

TYPE TEST CERTIFICATE OF DIELECTRIC PERFORMANCE

OBJECT three-phase SF₆ gas/porcelain insulated high voltage circuit breaker

TYPE 120-SFM-32B **SERIAL No.** X300539

Rated voltage (U _m)	145 kV	Rated current	3150 A
Rated frequency	50 Hz		

MANUFACTURER Crompton Greaves Ltd.
Nashik, India

CLIENT Crompton Greaves Ltd.
Nashik, India

TESTED BY KEMA HIGH-VOLTAGE LABORATORY
Arnhem, the Netherlands

DATES OF TESTS 25 until 27 September 2007

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 62271-100 clauses 6.2 and 6.3

This Type Test Certificate of dielectric performance has been issued by KEMA following exclusively the STL Guides.

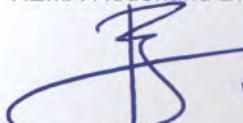
The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard and to justify the ratings assigned by the manufacturer as listed on page 3.

The Certificate applies only to the object tested. The responsibility for conformity of any object having the same designations with that tested rests with the Manufacturer.

This Certificate consists of 41 sheets in total.

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KEMA Nederland B.V.



P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 6 December 2007



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1 IDENTIFICATION OF THE TEST OBJECT

1.1 Ratings assigned by the manufacturer

Rated highest voltage for equipment (U_m)	145 kV
Rated current	3150 A
Rated frequency	50 Hz

1.2 Description of the test objects

Manufacturer	Crompton Greaves Ltd., Nashik, India
Type	120-SFM-32B
Serial number	X300539
Rated highest voltage for equipment (U_m)	145 kV
Rated frequency	50 Hz
Rated current	3150 A
<i>Rated insulation level (AC/LI)</i>	<i>275/650 kV</i>
<i>Rated SF₆ gas operating pressure</i>	0,7 MPa (g) at 20 °C
Minimum SF ₆ gas operating pressure	0,6 MPa (g) at 20 °C
Drawing(s)	see appendix B, drawing no. 3942580 and chapter 1.3

Current transformers

Spring charging motor	KPT, 230 V a.c., 300 W (elec. power)
Closing coil	CGL, 110 V d.c., 605 W
Opening coil 1	CGL, 110 V d.c., 637 W
Opening coil 2	CGL, 110 V d.c., 637 W
Year of manufacture	2007

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Mr S.S. Shete	Senior Manager – Design, Crompton Greaves Ltd.

2.2 The tests were carried out by

Name	Company
Mr. P. Kuijpers	KEMA Nederland B.V.,
Mr. H.J. Arnoldus	Arnhem, the Netherlands
Mr A.H. Minkhorst	

2.3 Reference to other reports

Report no.	Tests described
07-1039	Type test certificate of temperature-rise performance
07-1398	Report of performance for wet lightning impulse voltage withstand tests
2110125.01-QUA/INC	Tests of the degree of protection provided by the enclosure (IP55)
470-07	Mechanical operation test at ambient temperature (class M1, 2000 operations)

2.4 Purpose of the test

Purpose of the test was to verify whether the material complies with the specified requirements.

2.5 Measurement uncertainty

A table with measurement uncertainties is enclosed in appendix A. Unless otherwise indicated in the certificate, the measurement uncertainties of the results presented are as indicated in this table.

2.6 Applicable standards

When reference is made to a standard and the date of issue is not stated, this applies to the latest issue, including amendments which have been officially published prior to the date of the tests.

Where reference was made in the standard IEC 62271-100 to IEC 60694, it was verified that testing was performed in accordance with both IEC 60694 and the final draft for IEC 62271-1 Ed.1 (17A/799/FDIS), which will cancel and replace IEC 60694 when it will be published in due time.

3 GENERAL

For the purpose of the dielectric testing, the three poles of the circuit breaker were assembled by the client on the mounting frame, which was erected on a mobile trolley. A photograph of the test object is presented below.



A drawing of the circuit breaker arrangement is shown in the client's drawing no. 3942580, which is included in appendix B of this certificate. The arrangement of the outer poles of the circuit breaker was considered to be symmetrical with respect to the centre pole and the frame. Therefore the test conditions for dielectric testing were limited to those involving two poles (B and C), while the other outer pole (A) remained earthed throughout the tests. A table with the test conditions and the specified test voltages is presented on the next page.

condition/situation	voltage applied to	specified test voltage for:		circuit breaker position	earthing
		AC-tests, dry and wet (kV)	LI-test (kV)		
1	Bb	275	650	closed	Cc and frame
2	Cc	275	650	closed	Bb and frame
3	B	275	650	open	b, C, c and frame
4	b	275	650	open	B, C, c and frame
5	C	275	650	open	c, B, b and frame
6	c	275	650	open	C, B, b and frame

Note: terminals A and a were earthed throughout all the tests

Measurement of the RIV (radio interference voltage) was performed on a single outer pole (C) in 3 test conditions (2, 5 and 6 in the above table).

During the wet tests, the circuit breaker was subjected to artificial rain in accordance with clause 9.1 of IEC 60060-1. Testing under wet conditions was carried out after a pre-wetting period of at least 15 minutes.

Throughout all the tests the circuit breaker was filled with SF₆ gas at the minimum operating pressure. The wave shape of the impulse voltage was within the requirements during all impulse tests.

Correction factors for atmospheric conditions were calculated and applied, where applicable.

4 LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST

Date of test: 25 and 26 September 2007

The lightning impulse voltage withstand test was performed under dry conditions in accordance with clause 6.2.6.2 of IEC 62271-100. The specified test voltage was 650 kV.

Testing was performed in the test conditions as described above in chapter 3. In each test condition, 15 impulses of positive polarity and 15 impulse of negative polarity were applied.

Prior to testing, the correction factors for standard atmospheric conditions were calculated and applied. The results are presented below.

Atmospheric conditions on 25 September 2007

Ambient temperature	21 °C
Ambient air pressure	1009 hPa
Humidity	9,9 g/m ³

Correction factor to standard atmospheric conditions on 25 September 2007

$K_t = K_1 \cdot K_2$	0,9825
Corrected test voltage	639 kV

Atmospheric conditions on 26 September 2007

Ambient temperature	21 °C
Ambient air pressure	1010 hPa
Humidity	10,4 g/m ³

Correction factor to standard atmospheric conditions on 26 September 2007

$K_t = K_1 \cdot K_2$	0,9884
Corrected test voltage	642 kV

condition/situation	voltage applied to	earthing	circuit breaker position	see figure no.'s
1	Bb	Cc and frame	closed	11 - 20
2	Cc	Bb and frame	closed	1 - 10
3	B	b, C, c and frame	open	41 - 50
4	b	B, C, c and frame	open	31 - 40
5	C	c, B, b and frame	open	51 - 60
6	c	C, B, b and frame	open	21 - 30

