Type test report no. VR/R/VM/M 6E 002e

Dielectric tests of
tap selector and change-over selector

Product Approval
CTTP/Wag
10.02.2017

Type test for types: Tap selectors of size "RD" without change-over selector, with reversing change-over selector or with coarse change-over selector, designed with 1, 2 or 3 current paths (connected in parallel) for use in combination with single phase, 2 phase or 3 phase diverter switches type VACUTAP® VR, VACUTAP® VM, OILTAP® R or OILTAP® M.

Test specification: IEC 60214-1:2014, sub-clause 5.2.8: "Dielectric tests".

Test samples:
1: VACUTAP® VM III 650 Y – 170/RD – 18 35 3G, S/N: 1596238.
2: VACUTAP® VM III 650 Y – 123/RDE – 10 19 3W, S/N: 1525714.

Manufacturer: Maschinenfabrik Reinhausen GmbH, Regensburg, Germany.

Date of test: March to April 2015.

Places of test: Maschinenfabrik Reinhausen GmbH, Regensburg, Germany.

Tests performed:

Full wave lightning impulse tests (LI): Impulse 1.2/50 µs:
Each 3 applications performed with positive and negative polarity.

Chopped wave lightning impulse tests (LIC): Impulse 1.2/50/3 µs:
Each 3 applications performed with positive and negative polarity.

Switching impulse tests (SI): Impulse 250/2500 µs:
Each 3 applications performed with positive and negative polarity.

Applied voltage tests (AV): Performed with single-phase alternating voltage (50 Hz / 60 s).

Test voltages and tested insulation distances:

	Sym.	LI [kV]	LIC [kV]	SI [kV]	AV [kV]
Between any two adjacent contacts of the tap selector	a1	150	165	100	30
Between first and last contacts of the tap selector or of the change-over selector.	a	500	550	325	145
Between phases	b	500	550	325	160
Between the (-) contact of the coarse change-over selector and the take-off contact of the same phase	c1	590	649	385	210
Between the (-) contact of the coarse change-over selector of different phases	c2	590	649	385	230

Test results: The requirements of IEC 60214-1:2014 were met. All test voltages were withstood without discharge. Details see sub-clause 7.

This report contains 22 pages.

i. V. Dr. Thomas Strof
[valid without signature]

Maschinenfabrik Reinhausen GmbH
- PRODUCT APPROVAL -

1. Test specification

The type test was performed in accordance with IEC 60214-1:2014 “Tap-changers - Part 1: Performance requirements and test methods”, sub-clause 5.2.8: “Dielectric tests”.

2. Data of test samples

Test sample no.: **1**
On-load tap changer: VACUTAP® VM III 650 Y – 170/RD – 18 35 3G
Serial no.: 1596238
IBASE: 487056566
Year of manufacture: 2015
Part of test: Tap selector

Test sample no.: **2**
On-load tap changer: VACUTAP® VM III 650 Y – 123/RDE – 10 19 3W
Serial no.: 1525714
IBASE: 467020172
Year of manufacture: 2014
Part of test: Tap selector

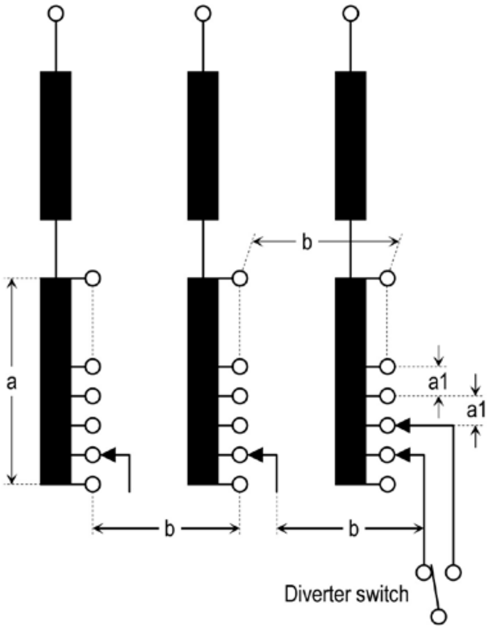
3. Specification of the insulating distances of the tap selector and change-over selector and the corresponding voltage stress of the transformer windings

Specification of the insulating distances of the tap selector and change-over selector:

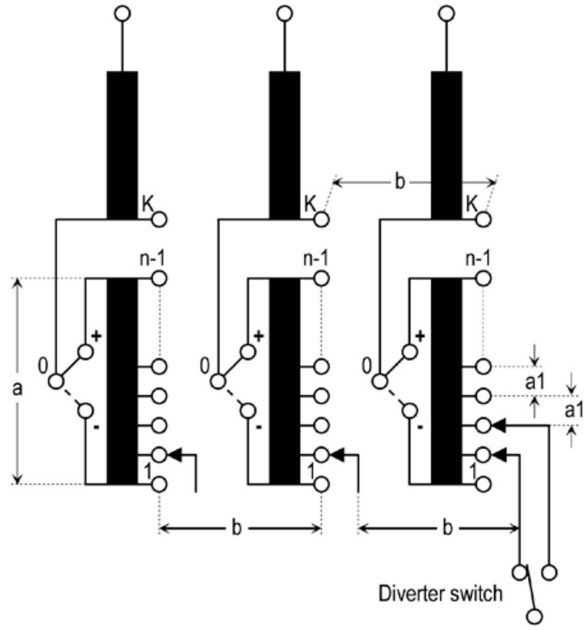
Symbol	Definition of the insulation distances of the transformer windings
a1	Between fine tap selector contacts of the winding of one tap position (connected or not connected).
a	Between start and end of a tapped winding and, in version with coarse winding, also between start and end of a coarse winding. *Note for coarse tap selector connection in (-) position of the change-over selector:* *When loading with impulse voltage, note the permissible withstand voltage "a" between the end of a coarse winding connected with the K fine tap selector contact and the fine tap selector contact at the end of the tapped winding of the same phase.*
b	Between the fine tap selector contacts of different phases and between change-over selector contacts of different phases, which are connected with the beginning/end of a tapped winding or with a fine tap selector contact.

Additionally for coarse tap selector connection in (+) position of the change-over selector:

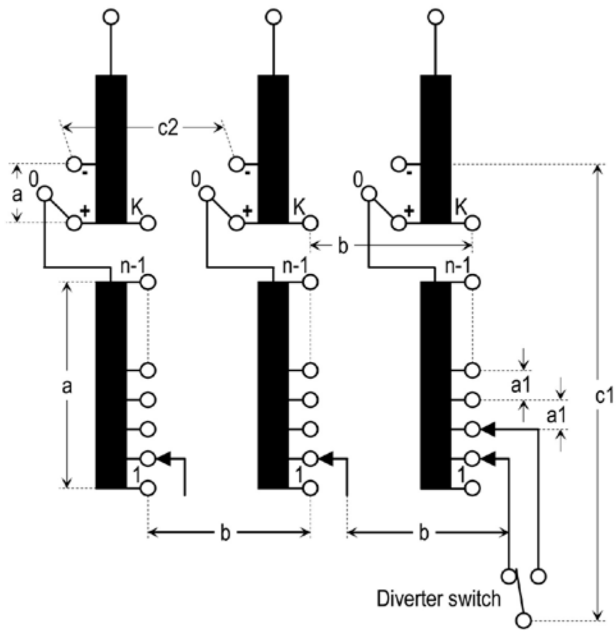
Symbol	Definition of the insulation distances of the transformer windings
c1	From (-) change-over selector contact to take-off lead of the same phase.
c2	Between (-) change-over selector contacts of different phases.



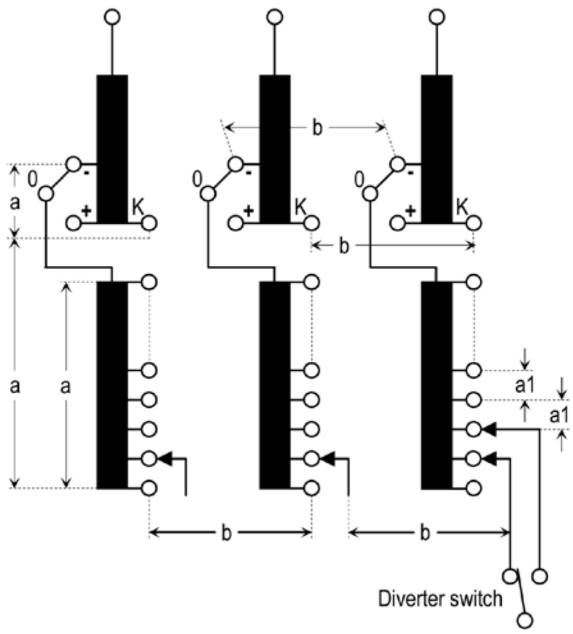
a) without change-over selector.



b) with reversing change-over selector.

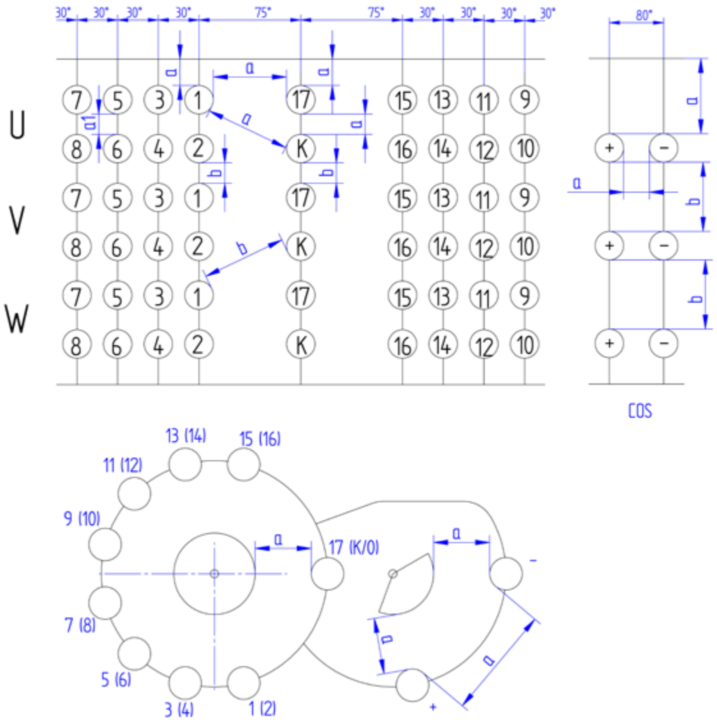


c) with coarse change-over selector in (+) position.

