ANKARA SERAMİK PORSELEN
SAN. VE TİC. A.Ş.
Yüksek Gerilim Laboratuarı

1. Organize Sanayi Bölgesi Osmanlı Caddesi, No: 15
06935 Sincan / ANKARA/TÜRKİYE

DENEY RAPORU
TEST REPORT

7300T
29.01.2026

Müşterinin adı/adresi *Customer name/address*	ANKARA SERAMIK A.S.
Numune adı *Name of test item (sample name)*	HCR - 123kV 800A
Sipariş numarası *PO (Purchase Order) No.*	-
Sipariş tarihi *PO (Purchase Order) date*	-
Sipariş sayısı *PO (Purchase Order) quantity*	-
Uygulanan standart *Applied standard*	IEC60137
Deney sınıfı *Test type*	Type Test
Deneyin yapıldığı tarih *Date of Test*	29.01.2026
Açıklamalar *Remarks*	-
Raporun sayfa sayısı *Number of pages of The Report*	19

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The Turkish Accreditation Agency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation (EA) and of the International Laboratory Accreditation (ILAC) for the Mutual recognition of the test reports.

Deney ve/veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (olması halinde) ve deney metotları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.
The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

Mühür Seal	***Tarih*** Date	***Deney Sorumlusu*** Person In Charge of Test	***Laboratuvar Müdürü*** Head of Testing Laboratory
ANKARA SERAMİK A.Ş. YÜKSEK GERİLİM TEST LABORATUVARI ANKARA	29.01.2026	Uğur Can ÇETİNER	Oytun Mehmet KIŞ

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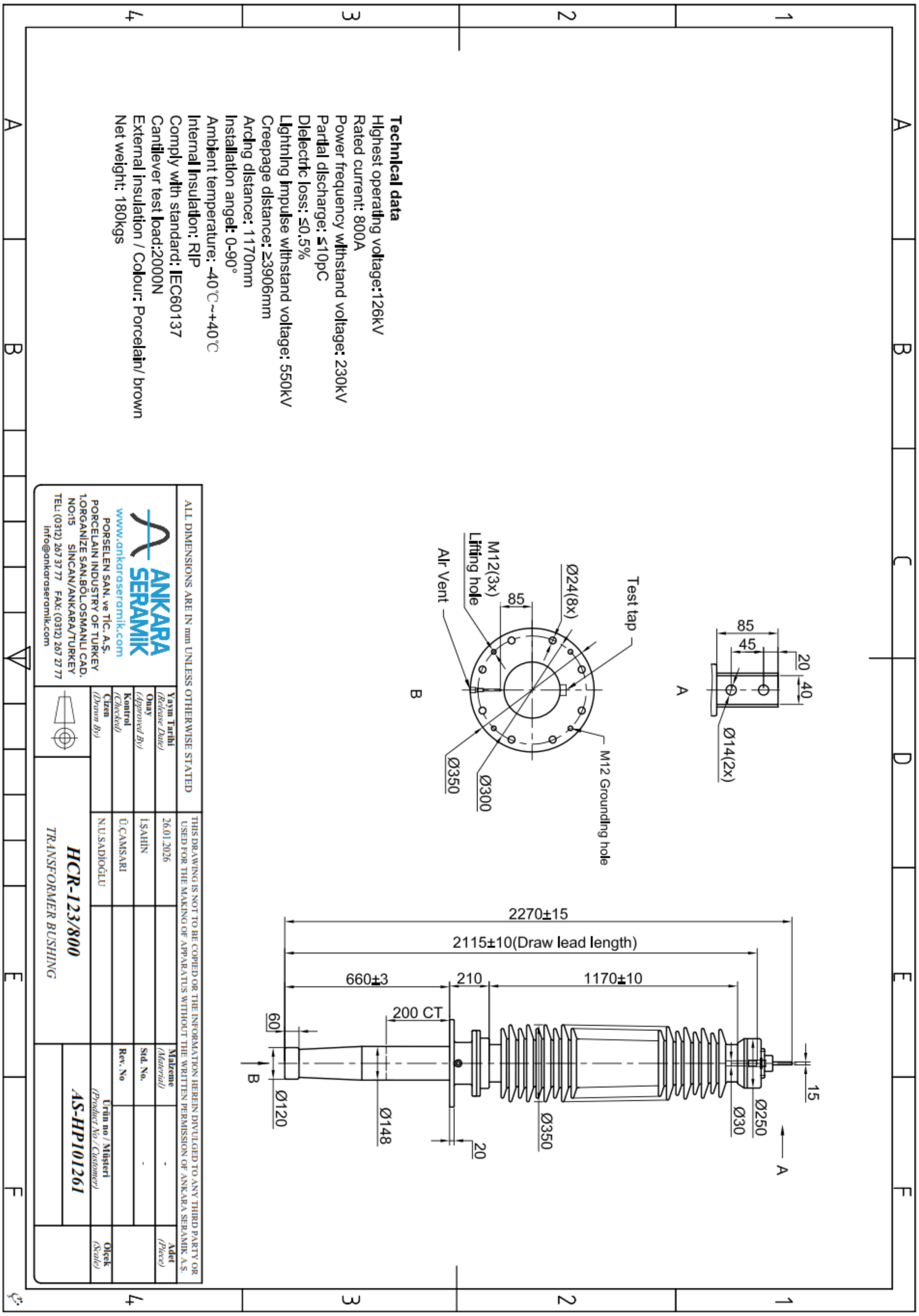
Technical Drawing of The Tested İnsulator



Test Condutions

Temperature(©C) : 15,8 **Humudity(%) : 38** **Pressure(hPa): 921,4**

Test Performed

General

The order or possible combination of the tests is at the discretion of the supplier, except the impulse voltage withstand tests which shall be made before the dry power-frequency voltage withstand test (see 9.4). Before and after the series of type tests, measurements of dielectric dissipation factor and capacitance (see 9.2) and of partial discharge quantity (see 9.5) shall be carried out in order to check whether damage has occurred.

