HSP Hochspannungsgeräte GmbH · P.O. Box 3185 · 53831 Troisdorf · Germany

Phone: +49 (0) 2241-2526-0
Fax: +49 (0) 2241-2526-116
E-mail: contact@hspkoeln.de
www.hspkoeln.de

HSP Hochspannungsgeräte GmbH
Camp-Spich-Str. 18
53842 Troisdorf-Spich
Germany

Deutsche Bank Cologne
BIC (SWIFT-Code): DEUTDEDKXXX
IBAN: DE69 3707 0060 0596 7831 00

Managing Directors:
Matthias Baca, Georg von Rohr

Registered office: Troisdorf-Spich
Local County Court Siegburg
Reg.-No. HRB 9858

10.01.2022

Certificate of Quality

HSP Order No.: 1313166 PO No.: 9500941502	
10) RIP CONDENSER BUSHING TRANSFORMER - OUTDOOR **ETFT 1050-252-D E7,2 SPEZ.** SPEC. NO.: 351210	2 pcs Serial No.: 301256 + 301257
30) RIP CONDENSER BUSHING TRANSFORMER - OUTDOOR **ETFT 650-172-D E5 SPEZ.** SPEC. NO.: 337920	3 pcs Serial No.: 301113 – 301115
60) RIP CONDENSER BUSHING TRANSFORMER - OUTDOOR **ETFT 550-126-C E4 SPEZ.** SPEC. NO.: 324703	4 pcs Serial No.: 301258 - 301261

We, HSP Hochspannungsgeräte GmbH, the manufacturer, certify that our manufactures are produced under permanent control according to the ISO 9001 and tested in our test laboratory which is released for tests to IEC standards and other standards deviated here from.
HSP has received the ISO 9001 certificate No. 00135 – QM 15 UM of the DQS valid until 17 November 2023.
We certify that the goods covered by this certificate, are with regards to quality according to our technical specifications and to our order acknowledgement.

HSP Hochspannungsgeräte GmbH

Vasilyev Alexei
Digital signiert von Vasilyev Alexei
DN: cn=Vasilyev Alexei, o=Siemens, email=alexei.vasilyev@hspkoeln.de
Datum: 2023.01.10 11:22:00 +01'00'

Vasilyev

HSP Pioneering high voltage.
Digital signiert von Korosoglou Nina
Datum: 2023.01.10 10:51:08 +01'00'

Korosoglou

CANTILEVER LOAD WITHSTAND TEST

Test laboratory	HSP Hochspannungsgeräte GmbH HS-Prüflaboratorium, Camp-Spich-Str. 18 D-53842 Troisdorf
Customer	HSP Hochspannungsgeräte GmbH Camp-Spich-Str. 18 D-53842 Troisdorf

Test Object:	**RIP Condenser Bushing, Transformer – Outdoor**
Type	**STARIP® – Si+ 123 – 800 E0**
Specification	344120 (see last page)
Highest voltage for equipment	123 kV
Rated current	800 A
Serial number	**283352**

Begin of tests	09.12.2019
End of tests	15.12.2019
Test standard	IEC 60137 (2017)
Test plan	HSP 1310299/20 - TTP
Test equipment	Documented in the laboratory test records

The equipment passed all indicated tests successfully.
The test results are valid for the tested equipment only.

Troisdorf 11.02.2020

HSP Hochspannungsgeräte GmbH
HS-Prüflaboratorium

Camp-Spich-Straße 18
53842 Troisdorf GERMANY

DAkkS Deutsche Akkreditierungsstelle D-PL-19413-01-00

i.A. Haberecht
Senior Test Engineer

i.A. Adams
Senior Test Engineer

CANTILEVER LOAD WITHSTAND TEST

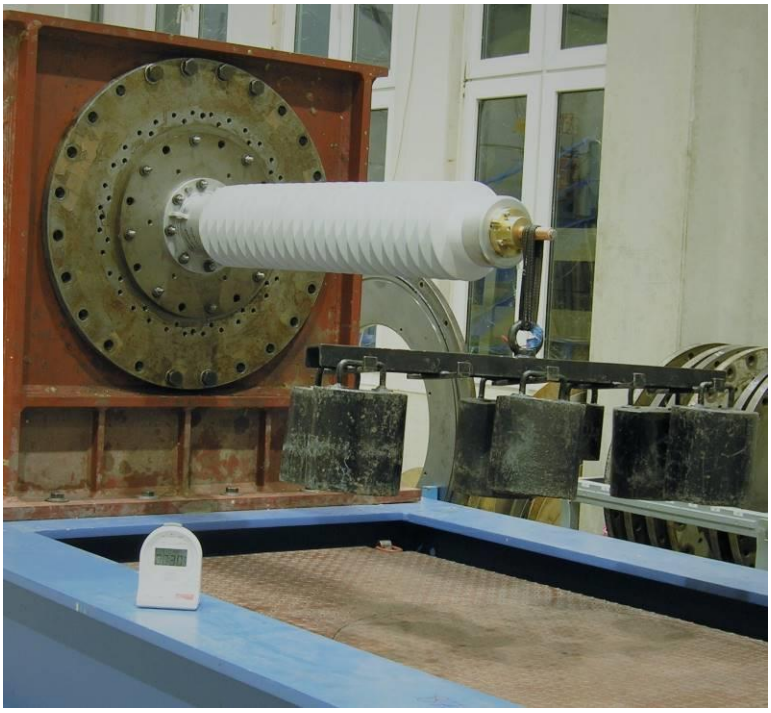
The following tests were executed successively:

50 Hz AC routine test before type test															Date of test: 09.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	260	260	260	260	260	260	260	**Test voltage 72 sec.**	260	260	260	260	260	260	260
tan δ [%]	0.37	0.37	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37	0.37	0.37	0.37	0.37
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

CANTILEVER LOAD WITHSTAND TEST — **Date of test: 10.12.2019**

Test setup:
The bushing was fixed in a steel frame at its flange in horizontal position.

Atmospheric conditions: 19 °C



Specified test force: 3150 N perpendicular to the axis of the bushing at air terminal

Distance between fixing- and force points: Specified: 1470 mm Applied: 1470 mm

Test equipment: 6 weights 50 kg each, 1 weight 20 kg plus mass of the support

Test:

F [N]	Duration [sec.]
3200	**60**

Result of test:
Neither damage nor deformation of the bushing was visible.

50 Hz AC routine test after type test															Date of test: 15.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	259	259	259	259	259	259	259	**Test voltage 72 sec.**	259	259	259	259	259	259	259
tan δ [%]	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38	0.38	0.38	0.38	0.38
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

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CANTILEVER LOAD WITHSTAND TEST

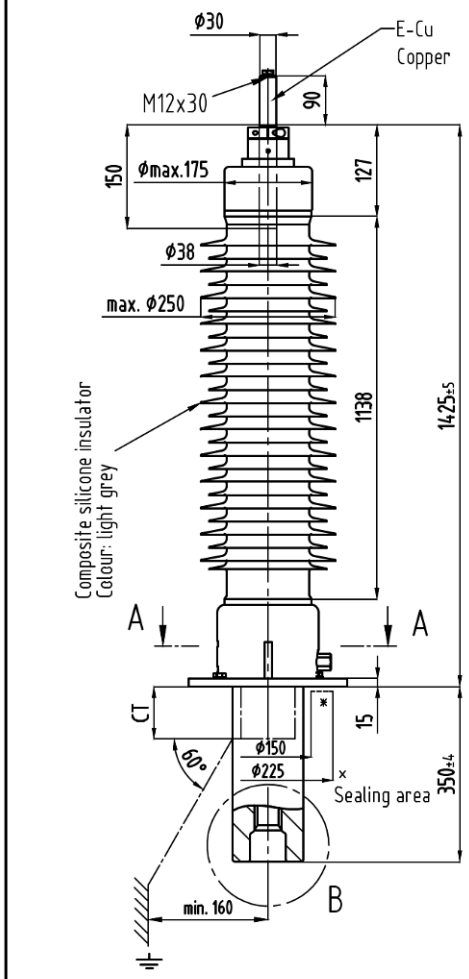
Supplemental Information - Test Object Specification

HSP Hochspannungsgeräte GmbH

Spec. No.: 344120	
Repl. for issue: 20.12.2019	Issue date: 10.01.2020
Offer-No.:	Order-No.:

Zng.: | Type: STARIP®-Si+ 123- 800 E0

Condenser graded bushing, Transformer-Outdoor, dry filling



Technical Data

Rated highest voltage for Equipment Um, (50/60Hz) phase-phase:	123.0 kV
Rated phase-to-earth voltage:	71 kV
Partial discharge level at test voltage:	≤ 4 pC
Power-frequency withstand voltage 50Hz, 1.2 min. dry:	255 kV
Rated lightning impulse withstand voltage (BIL): 1.2/50µs	550 kV
Rated switching impulse withstand voltage (SIL): 250/2500µs	0 kV
Rated current:	800 A
Max. service current:	800 A
CT accommodation length:	0 mm
Flashover distance:	1138 mm
Creepage distance, min.:	3906 mm
Cantilever test load:	3150 N
Mounting position:	0-90°
Ambient temperature:	-30...+40°C
Temperature of transformer oil:	max.100°C max. daily mean 90 °C
Test tap - test voltage:	2kV, 50Hz, 1.2min.
Routine test according to	IEC 60137-2017
Mass, approx.:	57 kg
Dry insulation foam is free of SF6	

Remarks:

- RIP (resin impregnated paper)
- Draw lead bolt, E-Cu, cable cross section 450mm²

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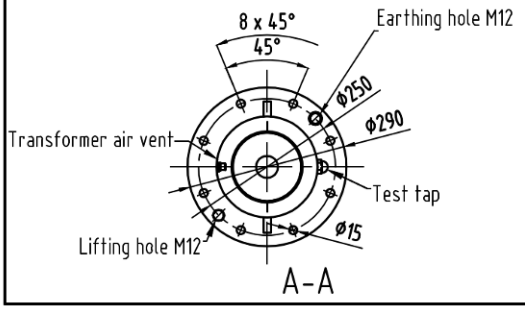

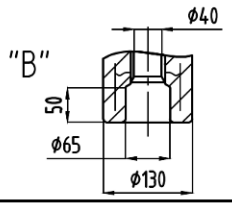

Rev.: 7534, 7556, 7562

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DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

Test laboratory	HSP Hochspannungsgeräte GmbH HS-Prüflaboratorium, Camp-Spich-Str. 18 D-53842 Troisdorf
Customer	HSP Hochspannungsgeräte GmbH Camp-Spich-Str. 18 D-53842 Troisdorf

Test Object:	**RIP Condenser Bushing, Transformer – Outdoor**
Type	**STARIP® – Si+ 123 – 800 E0**
Specification	344120 (see last page)
Highest voltage for equipment	123 kV
Rated current	800 A
Serial number	**283352**

Begin of tests	09.12.2019
End of tests	15.12.2019
Test standards	IEC 60137 (2017) and 60060-1 (2010)
Test plan	HSP 1310299/20 - TTP
Test equipment	Documented in the laboratory test records

The equipment passed all indicated tests successfully.
The test results are valid for the tested equipment only.

Troisdorf, 11.02.2020

HSP Hochspannungsgeräte GmbH
HS-Prüflaboratorium

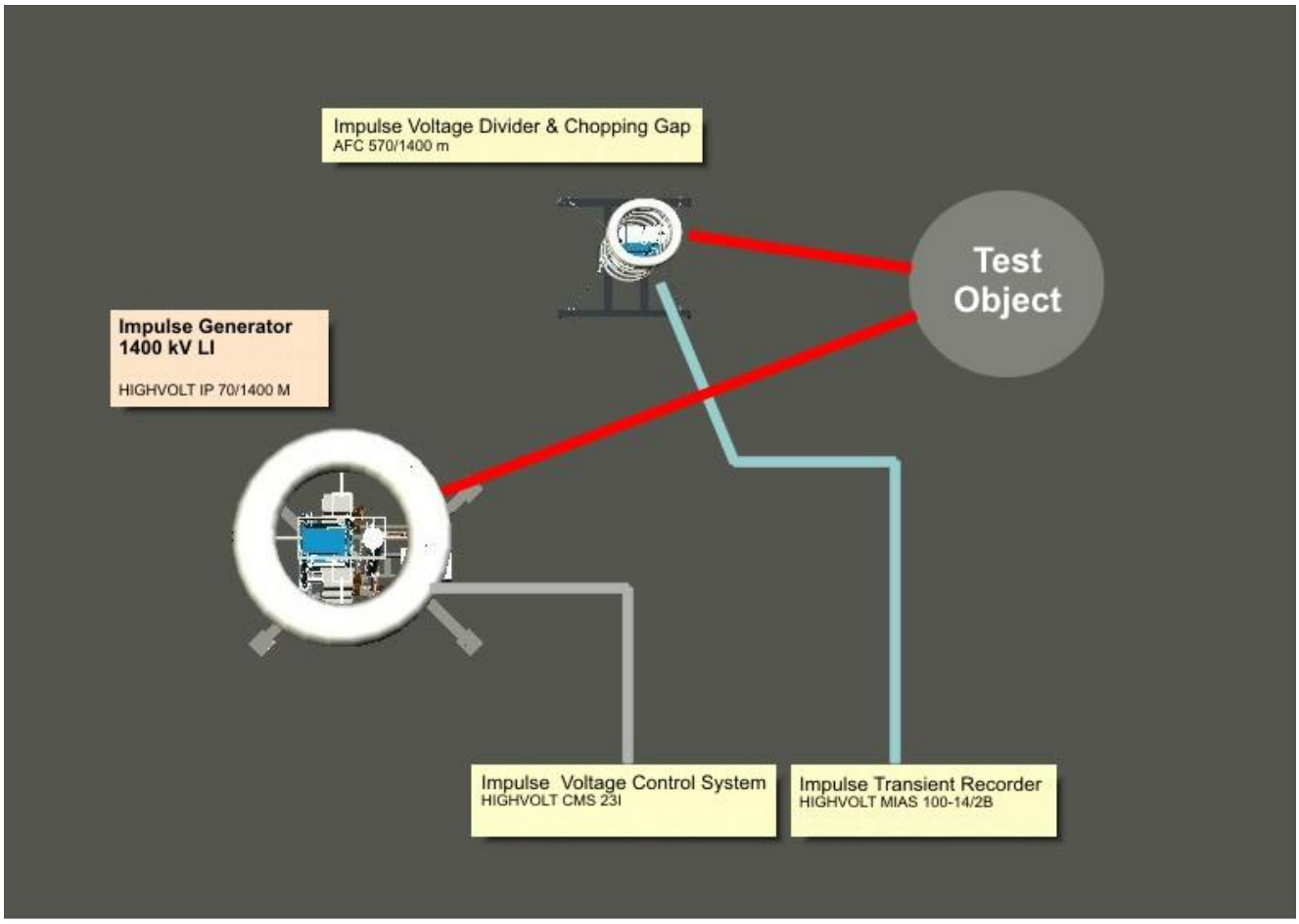
Camp-Spich-Straße 18
53842 Troisdorf GERMANY