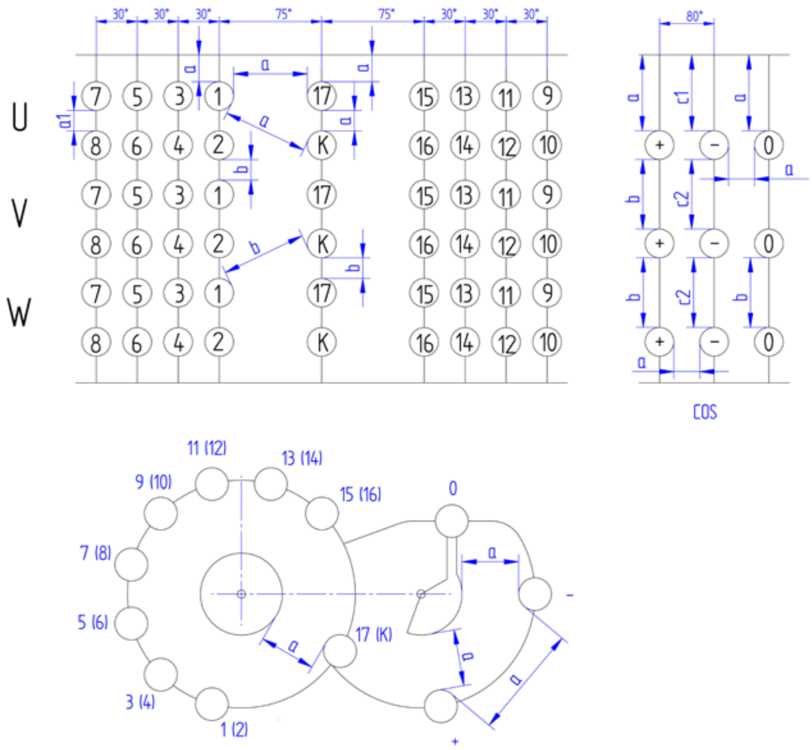


d) with coarse change-over selector in (-) position.

Figure 1: Insulating distances of the transformer windings.



a) Tap selector with reversing change-over selector (exemplary for connection arrangement 18 35 1W resp. 18 35 3W).



b) Tap selector with coarse change-over selector (exemplary for connection arrangement 18 35 1G resp. 18 35 3G).

Figure 2: Insulating distances on the tap selector and the change-over selector of type RD.

Note:
In case of several insulating distances of the same design all distances were tested, figure 2 shows only examples of these distances.

4. Scope of application

Tap selectors of size “RD” with reversing change-over selector, with coarse change-over selector or without change-over selector are designed on the principle of a modular system for use in combination with diverter switches type VACUTAP® VR, VACUTAP® VM, OILTAP® R or OILTAP® M.
The modular design allows a wide range of different features, like basic connection of selector, number of tap selector contacts, number of phases, number of current paths connected in parallel per phase and number of contact planes.

The insulation distances specified in sub-clause 2 are of the same design for all tap selectors and change-over selectors of size “RD”, independent of:

- Maximum rated through-current
- Number of parallel current paths per phase (1, 2 or 3)
- Number of phases (1, 2 or 3)

The insulation distances within a single contact plane do not depend on:

- Selector size (“RC”, “RD” or “RDE”)
- Number of tap selector contacts (10, 12, 14, 16 or 18)

The insulation distances “c1” and “c2” are existent both on the coarse change-over selector and the reversing change-over selector but are only relevant for the coarse change-over selector.

The different insulation distances specified in sub-clause 2 were tested on two samples, see sub-clause 3. Insulation distances within a single contact plane, which do not depend on the selector size, were tested on test sample 2. All other insulation distances were tested on test sample 1.

The tests cover the complete range of possible dielectric stresses within the type range of VACUTAP® VR, VACUTAP® VM, OILTAP® R or OILTAP® M.

Therefore this type test report is valid for all tap selectors with following characteristics:

- Selector size:	“RD”
- Change-over selector:	without, reversing or coarse change-over selector
- Combined diverter switch:	VACUTAP® VR, VACUTAP® VM, OILTAP® R or OILTAP® M
- Number of tap selector contacts:	10, 12, 14, 16 or 18
- Number of phases:	1, 2 or 3
- Parallel current paths per phase:	1, 2 or 3

5. Test arrangement

Treatment before testing:	The test samples were vacuum dried in accordance with the instructions of the manufacturer.
Test tank oil filling:	Plexiglas tank (22,000 liters) filled with clean transformer oil (Nynas 4000x) at room temperature. The breakdown strength of the transformer oil was between 63 kV / 2.5 mm and 80 kV / 2.5 mm.
Test setup:	The test samples were placed in a Plexiglas test tank and connected to test voltages (test sample see appendix, pictures 3a/b). The tests were performed on permanently installed measuring chains for alternating voltage (see appendix, picture 1) and impuls voltage (see appendix, picture 2). The tap selectors were tested alone (without diverter switch).

6. Tests performed

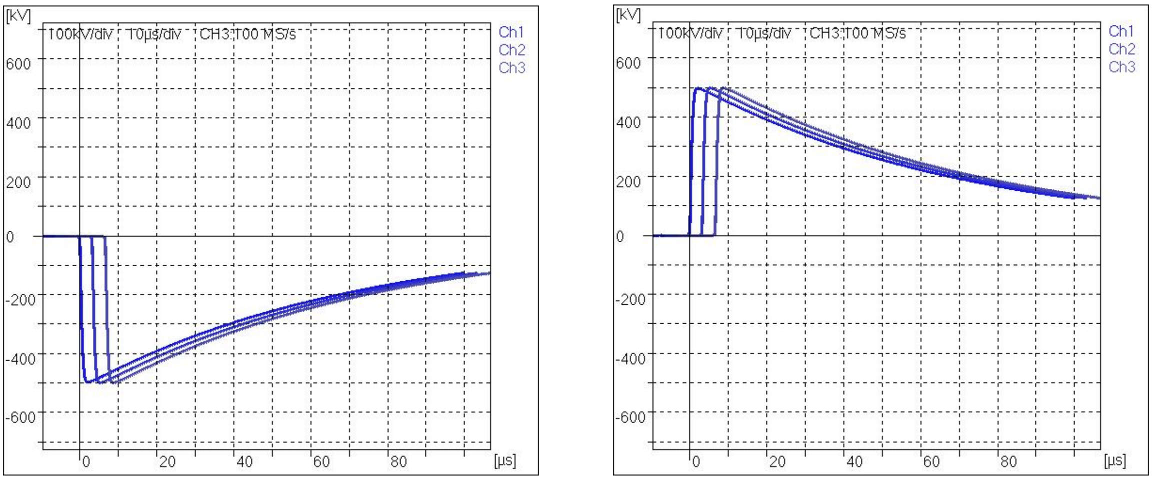
6.1 Full wave lightning impulse test (LI)

Test standards:	IEC 60214-1:2014, sub-clause 5.2.8.5
Impulse voltage generator:	Impuls generator (max. charging: 1800 kV), see appendix, picture 2.
Voltage waveform (T_1/T_2):	1.2 / 50 µs.
Voltage value (U_p):	See tables 1...5.
Oscillograms:	See figures 3a/b...7a/b.
Wiring and connections:	See appendix, figures 24...28.
Number of applications:	Three applications with positive and three with negative polarity.

6.1.1 Insulating distance “a”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a	1	-500	-498.1	1.2	1.239	50	52.09
	2		-500.3		1.239		52.08
	3		-500.1		1.238		52.05
	4	500	499.4		1.248		52.01
	5		500.0		1.247		52.06
	6		500.3		1.244		52.08

Table 1: Test results of full wave lightning impulse test (1.2/50 µs) on insulating distance “a”.

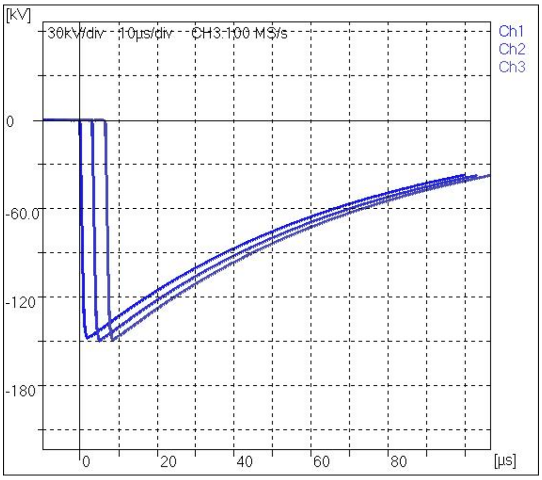


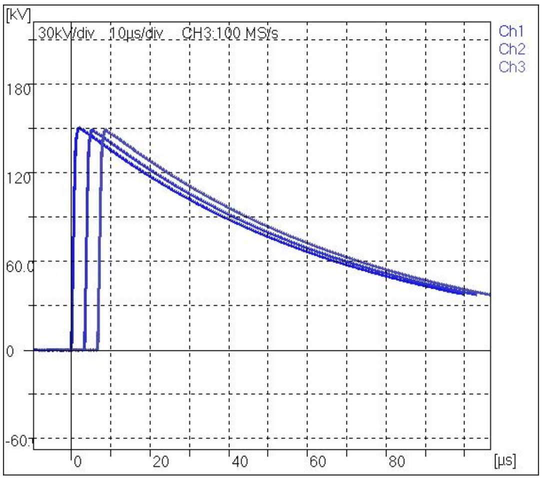
Figures 3a/3b: Oscillograms of full wave lightning impulse test (1.2/50 µs) on insulating distance “a”.