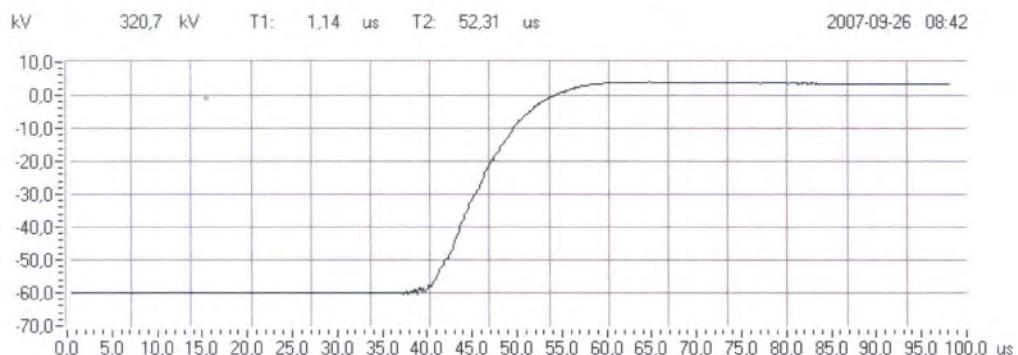


Fig. 1: Waveshape CB closed, voltage on Bb, Cc earthed, 50%

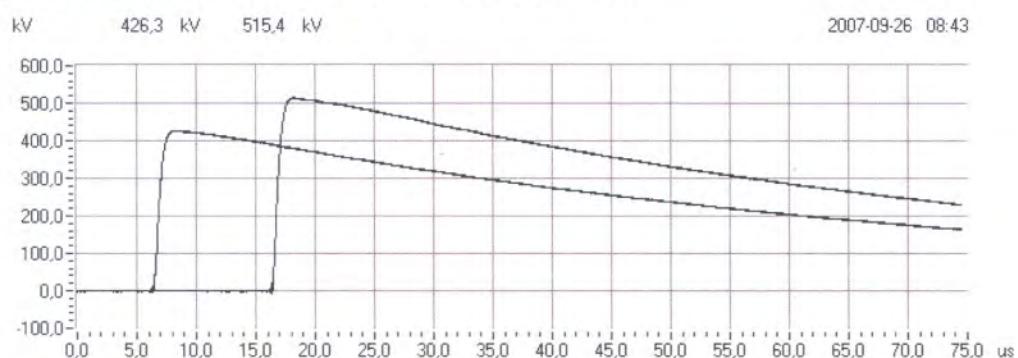


Fig. 2: CB closed, voltage on Bb, Cc earthed, 65% and 80%

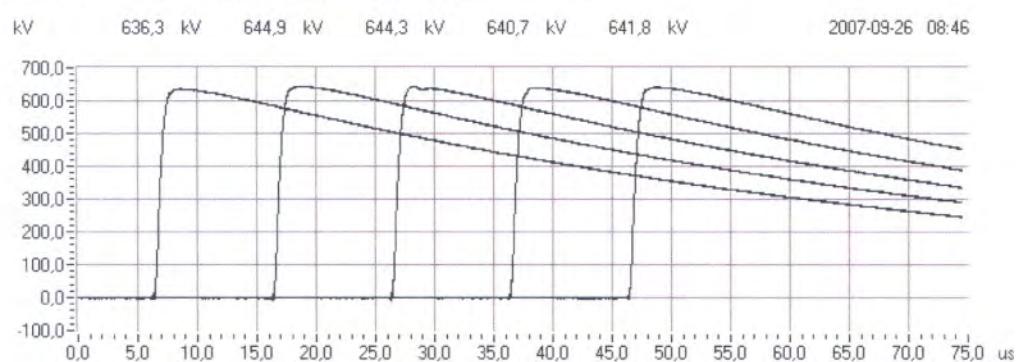


Fig. 3: CB closed, voltage on Bb, Cc earthed, 100%

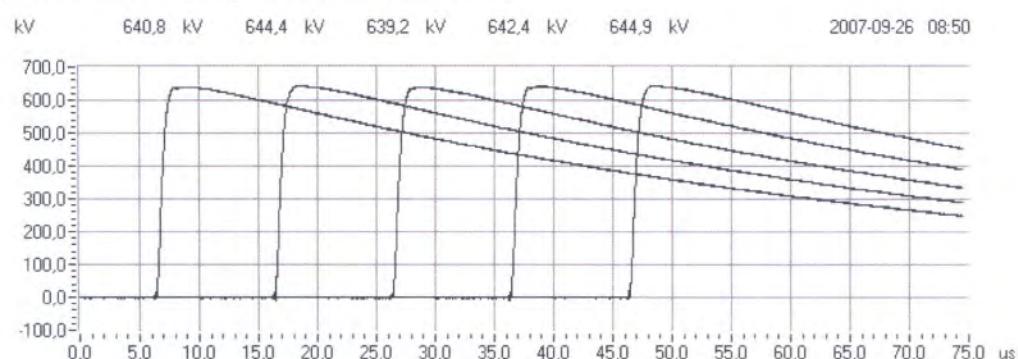


Fig. 4: CB closed, voltage on Bb, Cc earthed, 100%

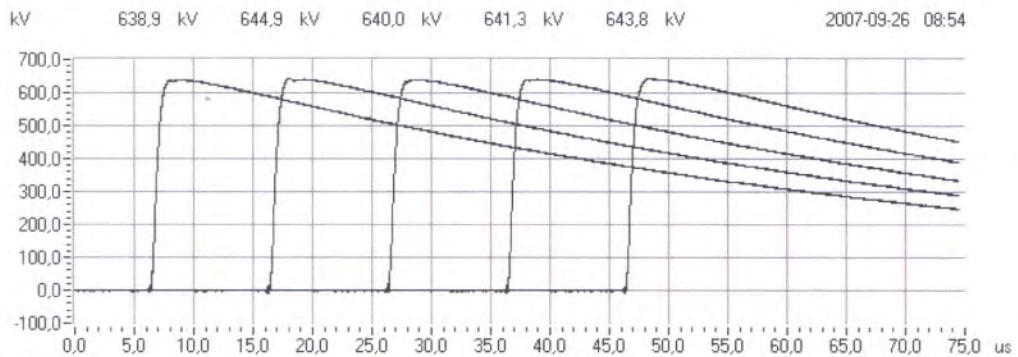


Fig. 5: CB closed, voltage on Bb, Cc earthed, 100%

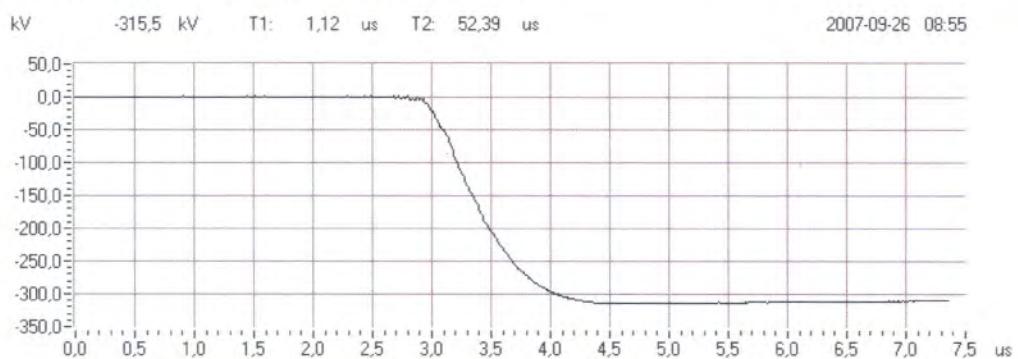


Fig. 6: Waveshape CB closed, voltage on Bb, Cc earthed, -50%

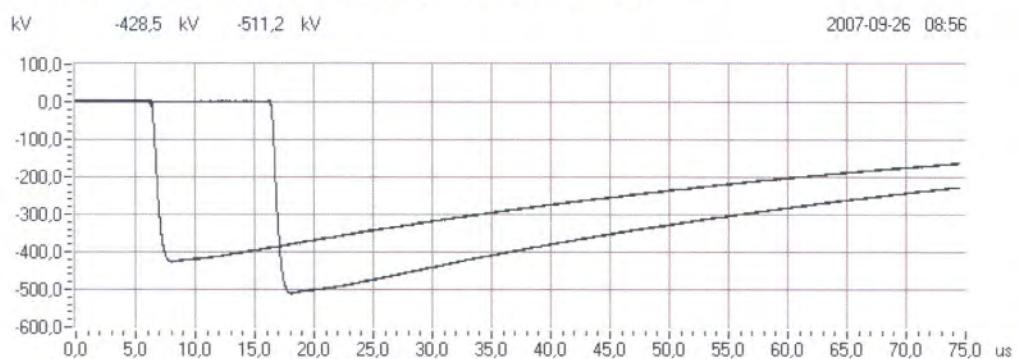


Fig. 7: CB closed, voltage on Bb, Cc earthed, -65% and -80%

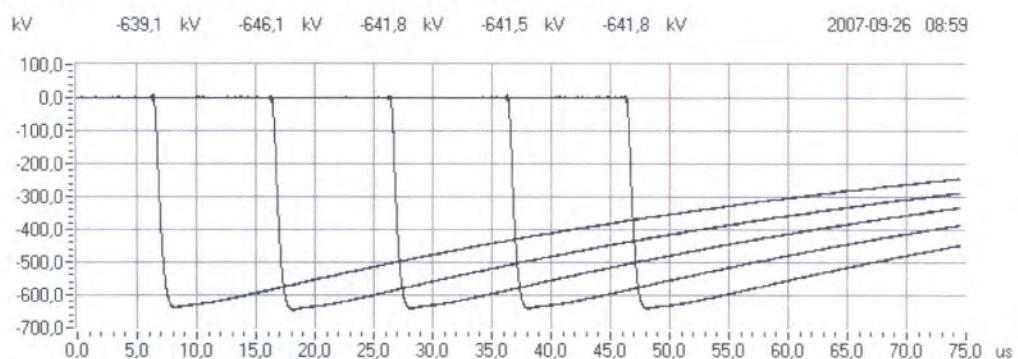


Fig. 8: CB closed, voltage on Bb, Cc earthed, -100%

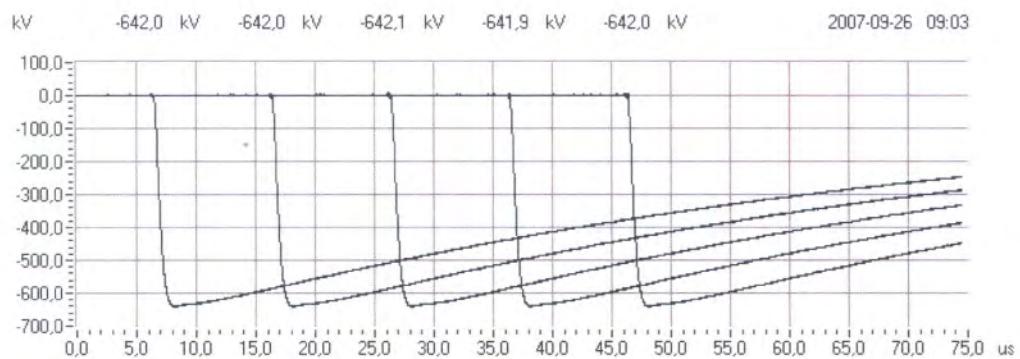


Fig. 9: CB closed, voltage on Bb, Cc earthed, -100%

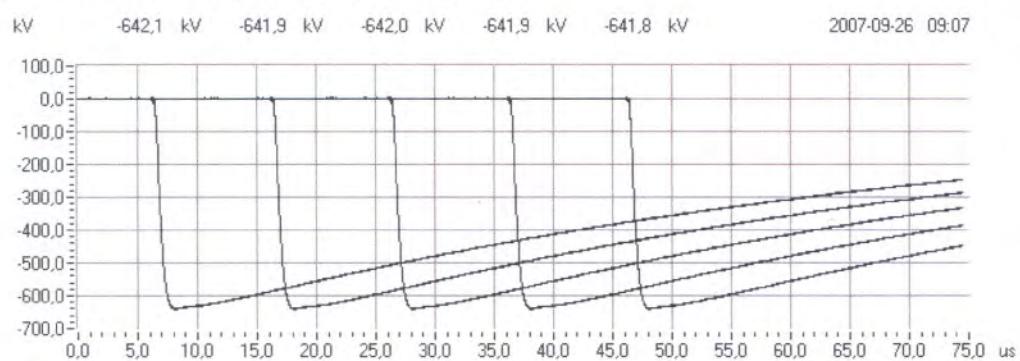


Fig. 10: CB closed, voltage on Bb, Cc earthed, -100%

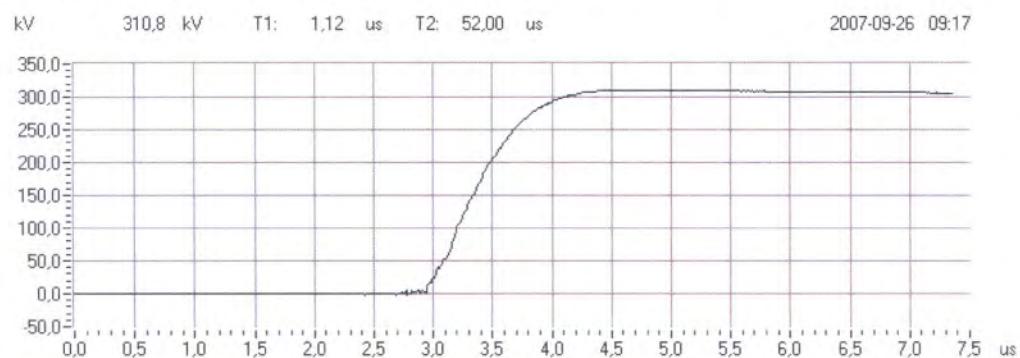


Fig. 11: Waveshape CB closed, voltage on Cc, Bb earthed, 50%

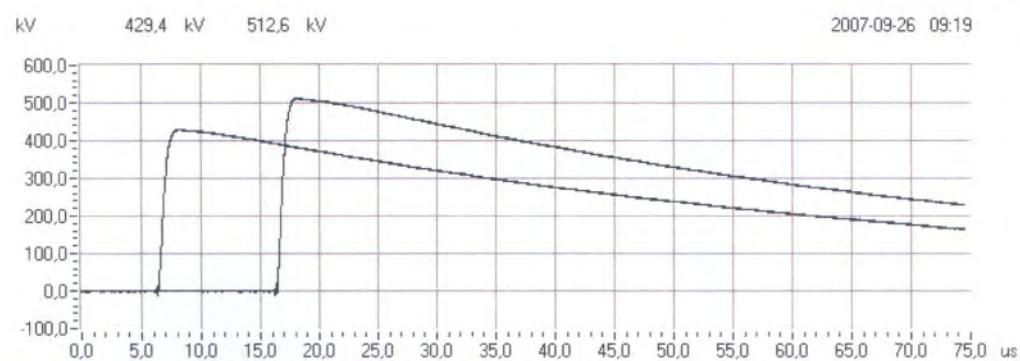


Fig. 12: CB closed, voltage on Cc, Bb earthed, 65% and 80%

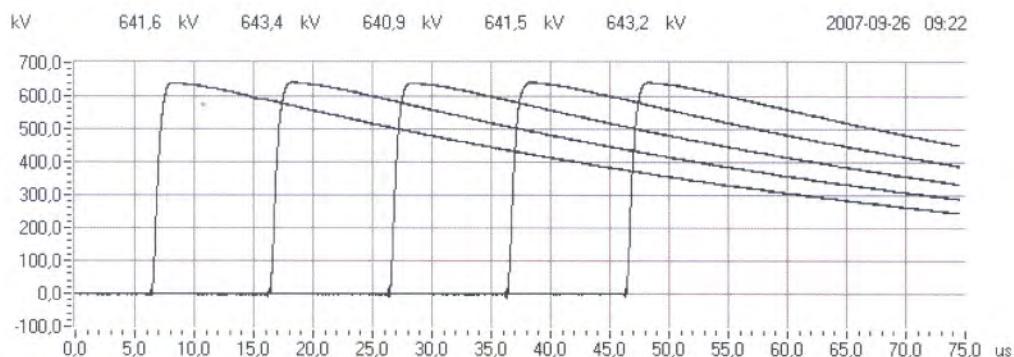


Fig. 13: CB closed, voltage on Cc, Bb earthed, 100%

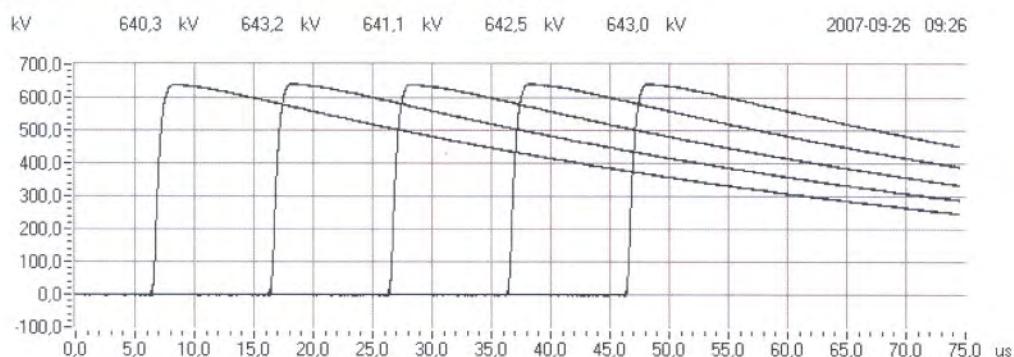


Fig. 14: CB closed, voltage on Cc, Bb earthed, 100%

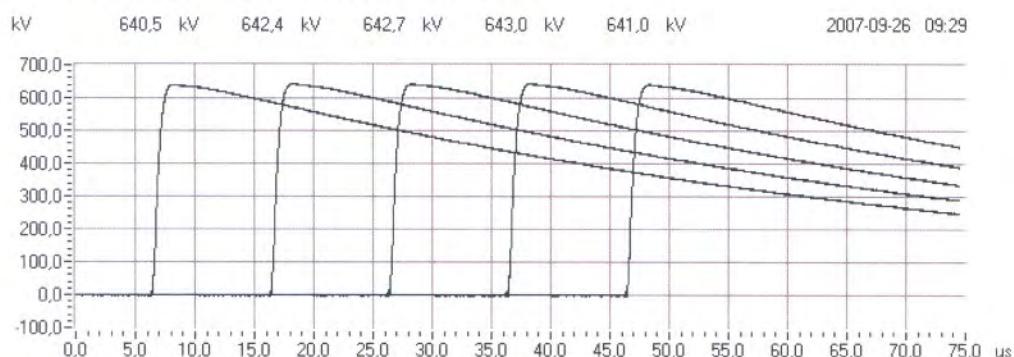


Fig. 15: CB closed, voltage on Cc, Bb earthed, 100%

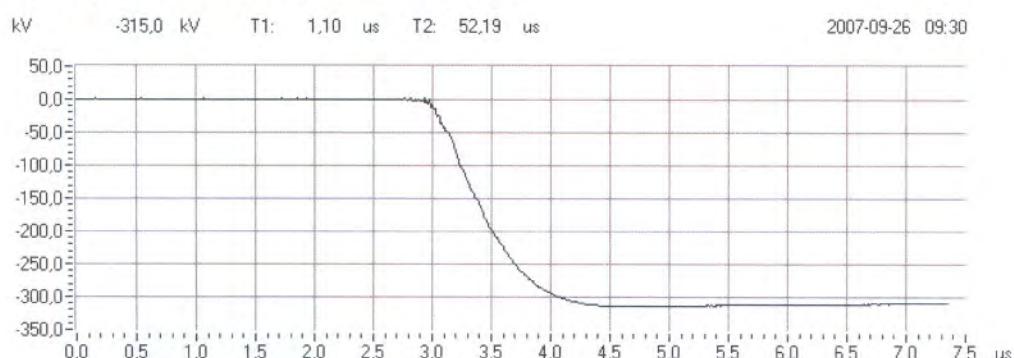


Fig. 16: Waveshape CB closed, voltage on Cc, Bb earthed, -50%

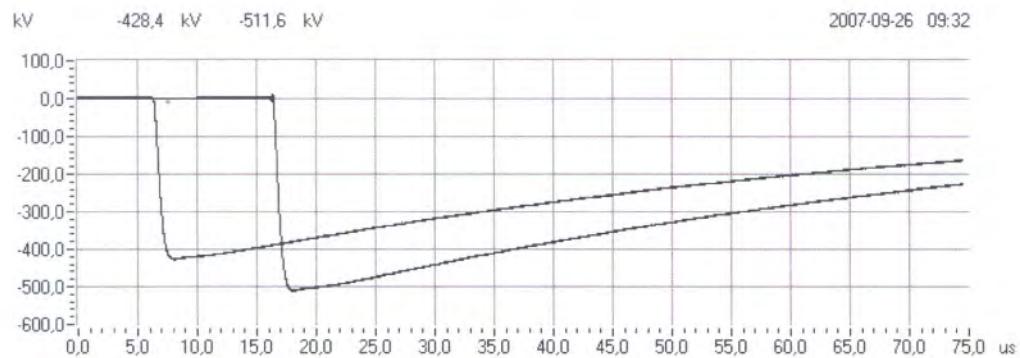


Fig. 17: CB closed, voltage on Cc, Bb earthed, -65% and -80%

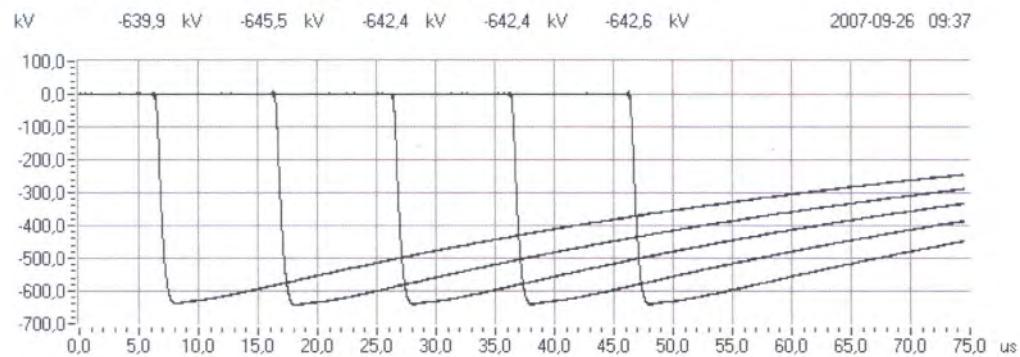


Fig. 18: CB closed, voltage on Cc, Bb earthed, -100%

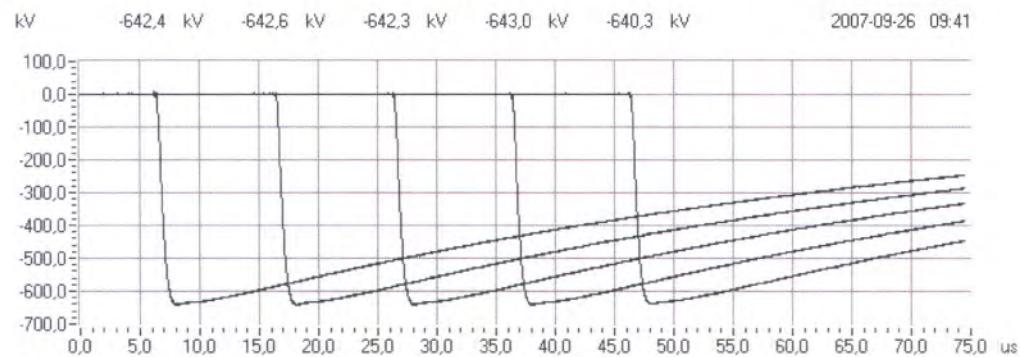


Fig. 19: CB closed, voltage on Cc, Bb earthed, -100%

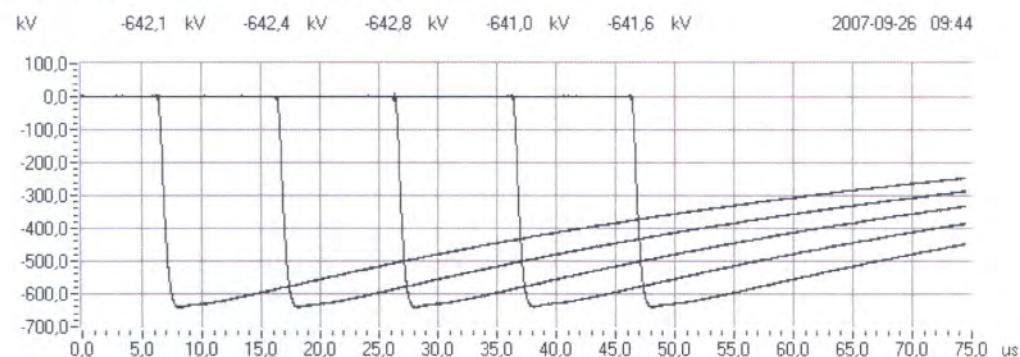


Fig. 20: CB closed, voltage on Cc, Bb earthed, -100%

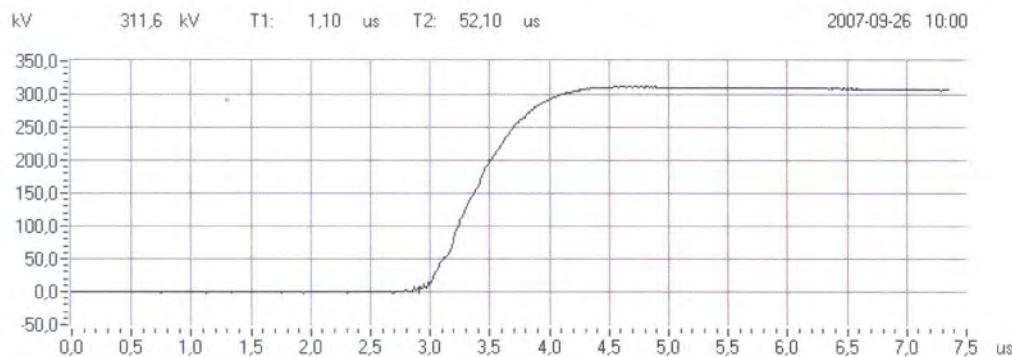


Fig. 21: Waveshape CB open, voltage on c, CBb earthed, 50%

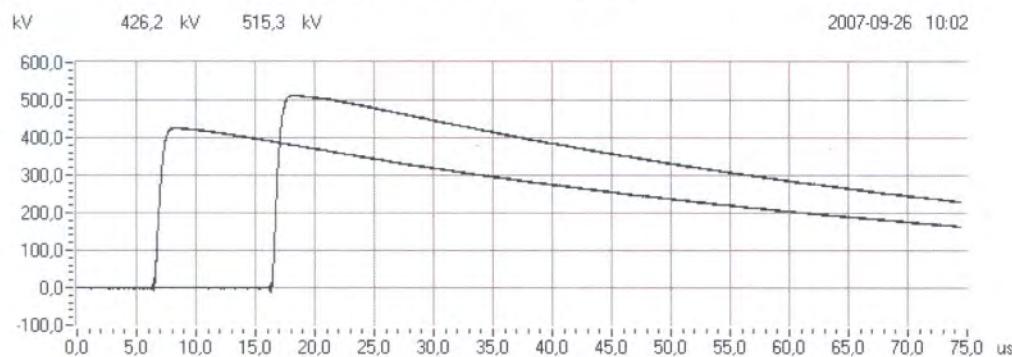


Fig. 22: CB open, voltage on c, CBb earthed, 65% and 80%

