3.3 - Fuse holder

25 introduction / extraction manual operations.

3.4 - Measure of the resistance of the main circuit under 100 Adc

4 - TEST CONDITIONS

-

5 - TESTS RESULTS

No of operating sequences	0	1000	2000
Pole A (μΩ)	35	34	37
Pole B (μΩ)	33	34	35
Pole C (μΩ)	35	36	38

During the 2000 operating cycles no malfunction as been detected in the switch disconnector.

EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

TEST REPORT
No. MT.00.3.C.098.I

Prefabricated panel Fluofix GC with SF6 three position switch disconnector type ISFG

Lightning Impulse Voltage Test
Power Frequency Voltage Test

Test regulations applied:

IEC 298 (1990).
IEC 694 (1980).

Tests results:

The prefabricated panel Fluofix GC passed the Tests.

Date of tests: June 20th, 2000.

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

1 - TECHNICAL DATA OF SWITCHGEAR

Prefabricated panel

Type: Fluofix GC
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Rated peak withstand current: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated frequency: 50 Hz
Drawing on page 7

With SF6 rotary three position switch disconnector

Type: ISFG
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Breaking capacity:
- Active charge: 630 A
- No-load transformer: 1250 kVA
- No-load cables: 16 A

Closing capacity: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated peak withstand current: 40 kAp
Rated frequency: 50 Hz
SF6 pressure (20 °C): 0.3 bar rel.

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Division

3 - TEST PERFORMED

Lightning Impulse Voltage Test at 125 / 145 kVp, 1.2 / 50 µs.
Power Frequency Voltage Test at 50 / 60 kV , 1 minute.

Note: This test report refers to tests performed within the procedure of the partial discharge tests according to IEC 298, sub-clause 6.1.9, specified on the test report nº MT.00.3.C.089.I.

4 - TEST CONDITIONS

Tests performed according circuit diagrams on page 6.

5 - TESTS RESULTS

According figure on page 5:

5.1 - Switch disconnectors closed

(Test to earth and between phases)

Voltage Applied To	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
Aaa'	BCbcb'c'F	15 / 0	15 / 0	125	Passed	8	50	Passed
Bbb'	ACaca'c'F	15 / 0	15 / 0	125	Passed	9	50	Passed
Ccc'	ABaba'b'F	15 / 0	15 / 0	125	Passed	10	50	Passed

5.2 - Switch disconnector S1 open, S2 and S3 closed

(Test to earth and between phases)

Voltage Applied to	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
A	BCabca'b'c'F	15 / 0	15 / 0	125	Passed	11	50	Passed
B	ACabca'b'c'F	15 / 0	15 / 0	125	Passed	12	50	Passed
C	ABabca'b'c'F	15 / 0	15 / 0	125	Passed	13	50	Passed

5.3 - Switch disconnector S1 and S3 open, S2 closed

(Test to earth and between phases)

Voltage Applied to	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
a	bcABCa'b'c'F	15 / 0	15 / 0	125	Passed	14	50	Passed
b	acABCa'b'c'F	15 / 0	15 / 0	125	Passed	15	50	Passed
c	abABCa'b'c'F	15 / 0	15 / 0	125	Passed	16	50	Passed

5.4 - Switch disconnector S1 open, S2 and S3 closed

(Test across the isolating distance)

Voltage Applied to	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
A	aa'	15 / 0	15 / 0	145	Passed	17	60	Passed
B	bb'	15 / 0	15 / 0	145	Passed	18	60	Passed
C	cc'	15 / 0	15 / 0	145	Passed	19	60	Passed

5.5 - Switch disconnector S1 and S3 open, S2 closed

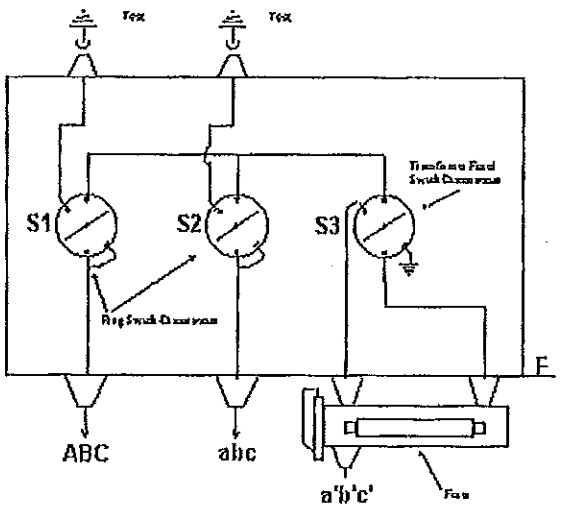
(Test across the isolating distance)

Voltage Applied to	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
a	Aa'	15 / 0	15 / 0	145	Passed	20	60	Passed
b	Bb'	15 / 0	15 / 0	145	Passed	21	60	Passed
c	Cc'	15 / 0	15 / 0	145	Passed	22	60	Passed

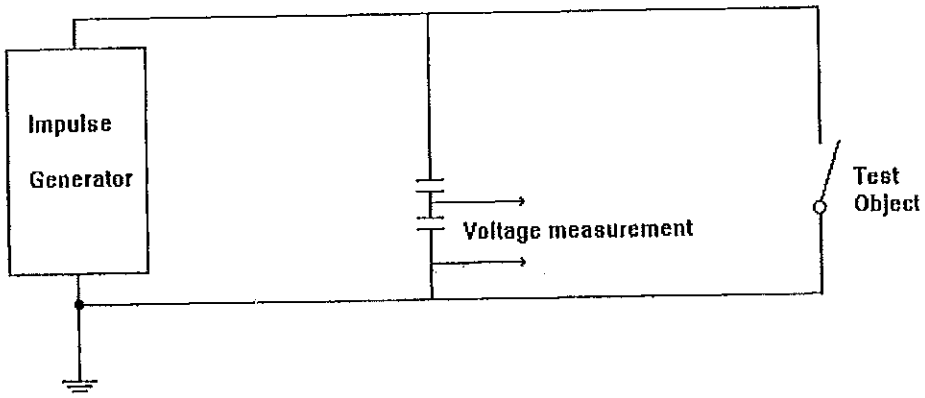
5.6 - Switch disconnector S1 and S3 closed on earth position, S2 closed on service position

(Test to earth and between phases)

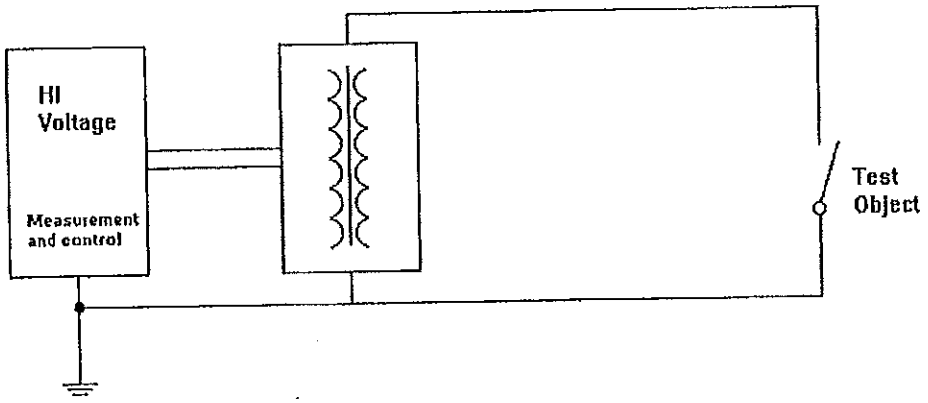
Voltage applied to	Connected to earth	Impulses / flashovers +	Impulses / flashovers -	Applied Voltage ± kVp 1.2/50 µs	Result	Oscillogram on page	Power frequency voltage kV / 1 minute	Result
a	bcF	15 / 0	15 / 0	125	Passed	23	50	Passed
b	acF	15 / 0	15 / 0	125	Passed	24	50	Passed
c	abF	15 / 0	15 / 0	125	Passed	25	50	Passed