9.2 Measurement of dielectric dissipation factor (tan δ) and capacitance at ambient Temperature

9.2.1 Applicability

The measurement is only applicable to capacitance-graded bushings according to 3.15.

9.2.2 Test method and requirements

During this test, the bushing conductor shall not carry current. The measurement shall be made at an ambient temperature of between 10 °C and 40 °C by means of a Schering bridge, or other similar equipment, at least at:

– 1,05 Um / √3 for bushings of Um ≤ 36 kV;

– 1,05 Um /√ 3 and Um for bushings of Um ≥ 52 kV.

The measurement shall not be made at a voltage exceeding the dry power-frequency withstand voltage.
A measurement of tan δ and capacitance at a voltage between 2 kV and 20 kV shall be carried out as a reference value for measurements carried out later when the bushing is in operation.

9.2.3 Acceptance

The maximum permissible values of tan δ and for the increase of tan δ with voltage are given in Table 8. If the values are not acceptable, it is permitted to wait for 1 h before repeating the test.
The actual temperature during the measurement shall be stated in the test report

9.5 Measurement of partial discharge quantity

9.5.1 Applicability

The measurement shall be carried out on all types of bushings, except for bushings according to 3.6 and 3.13, for which this test shall be a type test only, provided the insulating envelope of the bushing has been subjected to an adequate electrical test (e.g. wall test of the porcelain) before assembly.

9.5.2 Test method and requirements

The test shall be made in accordance with IEC 60270.

When, as a substitute for the measurement of partial discharge quantity, the radio interference voltage, expressed in microvolts,is measured by means of a radio interference meter,the method of calibration to be used is that described in IEC 60270.

Unless otherwise stated, the elements of the test circuit shall be such that background noise and sensitivity at the measuring circuit enable a partial discharge quantity of 5 pC or 20 % of the specific value to be detected, whichever value is higher.
The measurement shall be made after the dry power-frequency withstand voltage test (see 9.4) at the values given in Table 3 during the decrease of the voltage from the dry power-frequency withstand test level.
NOTE The system for detecting partial discharge quantity does not have to be continuously connected at voltage
above *U*m during this test.

9.5.3 Acceptance

The maximum acceptable values of partial discharge quantity, according to the type of bushing after the last dielectric test, shall be as given in Table 9.

When the measured values at 1,5 *U*m/ √ 3 are greater than those indicated in Table 9, the supplier may extend the test for a period of up to 1 h to check if the values return to the allowed limits. If the partial discharge at the end of the period is within limits, then the bushing shall be accepted.

Partial discharge measurements before dielectric tests may be requested for information purpose only, and are not subject to guarantee.

9.11 Visual inspection and dimensional check

9.11.1 Applicability

The inspections are applicable to all types of bushings and shall be made on the complete bushings before release. The visual inspection shall be made on each bushing.

9.11.2 Acceptance

No surface defects shall be tolerated which could affect the satisfactory performance in service.

Dimensions of parts for assembling and/or interconnection shall be in accordance with the relevant drawings, checked by sampling.

TYPE TEST TEST PERMORMED

8.4 Dry lightning impulse voltage withstand test

8.4.1 Applicability

The test is applicable to all types of bushings.

8.4.2 Test method and requirements

The magnitude of the test voltage is given in Table 3. The bushing shall be subjected to

– 15 full lightning impulses of positive polarity, followed by

– 15 full lightning impulses of negative polarity of the standard lightning impulse 1,2/50 µs.

Bushings for transformers of Um greater than 72,5 kV shall be subjected to

– 15 full lightning impulses of positive polarity, followed by

– 1 full lightning impulse of negative polarity at 110 % of the rated withstand voltage, followed by

– 5 chopped lightning impulses of negative polarity at 121 % of the rated withstand voltage, and by

– 14 full lightning impulses of negative polarity at 110 % of the rated withstand voltage.

The time to sparkover on the chopping device shall be between 2 µs and 6 µs.
It is permissible, after changing polarity, to apply some impulses of minor amplitude before the application of the test impulses. The time intervals between consecutive applications of the voltage shall be sufficient to avoid effects from the previous applications of voltage.
Voltage records shall be made for each impulse

8.4.3 Acceptance

The bushings shall be considered to have passed the test, if

– no puncture occurs at either polarity, and

– the number of flashovers in air does not exceed two for each series of 15 impulses;

except for transformer bushings for which

– no flashover on liquid immersed parts,

– not more than two flashovers in air at positive polarity, and

– no flashover in air at negative polarity

are permitted.

For gas-insulated bushings

– the number of disruptive discharges shall not exceed two for each series of 15 impulses;

– no disruptive discharges on non-self-restoring insulation shall occur.

This is verified by at least five impulses without disruptive discharge following that impulse out of the series of 15 impulses of each polarity, which caused the last disruptive discharge. If this impulse is one of the last five out of the series of 15 impulses of each polarity, additional impulses shall be applied.