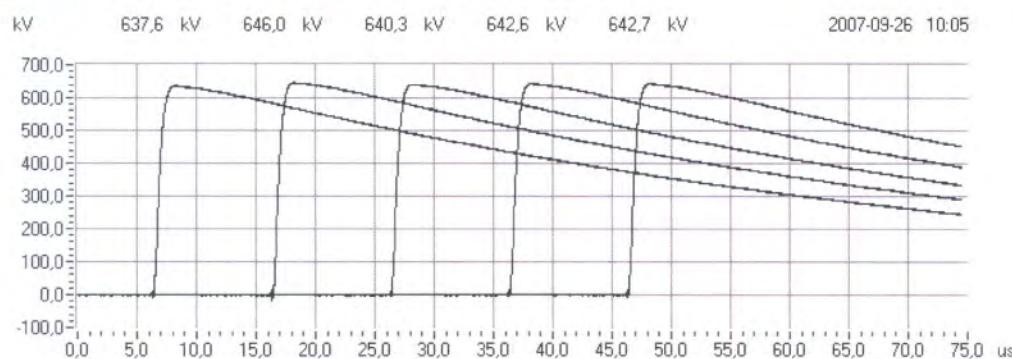


Fig. 23: CB open, voltage on c, CBb earthed, 100%

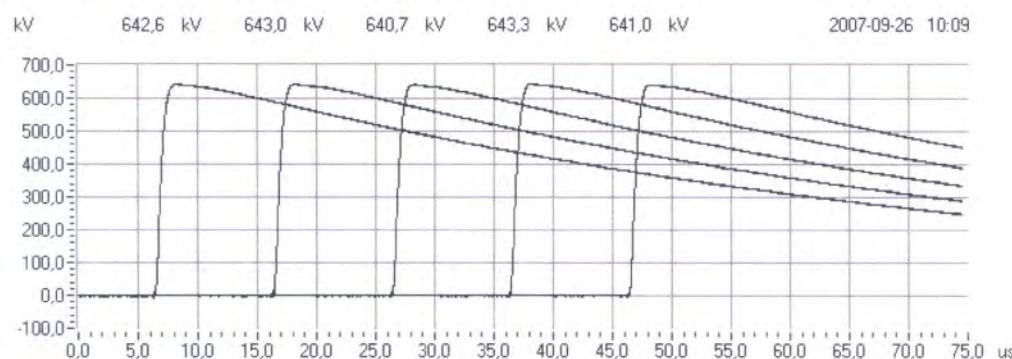


Fig. 24: CB open, voltage on c, CBb earthed, 100%



Fig. 25: CB open, voltage on c, CBb earthed, 100%

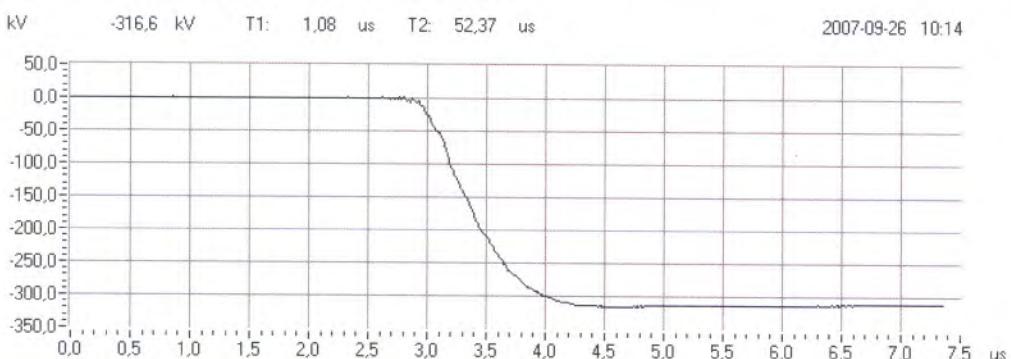


Fig. 26: Waveshape CB open, voltage on c, CBb earthed, -50%

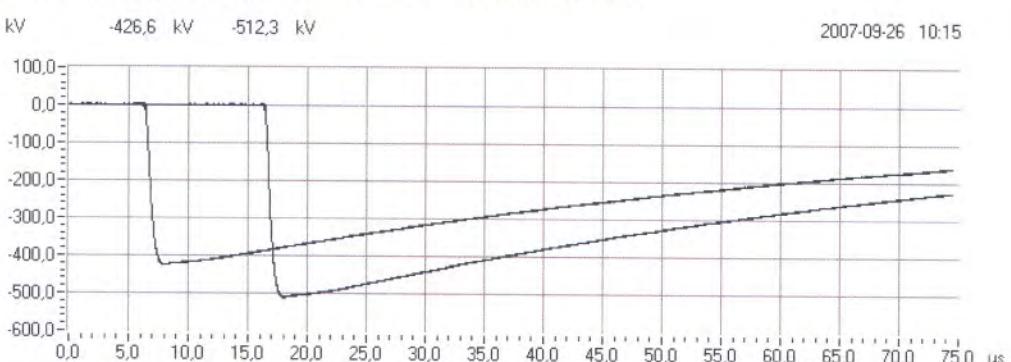


Fig. 27: CB open, voltage on c, CBb earthed, -65% and -80%

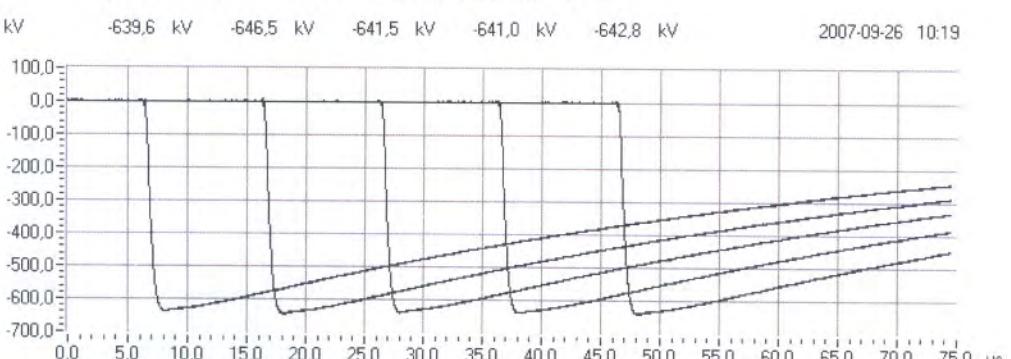


Fig. 28: CB open, voltage on c, CBb earthed, -100%

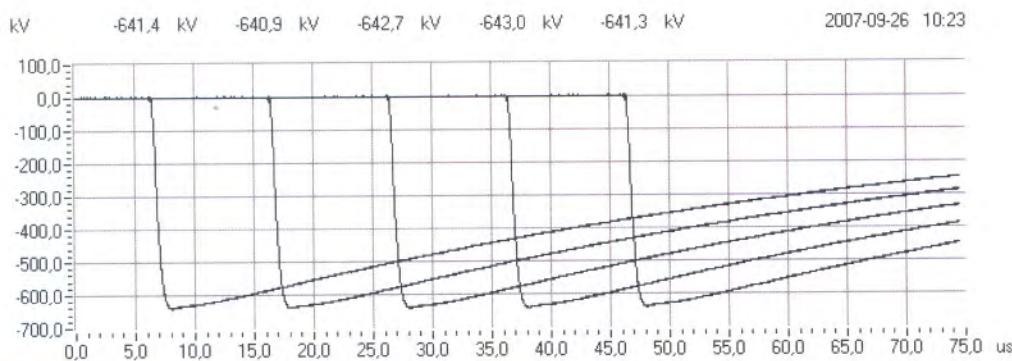


Fig. 29: CB open, voltage on c, CBb earthed, -100%

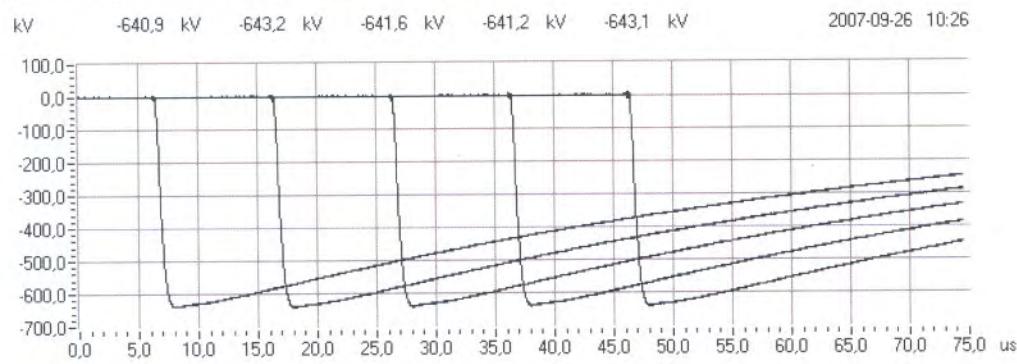


Fig. 30: CB open, voltage on c, CBb earthed, -100%

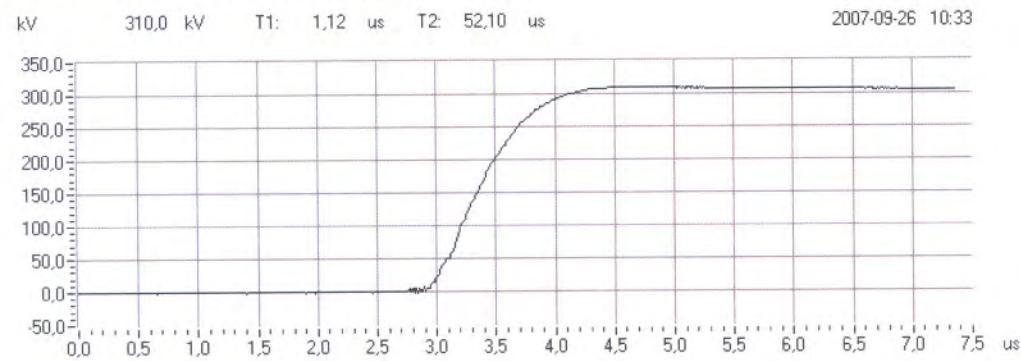


Fig. 31: Waveshape CB open, voltage on b, CcB earthed, 50%

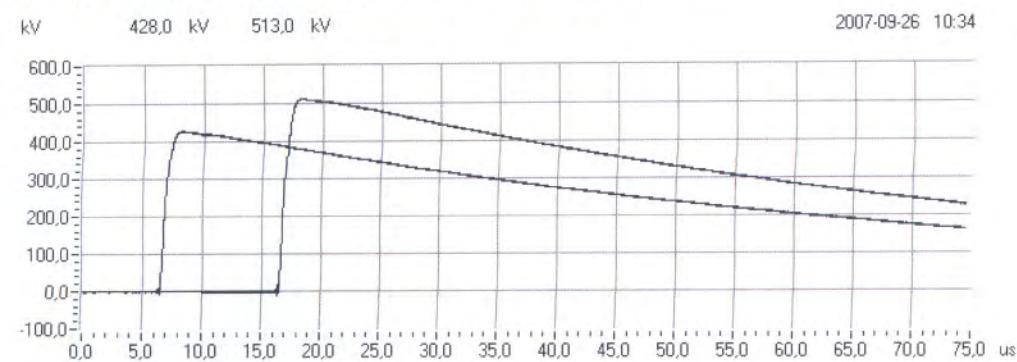


Fig. 32: CB open, voltage on b, CcB earthed, 65% and 80%

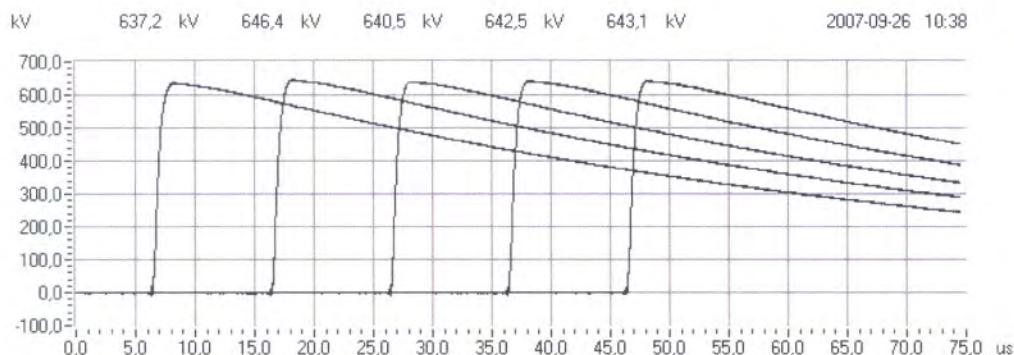


Fig. 33: CB open, voltage on b, CcB earthed, 100%

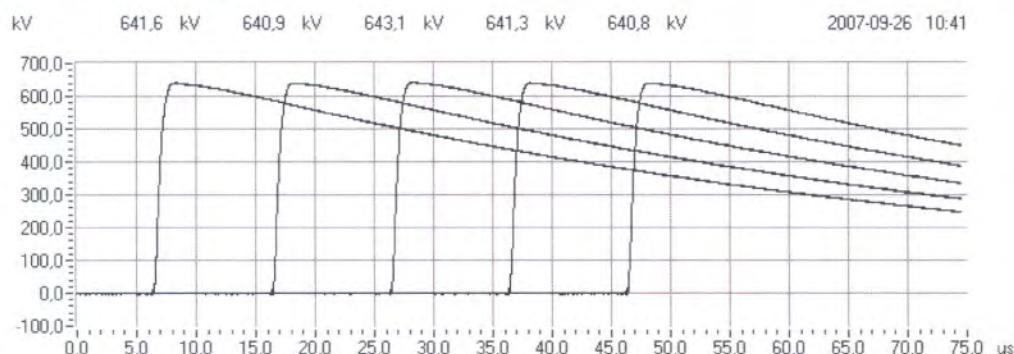


Fig. 34: CB open, voltage on b, CcB earthed, 100%

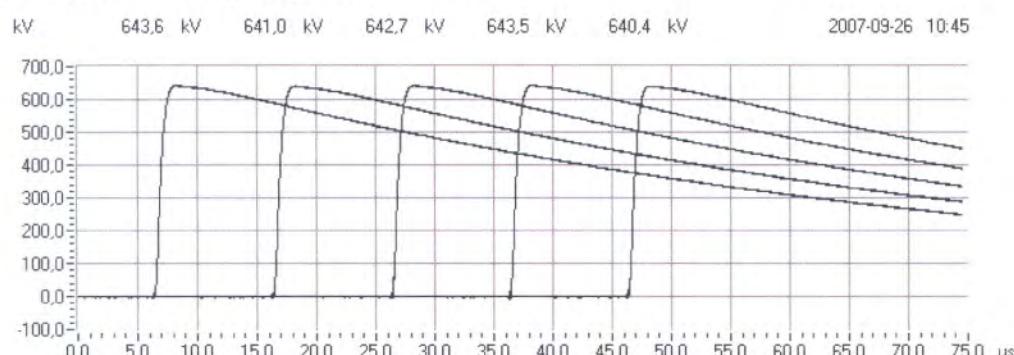


Fig. 35: CB open, voltage on b, CcB earthed, 100%

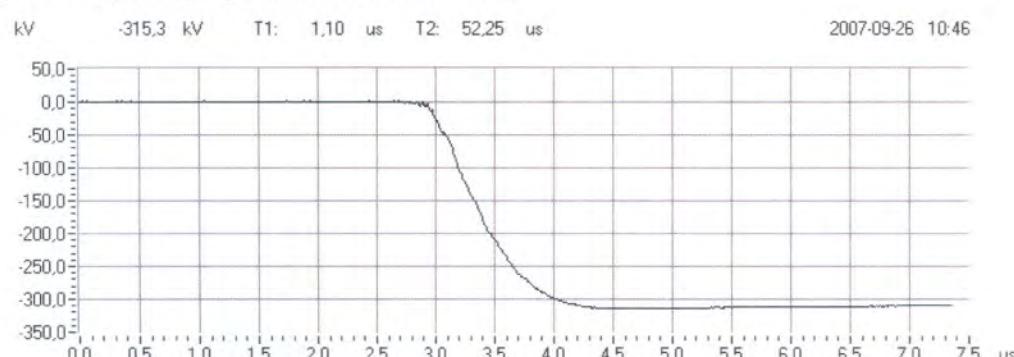


Fig. 36: Waveshape CB open, voltage on b, CcB earthed, -50%

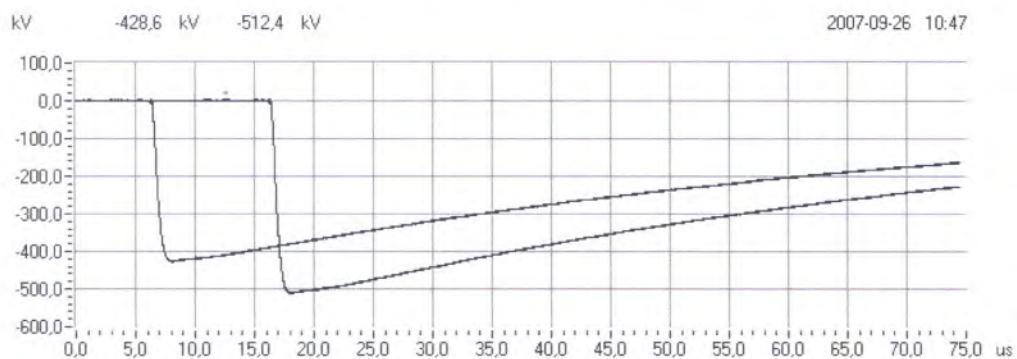


Fig. 37: CB open, voltage on b, CcB earthed, -65% and -80%

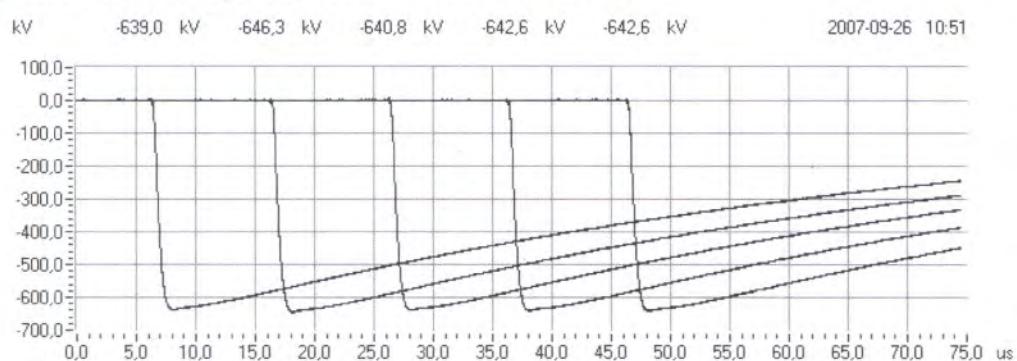


Fig. 38: CB open, voltage on b, CcB earthed, -100%

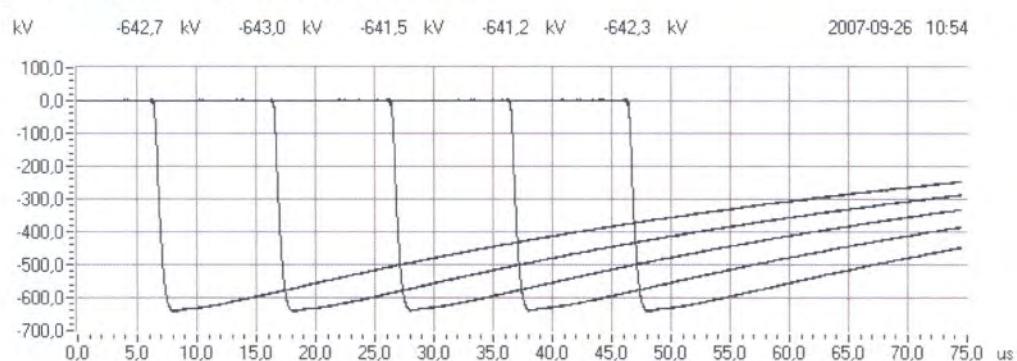


Fig. 39: CB open, voltage on b, CcB earthed, -100%

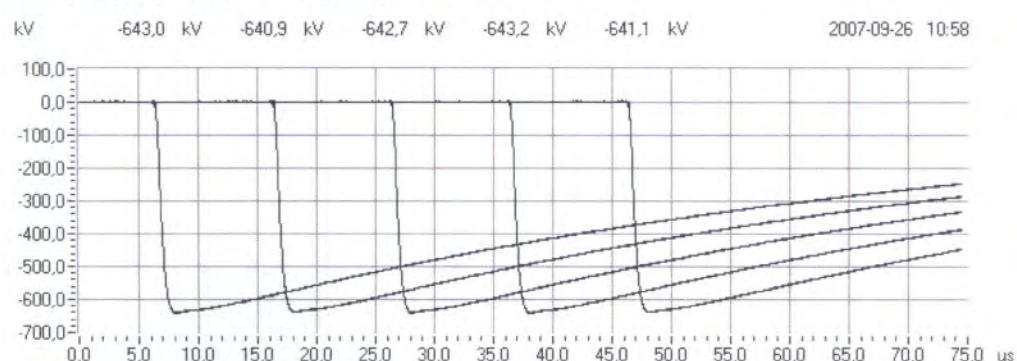


Fig. 40: CB open, voltage on b, CcB earthed, -100%

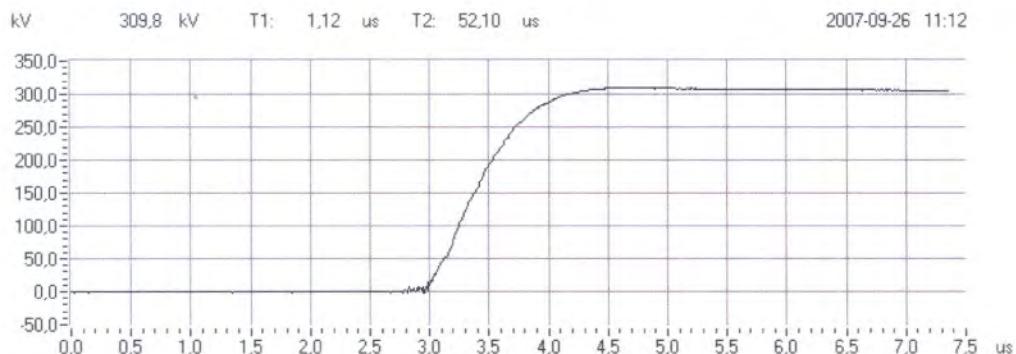


Fig. 41: Waveshape CB open, voltage on B, Ccb earthed, 50%

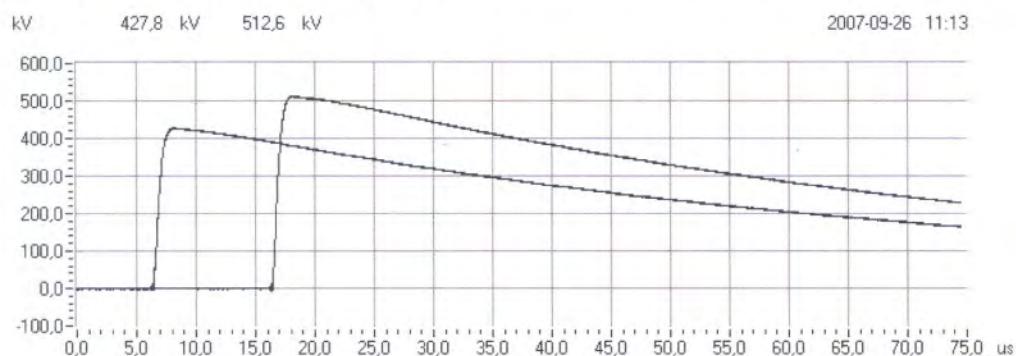


Fig. 42: CB open, voltage on B, Ccb earthed, 65% and 80%

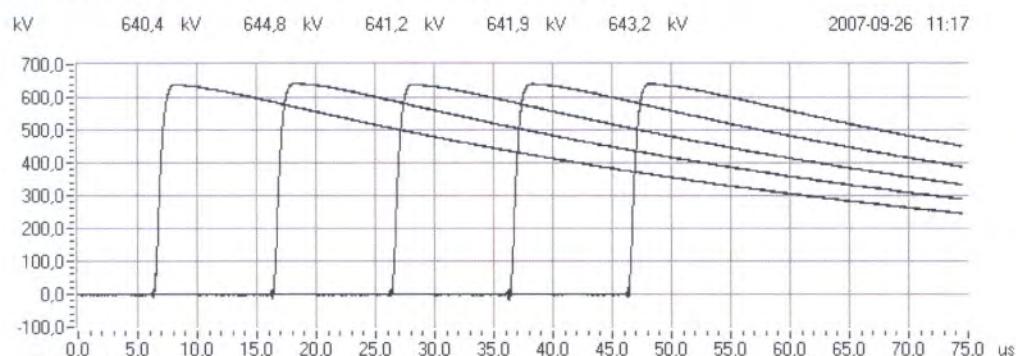


Fig. 43: CB open, voltage on B, Ccb earthed, 100%

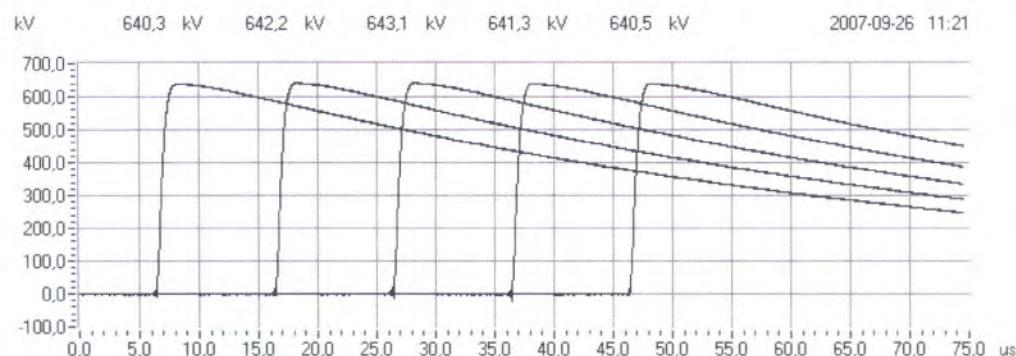


Fig. 44: CB open, voltage on B, Ccb earthed, 100%

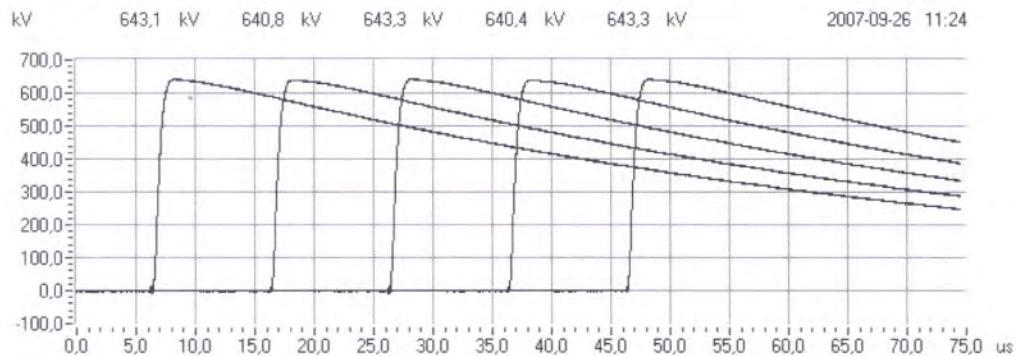


Fig. 45: CB open, voltage on B, Ccb earthed, 100%