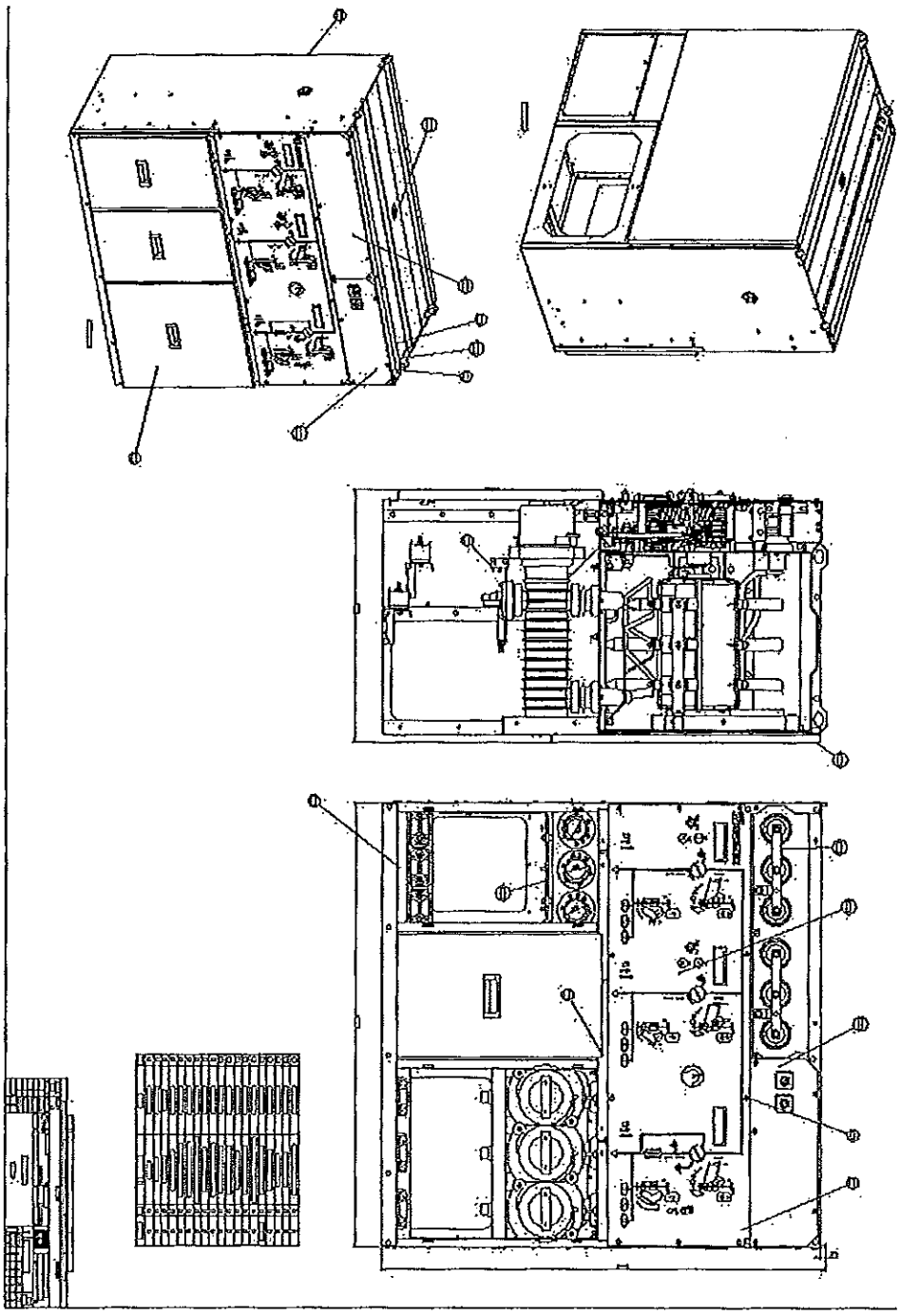


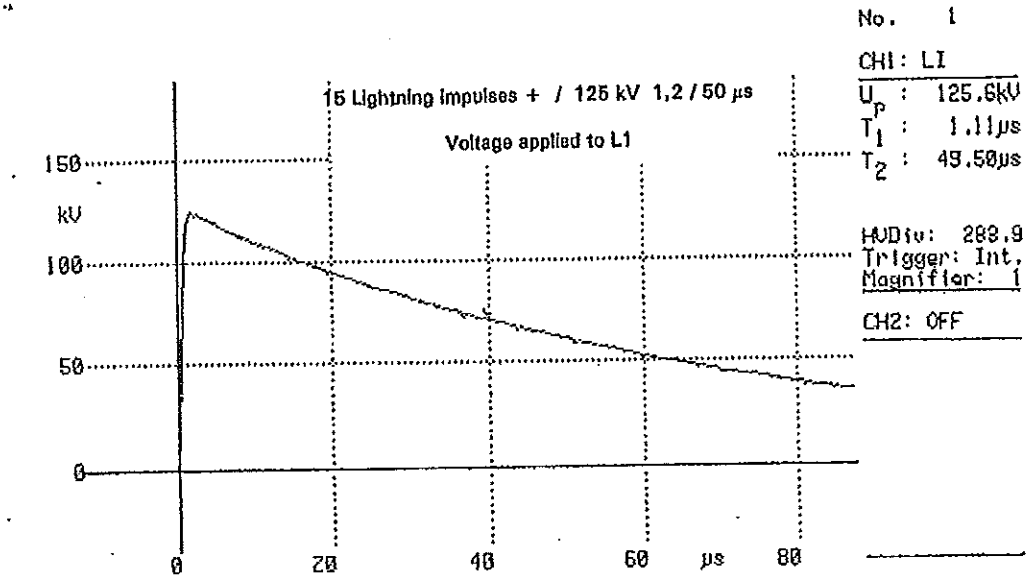
- Lightning Impulse Voltage Test

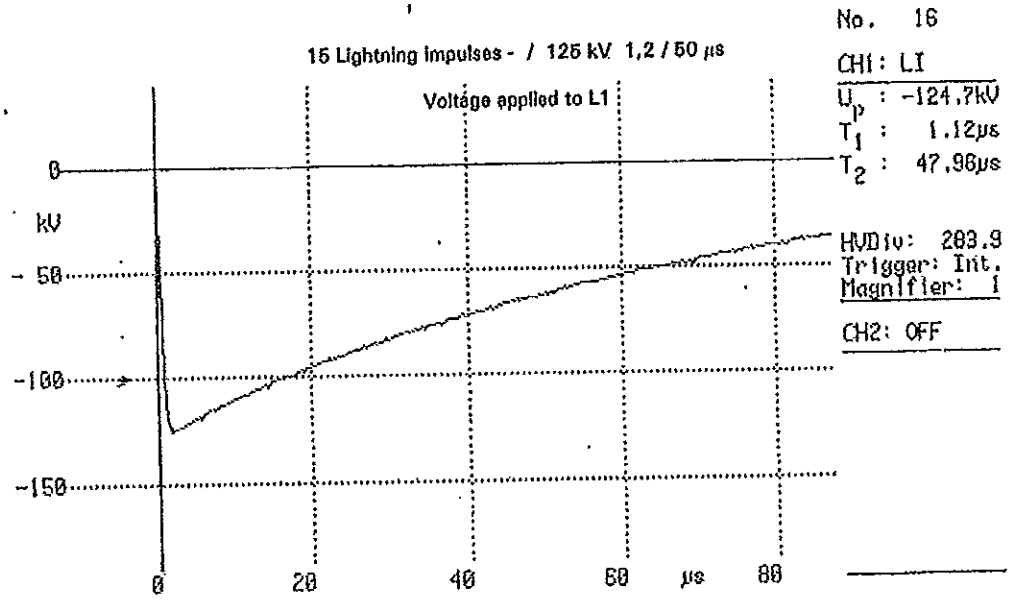


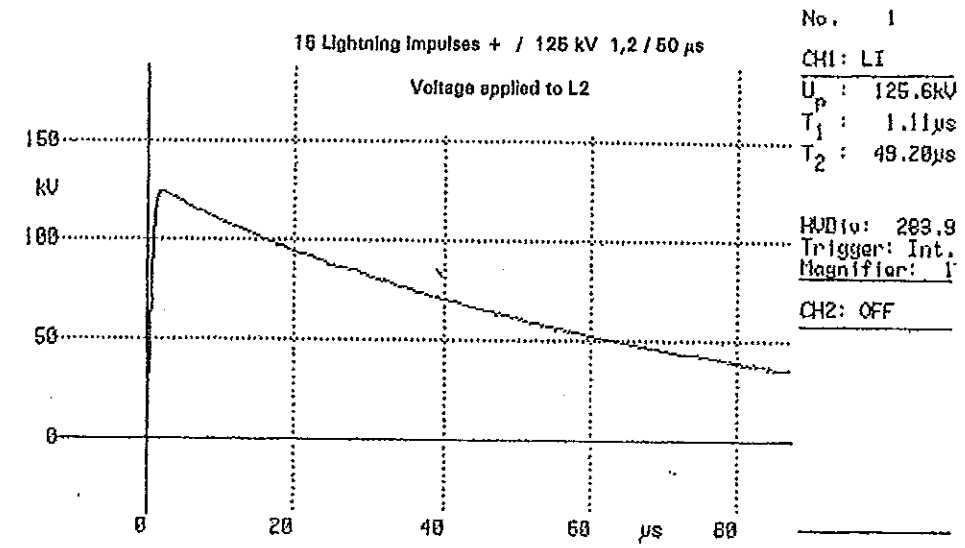
- Power Frequency Voltage Test