If disruptive discharges occur and for any reason evidence cannot be given during testing that the disruptive discharges were on self-restoring insulation, after the completion of the dielectric tests the bushing shall be dismantled and inspected. If punctures of non-selfrestoring insulation are observed, the bushing has failed the test.

The voltage shall be sufficient to avoid effects from the previous applications of voltage. Voltage records shall be made for each impulse

8.2 Dry or wet power-frequency voltage withstand test

8.2.1 Applicability

The dry test is applicable to all bushings according to 3.16, 3.19 and 3.21, which are not subjected to a routine test (see 9.4).

The wet test is applicable to all outdoor bushings according to 3.17, 3.18 and 3.20, and for which Um 245 kV and below.

8.2.2 Test method and requirements

The magnitude of the test voltage is given in Table 3. The test duration shall be 60 s, independent of test frequency, except for transformer bushings with Um equal to or above 1100 kV where the test duration is 300 s.

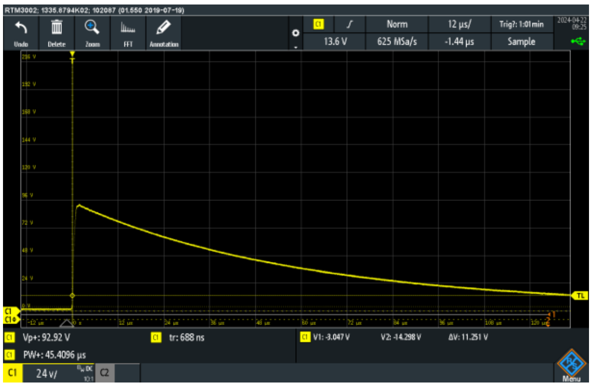
8.2.3 Acceptance

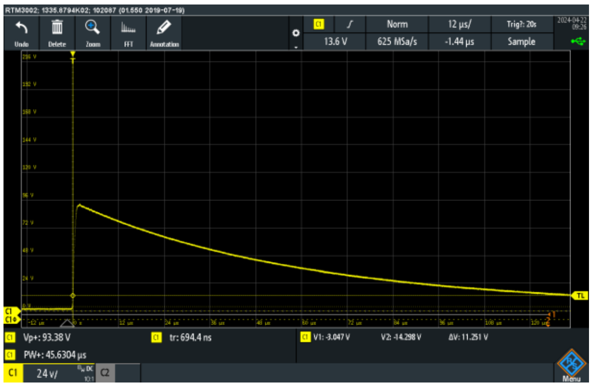
The bushing shall be considered to have passed the test if no flashover or puncture occurs. If there is a puncture, the bushing shall be considered to have failed the test. For capacitance graded bushings it is assumed that a puncture has occurred if the capacitance measured after the test raises above the capacitance previously measured by about the amount attributable to the capacitance of one layer. If a flashover occurs, the test shall be repeated once only. If during the repetition of the test no flashover or puncture occurs, the bushing shall be considered to have passed the test.

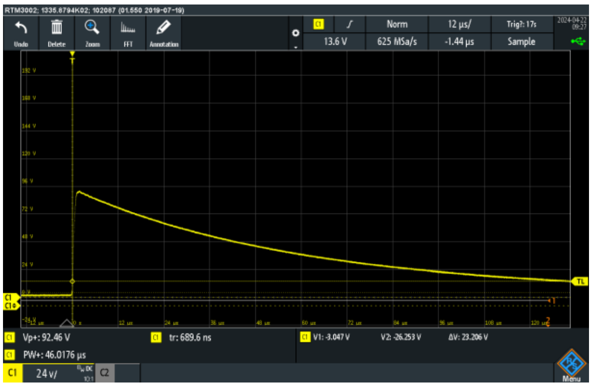
Table-1 Dry Lightning Impulse Chart in Positive

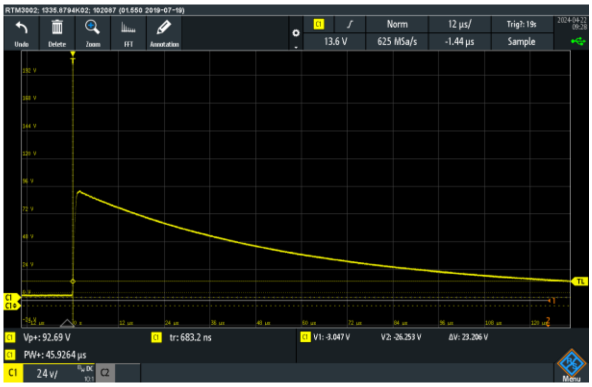
V_p(kV)$^{(3)}$	t1(µs)$^{(2)}$	t2(µs)
583,15241	1,146667	45,409
586,039303	1,156667	45,63
580,265517	1,148333	46,017
581,708964	1,138333	45,926
577,378624	1,148333	45,873
578,822071	1,135	45,848
584,595857	1,121667	45,758
583,15241	1,138333	45,705
581,708964	1,153333	45,952
565,831051	1,156667	45,504
584,595857	1,186667	45,681
587,48275	1,153333	45,718
578,822071	1,116667	45,768
581,708964	1,135	45,913
562,944158	1,153333	46,033