6.1.2 Insulating distance “a1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a1	1	-150	-148.6	1.2	1.198	50	51.28
	2		-150.2		1.196		51.23
	3		-149.8		1.193		51.27
	4	150	151.4		1.199		51.26
	5		149.9		1.197		51.22
	6		150.0		1.196		51.20

Table 2: Test results of full wave lightning impulse test (1.2/50 µs) on insulating distance “a1”.



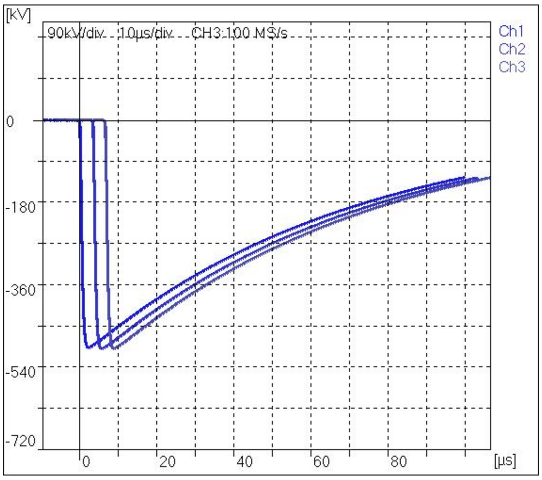


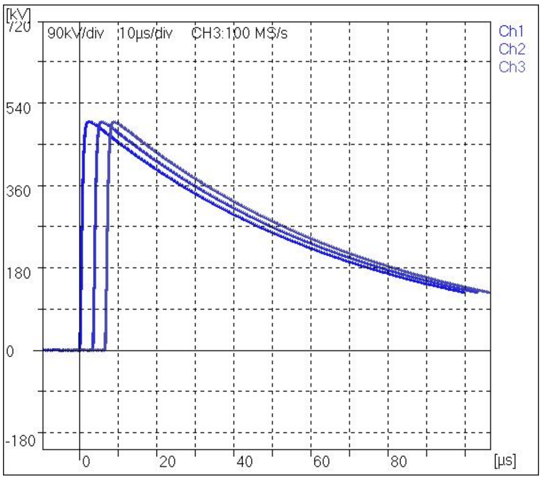
Figures 4a/4b: Oscillograms of full wave lightning impulse test (1.2/50 µs) on insulating distance “a1”.

6.1.3 Insulating distance “b”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
b	1	-500	-497.7	1.2	1.284	50	51.90
	2		-500.7		1.284		51.86
	3		-499.8		1.283		51.96
	4	500	500.9		1.297		51.96
	5		499.7		1.300		51.88
	6		499.8		1.300		51.88

Table 3: Test results of full wave lightning impulse test (1.2/50 µs) on insulating distance “b”.



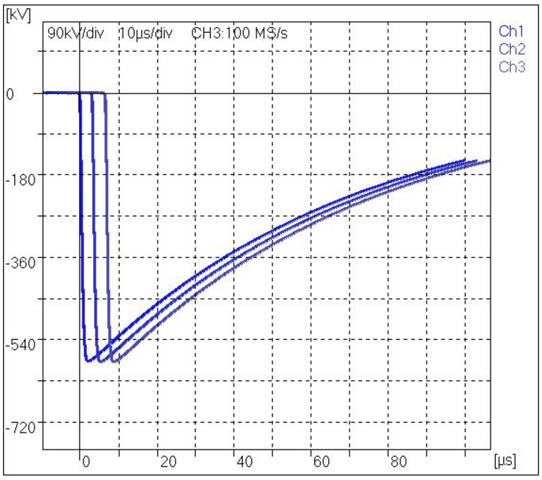


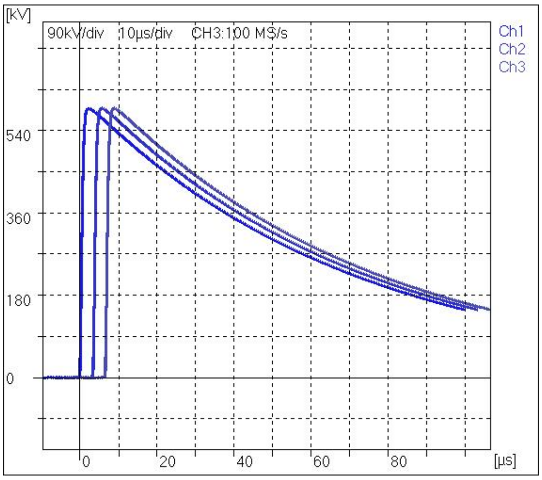
Figures 5a/5b: Oscillograms of full wave lightning impulse test (1.2/50 µs) on insulating distance “b”.

6.1.4 Insulating distance “c1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c1	1	-590	-588.5	1.2	1.236	50	51.80
	2		-589.9		1.237		51.79
	3		-589.8		1.235		51.82
	4	590	589.4		1.245		51.90
	5		589.8		1.244		51.89
	6		590.0		1.247		51.90

Table 4: Test results of full wave lightning impulse test (1.2/50 µs) on insulating distance “c1”.



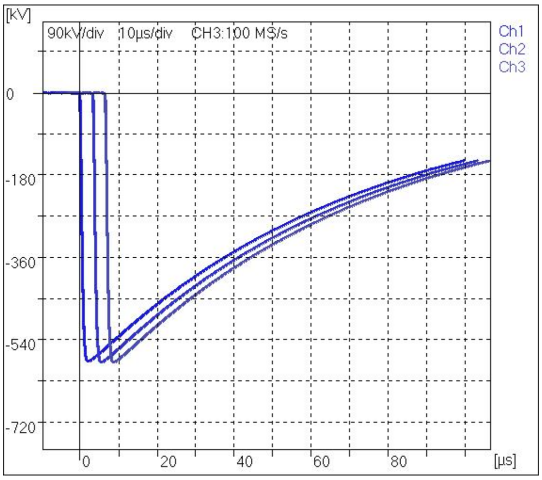


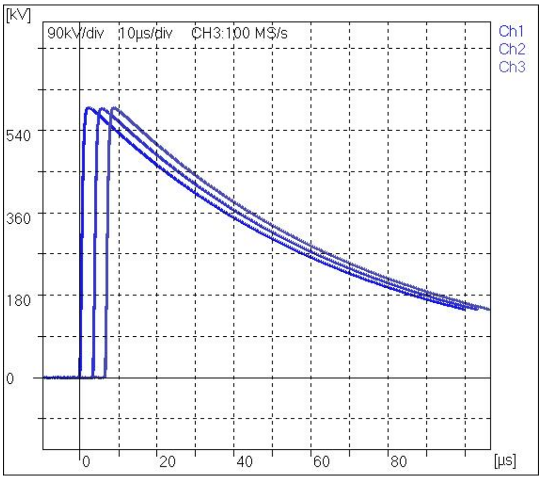
Figures 6a/6b: Oscillograms of full wave lightning impulse test (1.2/50 µs) on insulating distance “c1”.

6.1.5 Insulating distance “c2”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c2	1	-590	-588.6	1.2	1.242	50	51.80
	2		-590.1		1.242		51.78
	3		-590.1		1.243		51.82
	4	590	590.9		1.257		51.88
	5		589.5		1.254		51.86
	6		590.3		1.258		51.88

Table 5: Test results of full wave lightning impulse test (1.2/50 µs) on insulating distance “c2”.





Figures 7a/7b: Oscillograms of full wave lightning impulse test (1.2/50 µs) on insulating distance “c2”.

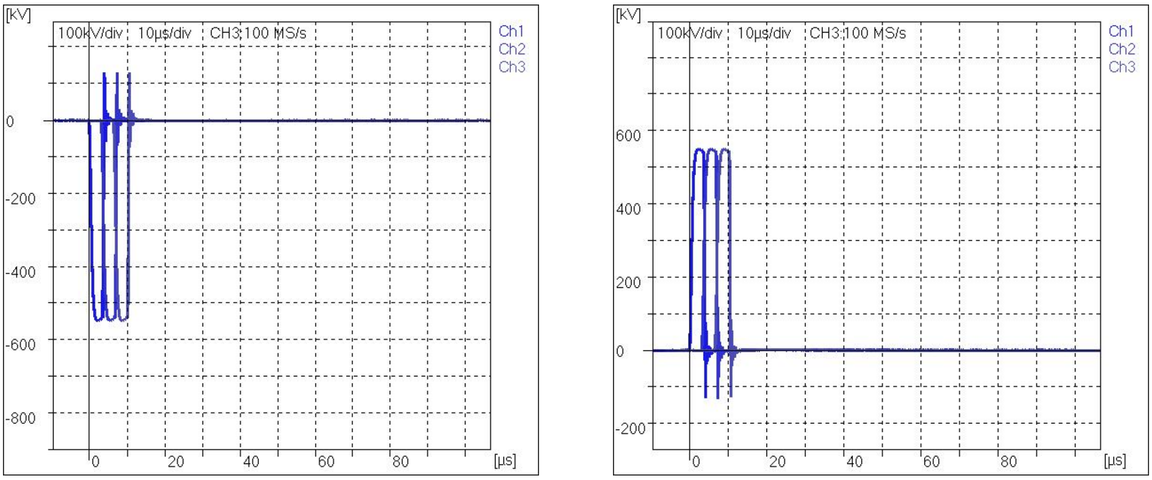
6.2 Chopped wave lightning impulse test (LIC)

Test standard:	IEC 60214-1:2014, sub-clause 5.2.8.6.
Impulse voltage generator:	Impuls generator (max. charging: 1800 kV), see appendix, picture 2.
Voltage waveform (T_1/T_2/T_c):	1.2 / 50 / 3 µs.
Voltage value (U_p):	See tables 6...10.
Oscillograms:	See figures 8a/b...12a/b.
Wiring and connections:	See appendix, figures 24...28.
Number of applications:	Three applications with positive and three with negative polarity.