DAkkS Deutsche Akkreditierungsstelle D-PL-19413-01-00

i.A. Haberecht
Senior Test Engineer

i.A. Adams
Senior Test Engineer

Basic Circuits & Principal Test Setup



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DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

The following tests were executed successively:

50 Hz AC routine test before type test															Date of test: 09.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	260	260	260	260	260	260	260	**Test voltage 72 sec.**	260	260	260	260	260	260	260
tan δ [%]	0.37	0.37	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37	0.37	0.37	0.37	0.37
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST — **Date of test: 13.12.2019**

Test setup:
The bushing was mounted on a solidly grounded test vessel filled with oil. The effective test vessel diameter was reduced by an inserted grounded aluminium cylinder Ø 340 mm x 710 mm. The test object was connected to the impulse generator and to the measuring divider by wires.

Atmospheric conditions:

Temperature:	20 °C
Air pressure:	974 hPa
Relative humidity:	39 %
Correction factor:	0.96 (not applied)

Wave shape: 1.2 µs / 50 µs

Specified test voltage: 550 kV full wave

Test:

Level [%]	U [kV]	quantity	figure	comment
80	+ 440	1	1	calibration impulse
100	+ 550	15	2-16	test impulses full wave
80	- 440	1	17	calibration impulse
110	- 605	1	18	test impulse full wave
121	- 666	5	19-28	test impulses chopped wave
110	- 605	14	29-42	test impulses full wave

Result of test:
During the test no flashover has occurred. See oscillograms on the next pages.

50 Hz AC routine test after type test															Date of test: 15.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	259	259	259	259	259	259	259	**Test voltage 72 sec.**	259	259	259	259	259	259	259
tan δ [%]	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38	0.38	0.38	0.38	0.38
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

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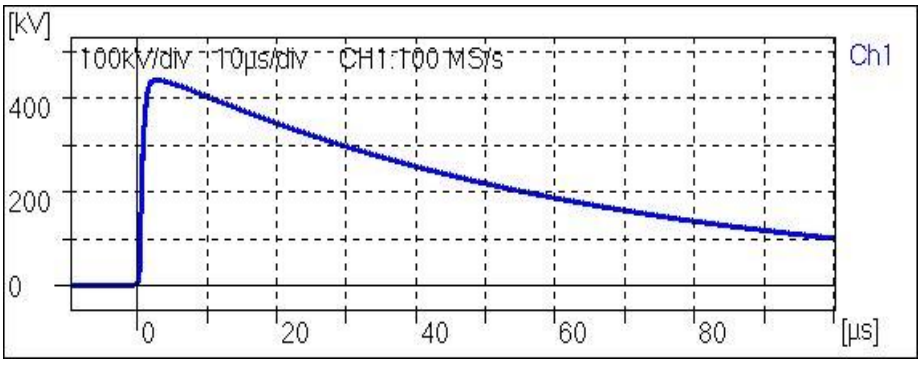
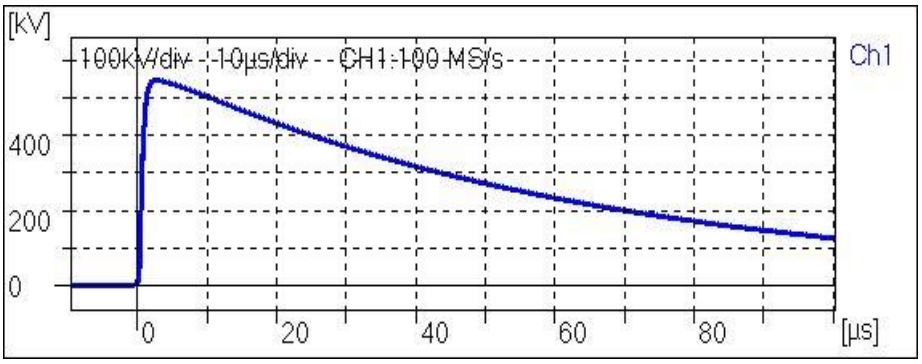
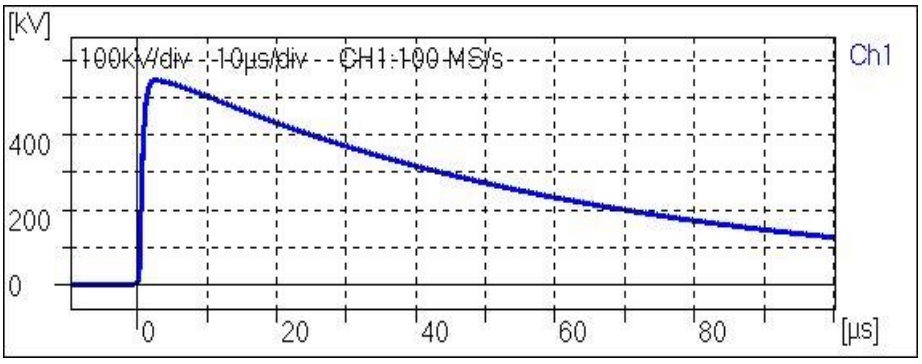
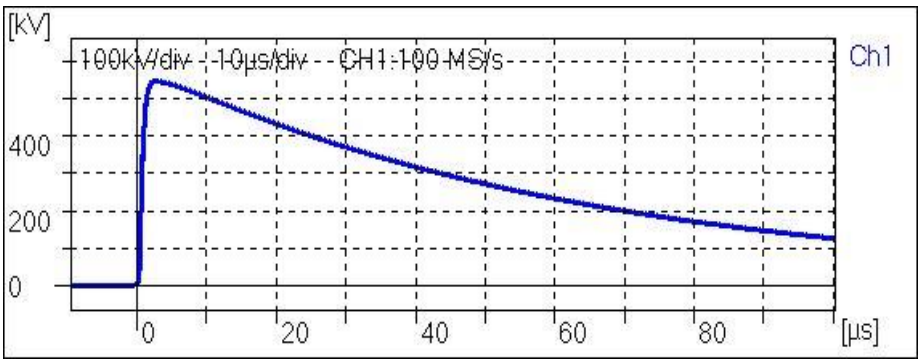
	Fig. 1 calibration impulse Ut = 441.9 kV T1 = 1.365 µs T2 = 49.30 µs β' = -1.346 %
	Fig. 2 test impulse full wave Ut = 550.9 kV T1 = 1.366 µs T2 = 49.49 µs β' = -1.476 %
	Fig. 3 test impulse full wave Ut = 551.1 kV T1 = 1.369 µs T2 = 49.51 µs β' = -1.464 %
	Fig. 4 test impulse full wave Ut = 550.9 kV T1 = 1.369 µs T2 = 49.51 µs β' = -1.475 %

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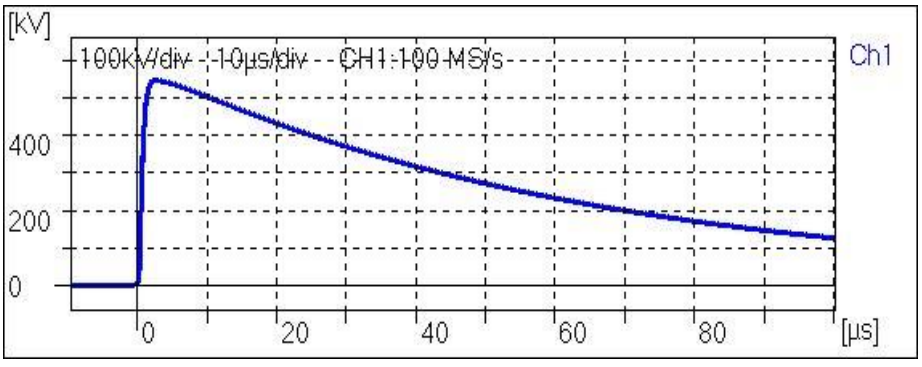
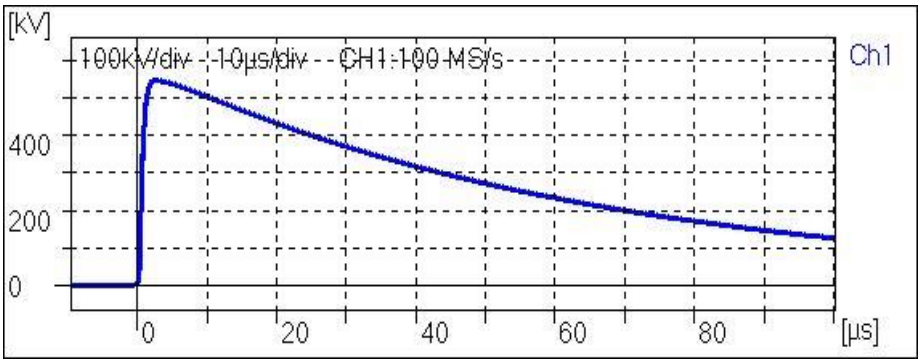
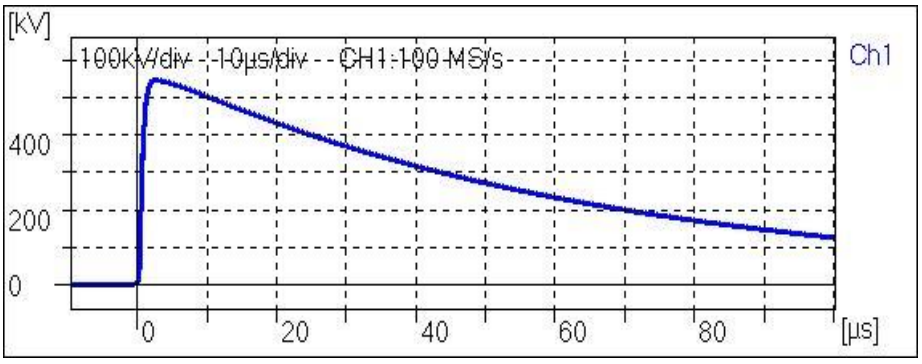
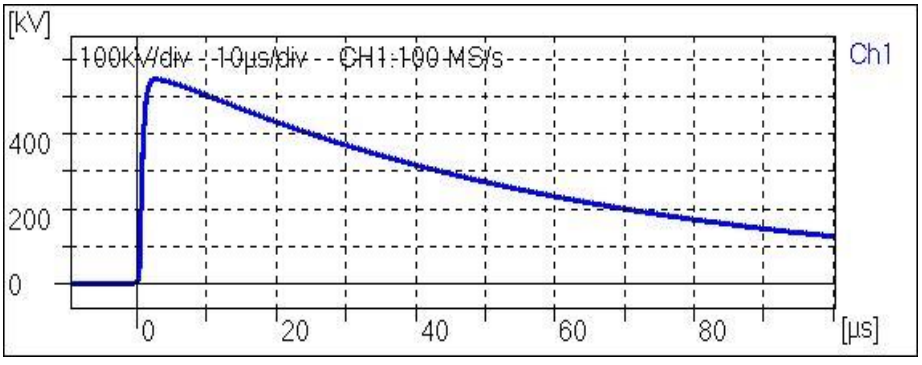
DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

	Fig. 5 test impulse full wave Ut = 550.6 kV T1 = 1.364 µs T2 = 49.54 µs β' = -1.535 %
	Fig. 6 test impulse full wave Ut = 550.5 kV T1 = 1.369 µs T2 = 49.52 µs β' = -1.470 %
	Fig. 7 test impulse full wave Ut = 550.5 kV T1 = 1.368 µs T2 = 49.50 µs β' = -1.507 %
	Fig. 8 test impulse full wave Ut = 550.5 kV T1 = 1.366 µs T2 = 49.54 µs β' = -1.482 %