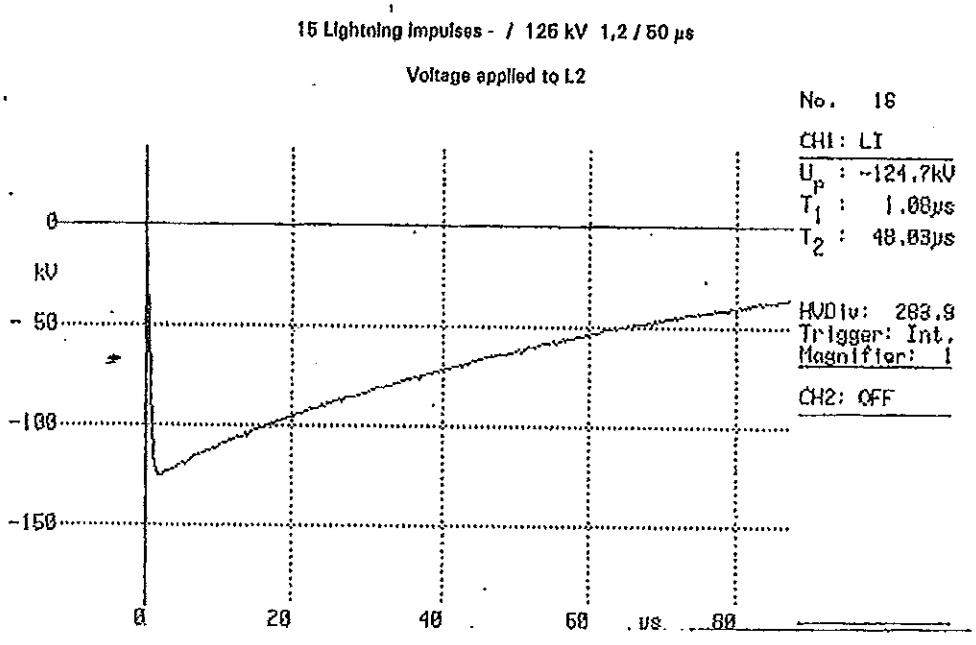


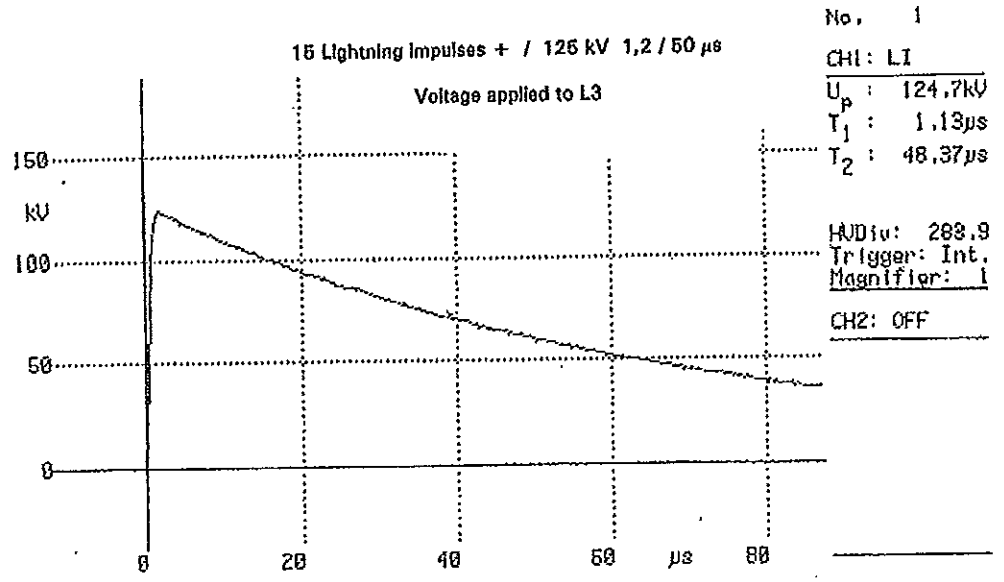


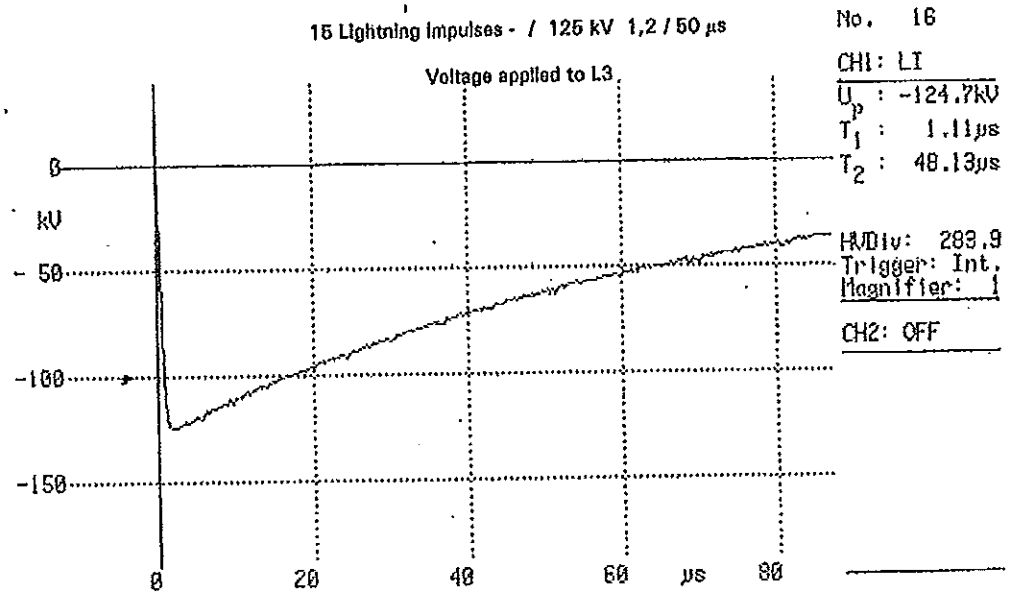








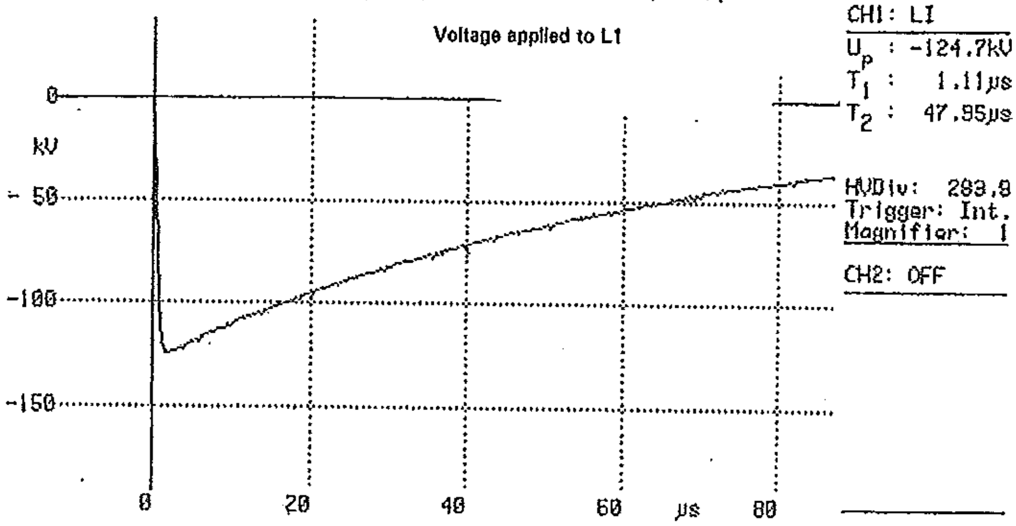




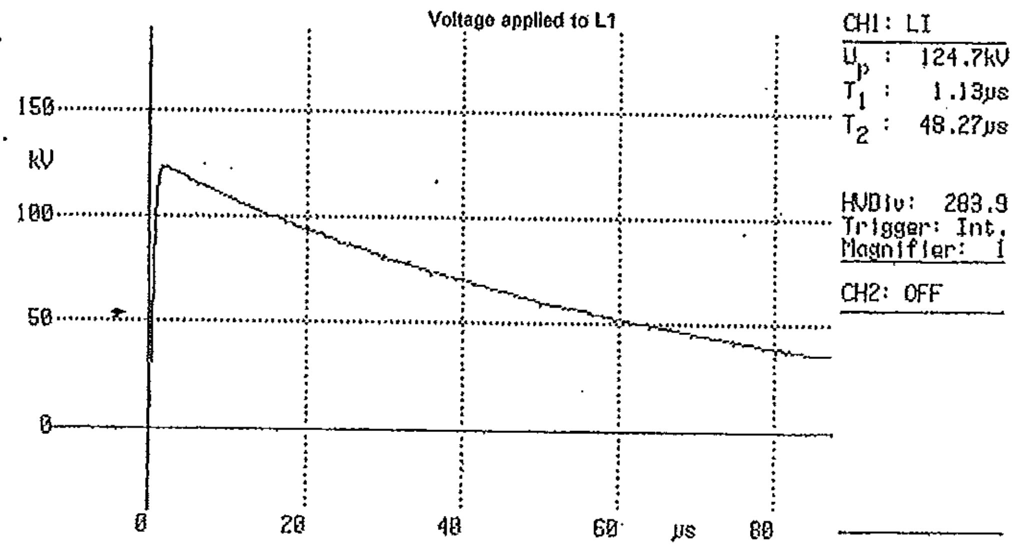
EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