6.2.1 Insulating distance “a”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV peak]		Front time (T_1) [µs]		Time to chopping (T_C) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a	1	-550	-548.0	1.2	1.251	4	3.680
	2		-548.1		1.255		3.794
	3		-548.1		1.253		3.802
	4	550	550.0		1.266		3.738
	5		549.9		1.266		3.759
	6		549.9		1.267		3.755

Table 6: Test results of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “a”.

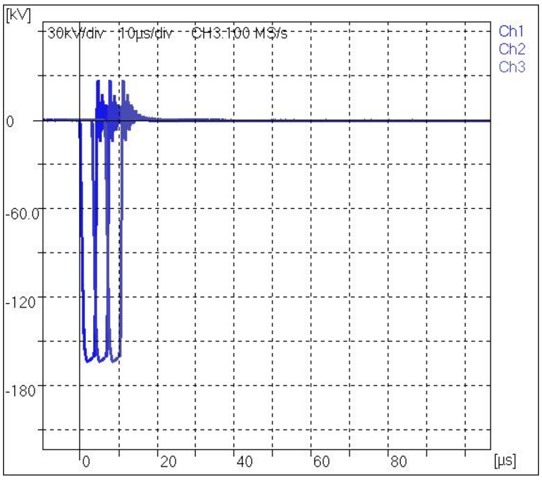


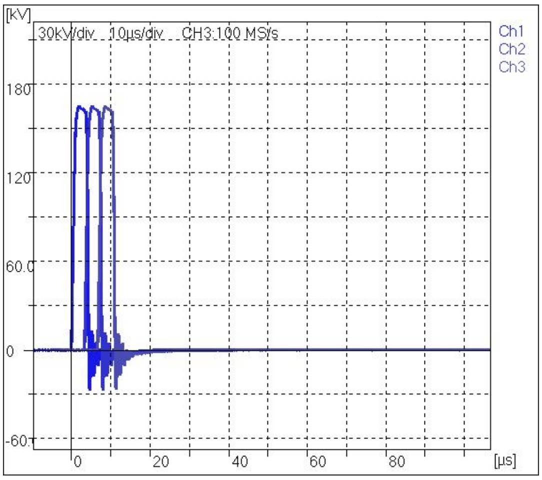
Figures 8a/8b: Oscillograms of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “a”.

6.2.2 Insulating distance “a1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to chopping (T_C) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a1	1	-165	-164.6	1.2	1.201	4	3.891
	2		-164.5		1.201		3.885
	3		-164.6		1.199		3.880
	4	165	165.8		1.200		3.886
	5		165.9		1.203		3.859
	6		165.6		1.199		3.862

Table 7: Test results of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “a1”.



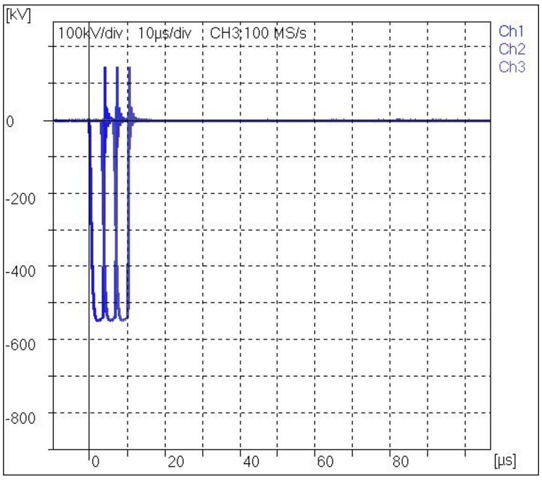


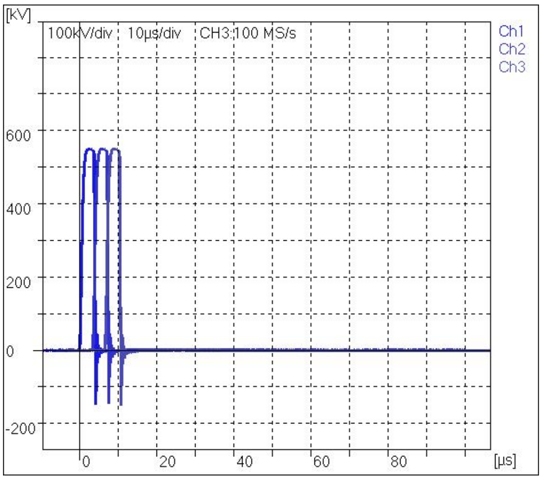
Figures 9a/9b: Oscillograms of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “a1”.

6.2.3 Insulating distance “b”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to chopping (T_C) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
b	1	-550	-548.0	1.2	1.289	4	3.832
	2		-548.1		1.289		3.811
	3		-548.1		1.287		3.824
	4	550	551.3		1.303		3.795
	5		551.5		1.304		3.786
	6		551.2		1.302		3.789

Table 8: Test results of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “b”.



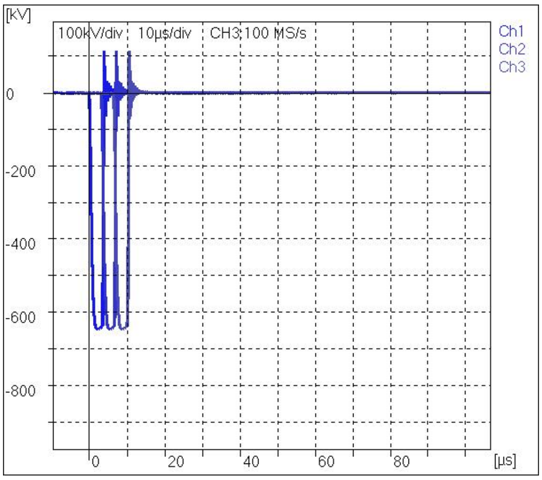


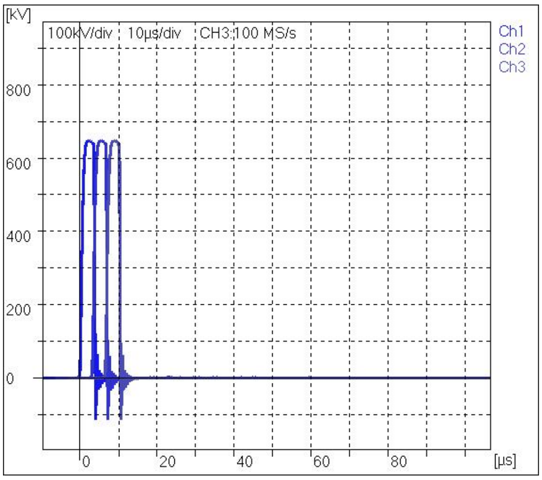
Figures 10a/10b: Oscillograms of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “b”.

6.2.4 Insulating distance “c1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to chopping (T_C) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c1	1	-649	-647.2	1.2	1.241	4	3.613
	2		-647.3		1.239		3.545
	3		-647.3		1.241		3.743
	4	649	648.8		1.250		3.727
	5		648.7		1.250		3.712
	6		648.7		1.251		3.704

Table 9: Test results of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “c1”.



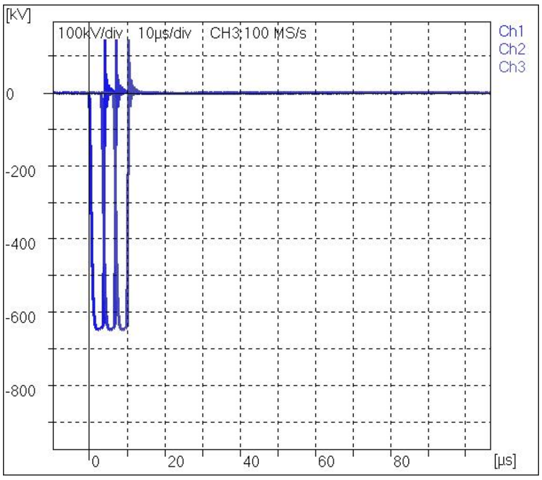


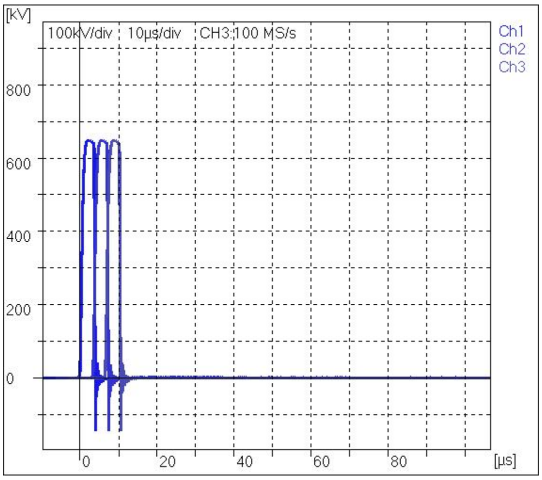
Figures 11a/11b: Oscillograms of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “c1”.