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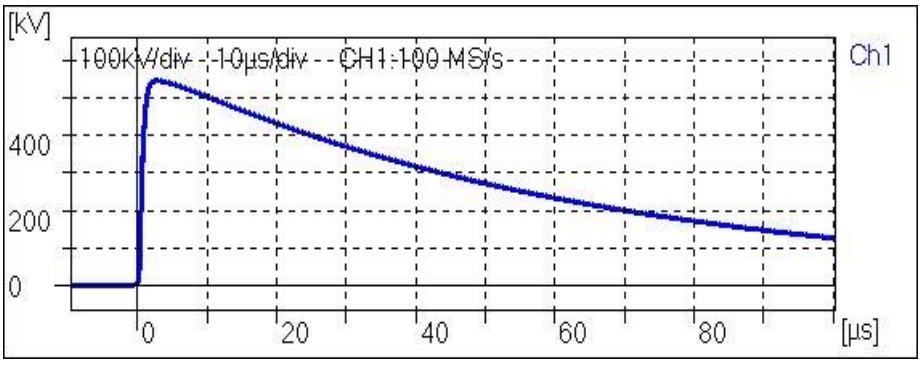
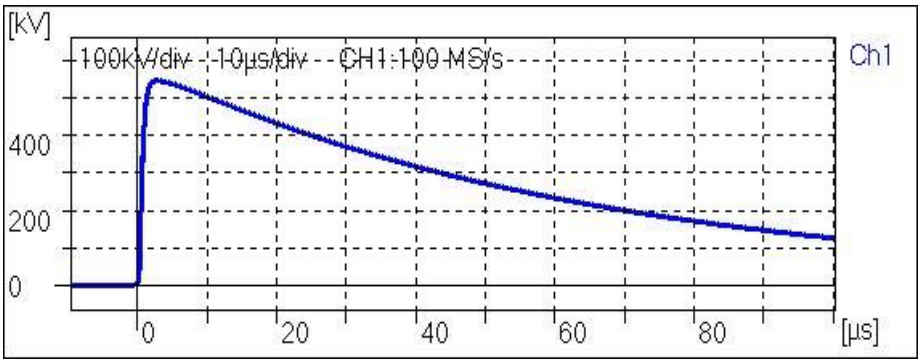
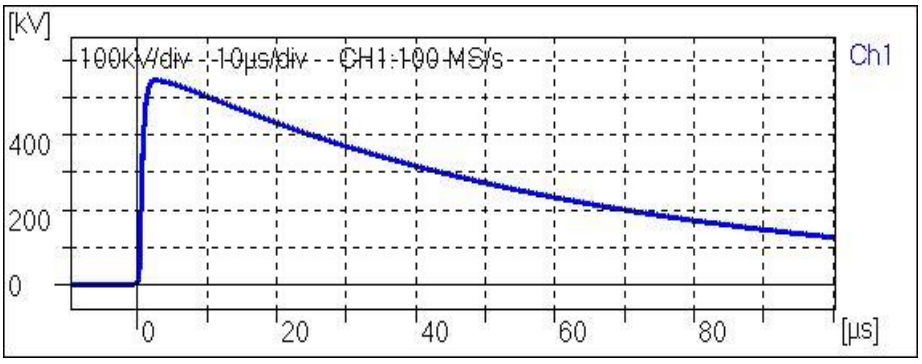
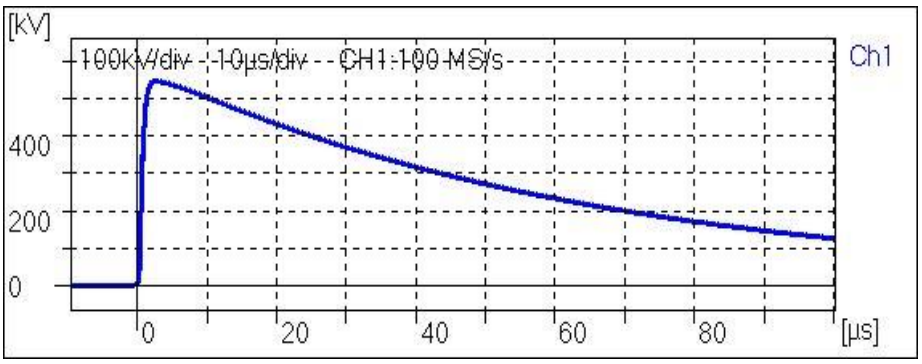
	Fig. 9 test impulse full wave Ut = 550.2 kV T1 = 1.366 µs T2 = 49.54 µs β' = -1.507 %
	Fig. 10 test impulse full wave Ut = 550.4 kV T1 = 1.365 µs T2 = 49.54 µs β' = -1.507 %
	Fig. 11 test impulse full wave Ut = 550.2 kV T1 = 1.366 µs T2 = 49.59 µs β' = -1.511 %
	Fig. 12 test impulse full wave Ut = 550.3 kV T1 = 1.364 µs T2 = 49.57 µs β' = -1.454 %

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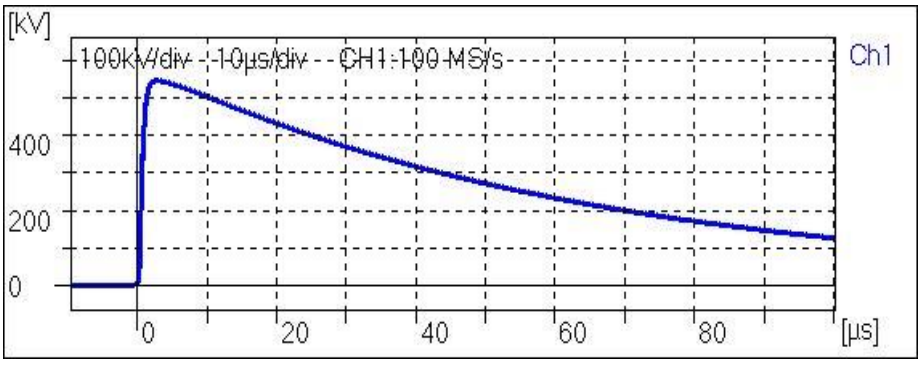
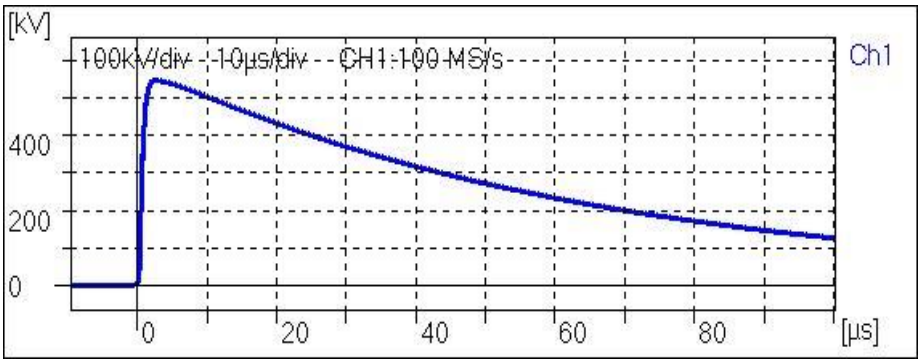
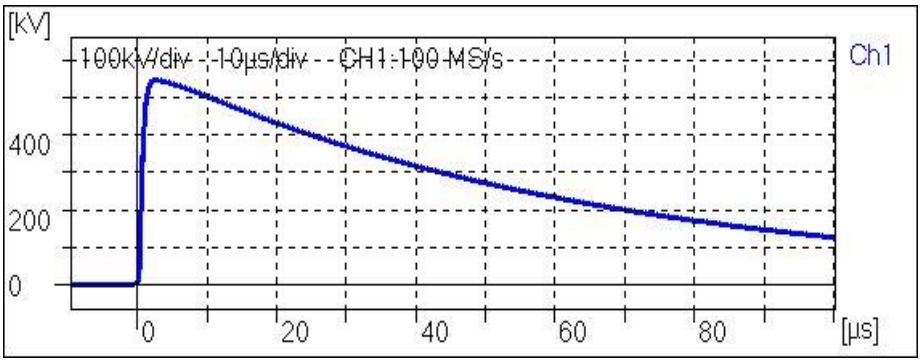
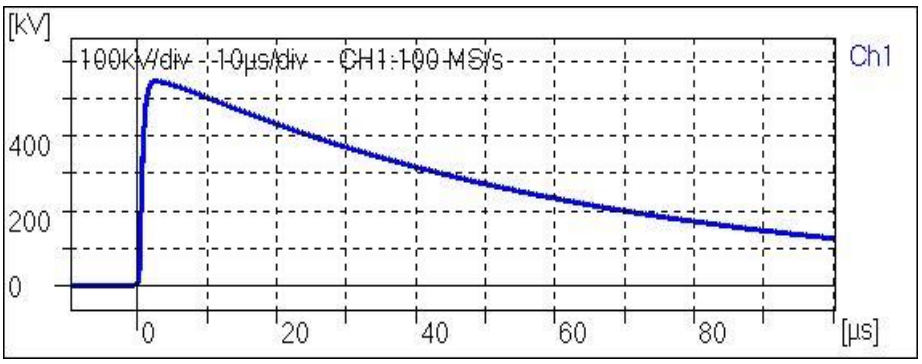
	Fig. 13 test impulse full wave Ut = 550.3 kV T1 = 1.367 µs T2 = 49.58 µs β' = -1.495 %
	Fig. 14 test impulse full wave Ut = 550.3 kV T1 = 1.367 µs T2 = 49.56 µs β' = -1.478 %
	Fig. 15 test impulse full wave Ut = 550.1 kV T1 = 1.366 µs T2 = 49.56 µs β' = -1.518 %
	Fig. 16 test impulse full wave Ut = 550.5 kV T1 = 1.368 µs T2 = 49.55 µs β' = -1.420 %

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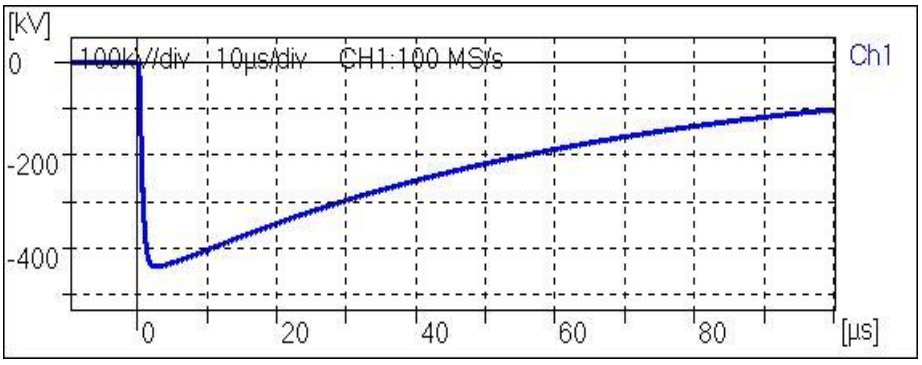
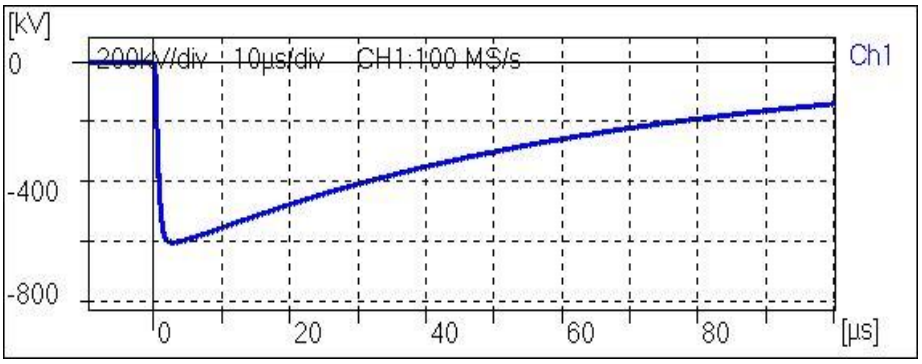
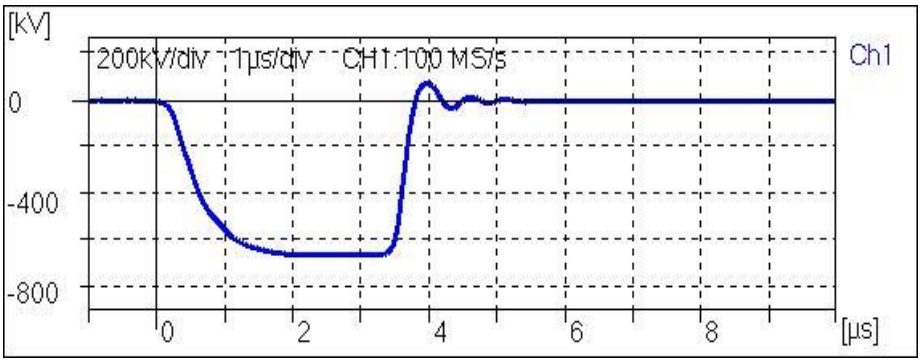
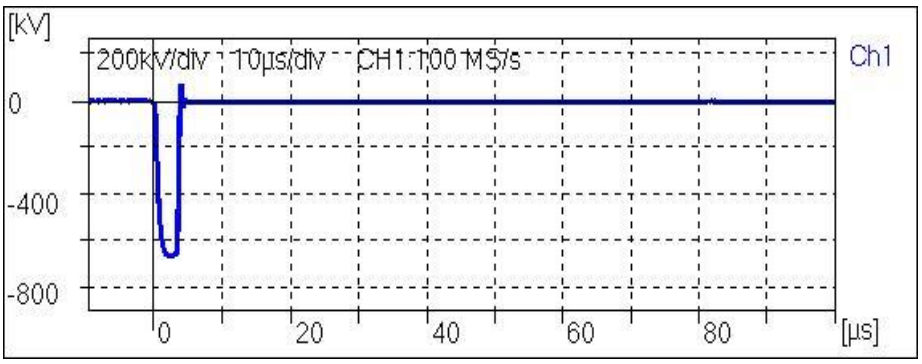
	Fig. 17 calibration impulse Ut = -439.9 kV T1 = 1.316 µs T2 = 49.35 µs β' = -1.434 %
	Fig. 18 test impulse full wave Ut = -605.6 kV T1 = 1.328 µs T2 = 49.52 µs β' = -1.464 %
	Fig. 19 test impulse chopped wave Ut = -667.9 kV T1 = 1.296 µs Tc = 3.491 µs
	Fig. 20 test impulse chopped wave Ut = -667.9 kV T1 = 1.296 µs Tc = 3.491 µs