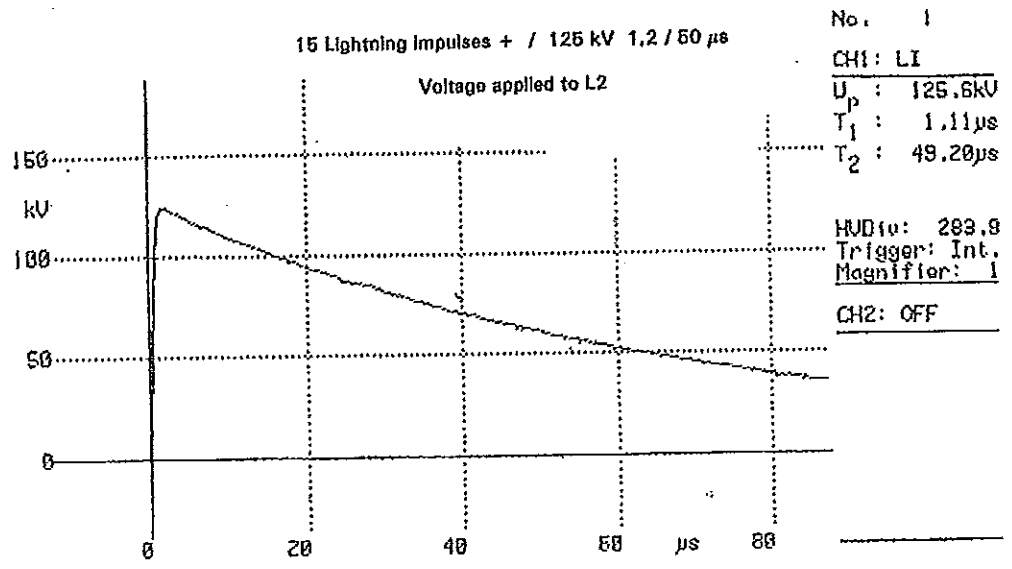
15 Lightning impulses - / 125 kV 1,2 / 50 μs

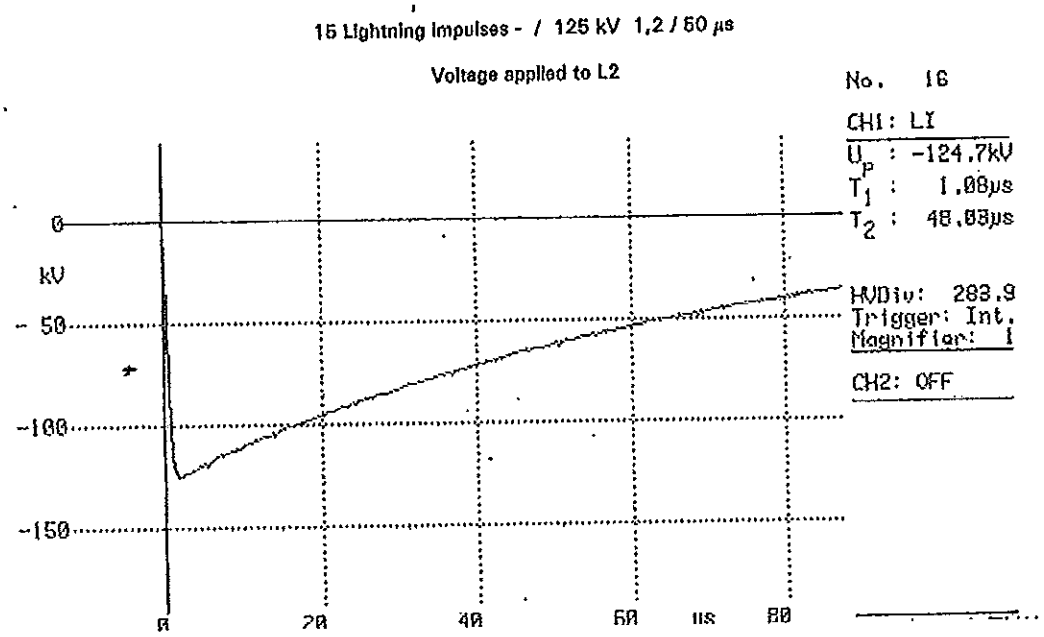


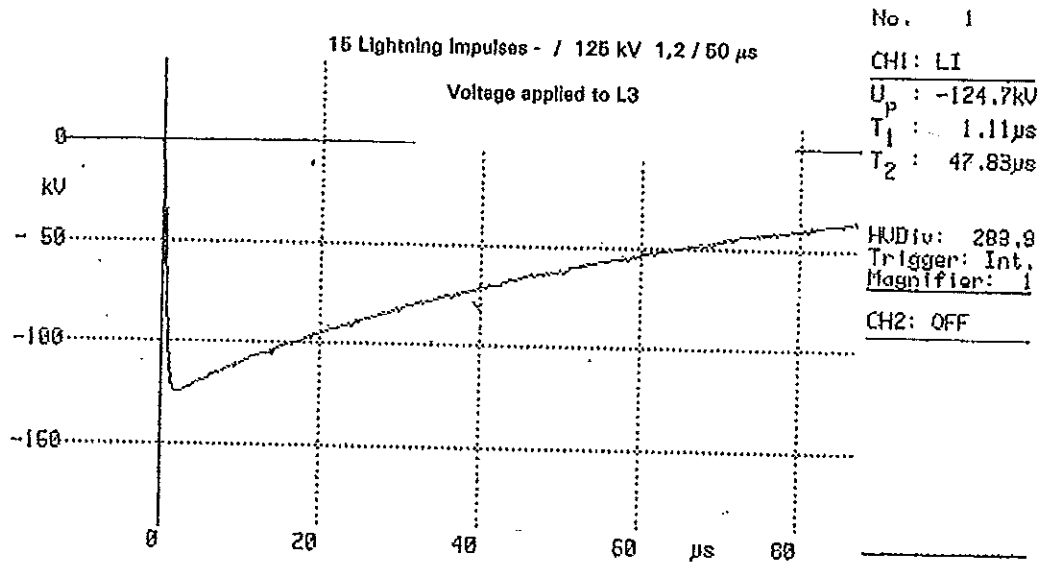
15 Lightning impulses + / 125 kV 1,2 / 50 μs