6.2.5 Insulating distance “c2”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Front time (T_1) [µs]		Time to chopping (T_C) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c2	1	-649	-648.3	1.2	1.246	4	3.825
	2		-648.7		1.248		3.575
	3		-648.5		1.244		3.618
	4	649	649.4		1.265		3.757
	5		649.6		1.266		3.745
	6		649.6		1.265		3.746

Table 10: Test results of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “c2”.





Figures 12a/12b: Oscillograms of chopped wave lightning impulse test (1.2/50/3 µs) on insulating distance “c2”.

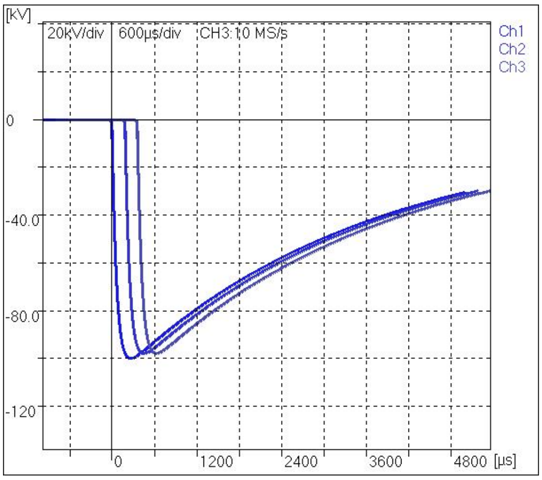
6.3 Switching impulse test (SI)

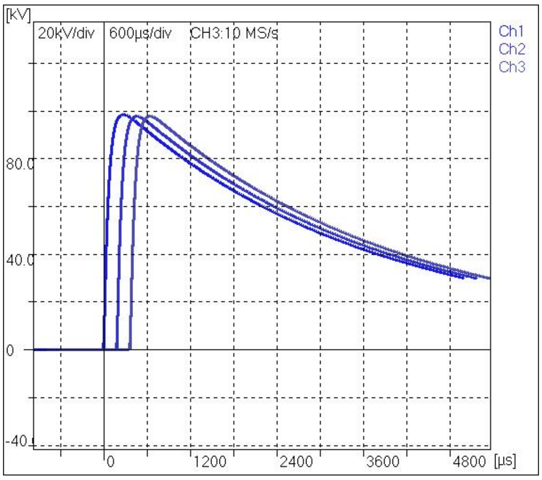
Test standard:	IEC 60214-1:2014, sub-clause 5.2.8.7.
Impulse voltage generator:	Impuls generator (max. charging: 1800 kV), see appendix, picture 2.
Voltage waveform (T_P/T_2):	250 / 2500 µs.
Voltage value (U_p):	See tables 11...15.
Oscillograms:	See figures 13a/b...17a/b.
Wiring and connections:	See appendix, figures 24...28.
Number of applications:	Three applications with positive and three with negative polarity.

6.3.1 Insulating distance “a1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV peak]		Time to peak (T_P) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a1	1	-100	-100.00	250	265.7	2500	2975
	2		-97.92		265.4		2974
	3		-97.95		265.6		2973
	4	100	98.53		265.7		2975
	5		97.94		265.7		2974
	6		97.92		265.9		2974

Table 11: Test results of switching impulse test (250/2500 µs) on insulating distance “a1”.



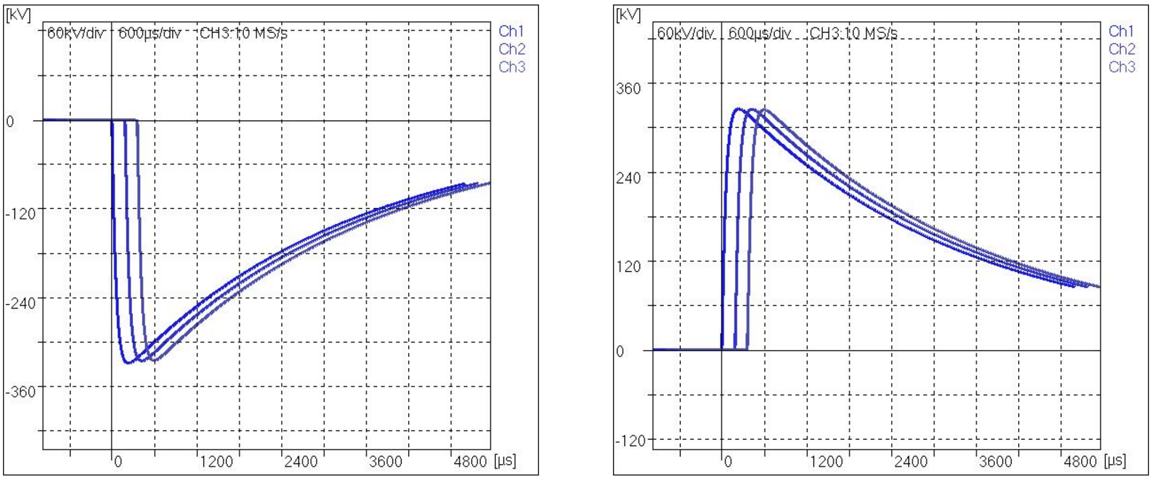


Figures 13a/14b: Oscillograms of switching impulse test (250/2500 µs) on insulating distance “a1”.

6.3.2 Insulating distance “a”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Time to peak (T_P) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
a	1	-325	-328.3	250	230.3	2500	2681
	2		-325.4		230.3		2680
	3		-324.8		230.3		2681
	4	325	325.8		231.2		2681
	5		325.3		231.4		2682
	6		324.6		231.1		2681

Table 12: Test results of switching impulse test (250/2500 µs) on insulating distance “a”.

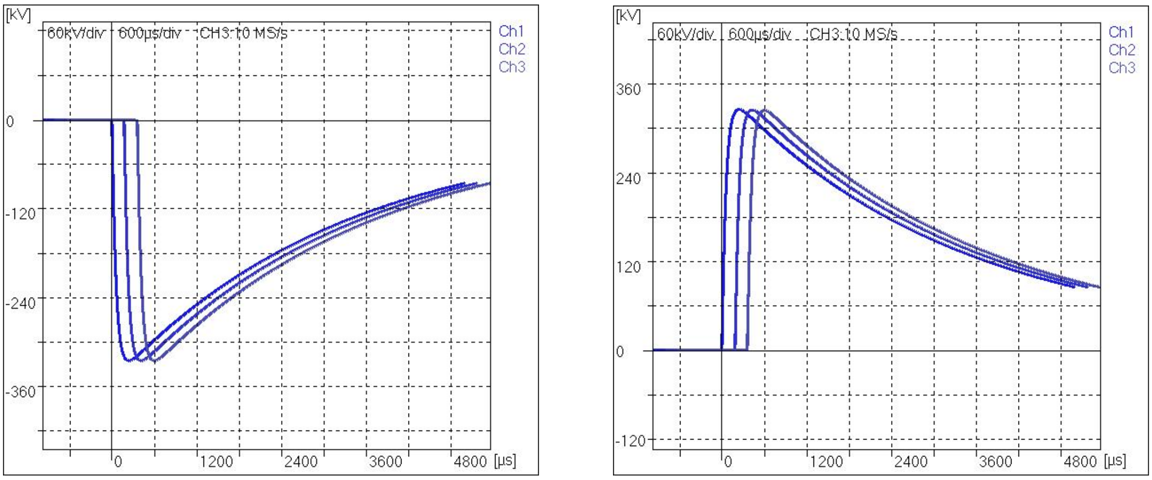


Figures 14a/14b: Oscillograms of switching impulse test (250/2500 µs) on insulating distance “a”.

6.3.3 Insulating distance “b”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Time to peak (T_P) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
b	1	-325	-325.0	250	234.5	2500	2687
	2		-325.0		234.4		2687
	3		-325.0		234.3		2686
	4	325	325.9		235.3		2688
	5		325.4		235.4		2689
	6		324.8		235.5		2688

Table 13: Test results of switching impulse test (250/2500 µs) on insulating distance “b”.

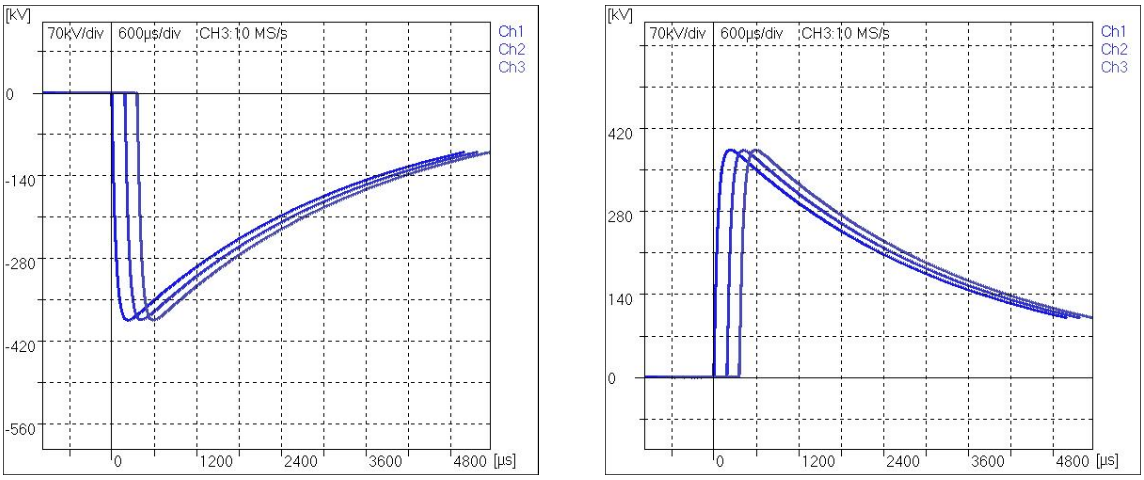


Figures 15a/15b: Oscillograms of switching impulse test (250/2500 µs) on insulating distance “b”.