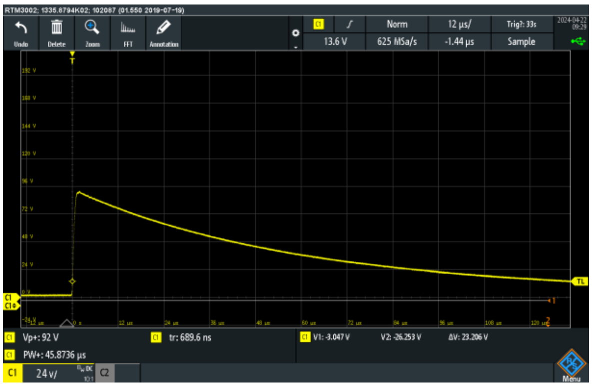
Positive Dry Lightning Impulse Oscilloscope Graphics

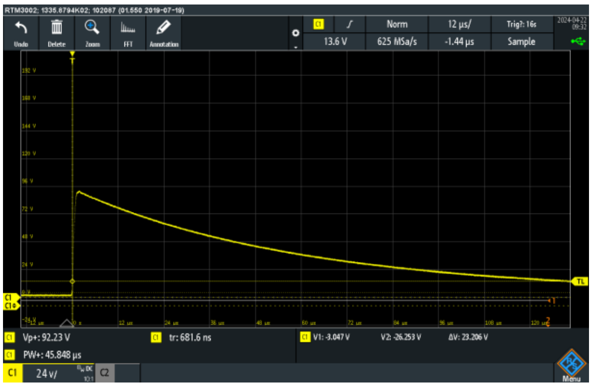


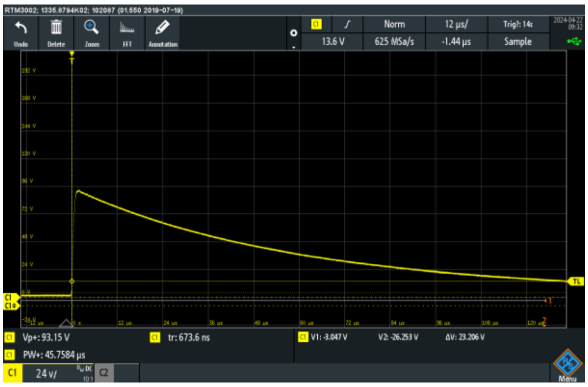


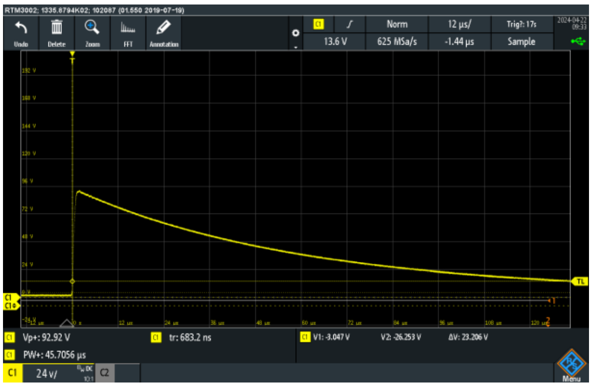




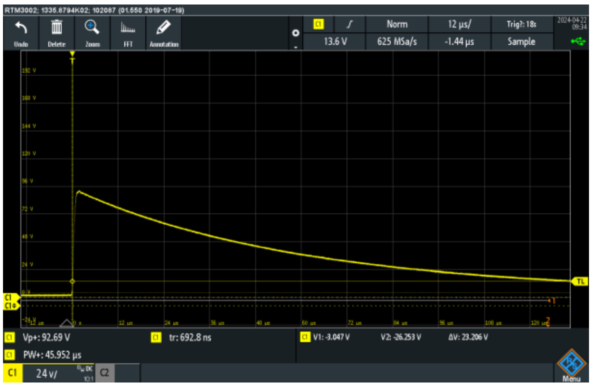


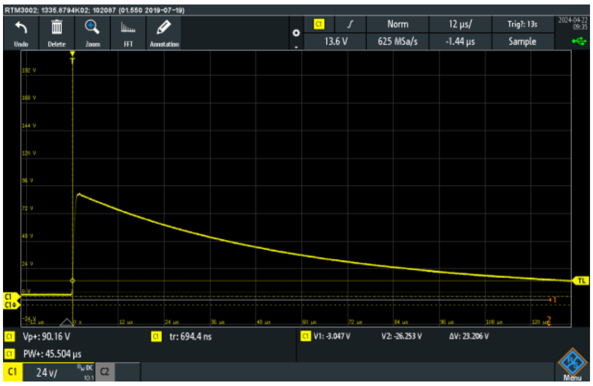


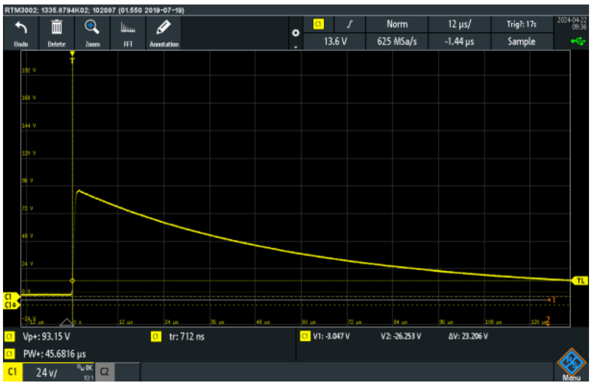


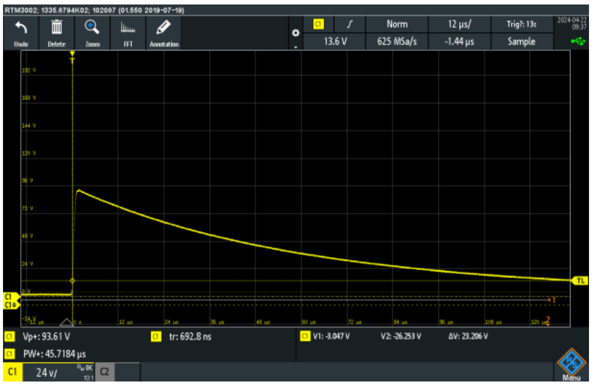