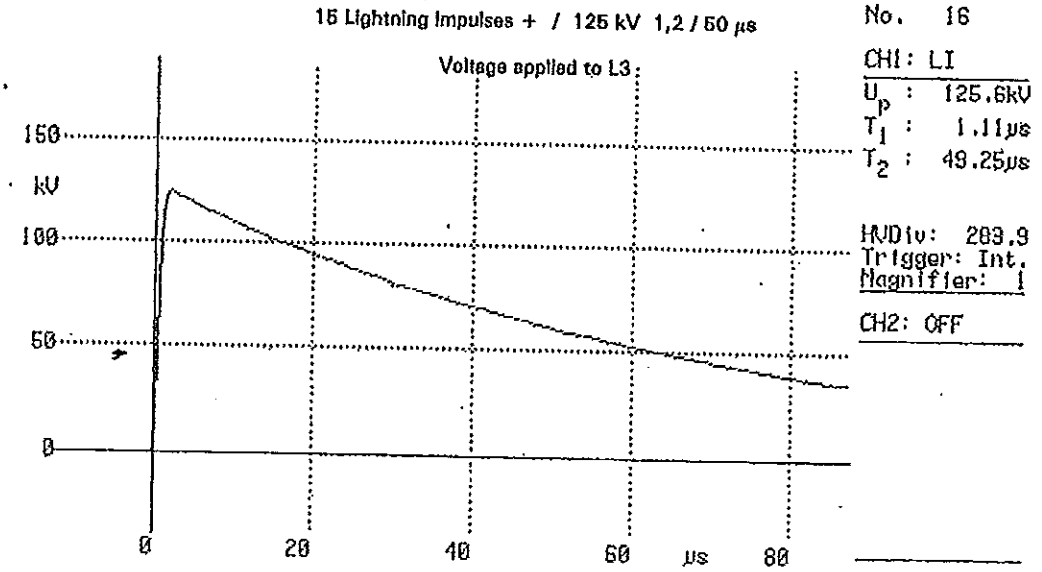


ВЯРНО С ОРИГИНАЛА

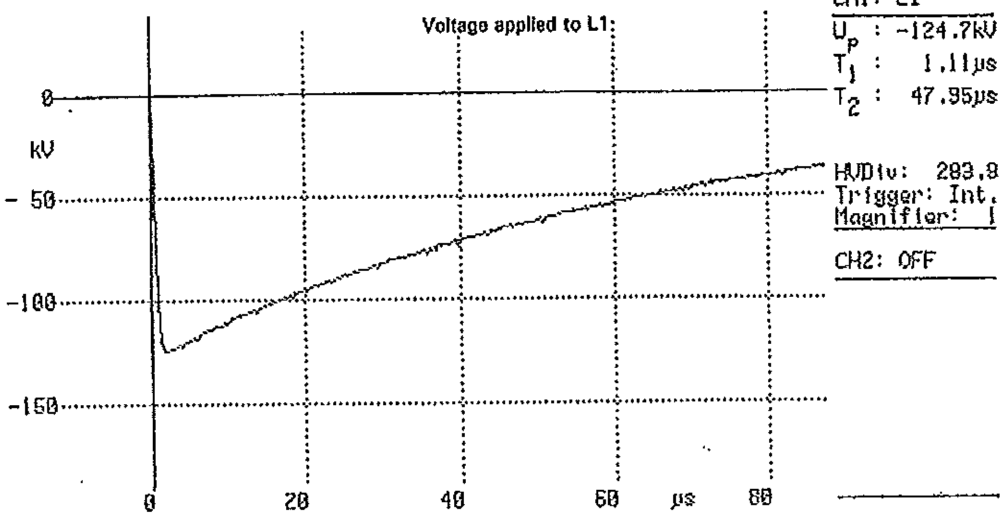




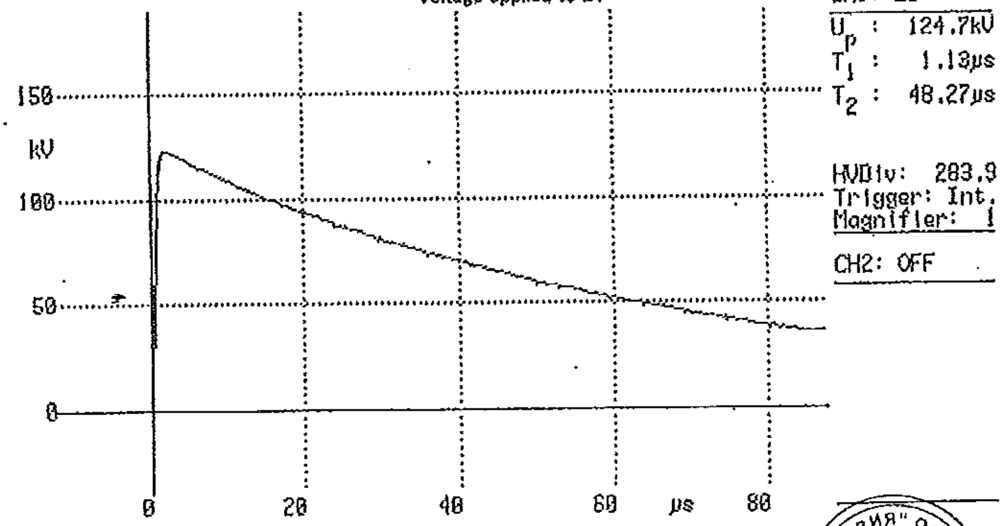


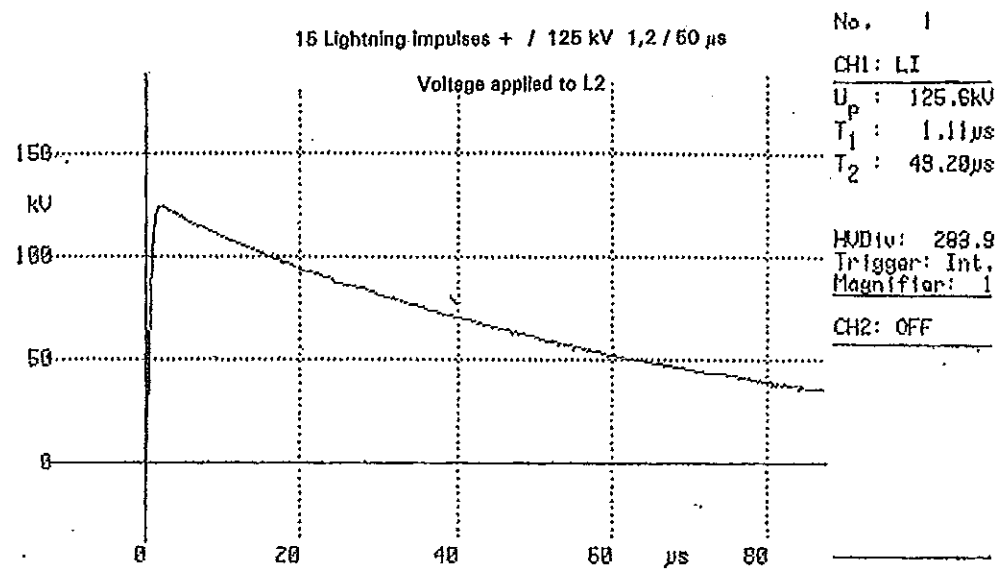


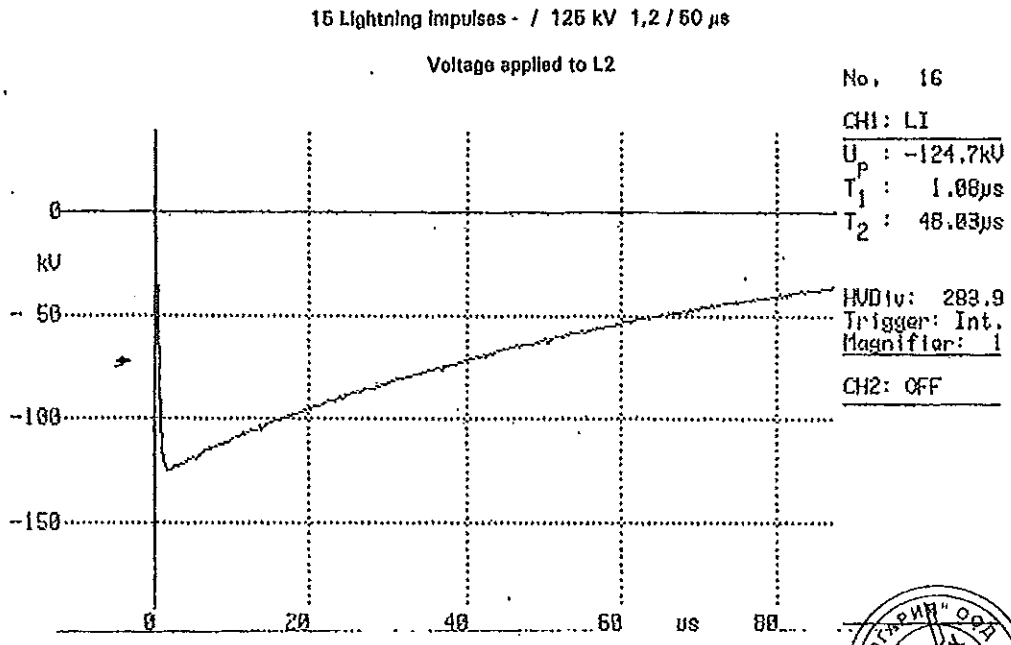
15 Lightning Impulses - / 125 kV 1,2 / 50 µs



15 Lightning Impulses + / 125 kV 1,2 / 50 µs

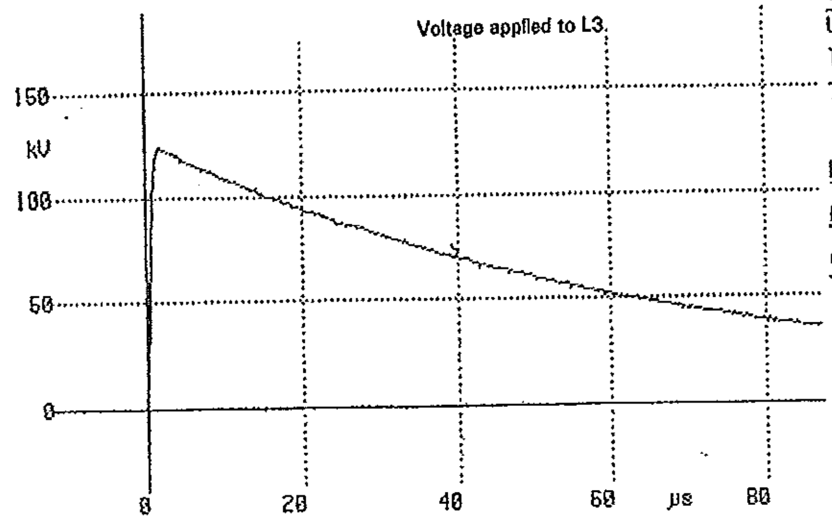






15 Lightning impulses + / 125 kV 1,2 / 50 µs

Voltage applied to L3



No. 1

CH1: LI

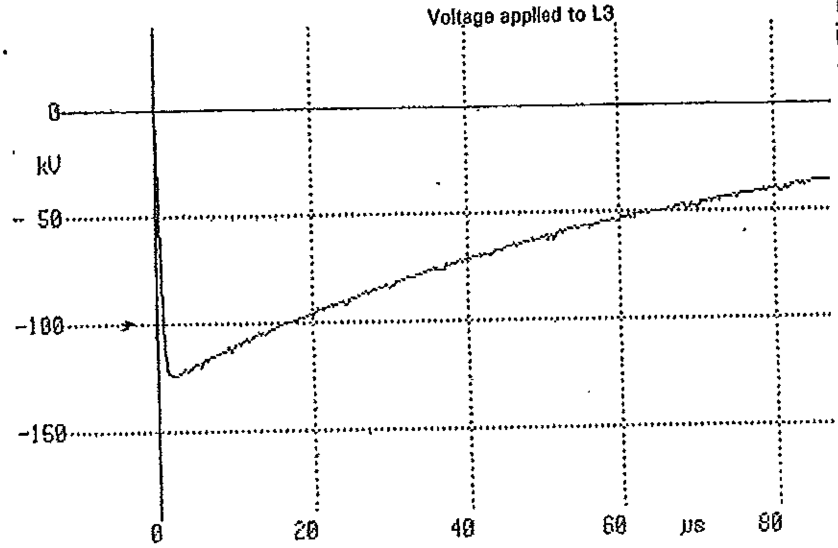
U_p : 124.7kV
T_1 : 1.13µs
T_2 : 48.37µs