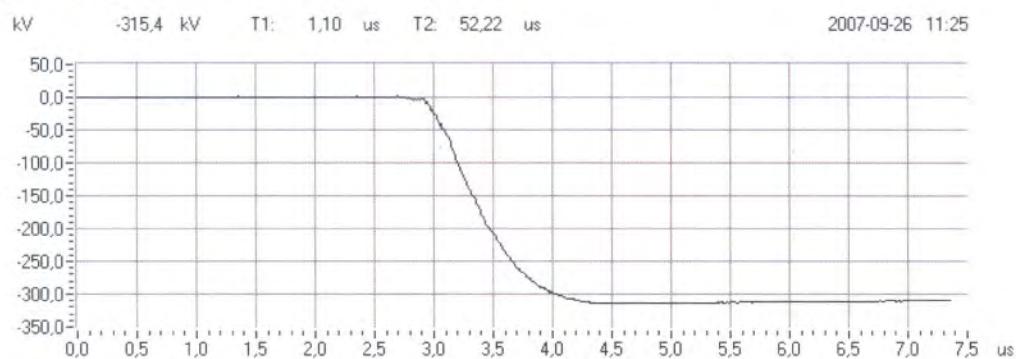


Fig. 46: Waveshape CB open, voltage on B, Ccb earthed, -50%

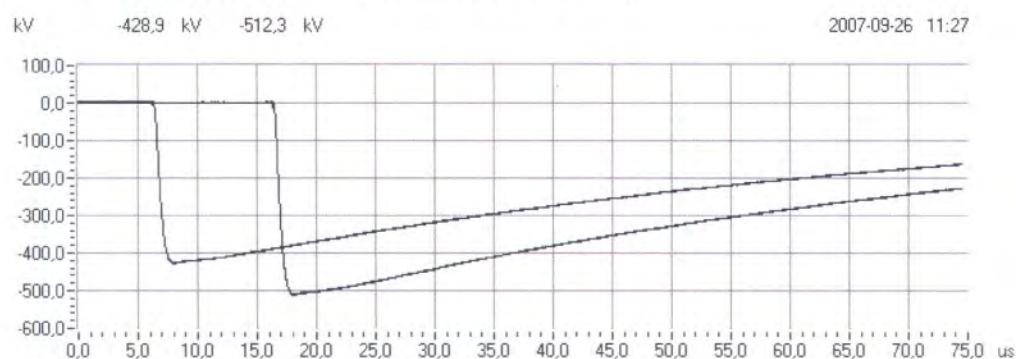


Fig. 47: CB open, voltage on B, Ccb earthed, -65% and -80%

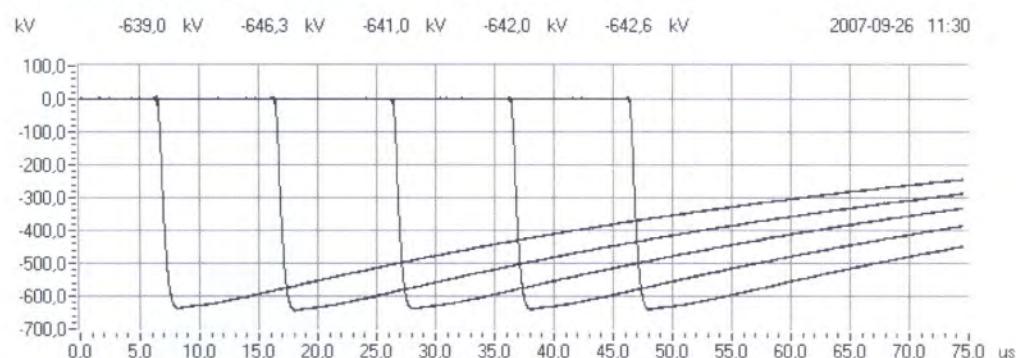


Fig. 48: CB open, voltage on B, Ccb earthed, -100%

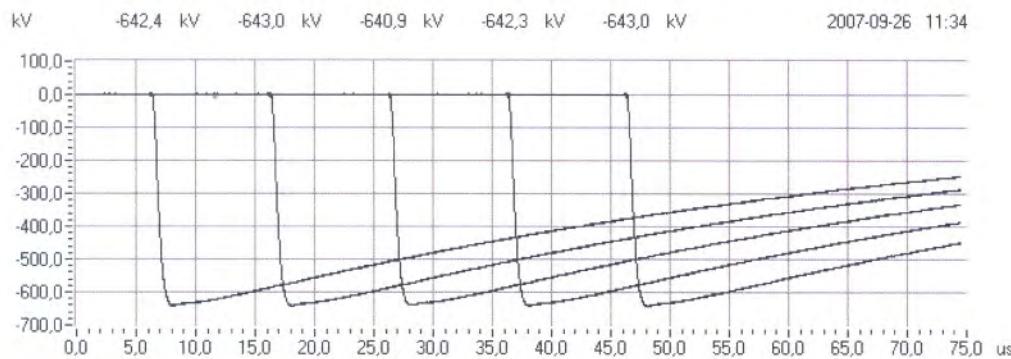


Fig. 49: CB open, voltage on B, Ccb earthed, -100%

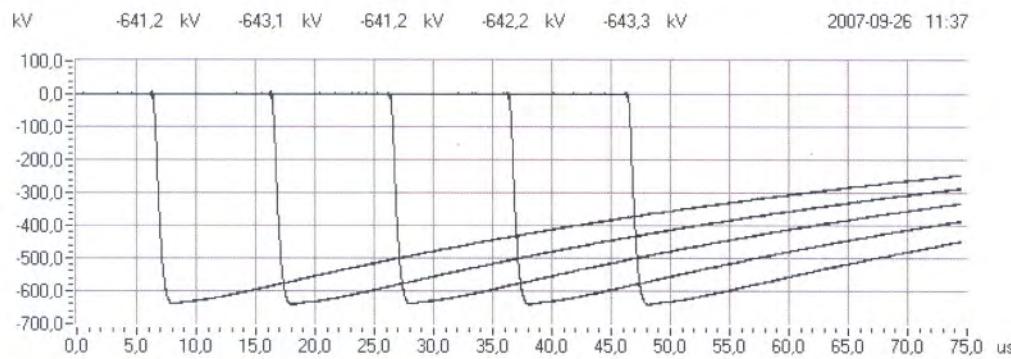


Fig. 50: CB open, voltage on B, Ccb earthed, -100%

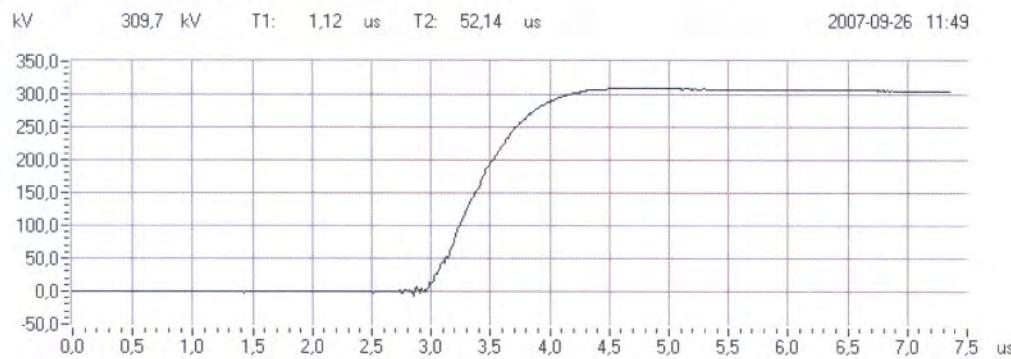


Fig. 51: Waveshape CB open, voltage on C, Bbc earthed, 50%

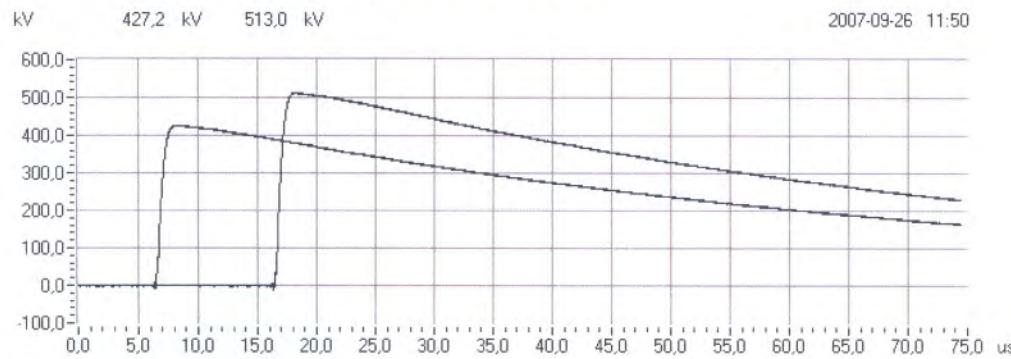


Fig. 52: CB open, voltage on C, Bbc earthed, 65% and 80%



Fig. 53: CB open, voltage on C, Bbc earthed, 100%



Fig. 54: CB open, voltage on C, Bbc earthed, 100%

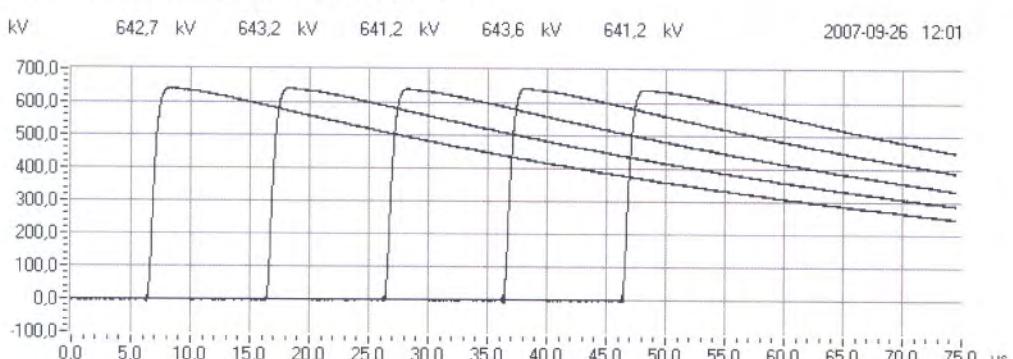


Fig. 55: CB open, voltage on C, Bbc earthed, 100%



Fig. 56: Waveshape CB open, voltage on C, Bbc earthed, -50%

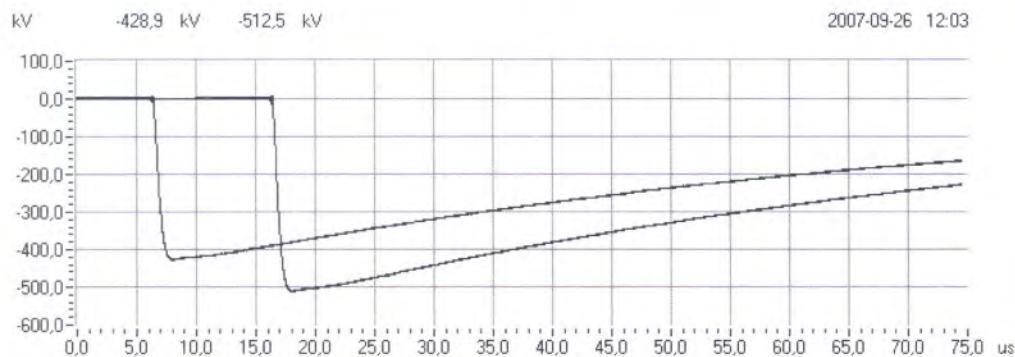


Fig. 57: CB open, voltage on C, BBC earthed, -65% and -80%

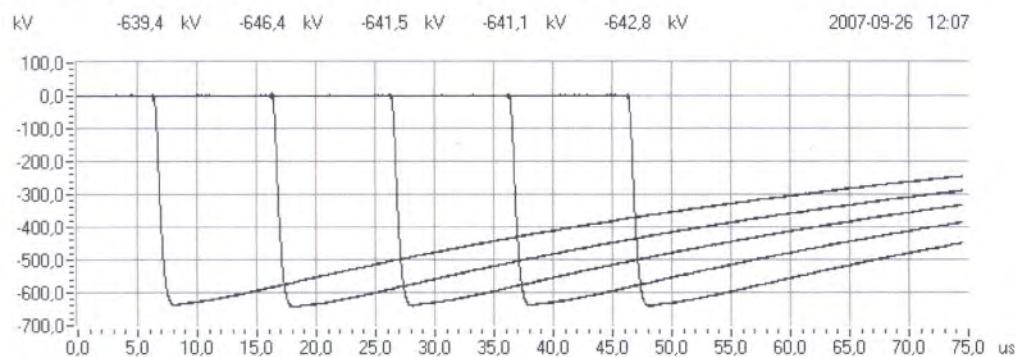


Fig. 58: CB open, voltage on C, BBC earthed, -100%

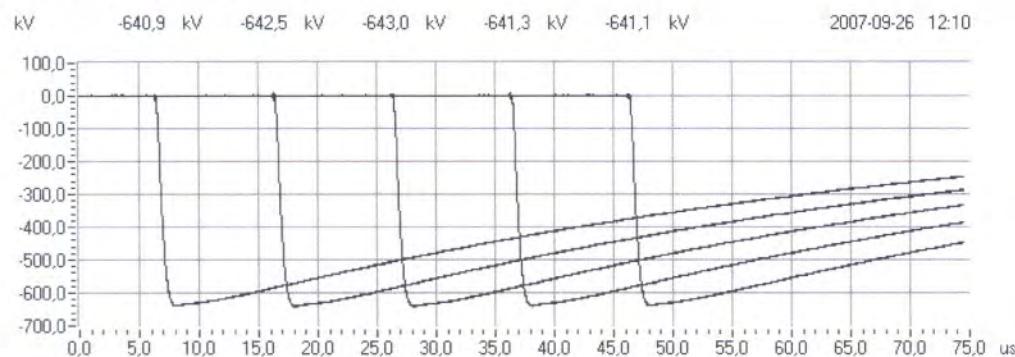


Fig. 59: CB open, voltage on C, BBC earthed, -100%

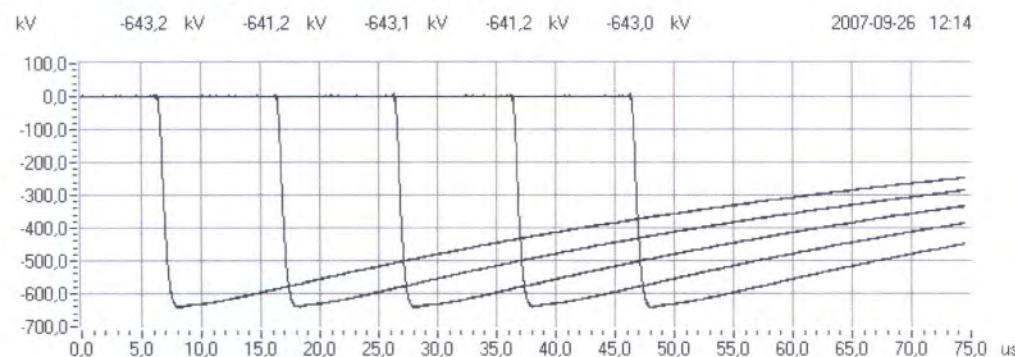


Fig. 60: CB open, voltage on C, BBC earthed, -100%

Requirement

The requirements were as mentioned in IEC 60694 clause 6.2.4:

- no more than 2 disruptive discharges on self-restoring insulation per series of 15 impulses
- no disruptive discharges on non self-restoring insulation

Result

Neither flashover nor breakdown occurred during the impulse testing. The test was passed.

5 DRY POWER-FREQUENCY VOLTAGE WITHSTAND TEST

Date of test: 27 September 2007

The dry power-frequency voltage withstand testing was performed in accordance with clause 6.2.6.1 of IEC 62271-100. The specified test voltage was 275 kV.

Testing was performed in the test conditions as described above in chapter 3. In each test condition, the test voltage was applied for the duration of 1 minute. Prior to testing, the correction factors for standard atmospheric conditions were calculated, but the correction was negligible and was not applied. The results are presented below.