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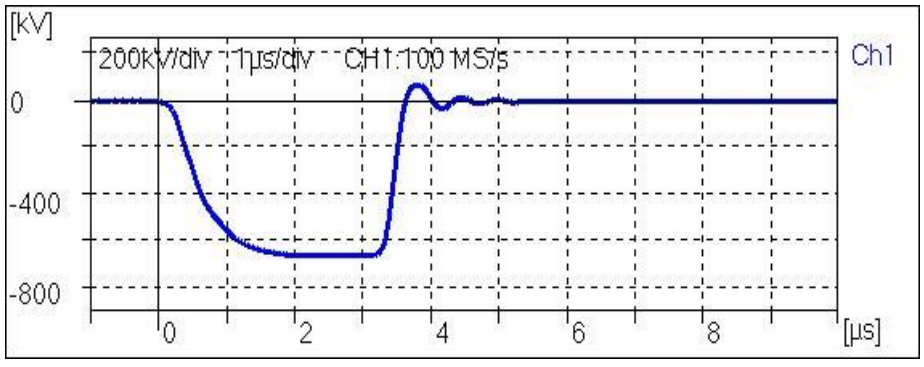
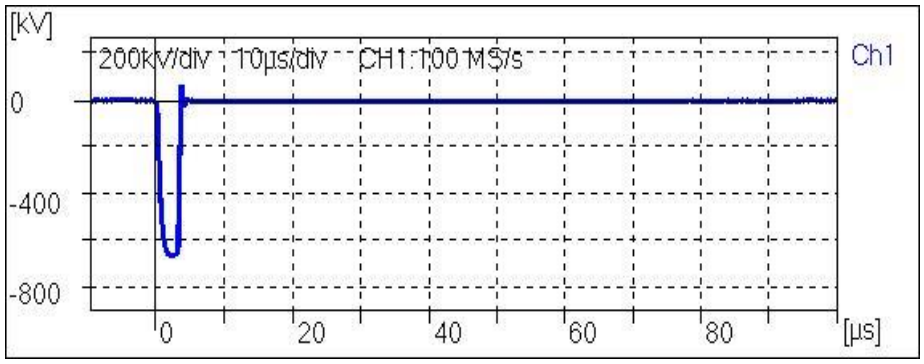
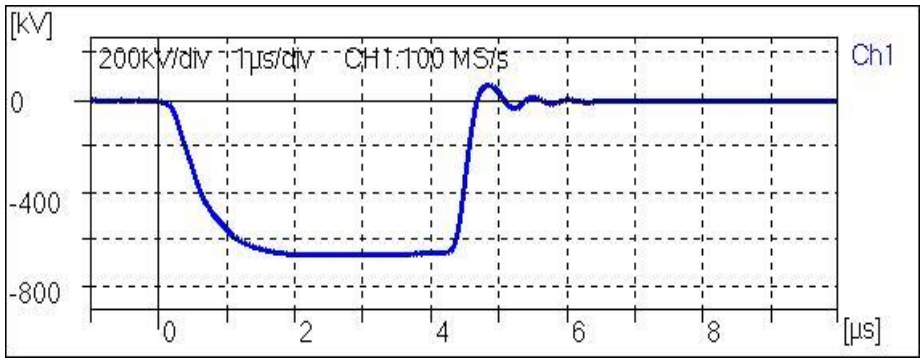
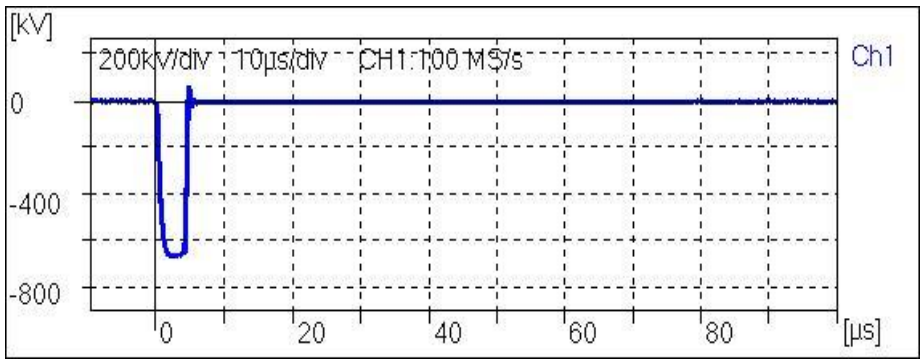
	Fig. 21 test impulse chopped wave Ut = -668.3 kV T1 = 1.298 µs Tc = 3.319 µs
	Fig. 22 test impulse chopped wave Ut = -668.3 kV T1 = 1.298 µs Tc = 3.319 µs
	Fig. 23 test impulse chopped wave Ut = -668.3 kV T1 = 1.302 µs Tc = 4.368 µs
	Fig. 24 test impulse chopped wave Ut = -668.3 kV T1 = 1.302 µs Tc = 4.368 µs

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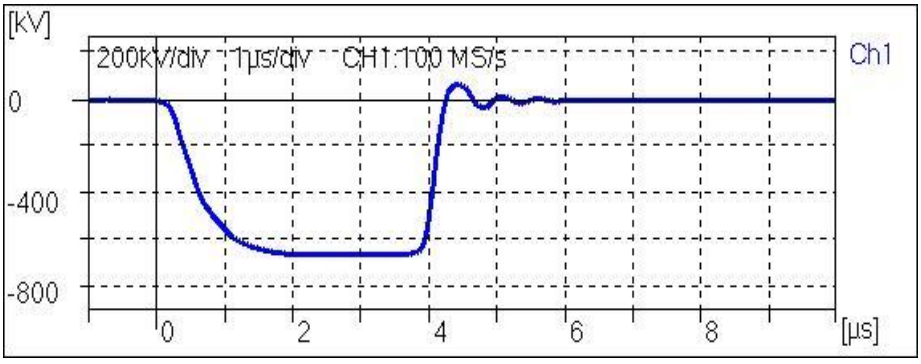
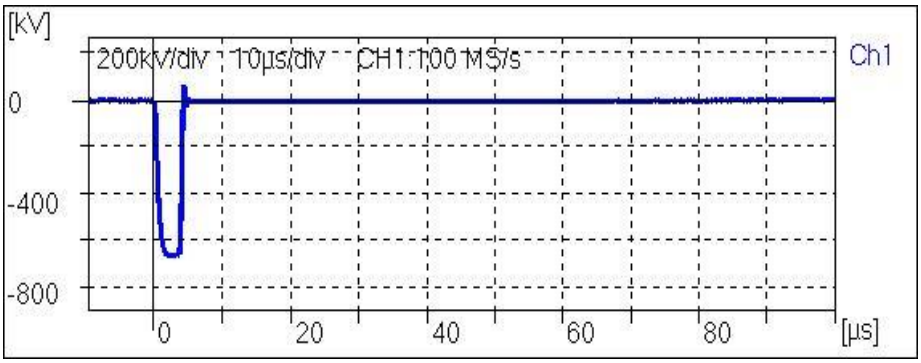
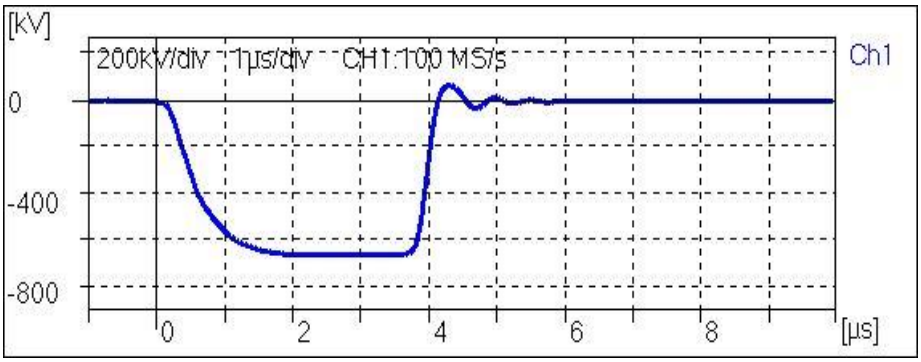
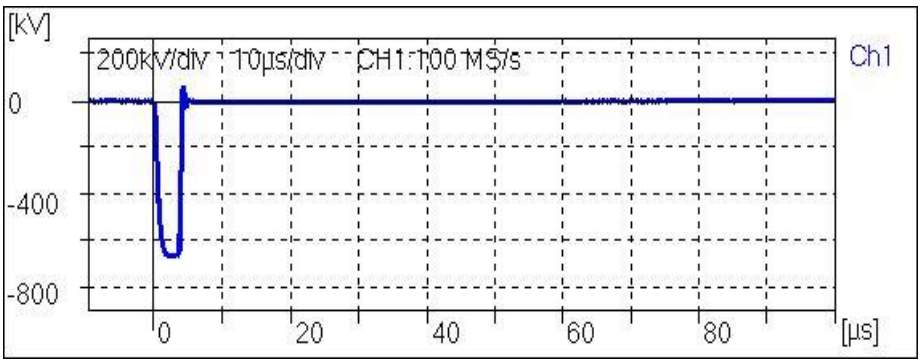
	Fig. 25 test impulse chopped wave Ut = -668.2 kV T1 = 1.301 µs Tc = 3.933 µs
	Fig. 26 test impulse chopped wave Ut = -668.2 kV T1 = 1.301 µs Tc = 3.933 µs
	Fig. 27 test impulse chopped wave Ut = -668.1 kV T1 = 1.299 µs Tc = 3.842 µs
	Fig. 28 test impulse chopped wave Ut = -668.1 kV T1 = 1.299 µs Tc = 3.842 µs

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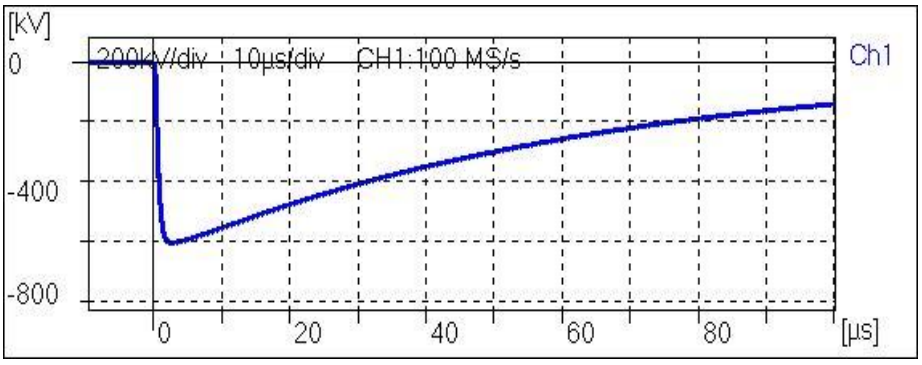
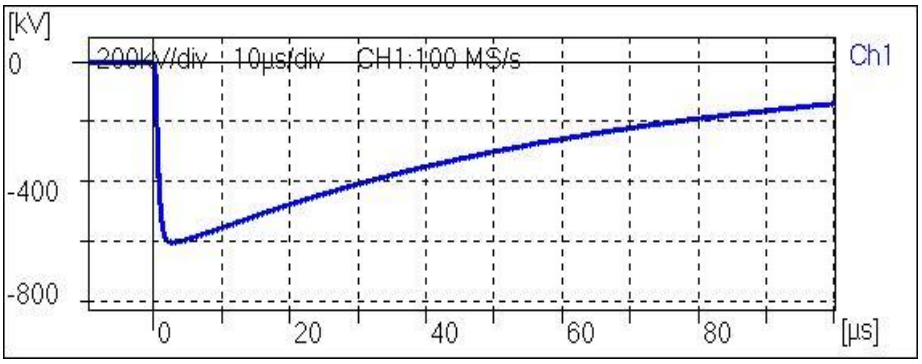
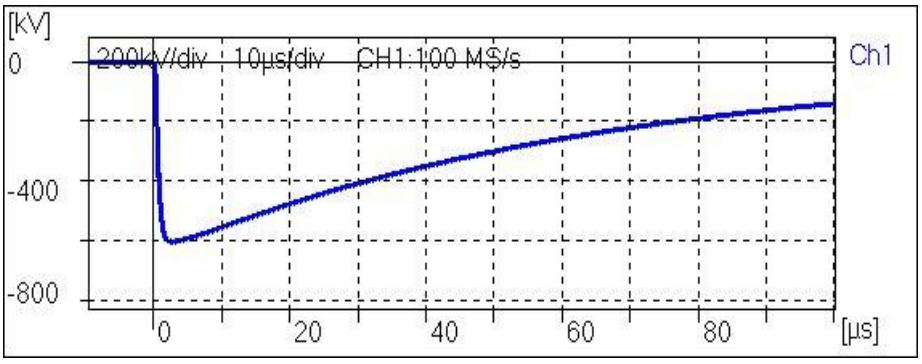
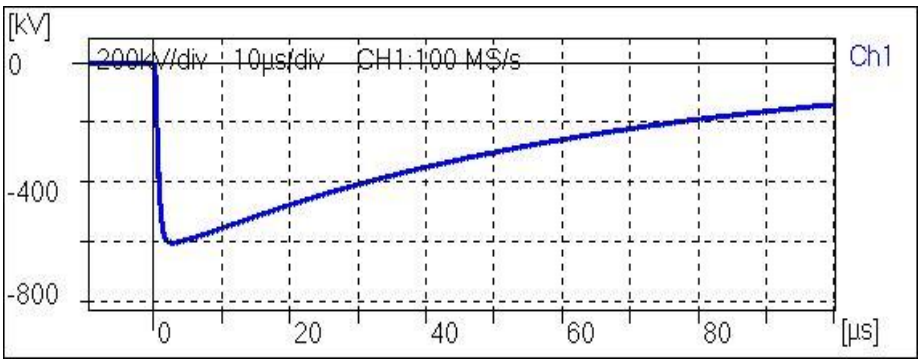
DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