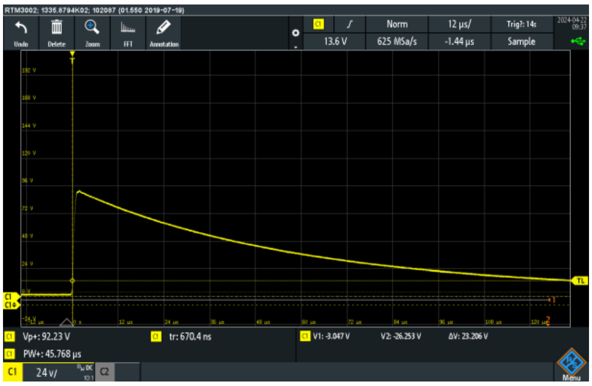
Positive Dry Lightning Impulse Oscilloscope Graphics

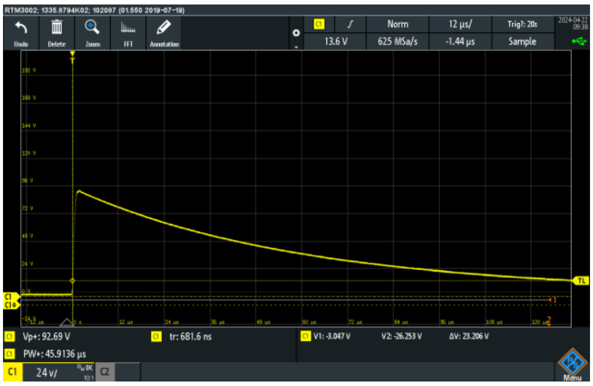












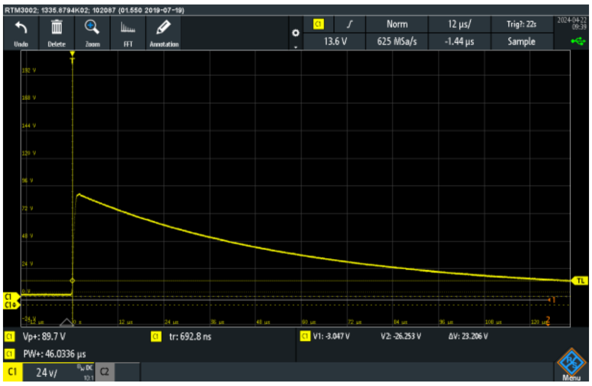
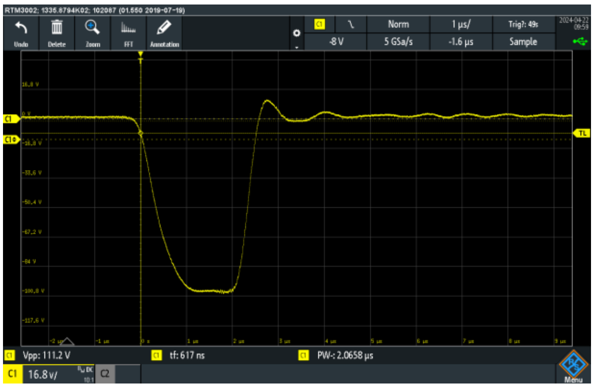
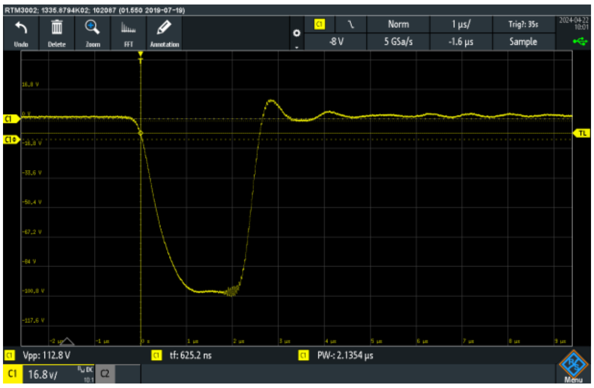


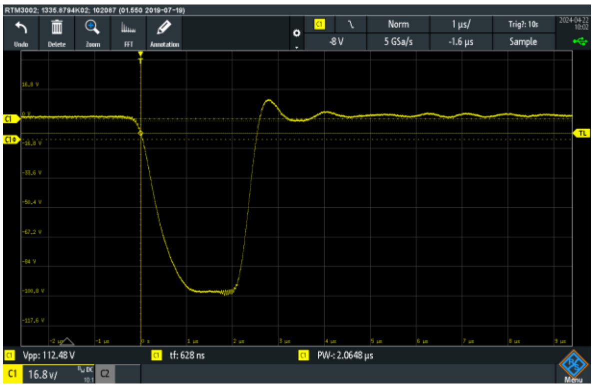
Table-1 Dry Lightning Impulse Chart in Negative