Atmospheric conditions on 27 September 2007

Ambient temperature	21 °C
Ambient air pressure	1010 hPa
Humidity	9,3 g/m ³

Correction factor to standard atmospheric conditions on 27 September 2007

$$K_t = K_1 \cdot K_2 = 0,996$$

Correction was negligible and not applied

condition/ situation	voltage applied to	earthing	circuit breaker position	applied voltage (kV, 50 Hz)	duration (s)	result
1	Bb	Cc and frame	closed	275	60	passed
2	Cc	Bb and frame	closed	275	60	passed
3	B	b, C, c and frame	open	275	60	passed
4	b	B, C, c and frame	open	275	60	passed
5	C	c, B, b and frame	open	275	60	passed
6	c	C, B, b and frame	open	275	60	passed

Note: terminals A and a were earthed throughout all the tests

Requirement

The requirements were as mentioned in IEC 60694 clause 6.2.4:

- no disruptive discharges shall occur

Result

Neither flashover nor breakdown occurred during the testing. The test was passed.

6 WET POWER-FREQUENCY VOLTAGE WITHSTAND TEST

Date of test: 27 September 2007

The wet power-frequency voltage withstand testing was performed in accordance with clause 6.2.6.1 of IEC 62271-100. The specified test voltage was 275 kV. The wetting procedures were in accordance with IEC 60060-1.

Testing was performed in the test conditions as described above in chapter 3. In each test condition, the test voltage was applied for the duration of 1 minute. Prior to testing, the correction factors for standard atmospheric conditions were calculated, but the correction was negligible and was not applied. The results are presented below.

Atmospheric conditions on 27 September 2007

Ambient temperature	21	°C
Ambient air pressure	1010	hPa
Humidity	9,3	g/m ³

Artificial rain parameters

Water temperature	21	°C
Water conductivity	101	Ωm
Angle of precipitation	45	°
Horizontal amount	1,2	mm/min
Vertical amount	1,5	mm/min
Pre-wetting period	≥ 15	min

Correction factor to standard atmospheric conditions on 27 September 2007

$K_t = K_1$ (no correction for humidity) 0,999

Correction was negligible and not applied

condition/ situation	voltage applied to	earthing	circuit breaker position	applied voltage (kV, 50 Hz)	duration (s)	result