	Fig. 29 test impulse full wave Ut = -606.1 kV T1 = 1.331 µs T2 = 49.47 µs β' = -1.452 %
	Fig. 30 test impulse full wave Ut = -606.0 kV T1 = 1.329 µs T2 = 49.45 µs β' = -1.459 %
	Fig. 31 test impulse full wave Ut = -605.7 kV T1 = 1.328 µs T2 = 49.47 µs β' = -1.480 %
	Fig. 32 test impulse full wave Ut = -605.8 kV T1 = 1.332 µs T2 = 49.47 µs β' = -1.423 %

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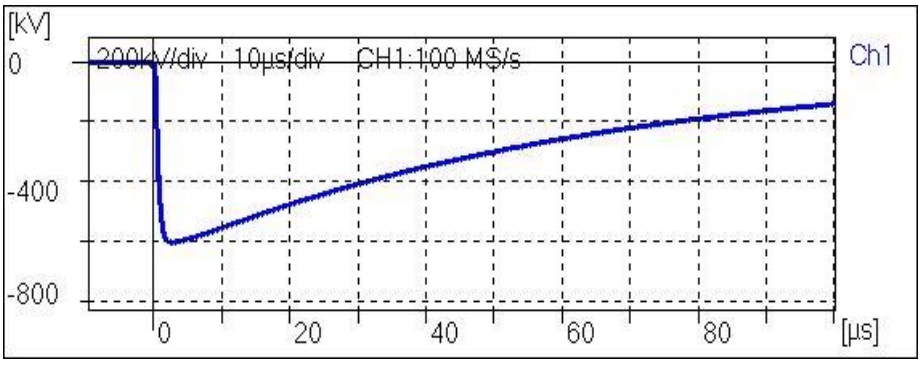
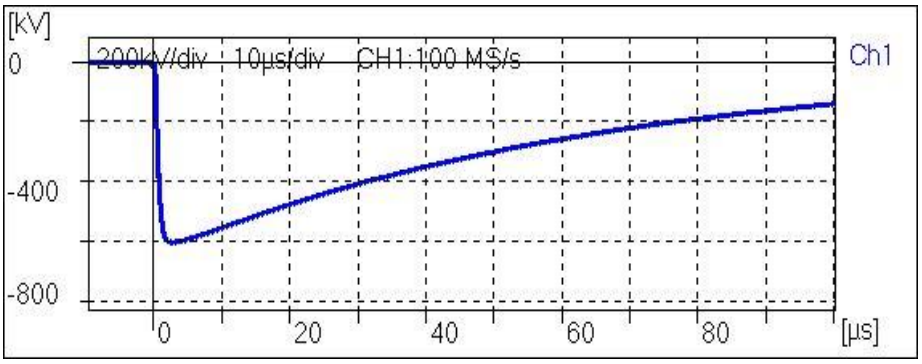
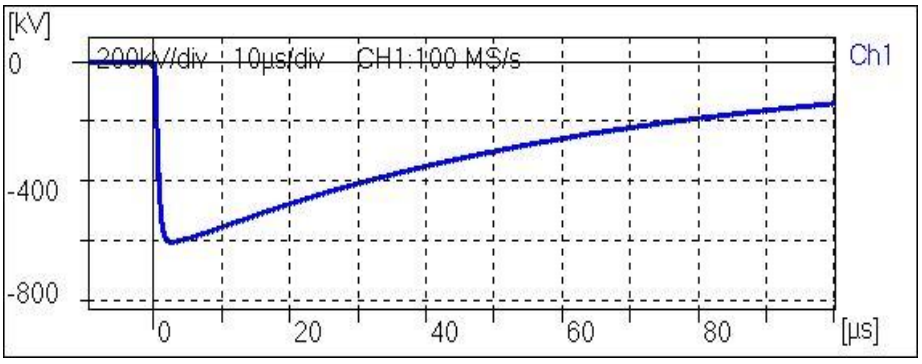
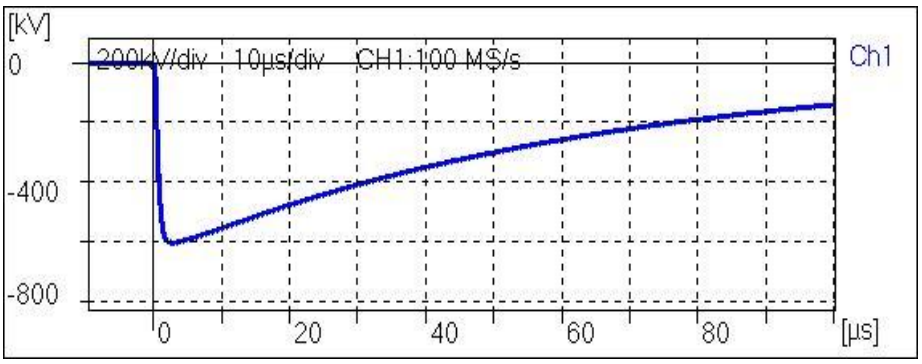
DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

	Fig. 33 test impulse full wave Ut = -605.8 kV T1 = 1.331 µs T2 = 49.48 µs β' = -1.452 %
	Fig. 34 test impulse full wave Ut = -605.9 kV T1 = 1.335 µs T2 = 49.47 µs β' = -1.471 %
	Fig. 35 test impulse full wave Ut = -605.9 kV T1 = 1.330 µs T2 = 49.46 µs β' = -1.441 %
	Fig. 36 test impulse full wave Ut = -605.8 kV T1 = 1.332 µs T2 = 49.47 µs β' = -1.447 %

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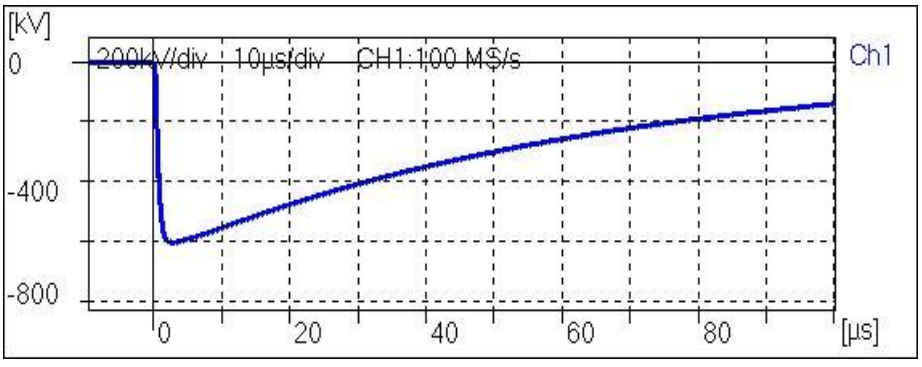
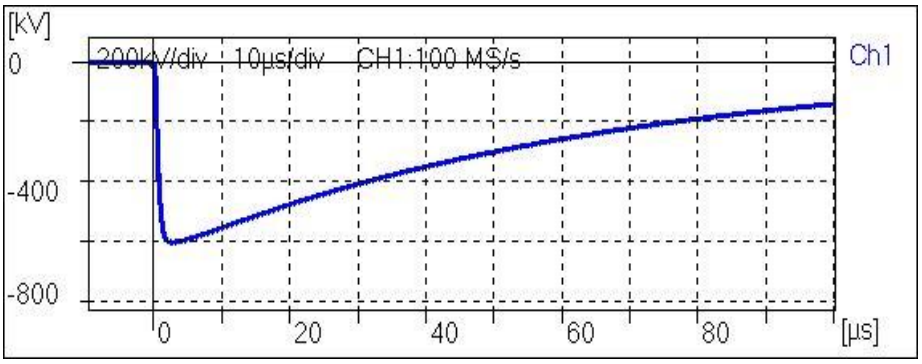
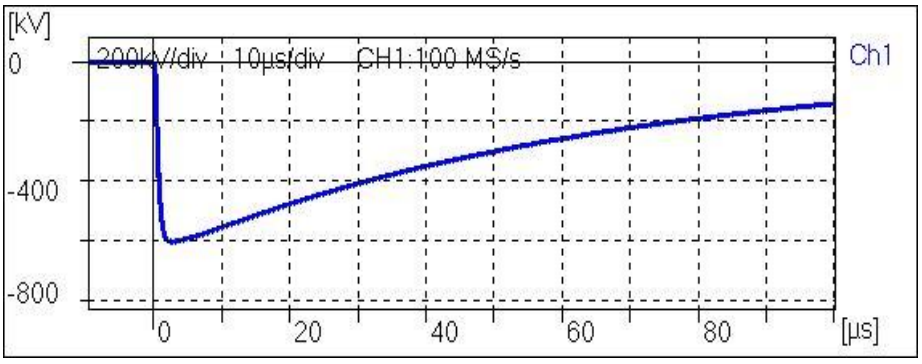
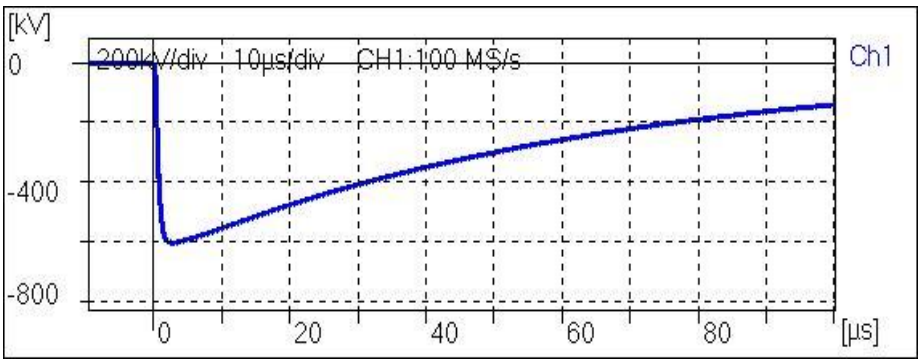
DRY LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

	Fig. 37 test impulse full wave Ut = -605.8 kV T1 = 1.336 µs T2 = 49.47 µs β' = -1.410 %
	Fig. 38 test impulse full wave Ut = -605.9 kV T1 = 1.333 µs T2 = 49.47 µs β' = -1.398 %
	Fig. 39 test impulse full wave Ut = -605.8 kV T1 = 1.332 µs T2 = 49.47 µs β' = -1.434 %
	Fig. 40 test impulse full wave Ut = -605.7 kV T1 = 1.329 µs T2 = 49.52 µs β' = -1.394 %

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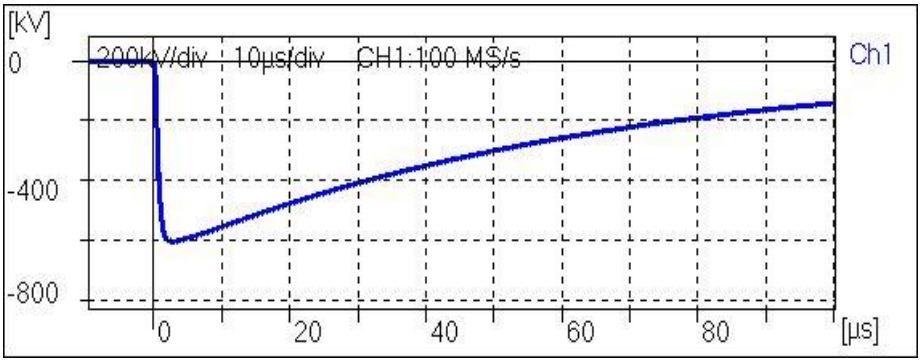
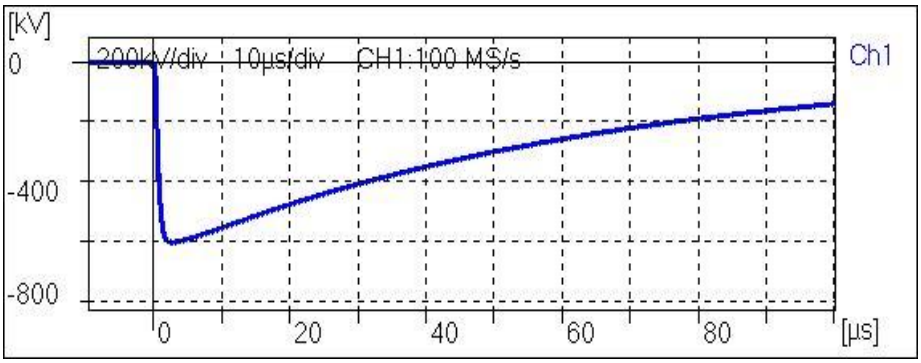
	Fig. 41 test impulse full wave Ut = -605.8 kV T1 = 1.332 µs T2 = 49.51 µs β' = -1.421 %
	Fig. 42 test impulse full wave Ut = -605.7 kV T1 = 1.331 µs T2 = 49.52 µs β' = -1.403 %