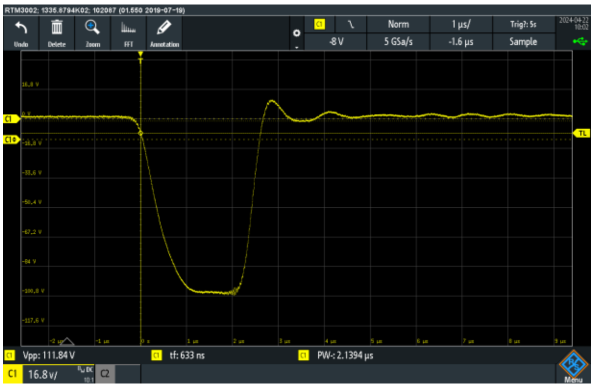
V_p(kV)[3]	t1(µs)[2]	t2(µs)
623,06	1,08	44,58
697,87	1,02	2,065
707,91	1,04	2,135
705,90	1,04	2,135
701,89	1,05	2,139
701,89	1,06	2,1
621,24	1,11	44,74
631,97	1,14	44,75
626,016	1,1	45,11
612,89	1,12	44,95
642,71	1,08	44,91
624,82	1,12	44,89
621,24	1,11	45,24
637,94	1,10	45,15
630,78	1,08	44,83
627,20	1,11	44,84
631,97	1,08	45,25
623,63	1,10	45,14
626,016	1,08	44,78
618,86	1,09	44,99

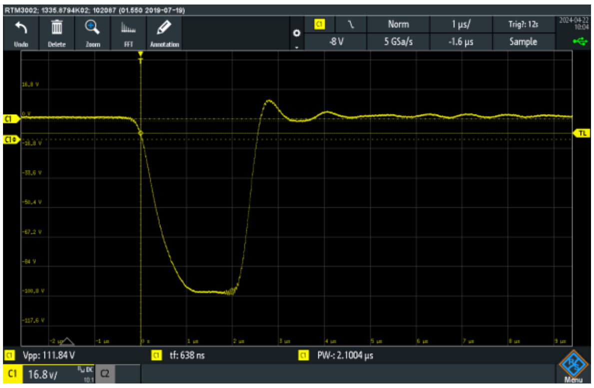
Negative Dry Lightning Impulse Oscilloscope Graphics

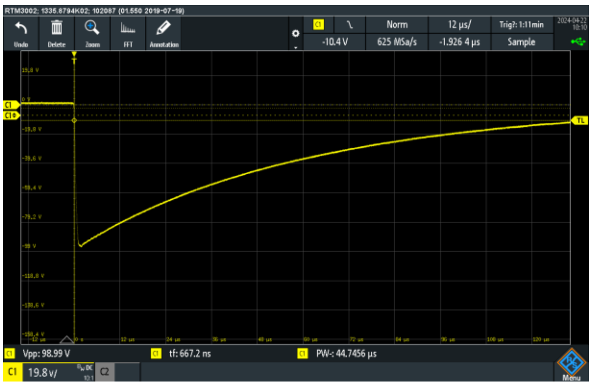




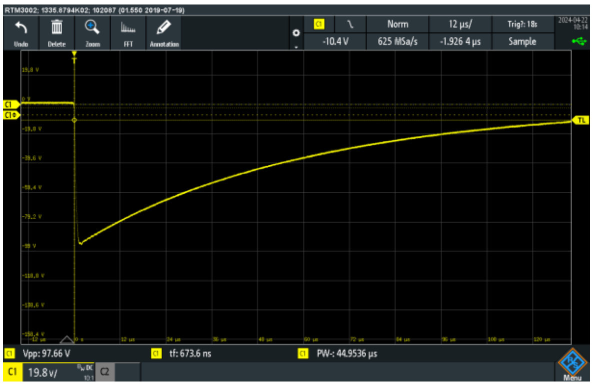


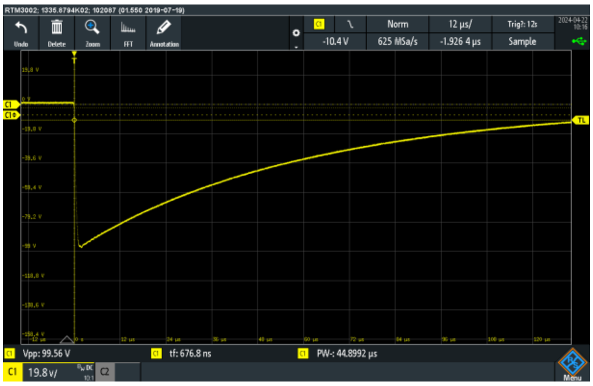


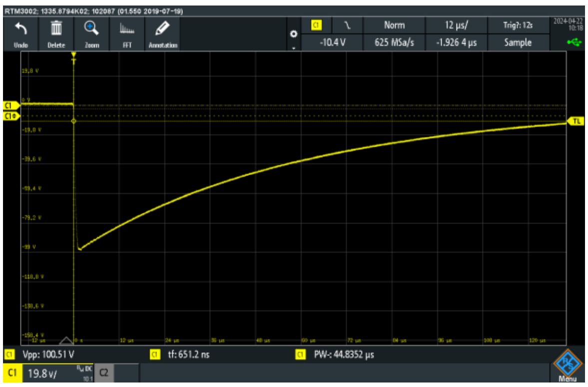




Negative Dry Lightning Impulse Oscilloscope Graphics







Negative Dry Lightning Impulse Oscilloscope Graphics

8.7 Electromagnetic compatibility tests (EMC)

8.7.1 Emission test

8.7.1.1 Applicability

This test is applicable for all indoor and outdoor bushings having highest voltage for equipment (Um) equal to and above 123 kV.