HVDiv: 283.9
Trigger: Int.
Magnifier: 1

CH2: OFF

15 Lightning impulses - / 125 kV 1,2 / 50 µs

Voltage applied to L3



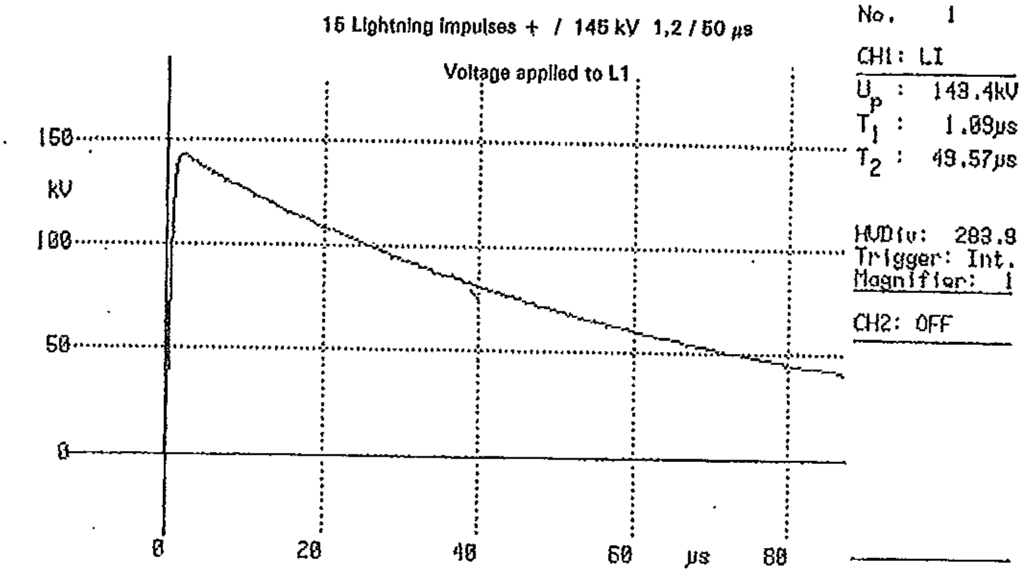
No. 16

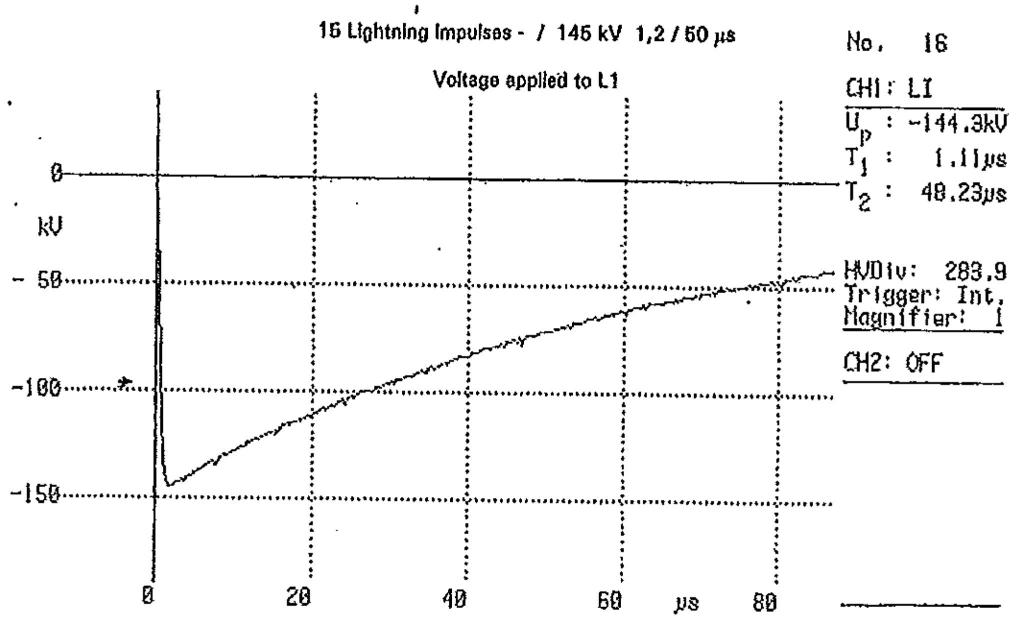
CH1: LI

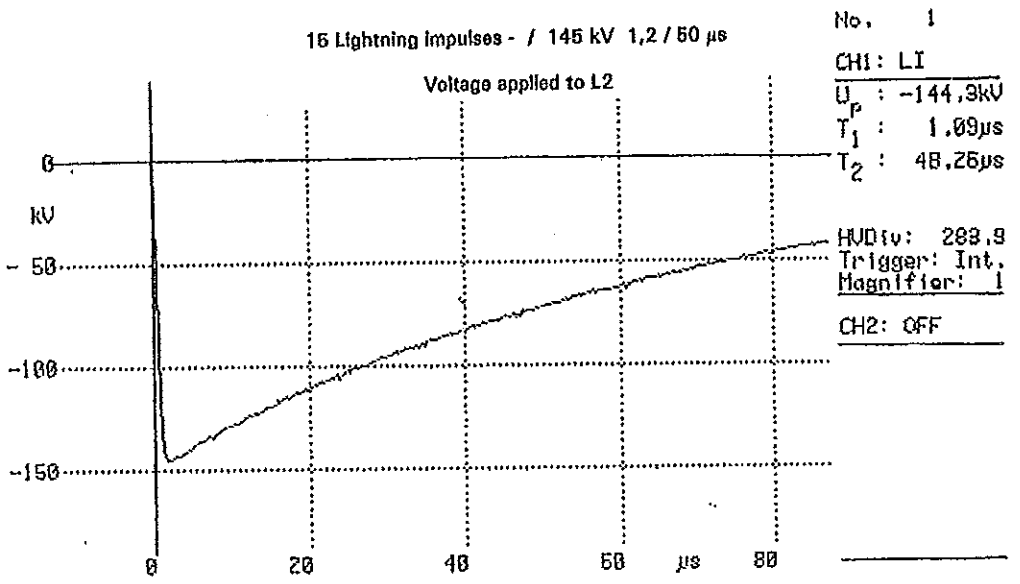
U_p : -124.7kV
T_1 : 1.11µs
T_2 : 48.13µs