6.3.4 Insulating distance “c1”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Time to peak (T_P) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c1	1	-385	-384.3	250	225.7	2500	2673
	2		-383.7		225.5		2675
	3		-384.3		225.7		2673
	4	385	384.6		226.4		2675
	5		383.8		226.5		2675
	6		384.3		226.3		2675

Table 14: Test results of switching impulse test (250/2500 µs) on insulating distance “c1”.

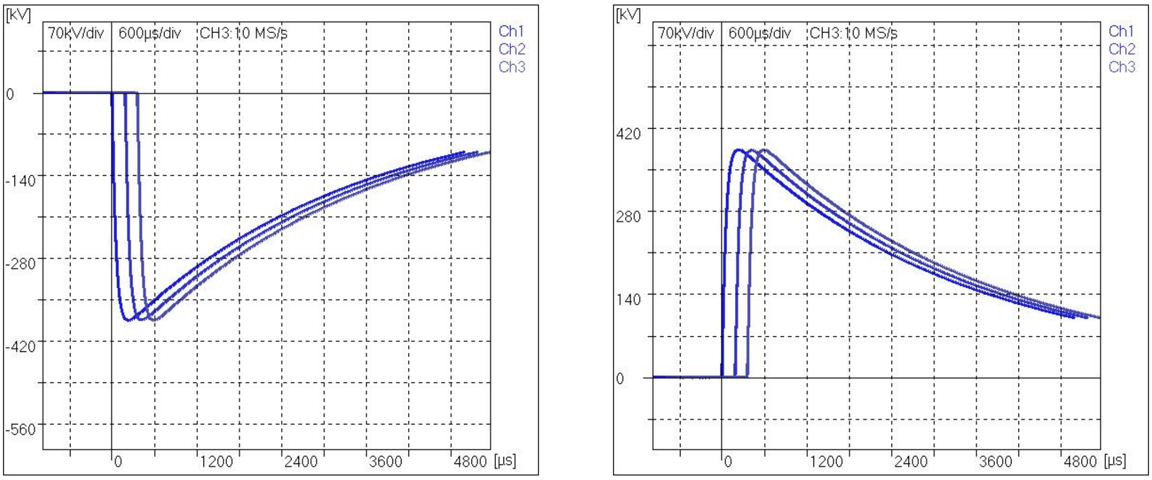


Figures 16a/16b: Oscillograms of switching impulse test (250/2500 µs) on insulating distance “c1”.

6.3.5 Insulating distance “c2”

Tested insulating distance	Test no.	Peak amplitude (U_p) [kV $_{peak}$]		Time to peak (T_P) [µs]		Time to half-value (T_2) [µs]	
		Nominal	Tested	Nominal	Tested	Nominal	Tested
c2	1	-385	-384.4	250	224.3	2500	2673
	2		-383.9		224.3		2675
	3		-383.9		224.4		2674
	4	385	385.0		225.1		2676
	5		383.9		225.2		2676
	6		384.0		225.3		2676

Table 15: Test results of switching impulse test (250/2500 µs) on insulating distance “c2”.



Figures 17a/17b: Oscillograms of switching impulse test (250/2500 µs) on insulating distance “c2”.

6.4 Applied voltage test (AV)

Test standards:	IEC 60214-1:2014, sub-clause 5.2.8.8.
Voltage generator:	Applied voltage generator (max. Voltage 700 kV), see appendix, picture 1
Voltage waveform:	Sine-shaped (frequency: 50 Hz).
Voltage value ($U_{r.m.s}$):	See tables 15...19.
Oscillograms:	See figures 18...22.
Wiring and connections:	See appendix, figures 24...28.
Test duration (t_D):	60 s

6.4.1 Insulating distance “a”

Tested insulating distance	Applied voltage (50 Hz) [kV $_{r.m.s}$]		Test duration [s]	
	Nominal	Tested	Nominal	Tested
a	145	145	60	62

Table 15: Test results of applied voltage test (50 Hz) on insulating distance “a”.

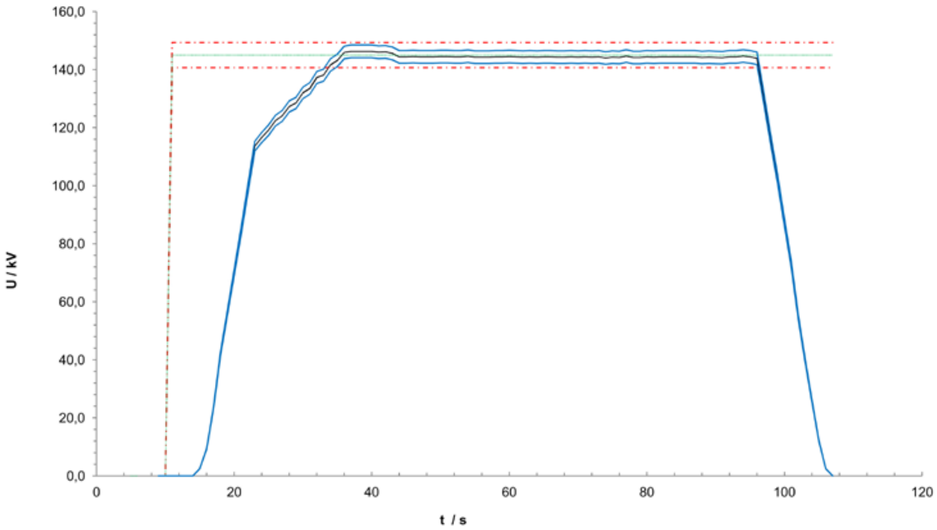


Figure 18: Oscillogram of applied voltage test (50 Hz) on insulating distance “a”.

6.4.2 Insulating distance “a1”

Tested insulating distance	Applied voltage (50 Hz) [kV r.m.s]		Test duration [s]	
	Nominal	Tested	Nominal	Tested
a1	30	30	60	60

Table 16: Test results of applied voltage test (50 Hz) on insulating distance “a1”.

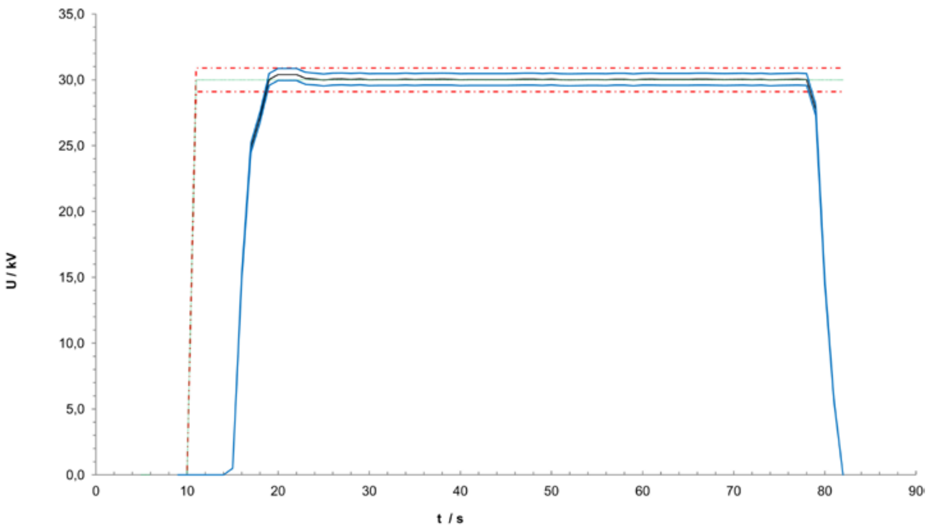


Figure 19: Oscillogram of applied voltage test (50 Hz) on insulating distance “a1”.

6.4.3 Insulating distance “b”

Tested insulating distance	Applied voltage (50 Hz) [kV r.m.s]		Test duration [s]	
	Nominal	Tested	Nominal	Tested
b	160	160	60	62

Table 17: Test results of applied voltage test (50 Hz) on insulating distance “b”.

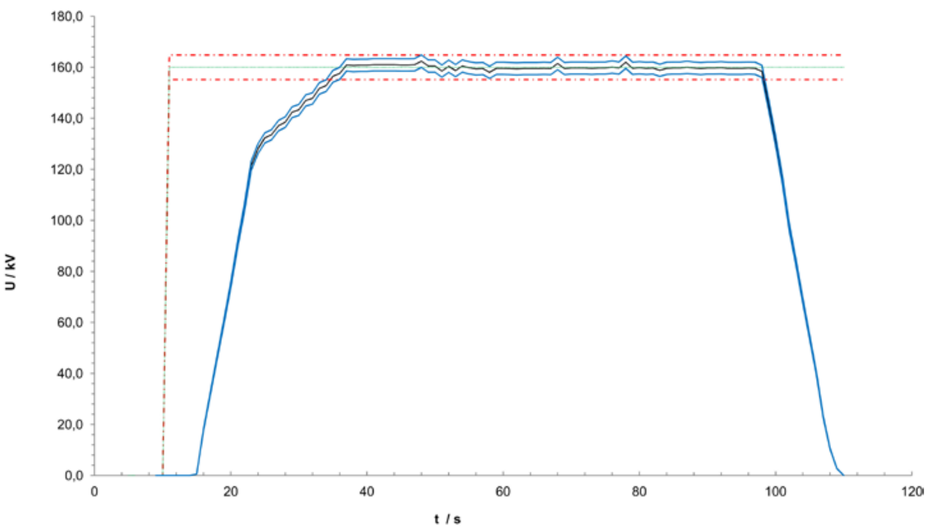


Figure 20: Oscillogram of applied voltage test (50 Hz) on insulating distance “b”.