8.7.1.2 Test method and requirements

The bushing shall be installed as stated in 7.3.
The flange and other normally earthed parts shall be connected to earth. Care should be taken to avoid influencing the measurements by earthed or unearthed objects near to the bushing and to the test and measuring circuits.

The bushing shall be dry and clean and at approximately the same temperature as the room in which the test is made. It should not be subjected to other dielectric tests within 2 h prior to the present test.

The test connections and their ends shall not be a source of radio interference voltage of higher values than those indicated below. The high-voltage connections shall extend in line with the bushing axis to a point at least 0,2 L above the top of the bushing, where L is the arcing distance of the bushing. The maximum diameter of this connection shall be half the diameter of the bushing head.

The measuring circuit shall comply with CISPR 18-2. The measuring circuit shall preferably be tuned to a frequency within 10 % of 0,5 MHz, but other frequencies in the range 0,5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be expressed in microvolts.

If measuring impedances different from those specified in CISPR publications are used, they shall be not more than 600 Ω nor less than 30 Ω, in any case the phase angle shall not exceed 20°. The equivalent radio interference voltage referred to 300 Ω can be calculated, assuming the measured voltage to be directly proportional to the resistance, except for bushings of large capacitance, for which a correction made on this basis may be inaccurate. Therefore, a 300 Ω resistance is recommended for bushings with earthed flanges.
The filter F shall have a high impedance at the measuring frequency, so that the impedance between the high-voltage conductor and earth is not appreciably shunted as seen from the bushing under test. This filter also reduces circulating radio-frequency currents in the test circuit, generated by the high-voltage transformer or picked up from extraneous sources. A suitable value for its impedance has been found to be 10 000 Ω to 20 000 Ω at the measuring frequency.

It shall be ensured by suitable means that the radio interference background level (radio interference level caused by external field and by the high-voltage transformer when magnetised at the full test voltage) is at least 6 dB and preferably 10 dB below the specified radio interference level of the bushing to be tested. Calibration methods for the measuring instrument and for the measuring circuits are given in CISPR 16-1 and CISPR 18-2 respectively.

As the radio interference level may be affected by fibres or dust settling on the insulators, it is permitted to wipe the insulators with a clean cloth before taking a measurement. The atmospheric conditions during the test shall be recorded. It is not known what correction factors apply to radio interference testing but it is known that tests may be sensitive to high relative humidity and the results of the test may be open to doubt if the relative humidity exceeds 80 %.

The following test procedure shall be followed:
A voltage of 1,1 Um /√ 3 shall be applied to the bushing and maintained for at least 5 min, Um being the highest voltage for equipment. The voltage shall then be decreased by steps down to 0,3 Um / √3 , raised again by steps to the initial value and finally decreased by steps to 0,3 Um /√ 3 . At each step radio interference measurement shall be taken and the radio interference level, as recorded during the last series of voltage reductions, shall be plotted versus the applied voltage; the curve so obtained is the radio interference characteristic of the bushing. The amplitude of voltage steps shall be approximately 0,1 Um / √3 .

8.7.1.3 Acceptance

The bushing shall be considered to have passed the test if the radio interference level at 1,1 Um / √3 does not exceed 2500 μV.

If it can be shown that the bushing, without external shielding, is partial discharge free, i.e. there is no discharge above the background noise level specified in 9.5.2, it can be considered to pass the emission test.

8.7.2 Immunity test

No test is required

8.8 Temperature rise test

8.8.1 Applicability

The test is applicable to all types of bushings, unless it can be demonstrated by a calculation based on comparative tests that specified temperature limits are met.

8.8.2 Test method and requirements

Bushings, one or both ends of which are intended to be immersed in mineral oil or another liquid-insulating medium, shall be appropriately immersed in liquid at ambient temperature, except for transformer bushings intended for use in mineral oil, where the oil shall be maintained at a temperature of 60 K ± 2 K above the ambient air. If the transformer is filled with another liquid-insulation medium, the temperature shall be subject to agreement.
In some applications using mineral oil (e.g. generator transformer), the transformer top-oil temperature is often restricted to values below the normal IEC limits. Subject to agreement between manufacturer and purchaser, the standard oil temperature rise of 60 K may be reduced to reflect the real transformer top oil temperature.

Bushings with a conductor drawn into the central tube shall be assembled with an appropriate conductor, the cross-section of which shall conform to Ir. When the transformer liquid is in communication with the bushing central tube, the liquid level shall not exceed one-third of the height of the external part.

The end of bushings, which are intended for immersion in a gaseous insulating medium other than air at atmospheric pressure, shall normally be appropriately immersed in an enclosure insulated with gas at minimum pressure, according to 3.30, the gas being at ambient temperature at the beginning of the test.

Gas-insulated bushings shall be at ambient temperature at the beginning of the test.
For transformer bushings operating in air-insulated ducting, the air side shall be enclosed in an appropriate chamber. During the test, the air in the chamber shall be heated to 40 K ± 2 K above ambient air, either by self-heating or indirectly.

An appropriate number of thermocouples or other measuring devices shall, as far as possible, be placed along the bushing conductor, central tube and other current-carrying parts, as well as possibly on the flange or other fixing device, so as to determine the temperature rise of the bushing components in relation to the values given in table 2 with reasonable accuracy.
The ambient air temperature shall be measured with lagged thermometers placed around the bushing at mid-height and at a distance of 1 m to 2 m from it.

NOTE A satisfactory degree of lagging is obtained by placing the thermometers in liquid-filled containers with a volume of approximately 0,5 l.

