential circuit and test voltage was applied between fittings. The test voltage was linearly raised to the withstand value and maintained for 1 min. Then the voltage was increased additionally which arcing of the insulator occurred.
It should be noted that the test voltage was corrected according to the atmosphere correction factor. According to the following ambient conditions, the atmosphere correction factor was 0.776.

Pressure: 845.9 hPa
Ambient temperature: 28.2˚C
Relative humidity: 21.8%

Acceptance Criteria: The insulator shall be considered to have passed the test if no flashover or puncture occurs. Additionally, regarding 24kV insulator, the dry power frequency withstand voltage should be equal or higher than 70 kV.

Result of Test (Date: 27-November-2024): Corrected withstand and breakdown voltage (V_{actual}) of the insulator were measured as follows which demonstrate that the insulator has passed the test.

Withstand voltage: 76 Kv

2.6.2. Water immersion pre-stressing

- According to IEC 62217 subclause 9.2.6

The insulator was cleaned and boiled in a suitable container for 42 h in deionized water with 0.1 % by weight of NaCl. At the end of the boiling period, the samples were allowed to cool. then check adhesion of the insulator housing to core.

Acceptance Criteria: The housing of insulator is inspected usually. No cracks are permissible.

Result of Test (Date: 28-November-2024): The insulator has passed this test and the crack was not observed.

2.6.3. Tracking and erosion test –Inclined Plane Test

- According to IEC 60587

This test was carried out at ambient temperature on sets of five specimens of insulator housing. The contaminant was flowed uniformly at rate of 0.6 ml/min on samples' surface. After that the apparatuses were switched on and the voltage raised to 4.5 kV. The voltage was maintained constant for 6 h. The constant tracking voltage is the highest voltage withstood by all five specimens for 6 h without failure.

Acceptance Criteria: The test is passed if the value of the current in the high voltage circuit through the specimens does not exceed 60 mA, ignition and puncturing of the sample do not occur.

Result of Test (Date: 26-November-2024): According to table 5, all five specimens survived 6 h at 4.5 kV and no ignition or puncture occurred.

Table 5: Tracking and Erosion Results

Sample	Current (mA)	Erosion Depth (mm)
1	14	0.32
2	14	1.10
3	15	0.54
4	13	0.70
5	14	1.26

2.6.4. Hydrophobicity test

2.6.4.1. Hydrophobicity Test- Method C

- According to IEC TS 62073

For determining the hydrophobicity of insulator, the mist was applied on the insulator housing from a distance of 20 cm ±10 cm, for a period of 10 s to 20 s. The measurements of the wettability were performed within 10 s after the spraying has been completed. The appearance on the insulator surface after mist exposure was identified with one of the seven wettability (hydrophobicity) classes (HC).

Acceptance Criteria: HC is a value between 1 (the most hydrophobic) and 7 (the least hydrophobic).

Result of Test (Date: 26-November-2024): According to figure 1, only discrete droplets were formed which are practically circular, so hydrophobicity class is **HC1**.

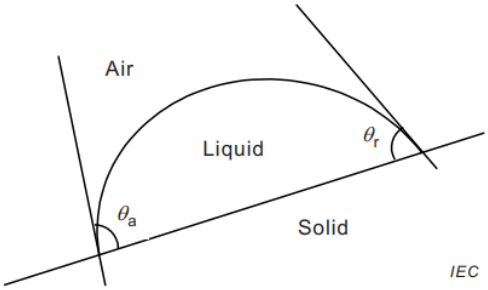
Figure 3: Hydrophobicity of the Insulator

2.6.4.2. Hydrophobicity Test- Method A

- According to IEC TS 62073

This test is performed to evaluate the hydrophobicity class of the shed, according the method A with contact angle device. Angles of a droplet on an inclined solid surface that exhibits two different angles. The advancing contact angle (θa) is the angle inside the water droplet between the solid surface and the droplet surface at the lower part of the droplet on the inclined surface (see Figure). The receding contact angle (θr) of a droplet on an inclined surface is the angle

inside the droplet between the solid surface and the droplet surface at the droplet rear (highest part on the inclined surface).



Acceptance Criteria: The test has passed if the receding contact angle (θr) greater than 60°.

Result of test (Date: 26-November-2024): According to table 6, for all drops the θ_r value was greater than 100°.

Table 6- Hydrophobicity Test-Method A result

θ_r	θ_a
102.13	104.74
106.03	108.70
102.14	103.12

θ_a θ_r

Figure 4: Hydrophobicity Test (Method A) of the Insulator

3. Used measuring / testing equipment

Figure 5: Shore A Durometer (Date of test: 27-November-2024)

Figure 6: Tracking Machine Tester (Date of test: 26-November-2024)

Figure 7: Flammability Test Machine (Date of test: 25-November-2024)

Figure 8: Brass Electrodes Used in Water Diffusion Test (Date of test: 02-December-2024)

Figure 9: Elcometer Used for Coating Thickness Measurement (Date of test: 25-November-2024)

Figure 10: Equipment of Lightening Impulse Voltage Test (Date of test: 26-November-2024)

Figure 11: Wet Power Frequency Voltage Test Chamber (Date of test: 26-November-2024)

Figure 12: Tensile Test Machine (Date of test: 25-November-2024)

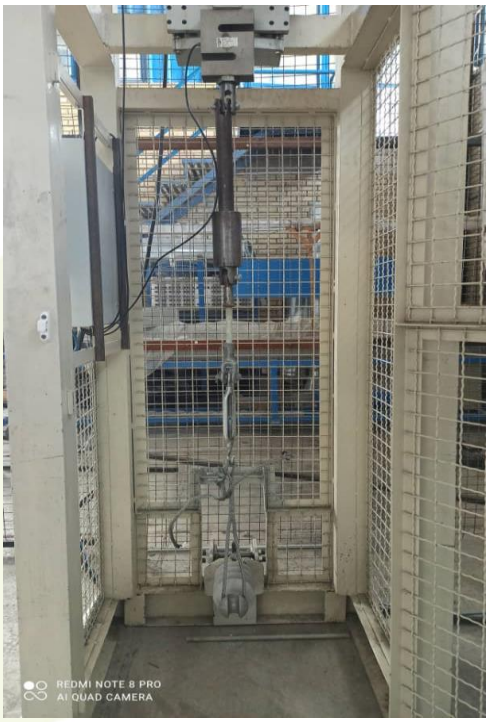


Figure 13: Bending Test Machine (Date of test: 25-November-2024)

Figure 14: UV Test Machine (Date of test: 14-December-2024)

Figure 15: Salt fog Test Machine (Date of test: 14-December-2024)

Figure 16: Contact angle device (Date of test: 26-November-2024)

Date of calibration	Serial number	Type	Equipment	#
2024/04	ST-140 I-S-95	ST140 I	HIPOT	1
2024/04	B022004	ZLT-UL94	Flammability tester	2
2024/04	S-960371	ST401	salt fog tester	3
2024/04	20170325001	ZL-1029	Tracking tester	4
2024/09	004221	Type A (WR-104A)	Shore A Durometer	5
2024/02	16102602	TR200	Roughness tester	6
2024/09	RZ16082341	---	Digital Caliper	7
2024/04	YY-170531	YXEL-225	UV tester	8
2024/04	M2A004152	UN3	Bending Tester	9
2024/07	A456CFBS VM14767	Elcometer456	Thickness Measurement	10
2024/07	AD12231	CAG200	contact angle tester	11
2024/04	---	---	Tensile Tester	12
2024/04	HC2020081409	HCDH-111	Arc Discharge Resistance Tester	13

4. Product Plane