Troisdorf 11.02.2020

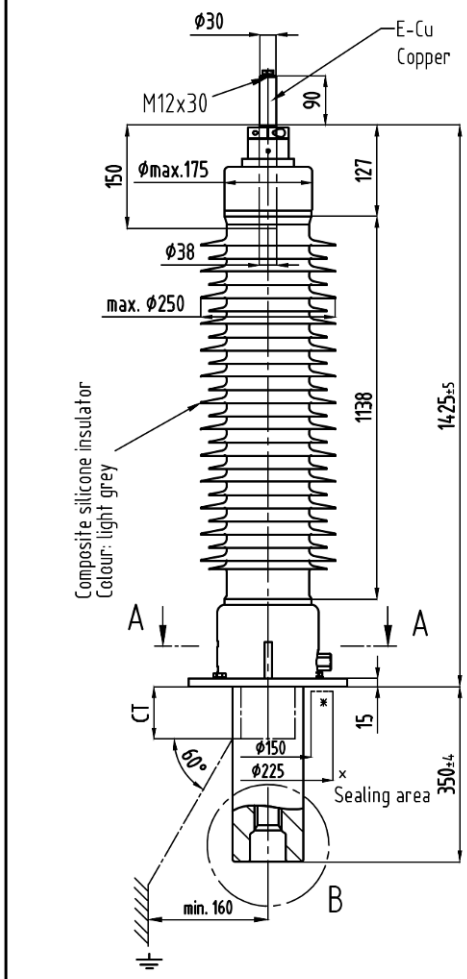
Supplemental Information - Test Object Specification

HSP Hochspannungsgeräte GmbH

Spec. No.: 344120	
Repl. for issue: 20.12.2019	Issue date: 10.01.2020
Offer-No.:	Order-No.:

Zng.: | Type: STARIP®-Si+ 123- 800 E0

Condenser graded bushing, Transformer-Outdoor, dry filling



Technical Data

Rated highest voltage for Equipment Um, (50/60Hz) phase-phase:	123.0 kV
Rated phase-to-earth voltage:	71 kV
Partial discharge level at test voltage:	≤ 4 pC
Power-frequency withstand voltage 50Hz, 1.2 min. dry:	255 kV
Rated lightning impulse withstand voltage (BIL): 1.2/50µs	550 kV
Rated switching impulse withstand voltage (SIL): 250/2500µs	0 kV
Rated current:	800 A
Max. service current:	800 A
CT accommodation length:	0 mm
Flashover distance:	1138 mm
Creepage distance, min.:	3906 mm
Cantilever test load:	3150 N
Mounting position:	0-90°
Ambient temperature:	-30...+40°C
Temperature of transformer oil:	max.100°C max. daily mean 90 °C
Test tap - test voltage:	2kV, 50Hz, 1.2min.
Routine test according to	IEC 60137-2017
Mass, approx.:	57 kg
Dry insulation foam is free of SF6	

Remarks:

- RIP (resin impregnated paper)
- Draw lead bolt, E-Cu, cable cross section 450mm²

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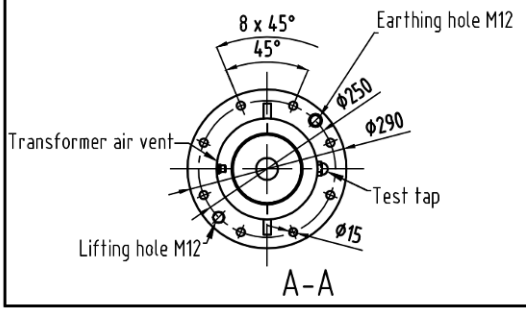

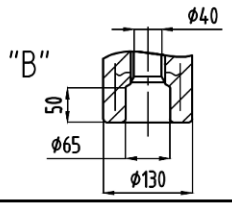

Rev.: 7534, 7556, 7562

Troisdorf 11.02.2020

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DAkkS Deutsche Akkreditierungsstelle D-PL-19413-01-00

LONG DURATION POWER-FREQUENCY VOLTAGE WITHSTAND TEST

Test laboratory	HSP Hochspannungsgeräte GmbH HS-Prüflaboratorium, Camp-Spich-Str. 18 D-53842 Troisdorf
Customer	HSP Hochspannungsgeräte GmbH Camp-Spich-Str. 18 D-53842 Troisdorf

Test Object:	**RIP Condenser Bushing, Transformer – Outdoor**
Type	**STARIP® – Si+ 123 – 800 E0**
Specification	344120 (see last page)
Highest voltage for equipment	123 kV
Rated current	800 A
Serial number	**283352**

Begin of tests	09.12.2019
End of tests	15.12.2019
Test standards	IEC 60137 (2017) and 60060-1 (2010)
Test plan	HSP 1310299/20 - TTP
Test equipment	Documented in the laboratory test records

The equipment passed all indicated tests successfully.
The test results are valid for the tested equipment only.

Troisdorf 11.02.2020

HSP Hochspannungsgeräte GmbH
HS-Prüflaboratorium

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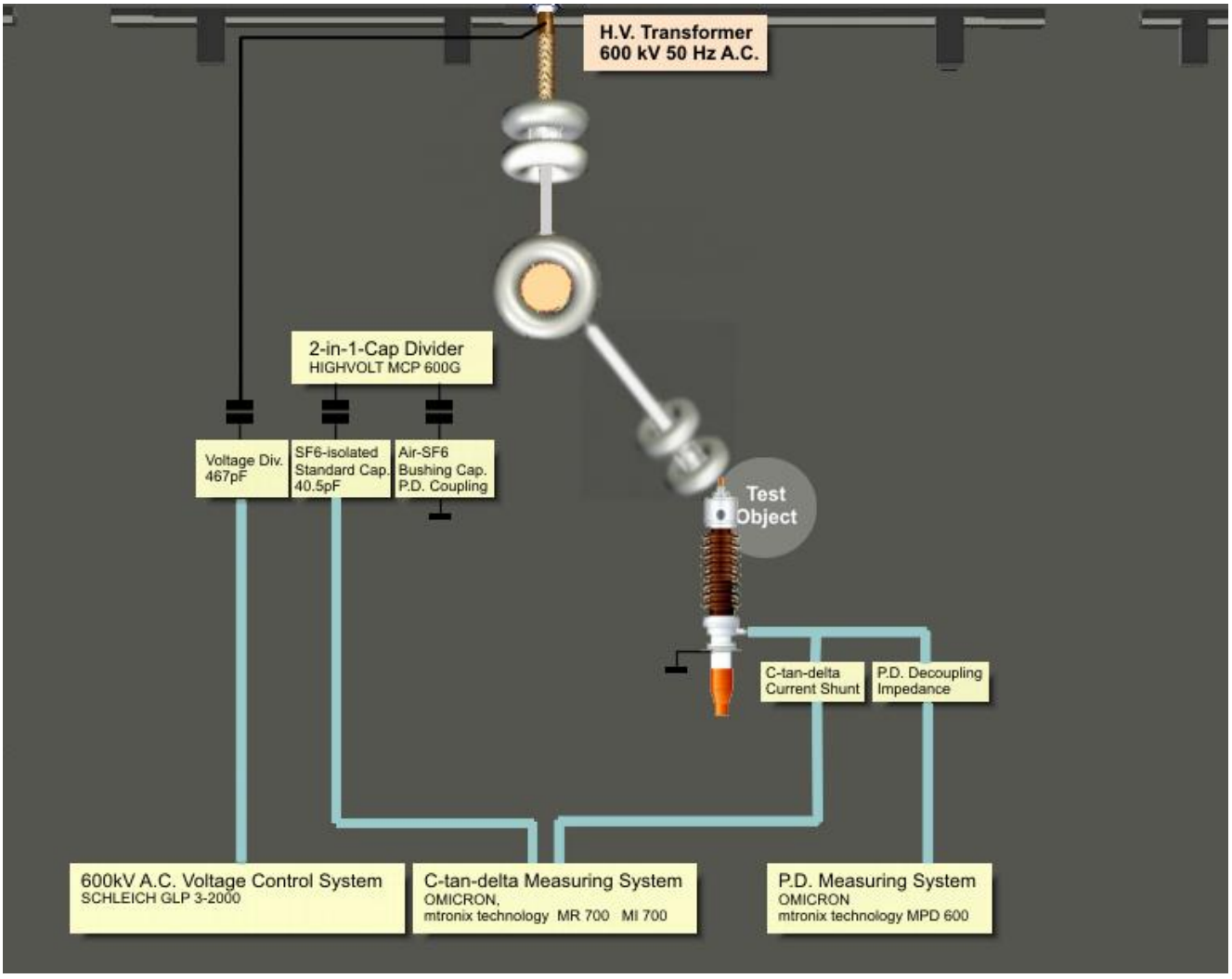
i.A. Haberecht
Senior Test Engineer

i.A. Adams
Senior Test Engineer

LONG DURATION POWER-FREQUENCY VOLTAGE WITHSTAND TEST

Basic Circuits & Principal Test Setup



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LONG DURATION POWER-FREQUENCY VOLTAGE WITHSTAND TEST

The following tests were executed successively:

50 Hz AC routine test before type test															Date of test: 09.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	260	260	260	260	260	260	260	**Test voltage 72 sec.**	260	260	260	260	260	260	260
tan δ [%]	0.37	0.37	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37	0.37	0.37	0.37	0.37
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

DRY POWER-FREQUENCY VOLTAGE WITHSTAND TEST WITH PARTIAL DISCHARGE MEASUREMENT

Test setup:
The bushing was mounted on a solidly grounded test vessel filled with oil. The effective test vessel diameter was reduced by an inserted grounded aluminium cylinder Ø 340 mm x 710 mm.

Atmospheric conditions:

Temperature:	20 °C
Air pressure:	973 hPa
Relative humidity:	38 %

According to IEC standard is the test applicable to all transformer bushings with Um 170 kV and above.

Test:

Applied 50 Hz test voltage:	107 kV
Duration:	60 minutes

p.d. measurement:

U [kV]	**107**	**107**	**107**	**107**	**107**	**107**	**107**	**107**	**107**	**107**	**107**	**107**
duration [min.]	5	5	5	5	5	5	5	5	5	5	5	5
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Result of test:
Neither a flashover nor a puncture has occurred.
During the complete test time no partial discharges above the background noise level were detected.
The background noise level was measured at 1 pC. See the complete test sequence on the next page

50 Hz AC routine test after type test															Date of test: 15.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	259	259	259	259	259	259	259	**Test voltage 72 sec.**	259	259	259	259	259	259	259
tan δ [%]	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38	0.38	0.38	0.38	0.38
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

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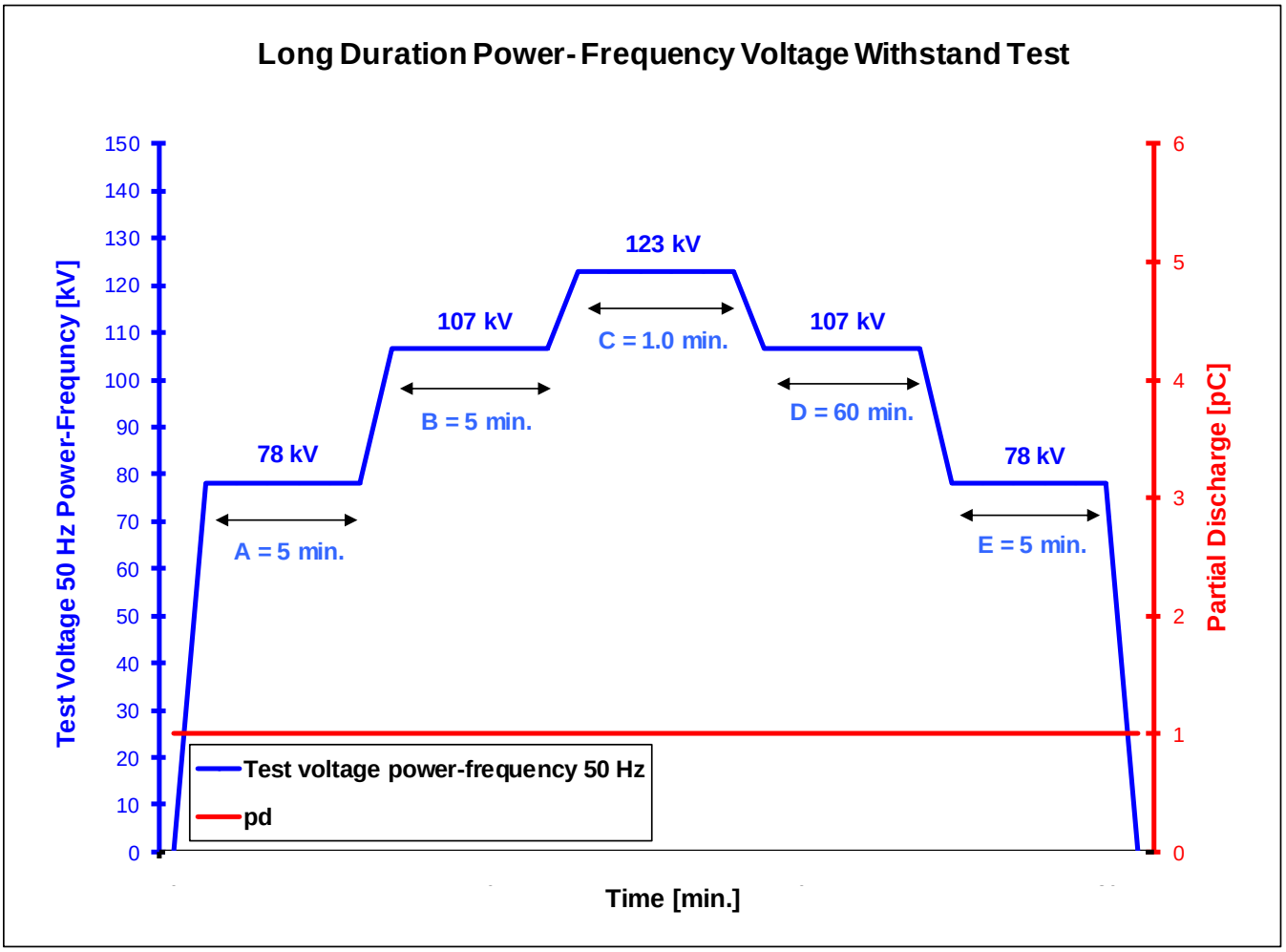
LONG DURATION POWER-FREQUENCY VOLTAGE WITHSTAND TEST