The temperature of the liquid or gas shall be measured by means of thermometers placed at a distance of 30 cm from the bushing and, in the case of liquid, 3 cm below the surface of the liquid.

The test shall be carried out at Ir ± 2 % at rated frequency, all parts of the bushing being substantially at earth potential. If the frequency at the test differs from the rated frequency, the current may be adjusted to achieve equivalent losses.

Temporary external connections used for this test shall be of such dimensions that they do not contribute unduly to the cooling of the bushing under test. These conditions are assumed to be fulfilled if the temperature decrease from the bushing termination to a point at 1 m distance along the connection does not exceed 5 K, or the thermal gradient along the external conductor is 5 K per metre for short connections.

The test shall be continued until the temperature rise is sensibly constant. This is considered to be the case if the temperature does not vary more than ± 1 K during 1 h.
In order to provide data for thermal modelling of bushings, e.g. GIS-outdoor bushings, operating under different current loading and ambient temperature conditions, it is recommended by agreement to carry out overload tests and to record time functions of all temperature readings.

To avoid destruction of the insulation in the case of bushings with the conductor embedded in the insulating material, the temperature of the hottest spot may, by agreement between purchaser and supplier, be determined by suitably validated finite element calculations. (See also Annex A for an approximate method.)

8.8.3 Acceptance

The bushing shall be considered to have passed the test if the permissible temperature limits in accordance with 4.8 are met, and if there is no visible evidence of damage.

8.10 Cantilever load withstand test

8.10.1 Applicability

The test is applicable to the air side of bushings.

8.10.2 Test method and requirements

The test values shall be in accordance with Table 1. For bushings according to 3.22, cantilever withstand load test values shall be restricted to:

300 N for Ir ≤ 800 A

The bushing shall be completely assembled and, if applicable, filled with the insulating medium specified. Unless otherwise stated, the bushing shall be installed vertically and its flange rigidly fixed to a suitable device.

A pressure equal to 1 bar ± 0,1 bar above the maximum operating pressure shall be applied inside the bushing, and also inside the central tube in the case of a bushing with a hollow stem with a gasket joint at the terminal to be tested.

For bushings with internal bellows, the pressure shall be stated by the supplier.
For bushings according to 3.5, 3.6 and 3.7 the test shall be performed with an internal gas pressure equal to the rated filling pressure.

For safety reasons on bushings with porcelain envelope the test may be performed without internal gas pressure and the relevant mechanical stress shall be replaced by an equivalent additional moment calculated in accordance with IEC 62155:2003, Annex D.

The load shall be applied perpendicular to the axis of the bushing at the mid-point of the terminal for 60 s. The load shall be in the direction which will cause the highest stress at the critical parts of the bushing in normal operation.

For bushings with more than one air side terminal, it is generally sufficient to apply the load to one terminal only.

For wall bushings the test load shall be applied to each end of the bushing separately.
Bushing types as defined in 3.5, 3.6 and 3.7 shall pass the leakage test according to 9.8 after the cantilever test.

8.10.3 Acceptance
The bushing shall be considered to have passed the test if there is no evidence of damage (deformation, rupture or leakage) and if it has withstood a repetition of all routine tests without significant change from previous results.

Test Results

Test Before Type Test

Applied Test	Specified Value	Measured Value	Test Result
Measurement of partial discharge quantity (pC)	Um (123kV)≤ 20pC	4 pC	Positive
	1,5 Um /√ 3(107) ≤20pC	4 pC	
	1,05 Um /√ 3 (75kV) ≤ 10pC	4 pC	
Measurement of main insulation dielectric dissipation factor (tanδ)	1,05 Um /√ 3 (75kV)< 0.005	0.00302	Positive
	Voltage from 10kV risv to 123Kv tanδ<0,001	<0,001	
Measurement of capacitance (pF)	Measurement of partial discharge quantity (pC)	445 pF	Positive
Visual inspection and dimensional check	Clause 9.11	The size is correct	Positive

Type Test Results

Applied Test	Specified Value	Measured Value	Test Result
Dry lightning impulse voltage withstand test	550kV Positive polarity	562,94 kV	Withstood
	-605kV for Negative polarity	612,89 kV	
	-666kV for chopped Negative polarity	697,87kV	
Dry power frequency voltage withstand test	230 kV, 1 min	245,4 kV	Withstood
Electromagnetic compatibility tests (EMC)	1,1 Um /√ 3 (78kV)<2500µV	242µV	Positive
Temperature rise test	Temperature Rise Limits(K) 60	34,3°C	Positive
	Max Temperature °C<120	68,6°C	
Cantilever load withstand test	2000N	2410N	Withstood
Short-Time Thermal Current	<180°C	110,46°C	Positive

Test After Type Test

Applied Test	Specified Value	Measured Value	Test Result
Measurement of partial discharge quantity (pC)	Um (123kV)≤ 20pC	4 pC	Positive
	1,5 Um /√ 3(107) ≤20pC	4 pC	
	1,05 Um /√ 3 (75kV) ≤ 10pC	4 pC	
Measurement of main insulation dielectric dissipation factor (tanδ)	1,05 Um /√ 3 (75kV)< 0.005	0.00302	Positive
	Voltage from 10kV risv to 123Kv tanδ<0,001	<0,001	
Measurement of capacitance (pF)	Measurement of partial discharge quantity (pC)	445 pF	Positive
Visual inspection and dimensional check	Clause 9.11	The size is correct	Positive