1	Bb	Cc and frame	closed	275	60	passed
2	Cc	Bb and frame	closed	275	60	passed
3	B	b, C, c and frame	open	275	60	passed
4	b	B, C, c and frame	open	275	60	passed
5	C	c, B, b and frame	open	275	60	passed
6	c	C, B, b and frame	open	275	60	passed

Note: terminals A and a were earthed throughout all the tests

Requirement

The requirements were as mentioned in IEC 60694 clause 6.2.4:

- no disruptive discharge on external self-restoring insulation shall occur.

Result

Neither flashover nor breakdown occurred during the testing. The test was passed.

7 DIELECTRIC TESTS ON THE AUXILIARY AND CONTROL EQUIPMENT

Date of tests: 26 September 2007

The auxiliary and control equipment of the test object was subjected to dielectric tests.

The tests were carried out in accordance with clause 6.2.10 of IEC 62271-100 and reference is made here to IEC 60694 clause 6.2.10.

For the purpose of these tests, the auxiliary and control equipment was grouped into the following 6 parts:

part 1: SF ₆ CB control circuit	(terminals 1-11)
part 2: alarm/indication contacts	(terminals 20-25)
part 3: lamp & heater control circuit	(terminals 12 + 14, jumpers 12-13 and 14-15 removed)
part 4: motor control circuit	(terminals 13 + 15, jumpers 12-13 and 14-15 removed)
part 5: spare auxiliary contacts 52a	(terminals 26-41)
part 6: spare auxiliary contacts 52b	(terminals 42-57)

For each part, the respective terminals were interconnected by means of 1 mm² copper wire and subsequently each part was subjected to power-frequency voltage withstand tests and lightning impulse voltage withstand tests. The test voltage was applied to each part separately in turn, while all the other parts and the frame were earthed.

All parts were tested at a power-frequency voltage of 2 kV for the duration of 1 minute.

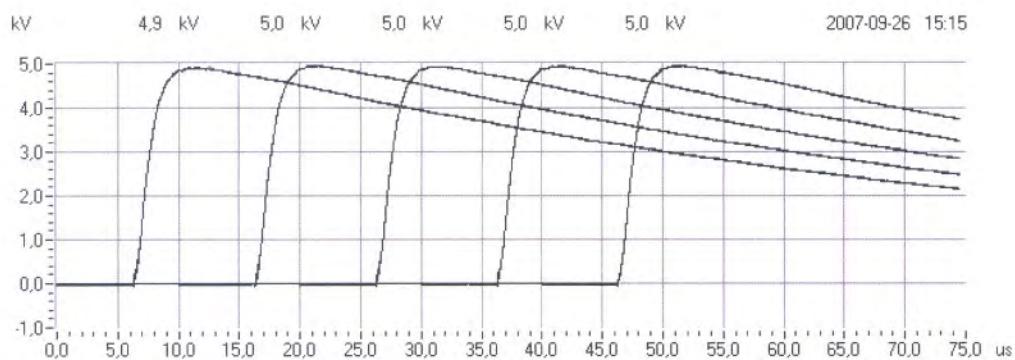
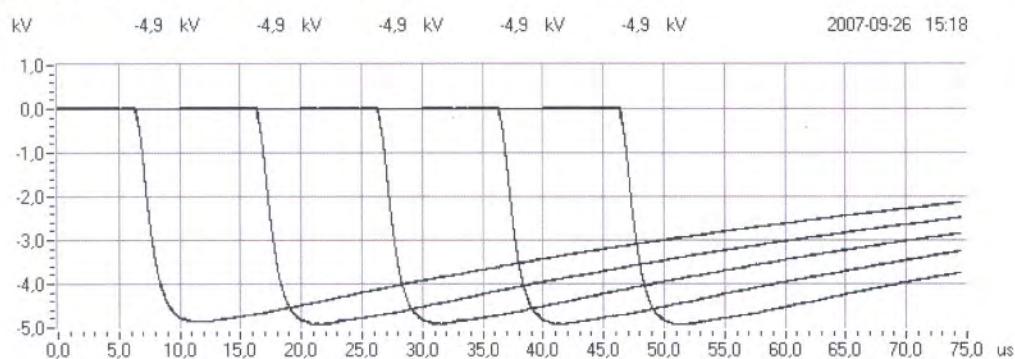
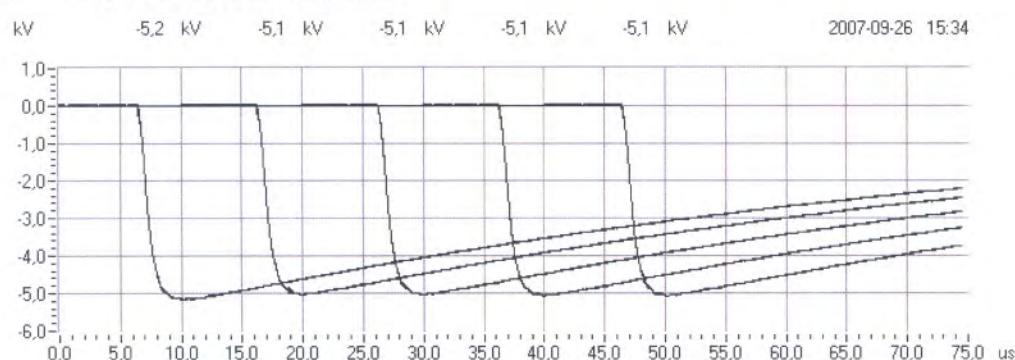
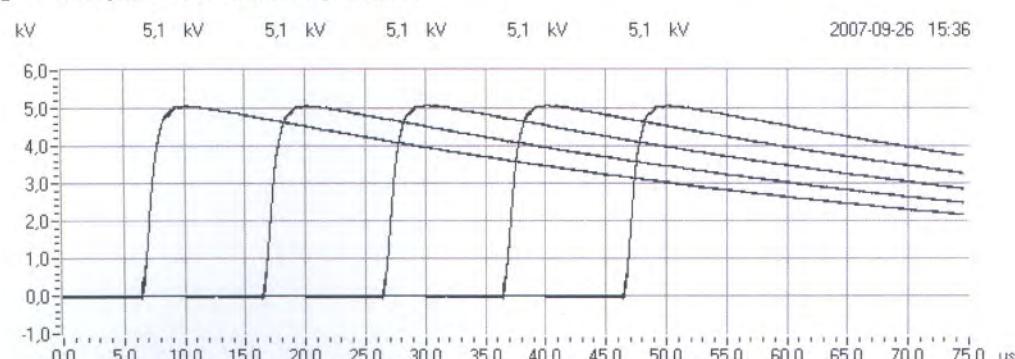
All parts were tested at a lightning impulse voltage of 5 kV (5 impulses at positive polarity and 5 impulses at negative polarity), except for the motor control circuit (part 4), for which the specified lightning impulse voltage withstand level amounted to 2,5 kV.