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LONG DURATION POWER-FREQUENCY VOLTAGE WITHSTAND TEST

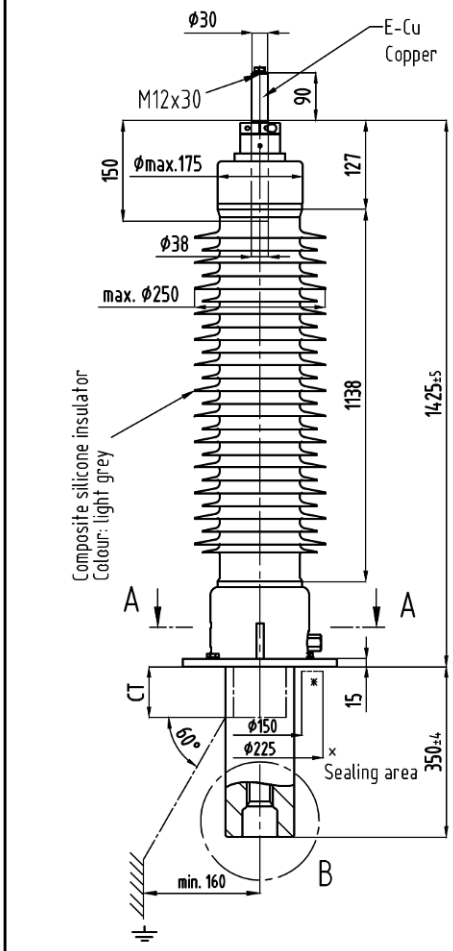
Supplemental Information - Test Object Specification

HSP Hochspannungsgeräte GmbH

Spec. No.: 344120	
Repl. for issue: 20.12.2019	Issue date: 10.01.2020
Offer-No.:	Order-No.:

Zng.: | Type: STARIP®-Si+ 123- 800 E0

Condenser graded bushing, Transformer-Outdoor, dry filling



Technical Data

Rated highest voltage for Equipment Um, (50/60Hz) phase-phase:	123.0 kV
Rated phase-to-earth voltage:	71 kV
Partial discharge level at test voltage:	≤ 4 pC
Power-frequency withstand voltage 50Hz, 1.2 min. dry:	255 kV
Rated lightning impulse withstand voltage (BIL): 1.2/50µs	550 kV
Rated switching impulse withstand voltage (SIL): 250/2500µs	0 kV
Rated current:	800 A
Max. service current:	800 A
CT accommodation length:	0 mm
Flashover distance:	1138 mm
Creepage distance, min.:	3906 mm
Cantilever test load:	3150 N
Mounting position:	0-90°
Ambient temperature:	-30...+40°C
Temperature of transformer oil:	max.100°C max. daily mean 90 °C
Test tap - test voltage:	2kV, 50Hz, 1.2min.
Routine test according to	IEC 60137-2017
Mass, approx.:	57 kg
Dry insulation foam is free of SF6	

Remarks:

- RIP (resin impregnated paper)
- Draw lead bolt, E-Cu, cable cross section 450mm²

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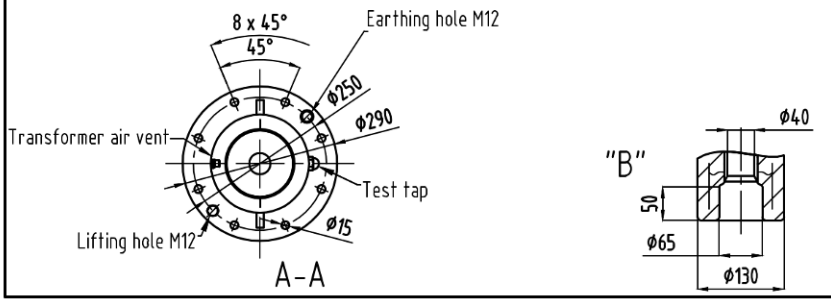

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DAkkS Deutsche Akkreditierungsstelle D-PL-19413-01-00

WET POWER-FREQUENCY VOLTAGE WITHSTAND TEST

Test laboratory	HSP Hochspannungsgeräte GmbH HS-Prüflaboratorium, Camp-Spich-Str. 18 D-53842 Troisdorf
Customer	HSP Hochspannungsgeräte GmbH Camp-Spich-Str. 18 D-53842 Troisdorf

Test Object:	**RIP Condenser Bushing, Transformer – Outdoor**
Type	**STARIP® – Si+ 123 – 800 E0**
Specification	344120 (see last page)
Highest voltage for equipment	123 kV
Rated current	800 A
Serial number	**283352**

Begin of tests	09.12.2019
End of tests	15.12.2019
Test standards	IEC 60137 (2017) and 60060-1 (2010)
Test plan	HSP 1310299/20 - TTP
Test equipment	Documented in the laboratory test records

The equipment passed all indicated tests successfully.
The test results are valid for the tested equipment only.

Troisdorf, 11.02.2020

HSP Hochspannungsgeräte GmbH
HS-Prüflaboratorium

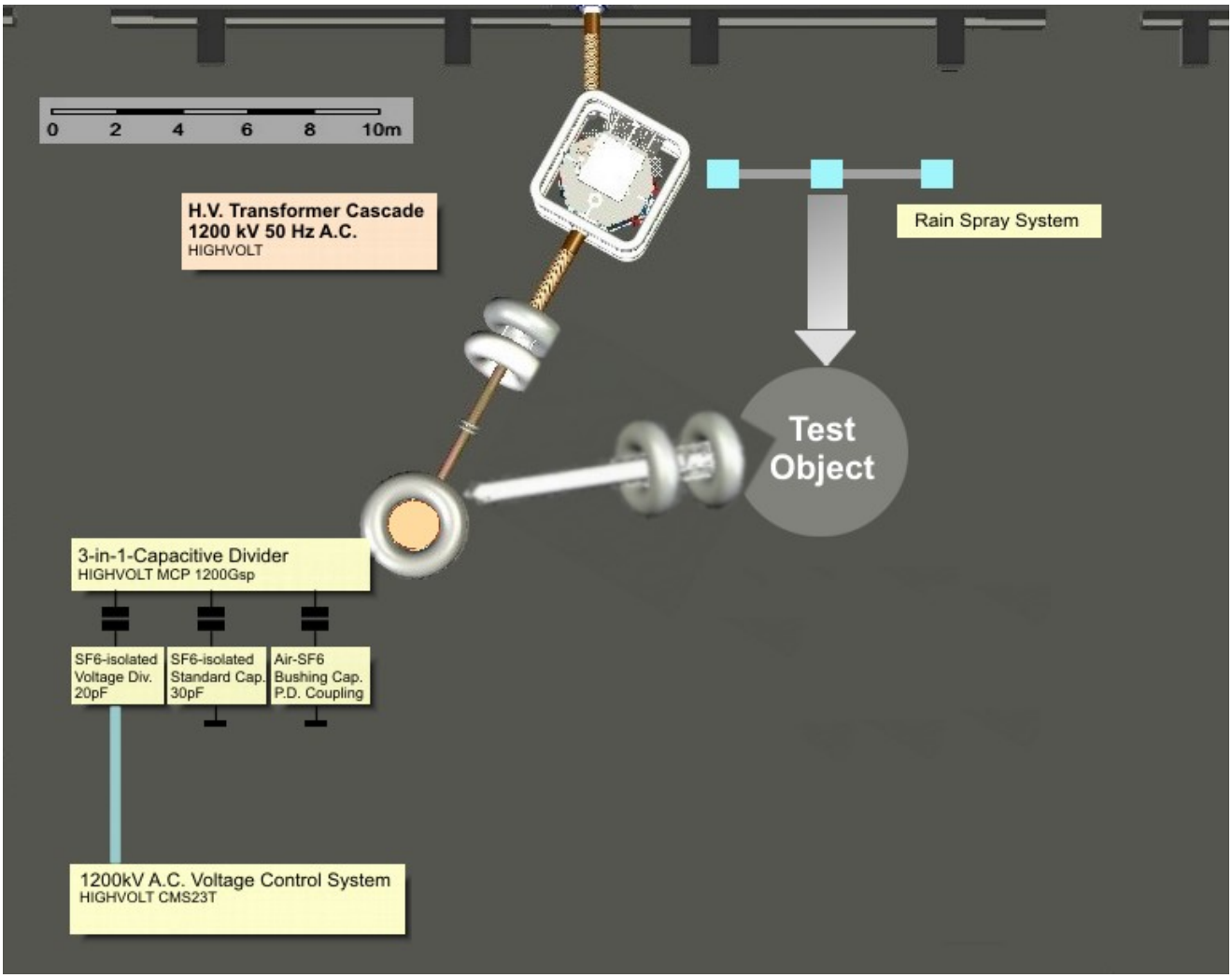
Camp-Spich-Straße 18
53842 Troisdorf GERMANY

DAkkS Deutsche Akkreditierungsstelle D-PL-19413-01-00

i.A. Haberecht
Senior Test Engineer

i.A. Adams
Senior Test Engineer

Basic Circuits & Principal Test Setup



Troisdorf 11.02.2020

HSP Hochspannungsgeräte GmbH
HS-Prüflaboratorium

Camp-Spich-Straße 18
53842 Troisdorf GERMANY

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WET POWER-FREQUENCY VOLTAGE WITHSTAND TEST

The following tests were executed successively:

50 Hz AC routine test before type test															Date of test: 09.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	260	260	260	260	260	260	260	**Test voltage 72 sec.**	260	260	260	260	260	260	260
tan δ [%]	0.37	0.37	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37	0.37	0.37	0.37	0.37
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

WET POWER-FREQUENCY VOLTAGE WITHSTAND TEST — **Date of test: 13.12.2019**

Test setup:
The bushing was mounted on an oil filled and grounded test vessel. The test object was connected to the transformer by a wire.

Atmospheric conditions:
Temperature: 20 °C
Air pressure: 976 hPa

Rain:
Average rainfall (vert.): 1.8 mm/min.
Average rainfall (hor.): 1.6 mm/min.
Resistivity at 20 °C 98 Ω m

Pre-wetting-time was more than 15 minutes.

Specified test voltage: 230 kV for 60 seconds

Test:

Applied test voltage [kV]	Duration [sec.]
255	**72**

Result of test:
During the test time neither a flashover nor a puncture has occurred.

50 Hz AC routine test after type test															Date of test: 15.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	259	259	259	259	259	259	259	**Test voltage 72 sec.**	259	259	259	259	259	259	259
tan δ [%]	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38	0.38	0.38	0.38	0.38
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

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WET POWER-FREQUENCY VOLTAGE WITHSTAND TEST

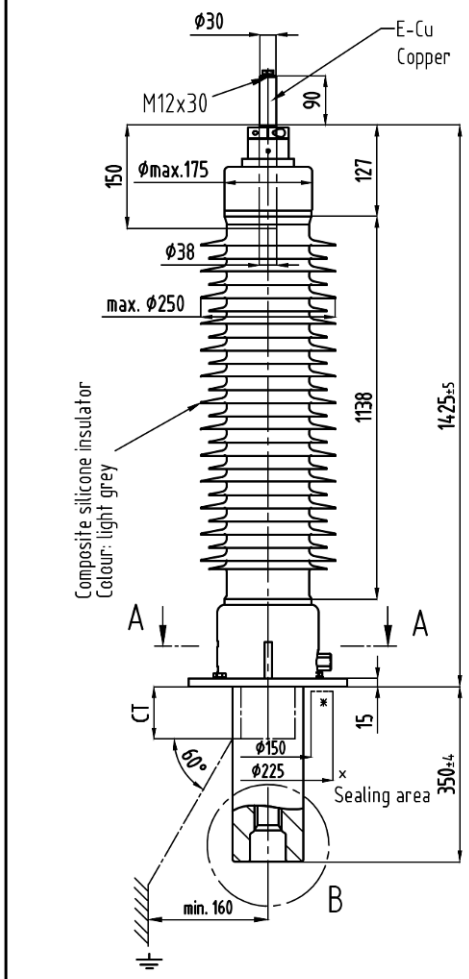
Supplemental Information - Test Object Specification

HSP Hochspannungsgeräte GmbH

Spec. No.: 344120	
Repl. for issue: 20.12.2019	Issue date: 10.01.2020
Offer-No.:	Order-No.:

Zng.: | Type: STARIP®-Si+ 123- 800 E0

Condenser graded bushing, Transformer-Outdoor, dry filling



Technical Data

Rated highest voltage for Equipment Um, (50/60Hz) phase-phase:	123.0 kV
Rated phase-to-earth voltage:	71 kV
Partial discharge level at test voltage:	≤ 4 pC
Power-frequency withstand voltage 50Hz, 1.2 min. dry:	255 kV
Rated lightning impulse withstand voltage (BIL): 1.2/50µs	550 kV
Rated switching impulse withstand voltage (SIL): 250/2500µs	0 kV
Rated current:	800 A
Max. service current:	800 A
CT accommodation length:	0 mm
Flashover distance:	1138 mm
Creepage distance, min.:	3906 mm
Cantilever test load:	3150 N
Mounting position:	0-90°
Ambient temperature:	-30...+40°C
Temperature of transformer oil:	max.100°C max. daily mean 90 °C
Test tap - test voltage:	2kV, 50Hz, 1.2min.
Routine test according to	IEC 60137-2017
Mass, approx.:	57 kg
Dry insulation foam is free of SF6	

Remarks:

- RIP (resin impregnated paper)
- Draw lead bolt, E-Cu, cable cross section 450mm²

09.07.19
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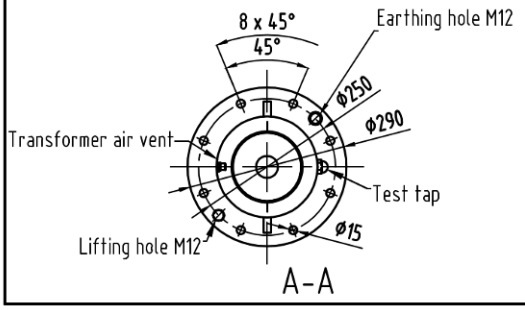

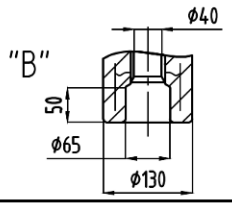

Rev.: 7534, 7556, 7562

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EMISSION TEST

Test laboratory	HSP Hochspannungsgeräte GmbH HS-Prüflaboratorium, Camp-Spich-Str. 18 D-53842 Troisdorf
Customer	HSP Hochspannungsgeräte GmbH Camp-Spich-Str. 18 D-53842 Troisdorf

Test Object:	**RIP Condenser Bushing, Transformer – Outdoor**
Type	**STARIP® – Si+ 123 – 800 E0**
Specification	344120 (see last page)
Highest voltage for equipment	123 kV
Rated current	800 A
Serial number	**283352**

Begin of tests	09.12.2019
End of tests	15.12.2019
Test standards	IEC 60137 (2017) and 60060-1 (2010)
Test plan	HSP 1310299/20 - TTP
Test equipment	Documented in the laboratory test records

The equipment passed all indicated tests successfully.
The test results are valid for the tested equipment only.