6.4.4 Insulating distance "c1"

Tested insulating distance	Applied voltage (50 Hz) [kV r.m.s]		Test duration [s]	
	Nominal	Tested	Nominal	Tested
c1	210	230	60	63

Table 18: Test results of applied voltage test (50 Hz) on insulating distance "c1".

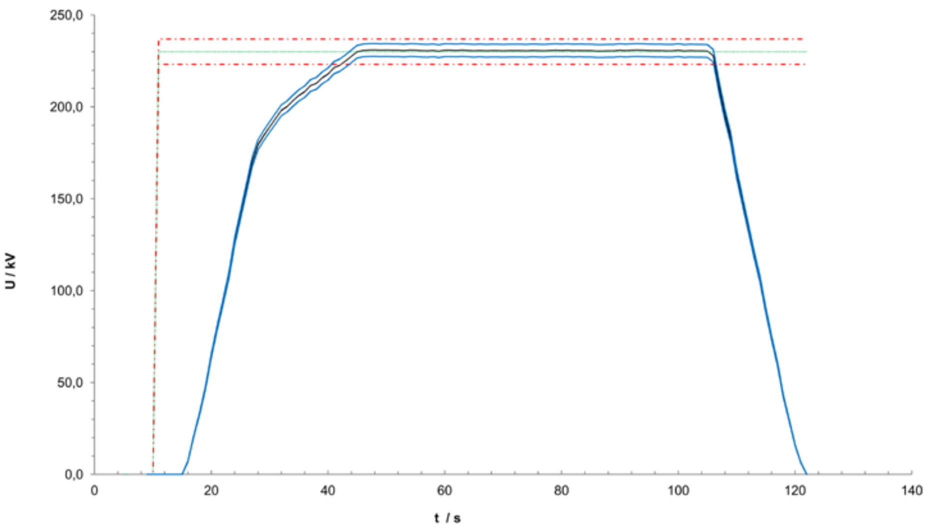


Figure 21: Oscillogram of applied voltage test (50 Hz) on insulating distance "c1".

6.4.5 Insulating distance "c2"

Tested insulating distance	Applied voltage (50 Hz) [kV r.m.s]		Test duration [s]	
	Nominal	Tested	Nominal	Tested
c2	230	250	60	63

Table 19: Test results of applied voltage test (50 Hz) on insulating distance "c2".

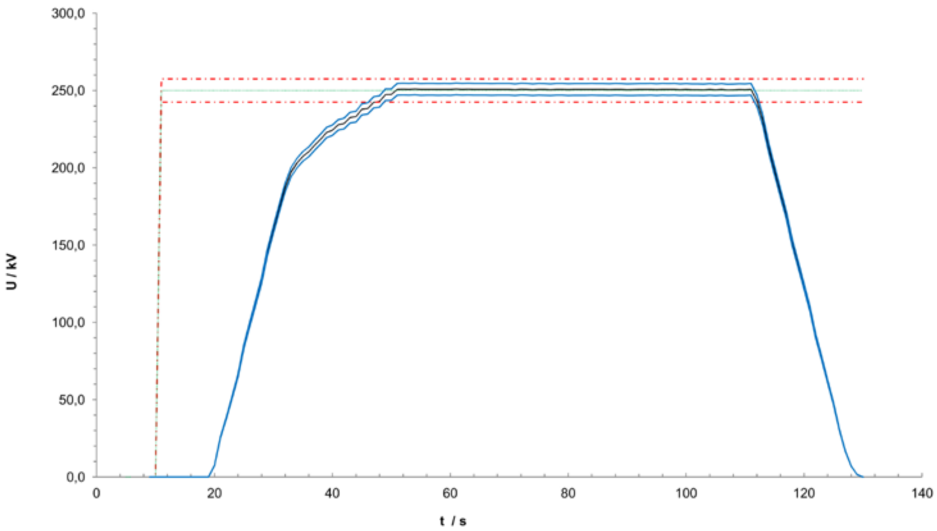


Figure 22: Oscillogram of applied voltage test (50 Hz) on insulating distance "c2".

7. Test result

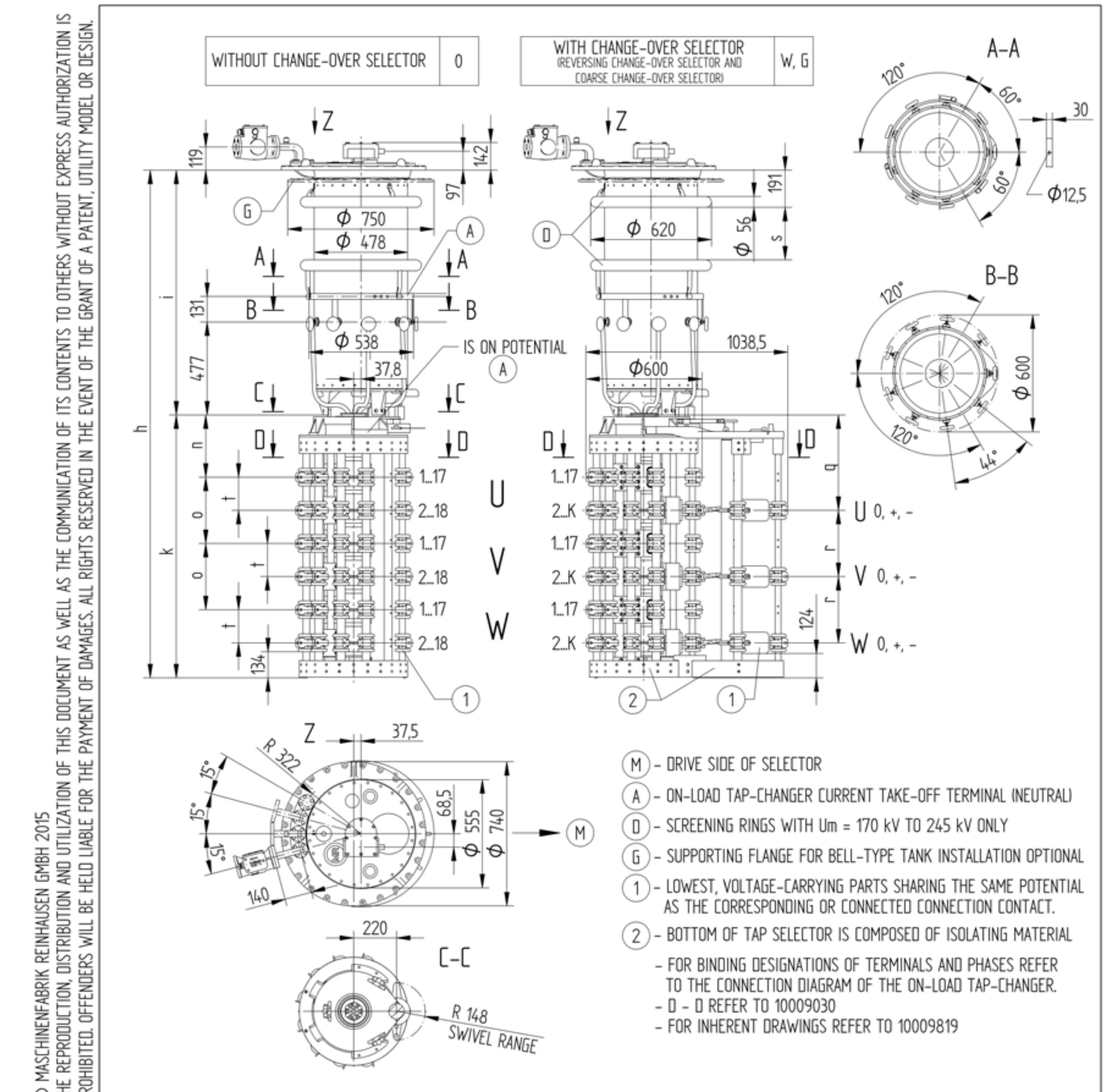
The requirements according to IEC 60214-1:2014 “Tap-changers - Part 1: Performance requirements and test methods”, sub-clause 5.2.8: “Dielectric tests” were met.

The full wave lightning impulse voltage tests (LI), the chopped wave lightning impulse tests (LIC), the switching impulse tests (SI) as well as the applied voltage tests (AV) were withstood without any discharge. The confirmed values are shown in table 20.

Tested insulating distance (Symbol see figures 1 and 2)	Full wave lightning impulse test (LI) 1.2/50 µs [kV $_{peak}$]	Chopped wave lightning impulse test (LIC) 1.2/50/3 µs [kV $_{peak}$]	Switching impulse test (SI) 250/2500 µs [kV $_{peak}$]	Power-frequency voltage tests 50 Hz / 60 s [kV $_{r.m.s.}$]
a1	150	165	100	30
a	500	550	325	145
b	500	550	325	160
c1	590	649	385	210
c2	590	649	385	230

Table 20: Confirmed withstand voltages of defined insulation distances.