Results of the power-frequency voltage withstand tests

part under test	earthed parts	applied test voltage (kV, 50 Hz)	duration (s)	result
1	2, 3, 4, 5, 6, frame	2	60	passed
2	1, 3, 4, 5, 6, frame	2	60	passed
3	1, 2, 4, 5, 6, frame	2	60	passed
4	1, 2, 3, 5, 6, frame	2	60	passed
5	1, 2, 3, 4, 6, frame	2	60	passed
6	1, 2, 3, 4, 5, frame	2	60	passed

Results of the lightning impulse voltage withstand tests

part under test	voltage applied to	applied test voltage (kV)	see figure no.'s
1	2, 3, 4, 5, 6, frame	5	1 and 2
2	1, 3, 4, 5, 6, frame	5	5 and 6
3	1, 2, 4, 5, 6, frame	5	3 and 4
4	1, 2, 3, 5, 6, frame	2,5	11 and 12
5	1, 2, 3, 4, 6, frame	5	7 and 8
6	1, 2, 3, 4, 5, frame	5	9 and 10

**Fig. 1: Crompton GCB, secondary circuit 1****Fig. 2: Crompton GCB, secondary circuit 1****Fig. 3: Crompton GCB, secondary circuit 3****Fig. 4: Crompton GCB, secondary circuit 3**

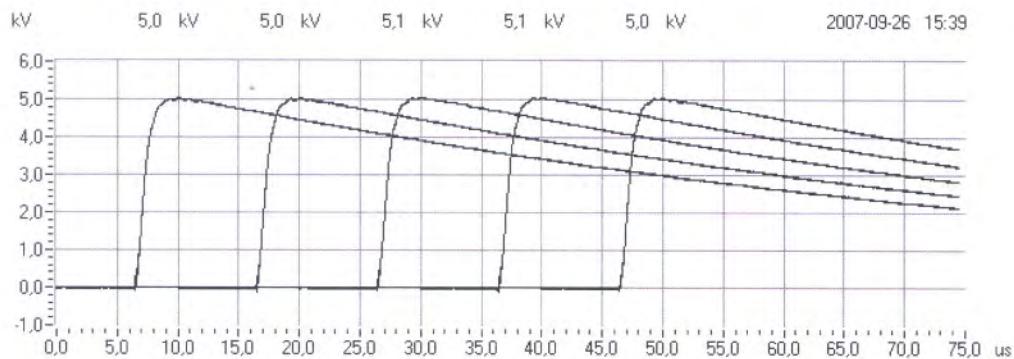


Fig. 5: Crompton GCB, secondary circuit 2

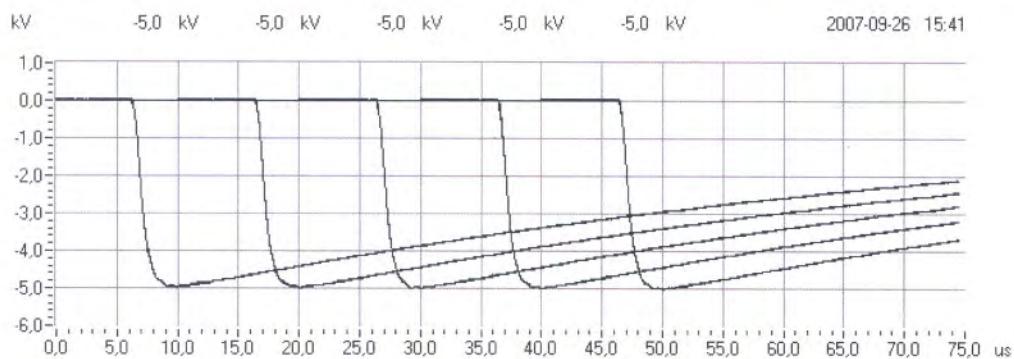


Fig. 6: Crompton GCB, secondary circuit 2

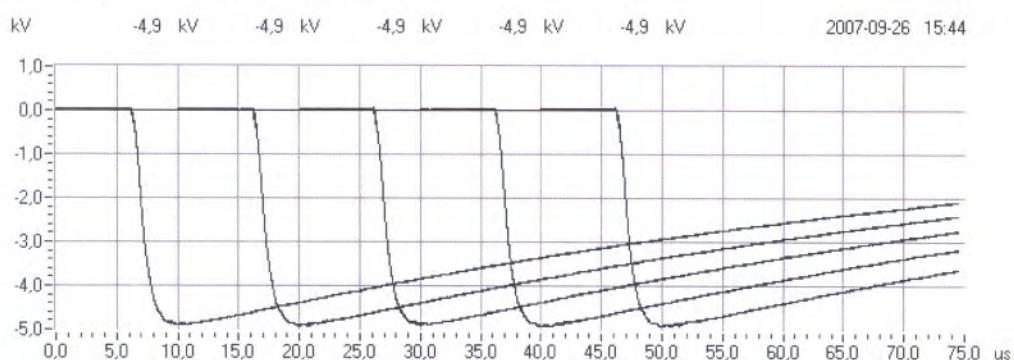


Fig. 7: Crompton GCB, secondary circuit 5

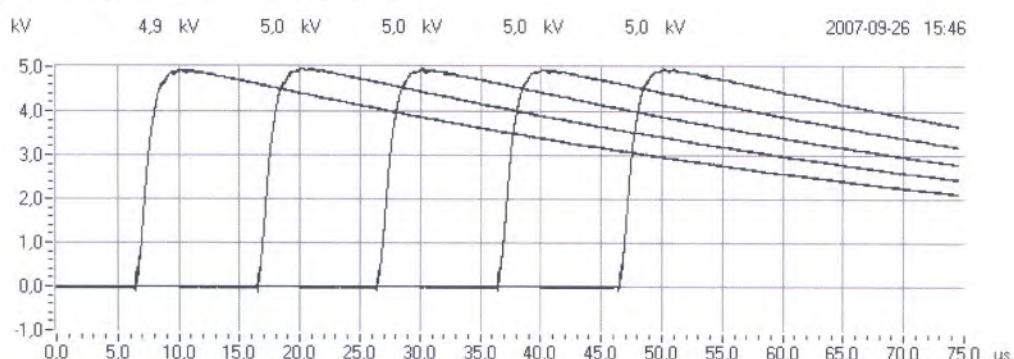


Fig. 8: Crompton GCB, secondary circuit 5

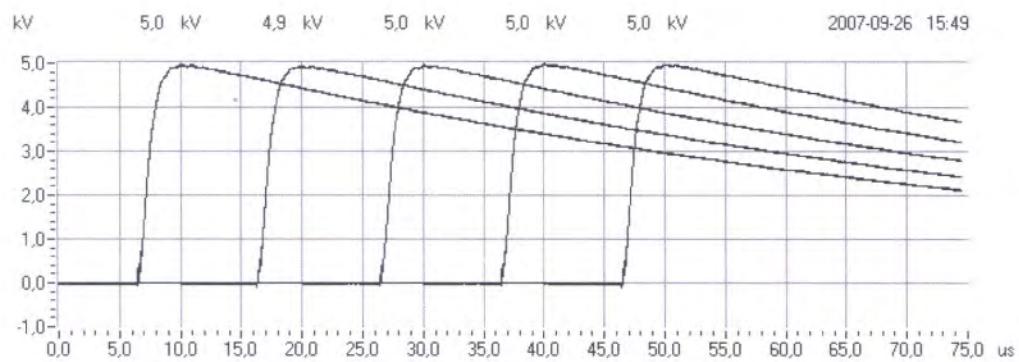


Fig. 9: Crompton GCB, secondary circuit 6

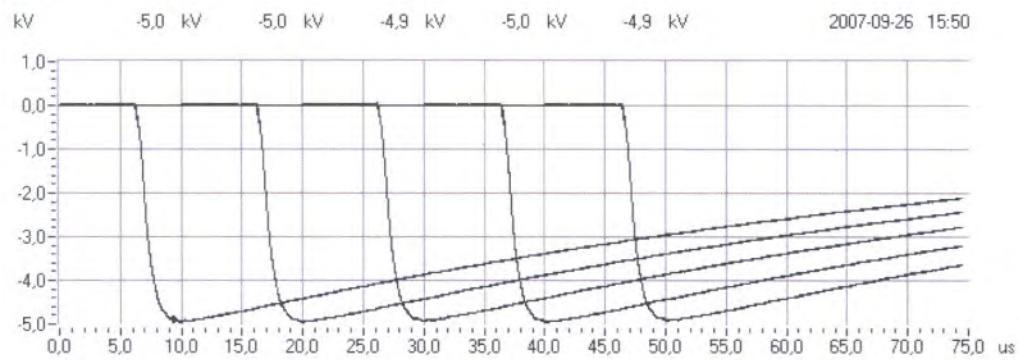


Fig. 10: Crompton GCB, secondary circuit 6

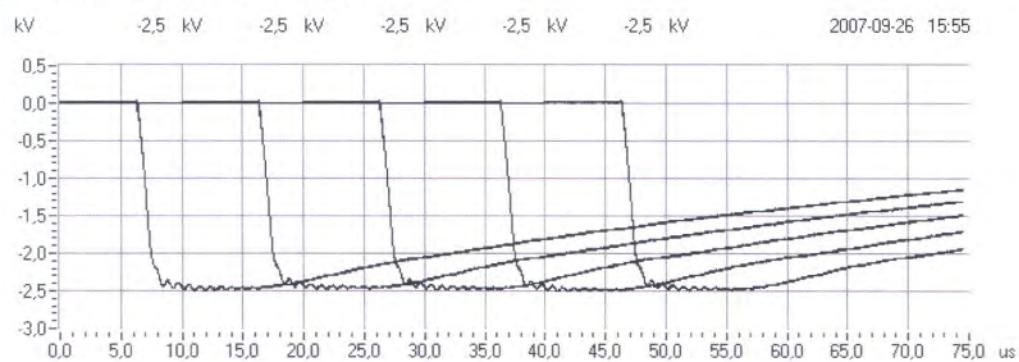


Fig. 11: Crompton GCB, secondary circuit 4

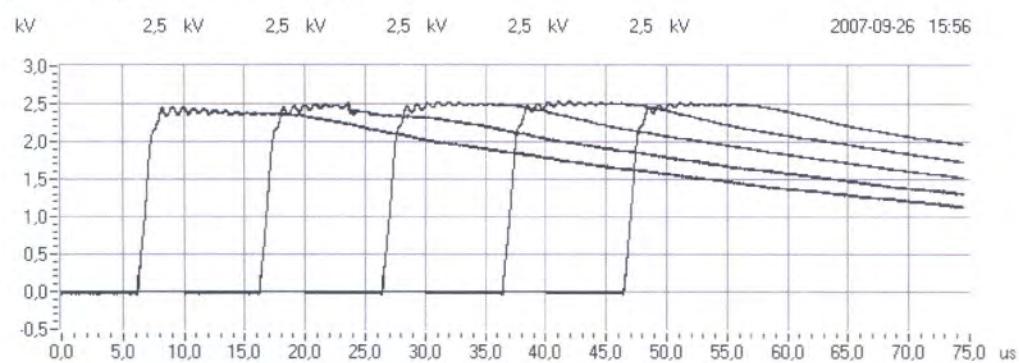


Fig. 12: Crompton GCB, secondary circuit 4

Requirements

The requirements were as mentioned in IEC 60694 clause 6.2.10:

- no disruptive discharge shall occur
- after the tests, the auxiliary and control circuits shall still be fully operational

Result

Neither flashover nor breakdown occurred during the tests. Upon completion of the tests, the auxiliary and control equipment was functionally tested and was still working properly.

The test was passed.

8 RADIO INTERFERENCE VOLTAGE (RIV) TEST

Date of test: 27 September 2007

The radio interference voltage test was performed under dry conditions in accordance with clause 6.3 of IEC 62271-100. Testing was performed in 3 test conditions as described above in chapter 3 (test conditions 2, 5 and 6) on one of the outer poles (C). Care was given to avoid influencing the measurements by earthed or non-earthed objects near to the switchgear. The measuring circuit was in compliance with CISPR 18-2.