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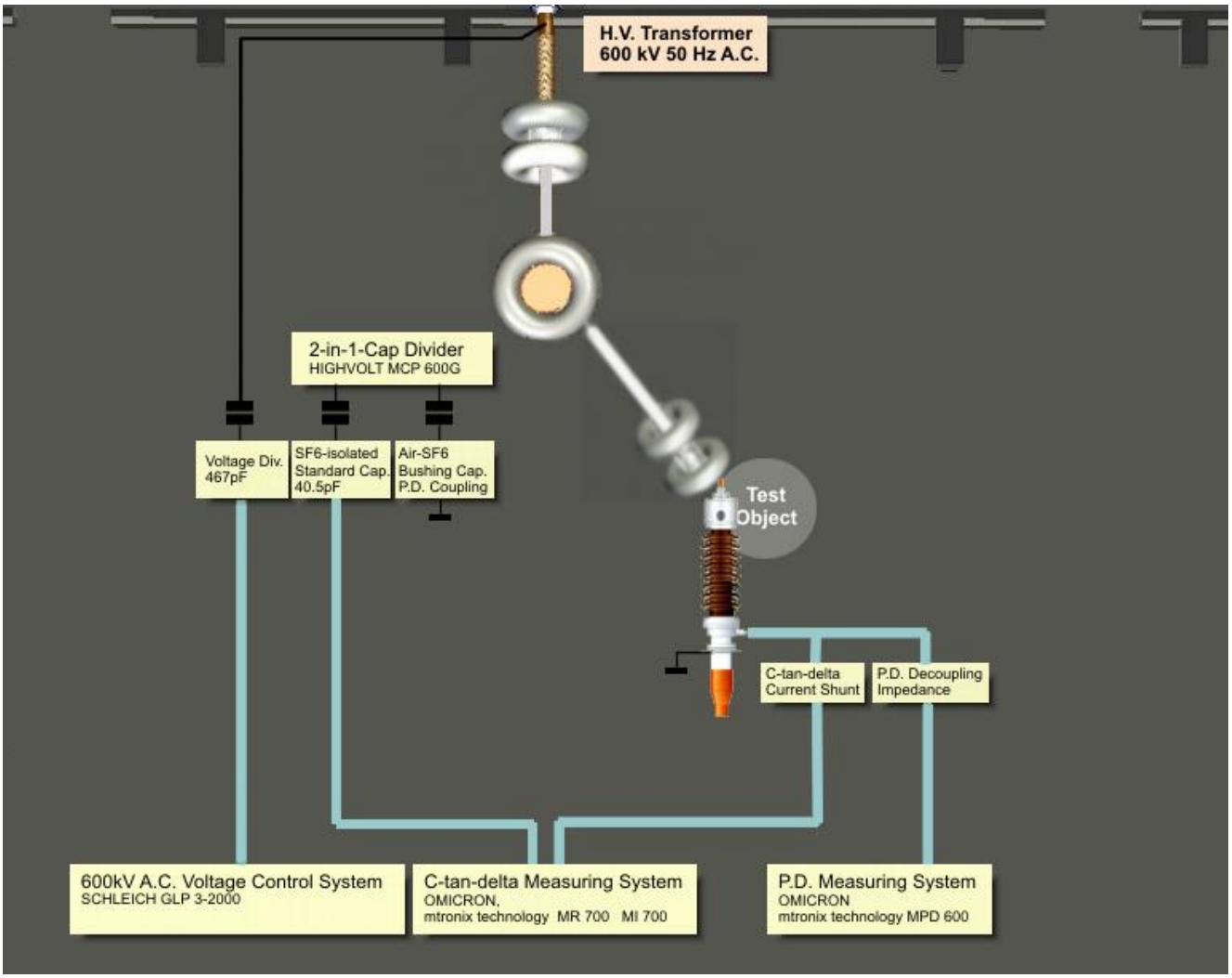
i.A. Haberecht
Senior Test Engineer

i.A. Adams
Senior Test Engineer

Basic Circuits & Principal Test Setup



Troisdorf 11.02.2020

EMISSION TEST

The following tests were executed successively:

50 Hz AC routine test before type test															Date of test: 09.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	260	260	260	260	260	260	260	**Test voltage 72 sec.**	260	260	260	260	260	260	260
tan δ [%]	0.37	0.37	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37	0.37	0.37	0.37	0.37
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

EMISSION TEST — **Date of test: 13.12.2019**

Test setup:
The bushing was mounted on a solidly grounded test vessel filled with oil. The effective test vessel diameter was reduced by an inserted grounded aluminium cylinder Ø 340 mm x 710 mm.
The test object was connected to the high voltage by steel rod Ø 30 mm x 700 mm.

Atmospheric conditions:

Temperature:	20 °C
Air pressure:	974 hPa
Relative humidity:	39 %

Test:

50 Hz AC test voltage: series of voltage steps from $1.1 \times U_m/\sqrt{3}$ to $0.3 \times U_m/\sqrt{3}$

p.d. measurement

U [kV]	78	71	64	57	50	43	36	28	21
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Result of test:
During the test no partial discharges above the background noise level were detected. The background noise level was measured at 1 pC. See the complete test sequence on the next page.

50 Hz AC routine test after type test															Date of test: 15.12.2019
U [kV]	**10**	**36**	**75**	**107**	**129**	**160**	**230**	**255**	**230**	**160**	**129**	**107**	**75**	**36**	**10**
C_1 [pF]	259	259	259	259	259	259	259	**Test voltage 72 sec.**	259	259	259	259	259	259	259
tan δ [%]	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38	0.38	0.38	0.38	0.38
p.d. [pC]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

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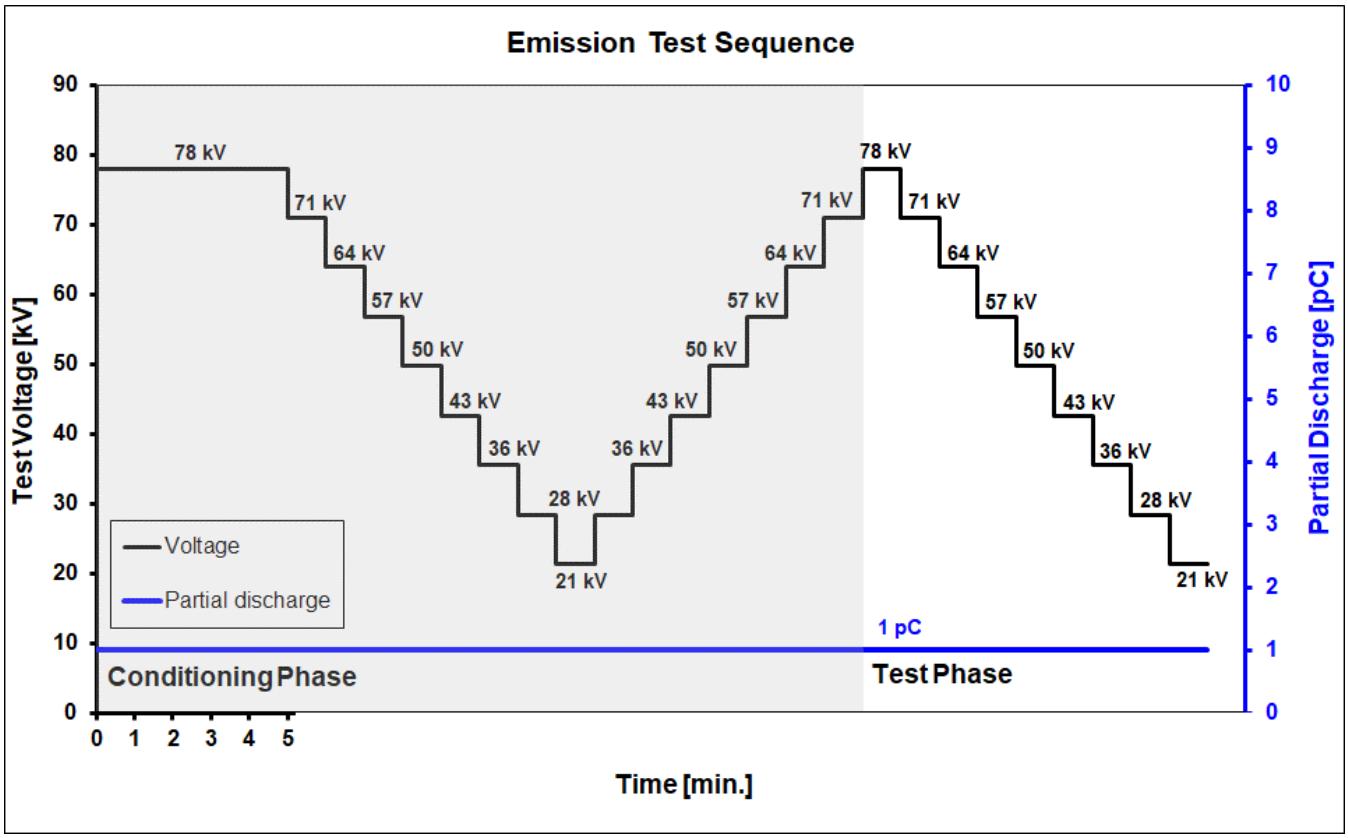
EMISSION TEST



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Supplemental Information - Test Object Specification

HSP Hochspannungsgeräte GmbH

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Offer-No.:	Order-No.:

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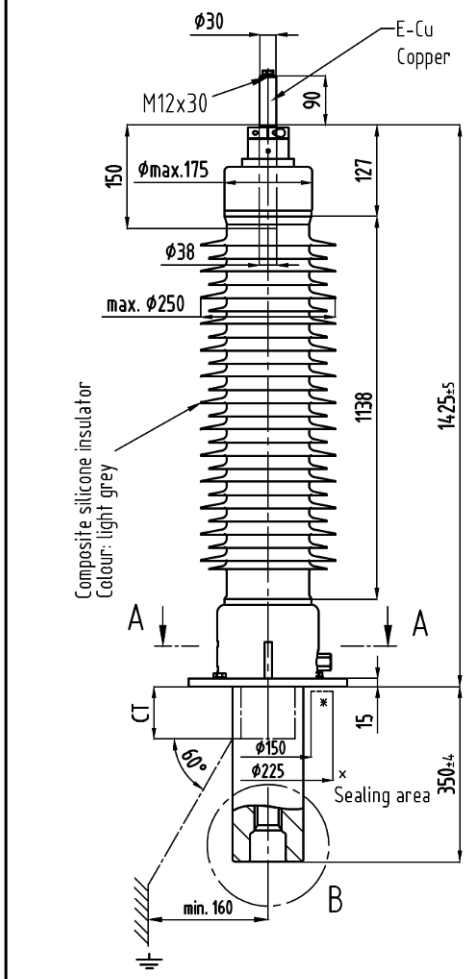

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Rated current:	800 A
Max. service current:	800 A
CT accommodation length:	0 mm
Flashover distance:	1138 mm
Creepage distance, min.:	3906 mm
Cantilever test load:	3150 N
Mounting position:	0-90°
Ambient temperature:	-30...+40°C
Temperature of transformer oil:	max.100°C max. daily mean 90 °C
Test tap - test voltage:	2kV, 50Hz, 1.2min.
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Mass, approx.:	57 kg
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Remarks:

- RIP (resin impregnated paper)
- Draw lead bolt, E-Cu, cable cross section 450mm²

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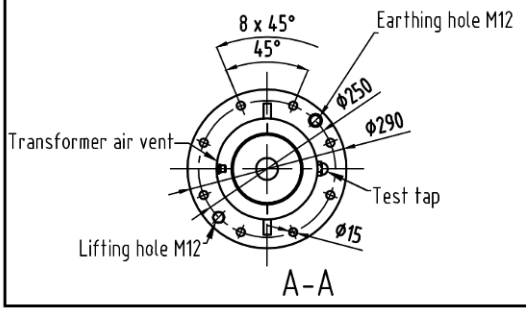

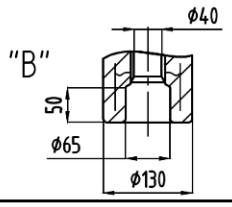

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