8. Appendix



SELECTOR SIZE			RC				RD				RDE			
Um [KV]			72,5	123	170	245	72,5	123	170	245	72,5	123	170	245
DIMENSIONS [MM]	h		2346	2476	2606	2706	2586	2716	2846	2946	2706	2836	2966	3066
	i		996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	s	VM	-	-	267	367	-	-	267	367	-	-	267	367
		M	-	-	309	409	-	-	309	409	-	-	309	409
	k		1350				1590				1710			
	n		319				359				379			
	o		340				420				460			
	t		170				210				230			
	r		340				420				460			
	q		489				569				609			
OIL VOLUME [DM³]			130	150	170	190	130	150	170	190	130	150	170	190
DISPLACEMENT [DM³]			216	239	272	272	222	245	278	278	224	247	280	280
WEIGHT [KG] APPROX.		VM	415	420	425	430	426	431	436	441	432	437	442	447
		M	385	390	395	400	396	401	406	411	402	407	412	417

	DATE	NAME	DOCUMENT NO.
DFTR.	20.07.2015	DOBLER	SED 4311295 001 01
CHKD.	20.07.2015	HILTNER	CHANGE NO. 1068061
STAND.	20.07.2015	KLEYN	SCALE 1:10

DIMENSION IN mm EXCEPT AS NOTED

ON-LOAD TAP-CHANGER OILTAP® M, VACUTAP® VM®
MIII600Y, VMIII650Y-72,5...245- RC/RD/RDE
DIMENSION DRAWING

SERIAL NUMBER

MATERIAL NUMBER 100097910E

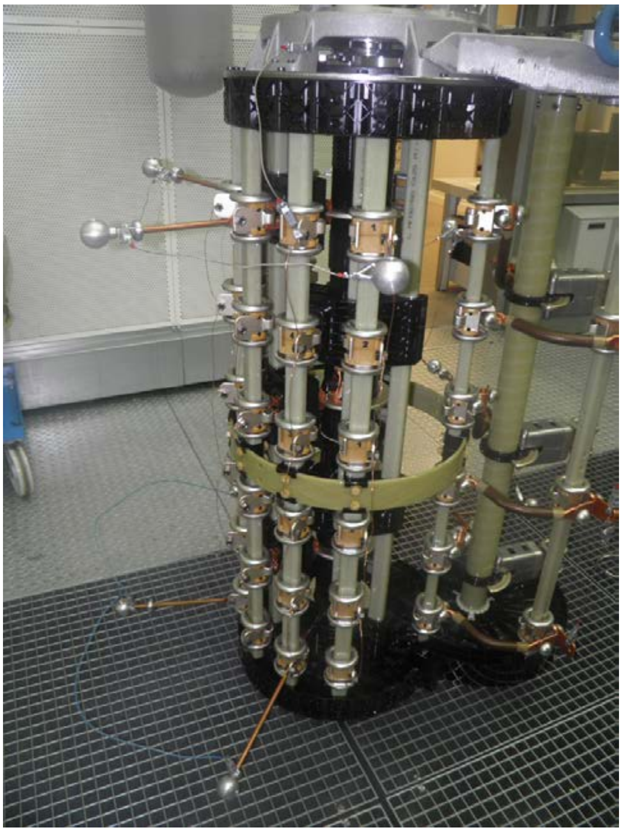
SHEET 1/1

A1

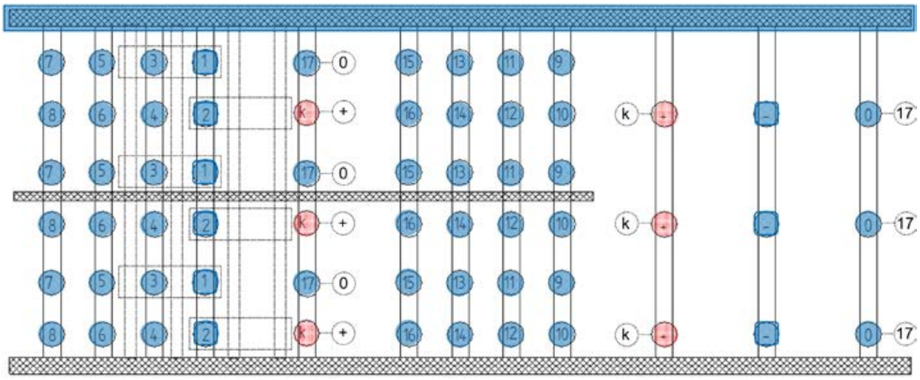
Figure 23: Dimension drawing the test sample (VACUTAP® VM III 650 Y – 170/RD – 18 35 3G).

Picture 1: Test setup for applied voltage test

Figure 2: Test setup for impulse voltage tests.

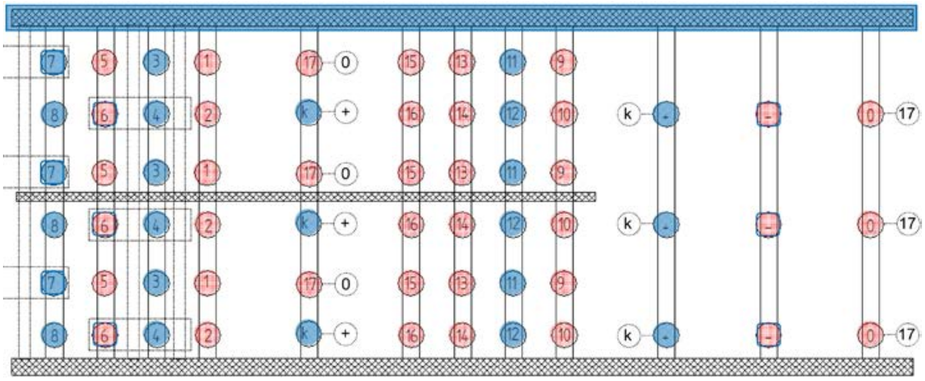


Pictures 3a/b: Test sample prepared for the test.



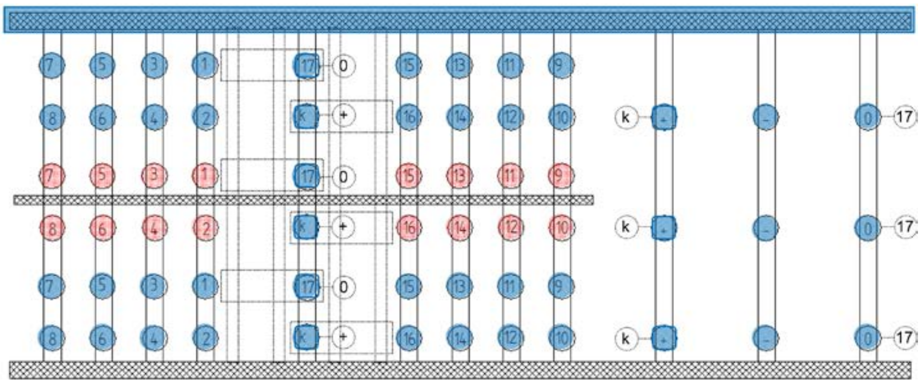
BLUE: Connection to ground.
RED: Test voltage (100 %)

Figure 24: Wiring for testing insulating distancees “a“.



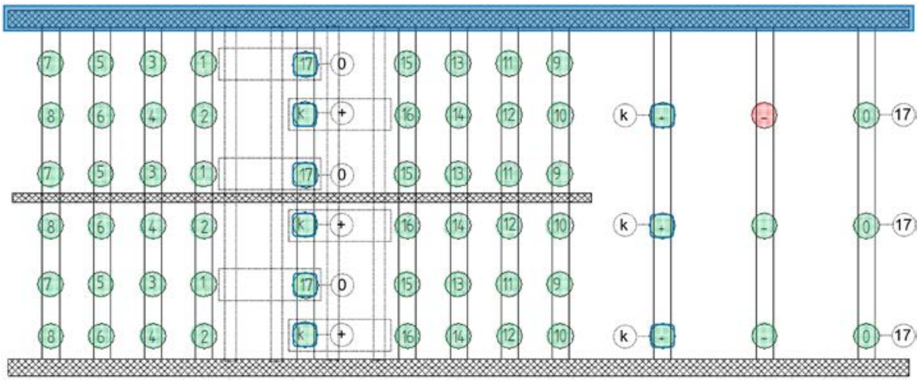
BLUE: Connection to ground.
RED: Test voltage (100 %)

Figures 25: Wiring for testing insulating distance “a1“.



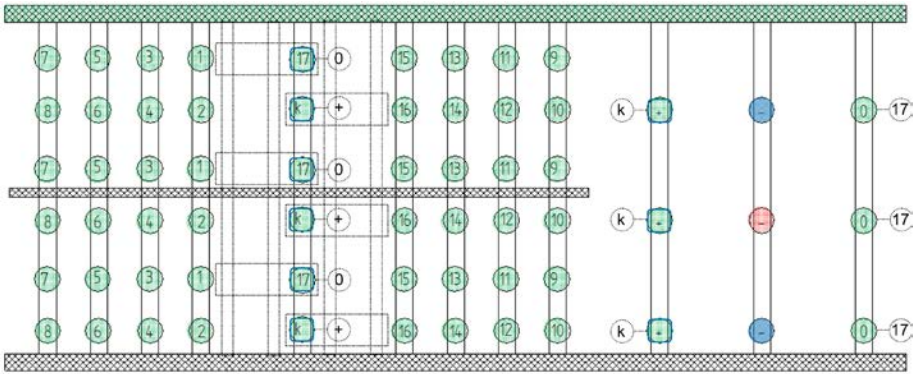
BLUE: Connection to ground.
RED: Test voltage (100 %)

Figure 26: Wiring for testing insulating distance “b“.



BLUE: Connection to ground.
RED: Test voltage (100 %)
GREEN: Test voltage (50%)

Figure 27: Wiring for testing insulating distancees “c1“.



BLUE: Connection to ground.
RED: Test voltage (100 %)
GREEN: Test voltage (50%)

Figure 28: Wiring for testing insulating distancees “c2“.