In each test condition a power-frequency voltage of $1,1.U_{\text{r}}/\sqrt{3}$ (50 Hz) was applied to the switchgear and maintained for at least 5 minutes. The voltage was then decreased by steps down to $0,3.U_{\text{r}}/\sqrt{3}$, raised again by steps up to the initial value and finally decreased by steps down to $0,3.U_{\text{r}}/\sqrt{3}$. At each step, the radio interference measurement was taken and the radio interference level, as recorded during the last series of voltage reductions, was plotted versus the applied voltage. No correction factors for standard atmospheric conditions were applied.

The results are presented below.

Atmospheric conditions on 27 September 2007

Ambient temperature	21 °C
Ambient air pressure	1010 hPa
Humidity	9,3 g/m ³

General information

Measuring frequency	0,5 MHz
Primary test frequency	50 Hz

Calibration test set-up

Calibration voltage	100 mV (100 dB(µV))
Calibration frequency	0,5 MHz
Reading measurement receiver	84,5 dB(µV)
Correction factor	15,5 dB(µV) (= calibration voltage – reading receiver)

Background noise

Measuring frequency	0,5 MHz
Reading measurement receiver	15 dB(µV)
Background noise	30,5 dB(µV) (= reading receiver + correction factor)

Test condition 2: circuit breaker closed, Cc on high voltage, Aa, Bb and frame grounded

applied test voltage		receiver reading	correction factor	actual RIV value		remark
kV	% of $U_r/\sqrt{3}$	dB(µV)	dB(µV)	dB(µV)	µV	
92,1 kV (110 % of $U_r/\sqrt{3}$) for 5 minutes						
92,1	110	16	15,5	31,5	37,6	background
83,7	100	16	15,5	31,5	37,6	background
75,3	90	16	15,5	31,5	37,6	background
67,0	80	16	15,5	31,5	37,6	background
58,6	70	16	15,5	31,5	37,6	background
50,2	60	16	15,5	31,5	37,6	background
41,9	50	16	15,5	31,5	37,6	background
33,5	40	16	15,5	31,5	37,6	background
25,1	30	16	15,5	31,5	37,6	background
33,5	40	16	15,5	31,5	37,6	background
41,9	50	16	15,5	31,5	37,6	background
50,2	60	16	15,5	31,5	37,6	background
58,6	70	16	15,5	31,5	37,6	background
67,0	80	16	15,5	31,5	37,6	background
75,3	90	16	15,5	31,5	37,6	background
83,7	100	16	15,5	31,5	37,6	background
92,1	110	16	15,5	31,5	37,6	background
92,1 kV (110 % of $U_r/\sqrt{3}$) for 1 minute						
92,1	110	15	15,5	30,5	33,5	background
83,7	100	15	15,5	30,5	33,5	background
75,3	90	15	15,5	30,5	33,5	background
67,0	80	15	15,5	30,5	33,5	background
58,6	70	15	15,5	30,5	33,5	background
50,2	60	15	15,5	30,5	33,5	background
41,9	50	15	15,5	30,5	33,5	background
33,5	40	15	15,5	30,5	33,5	background
25,1	30	15	15,5	30,5	33,5	background

Test condition 6: circuit breaker open, c on high voltage, C, A, a, B, b and frame grounded

applied test voltage		receiver reading	correction factor	actual RIV value		remark
kV	% of $U_r/\sqrt{3}$	dB(μV)	dB(μV)	dB(μV)	μV	
92,1 kV (110 % of $U_r/\sqrt{3}$) for 5 minutes						
92,1	110	14,5	15,5	30	31,6	background
83,7	100	14,5	15,5	30	31,6	background
75,3	90	14,5	15,5	30	31,6	background
67,0	80	14,5	15,5	30	31,6	background
58,6	70	14,5	15,5	30	31,6	background
50,2	60	14,5	15,5	30	31,6	background
41,9	50	14,5	15,5	30	31,6	background
33,5	40	14,5	15,5	30	31,6	background
25,1	30	14,5	15,5	30	31,6	background
33,5	40	14,5	15,5	30	31,6	background
41,9	50	14,5	15,5	30	31,6	background
50,2	60	14,5	15,5	30	31,6	background
58,6	70	14,5	15,5	30	31,6	background
67,0	80	14,5	15,5	30	31,6	background
75,3	90	14,5	15,5	30	31,6	background
83,7	100	14,5	15,5	30	31,6	background
92,1	110	14,5	15,5	30	31,6	background
92,1 kV (110 % of $U_r/\sqrt{3}$) for 1 minute						
92,1	110	14	15,5	29,5	29,8	background
83,7	100	14	15,5	29,5	29,8	background
75,3	90	14	15,5	29,5	29,8	background
67,0	80	14	15,5	29,5	29,8	background
58,6	70	14	15,5	29,5	29,8	background
50,2	60	14	15,5	29,5	29,8	background
41,9	50	14	15,5	29,5	29,8	background
33,5	40	14	15,5	29,5	29,8	background
25,1	30	14	15,5	29,5	29,8	background

Test condition 5: circuit breaker open, C on high voltage, c, A, a, B, b and frame grounded

applied test voltage		receiver reading	correction factor	actual RIV value		remark
kV	% of $U_r/\sqrt{3}$	dB(μV)	dB(μV)	dB(μV)	μV	
92,1 kV (110 % of $U_r/\sqrt{3}$) for 5 minutes						
92,1	110	15,5	15,5	31	35,5	background
83,7	100	15,5	15,5	31	35,5	background
75,3	90	15,5	15,5	31	35,5	background
67,0	80	15,5	15,5	31	35,5	background
58,6	70	15,5	15,5	31	35,5	background
50,2	60	15,5	15,5	31	35,5	background
41,9	50	15,5	15,5	31	35,5	background
33,5	40	15,5	15,5	31	35,5	background
25,1	30	15,5	15,5	31	35,5	background
33,5	40	15,5	15,5	31	35,5	background
41,9	50	15,5	15,5	31	35,5	background
50,2	60	15,5	15,5	31	35,5	background
58,6	70	15,5	15,5	31	35,5	background
67,0	80	15,5	15,5	31	35,5	background
75,3	90	15,5	15,5	31	35,5	background
83,7	100	15,5	15,5	31	35,5	background
92,1	110	15,5	15,5	31	35,5	background
92,1 kV (110 % of $U_r/\sqrt{3}$) for 1 minute						
92,1	110	15,5	15,5	31	35,5	background
83,7	100	15,5	15,5	31	35,5	background
75,3	90	15,5	15,5	31	35,5	background
67,0	80	15,5	15,5	31	35,5	background
58,6	70	15,5	15,5	31	35,5	background
50,2	60	15,5	15,5	31	35,5	background
41,9	50	15,5	15,5	31	35,5	background
33,5	40	15,5	15,5	31	35,5	background
25,1	30	15,5	15,5	31	35,5	background

Requirements

The requirements were as mentioned in IEC 60694 clause 6.3:

- RIV limit at $1,1.U_r/\sqrt{3}$: $68 \text{ dB}(\mu\text{V}) = 2500 \mu\text{V}$

Result

The measured RIV value was well below the required limit in the entire applied voltage range for all test conditions. The test was passed.

APPENDIX A MEASUREMENT UNCERTAINTIES

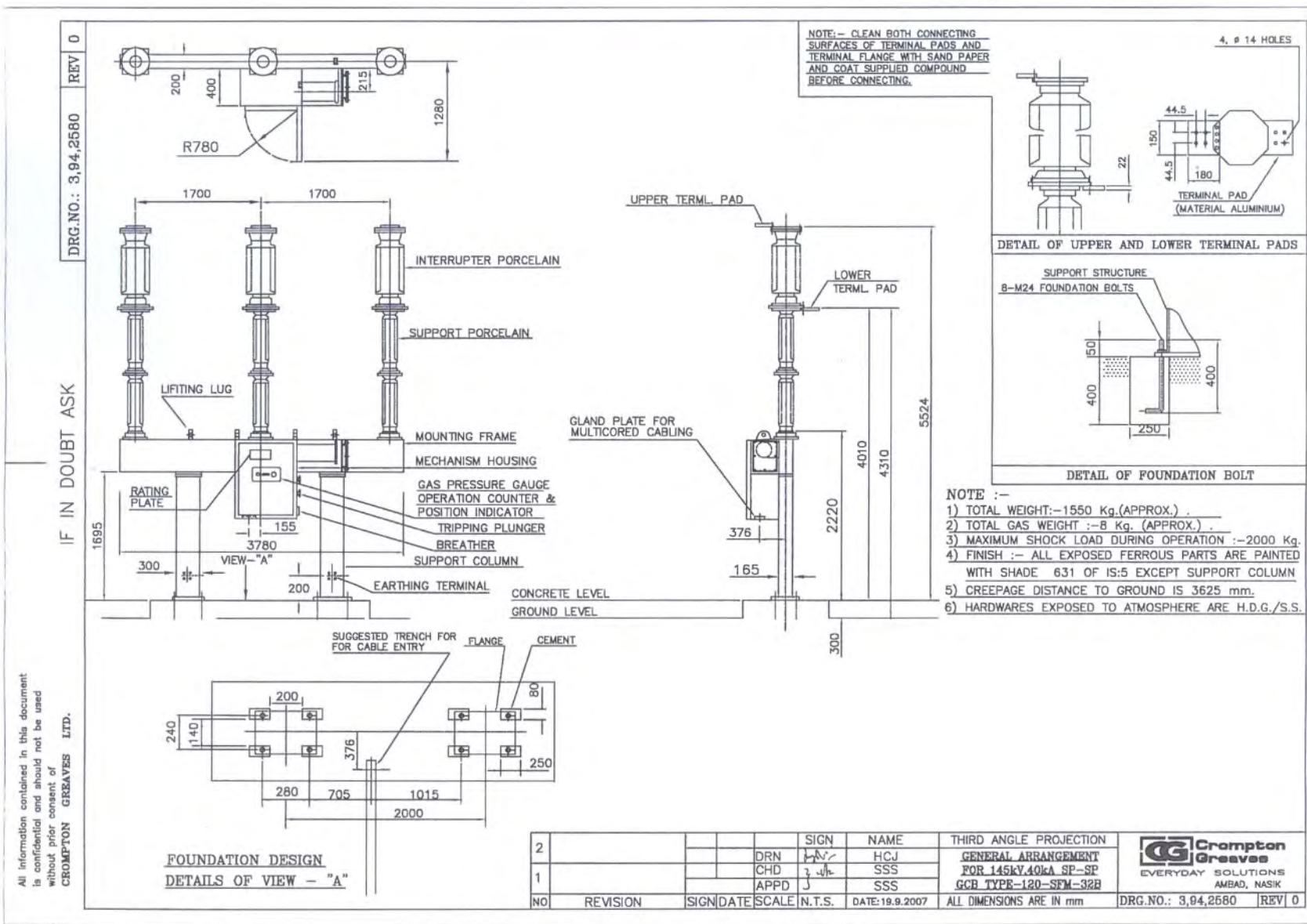
The measurement uncertainties in the results presented are as specified below unless otherwise indicated.

measurement	measurement uncertainty
dielectric tests and impulse current tests	peak value: $\leq 3\%$ time parameters: $\leq 10\%$
capacitance measurement	0,3%
tan δ measurement	$\pm 0,5\% \pm 5 \times 10^{-5}$
partial discharge measurement	< 10 pC : 2 pC 10 - 100 pC : 5 pC > 100 pC : 20 %
measurement of impedance ac-resistance measurement	$\leq 1\%$
measurement of losses	$\leq 1\%$
measurement of insulation resistance	$\leq 10\%$
measurement of dc resistance	1 $\mu\Omega$ - 5 $\mu\Omega$: 1% 5 $\mu\Omega$ - 10 $\mu\Omega$: 0,5% 10 $\mu\Omega$ - 200 $\mu\Omega$: 0,2%
radio interference test	2 dB
calibration of current transformers	$2,2 \times 10^{-4}$ I ₁ /I ₀ and 290 μ rad
calibration of voltage transformers	$1,6 \times 10^{-4}$ U ₁ /U ₀ en 510 μ rad
measurement of conductivity	5%
measurement of temperature	-50 °C - -40 °C : 3 K -40 °C - 125 °C : 2 K 125 °C - 150 °C : 3 K
tensile test	1%
sound level measurement	type 1 meter as per IEC 651 and ANSI S1.4.1971
measurement of voltage ratio	0,1%

APPENDIX B MANUFACTURER'S DRAWINGS

2 pages

Drawing no.	Description	Date	Rev.
3942580	General arrangement for 145 kV, 40 kA SP-SP GCB type-120-SFM-32B	19-9-2007	0
4942584	Rating plate details for 145 kV, 40 kA SP-SP GCB type-120-SFM-32B	20-09-2007	0



07-1038

-40-

KEMA

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IF IN DOUBT ASK

DRG NO.: 4.04.2584 REV 0

CG Crompton Greaves

EVERYDAY SOLUTIONS

GAS CIRCUIT BREAKER

TYPE 120-SFM-32B		SR. NO. :	YEAR 2007
RATED VOLTAGE	145 kV	RATED FREQUENCY	50 Hz
RATED NORMAL CURRENT	3150 A	RATED MAKING CAPACITY	100 kA _p
RATED SHORT CIRCUIT BREAKING CURRENT	40 kA		RATED SHORT TIME CURRENT 40 kA FOR 3 SECONDS
RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE		FIRST POLE TO CLEAR FACTOR	1.5
		650 kVp RAT.OPR.SEQ. 0-0.3SEC-CO-3MIN-CO	
RATED SF6 GAS PRESSURE 7 kg/cm ² -g(AT 20°C)		GAS WT 8 Kg	TOTAL WT. 1550 Kg
RATED COIL VOLTAGE — CLOSING 110 V DC ,TRIPPING 110 V DC			
MOTOR VOLTAGE	230 V AC	AUX CIRCUIT VOLTAGE 1φ,230V AC,50 Hz	

MATERIAL: STAINLESS STEEL 0.5THK

2		I	SIGN.	NAME	THIRD ANGLE PROJECTION	 Crompton Greaves EVERYDAY SOLUTIONS AMBAD, NASHIK
1		I	DRN	HCJ	RATING PLATE DETAILS FOR 145KVA 40KA SP-SP	
		I	CHD	SSS	GCB TYPE-120-57A-32B	
NO	REVISION	SIGN DATE	SCALE	N.T.S.	DATE 20.09.07	ALL DIMENSIONS ARE IN mm DRG. NO. 4/94,2584 REV 0