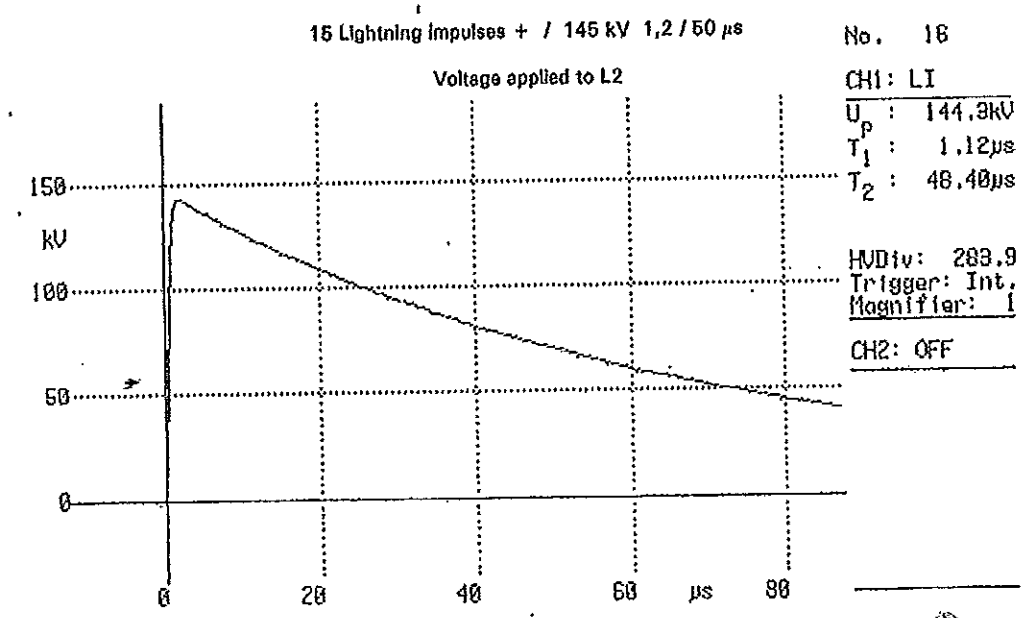
HVDiv: 283.9
Trigger: Int.
Magnifier: 1

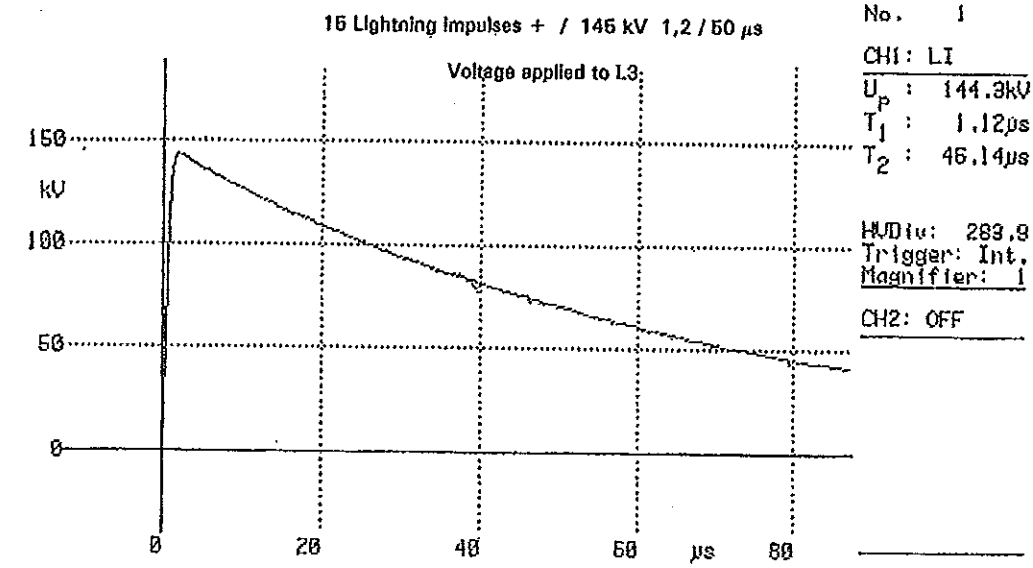
CH2: OFF

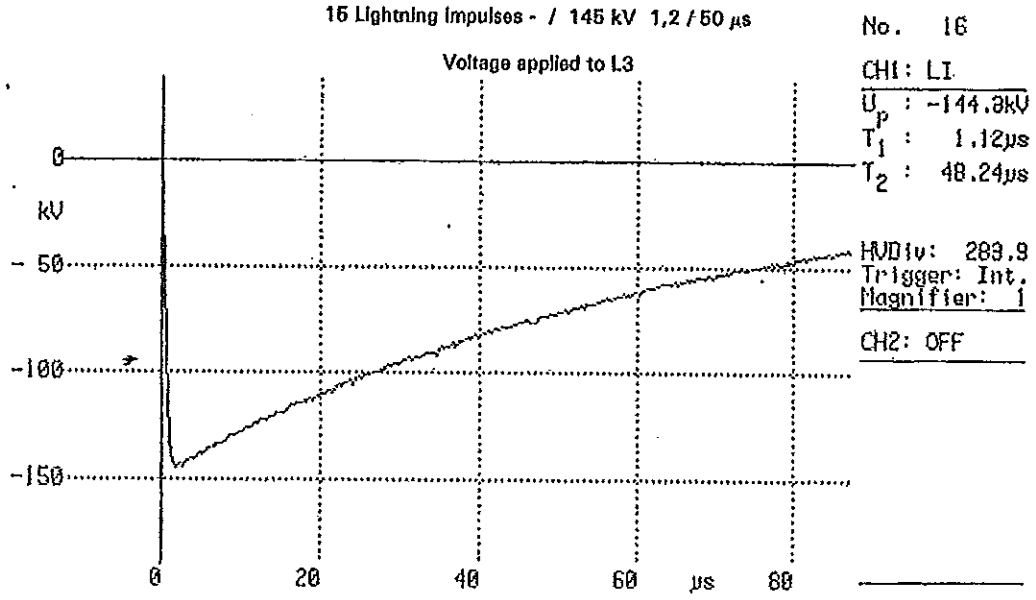

15 Lightning impulses + / 145 kV 1,2 / 50 μs
Voltage applied to L1
150
kV
100
50
0
0
20
40
60
μs
80
No. 1
CH1: LI
U_p : 143.4kV
T_1 : 1.09μs
T_2 : 49.57μs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF

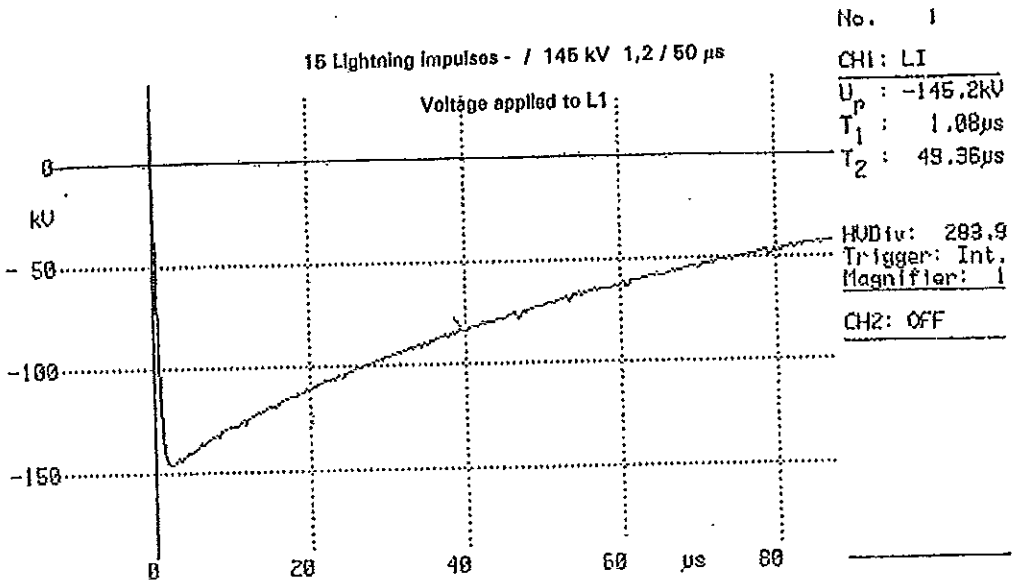

15 Lightning impulses - / 145 kV 1,2 / 50 μs
Voltage applied to L1
0
kV
- 50
-100
-150
0
20
40
60
μs
80
No. 16
CH1: LI
U_p : -144.3kV
T_1 : 1.11μs
T_2 : 48.23μs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF

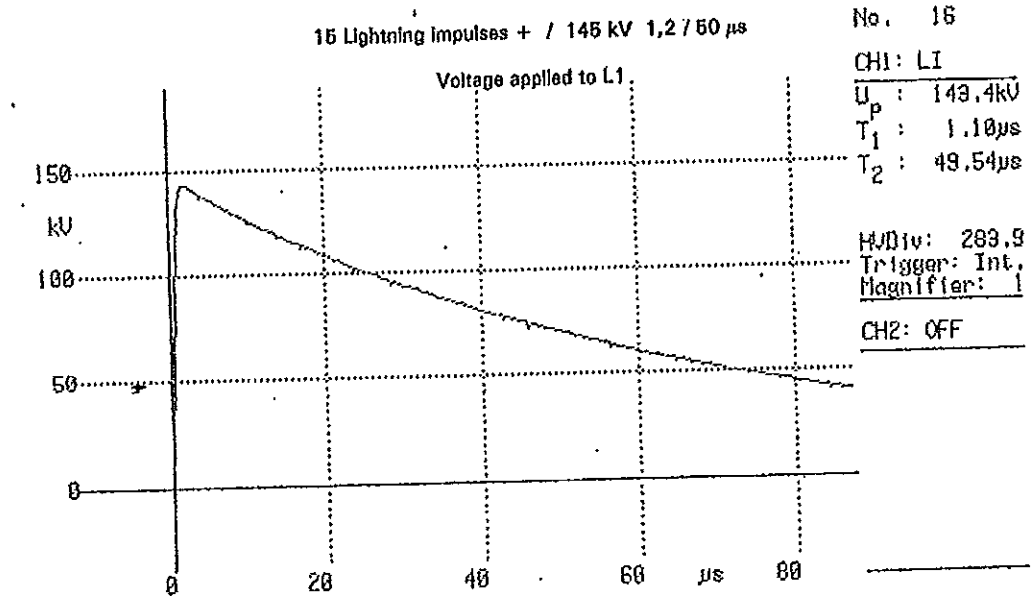


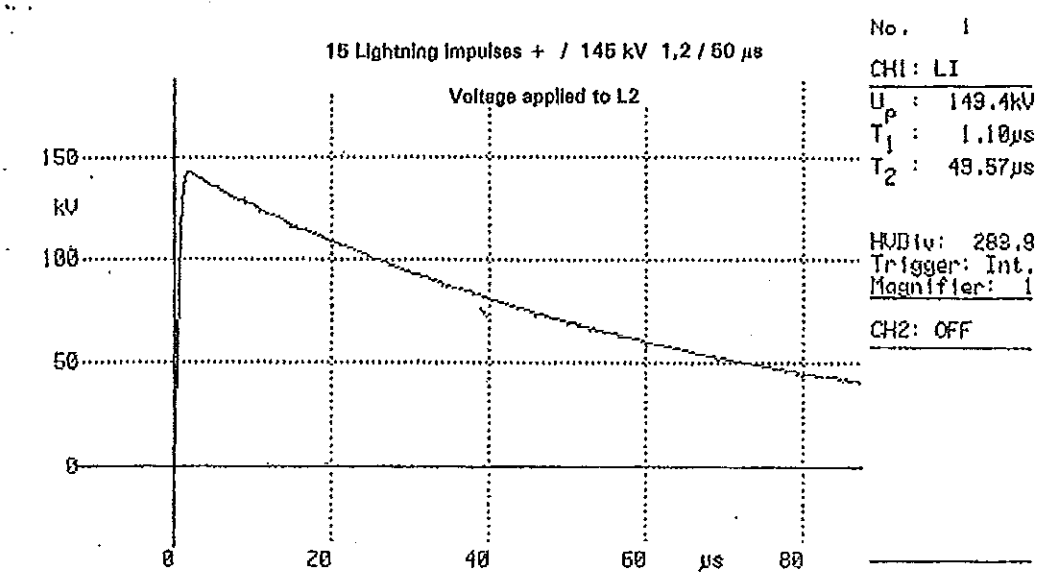


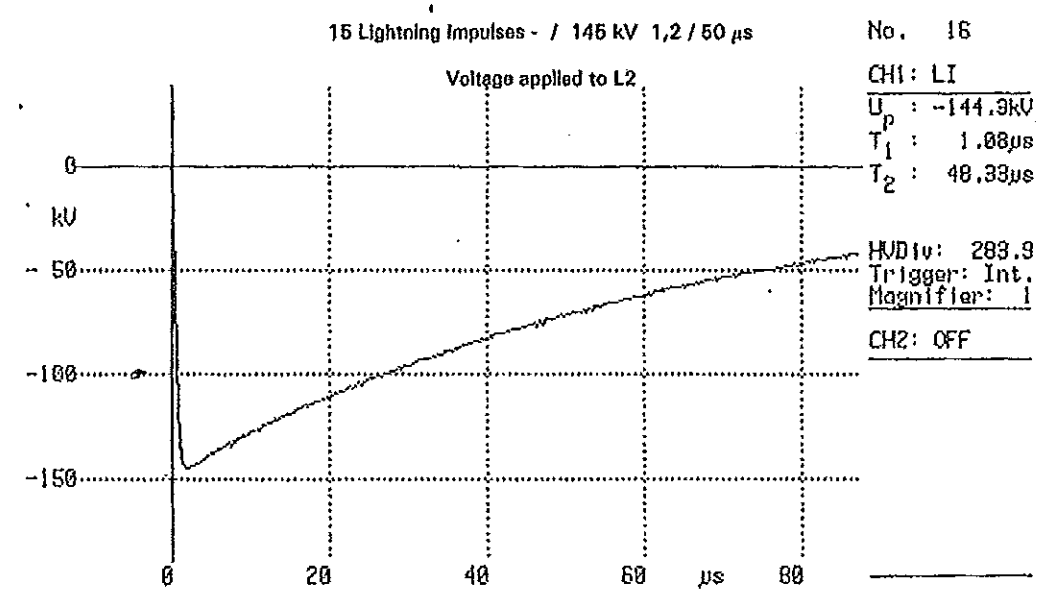

15 Lightning Impulses + / 145 kV 1,2 / 50 µs
Voltage applied to L3
150
kV
100
50
0
0
20
40
60
µs
80
No. 1
CH1: LI
Up : 144.3kV
T1 : 1.12µs
T2 : 46.14µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF


15 Lightning Impulses - / 145 kV 1,2 / 50 µs
Voltage applied to L3
0
kV
- 50
-100
-150
0
20
40
60
µs
80
No. 16
CH1: LI
Up : -144.3kV
T1 : 1.12µs
T2 : 48.24µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF


No. 1
15 Lightning Impulses - / 145 kV 1,2 / 50 µs
Voltage applied to L1
CH1: LI
U_p : -145,2kV
T_1 : 1,08µs
T_2 : 49,36µs
HVDiv: 283,9
Trigger: Int.
Magnifier: 1
CH2: OFF
0
kV
- 50
-100
-150
0
20
40
60
µs
80

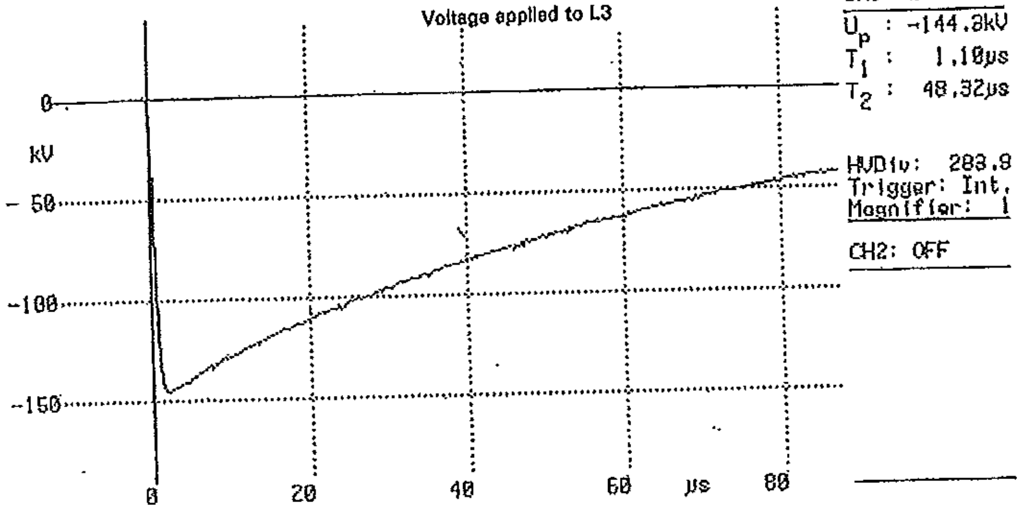

No. 16
15 Lightning Impulses + / 145 kV 1,2 / 50 µs
Voltage applied to L1
CH1: LI
U_p : 143,4kV
T_1 : 1,10µs
T_2 : 49,54µs
HVDiv: 283,9
Trigger: Int.
Magnifier: 1
CH2: OFF
150
kV
100
50
0
0
20
40
60
µs
80


15 Lightning Impulses + / 145 kV 1,2 / 50 µs
Voltage applied to L2
150
kV
100
50
0
0
20
40
60
µs
80
No. 1
CH1: LI
Up : 149.4kV
T1 : 1.10µs
T2 : 49.57µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF


15 Lightning Impulses - / 145 kV 1,2 / 50 µs
Voltage applied to L2
0
kV
-50
-100
-150
0
20
40
60
µs
80
No. 16
CH1: LI
Up : -144.9kV
T1 : 1.08µs
T2 : 48.33µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF

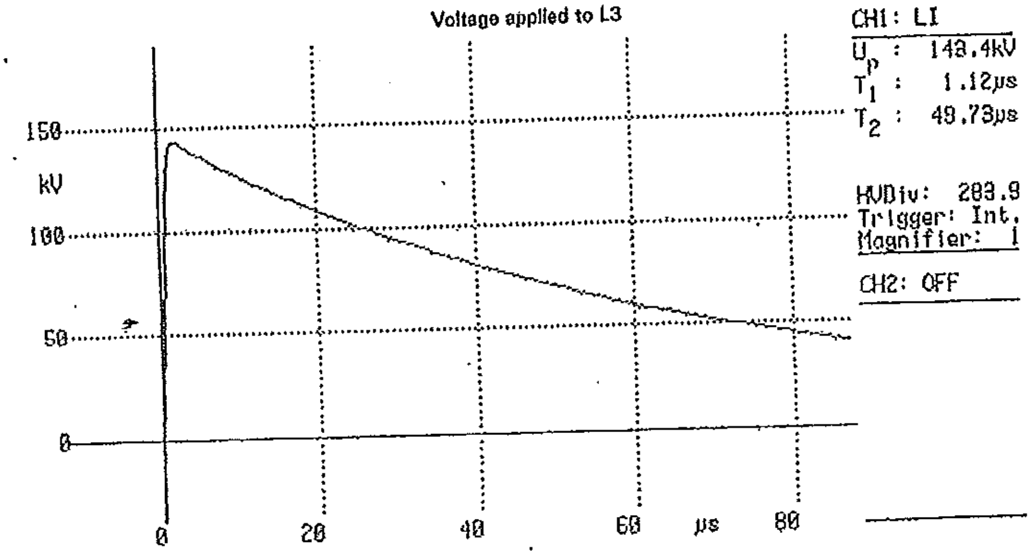
15 Lightning Impulses - / 145 kV 1,2 / 50 µs

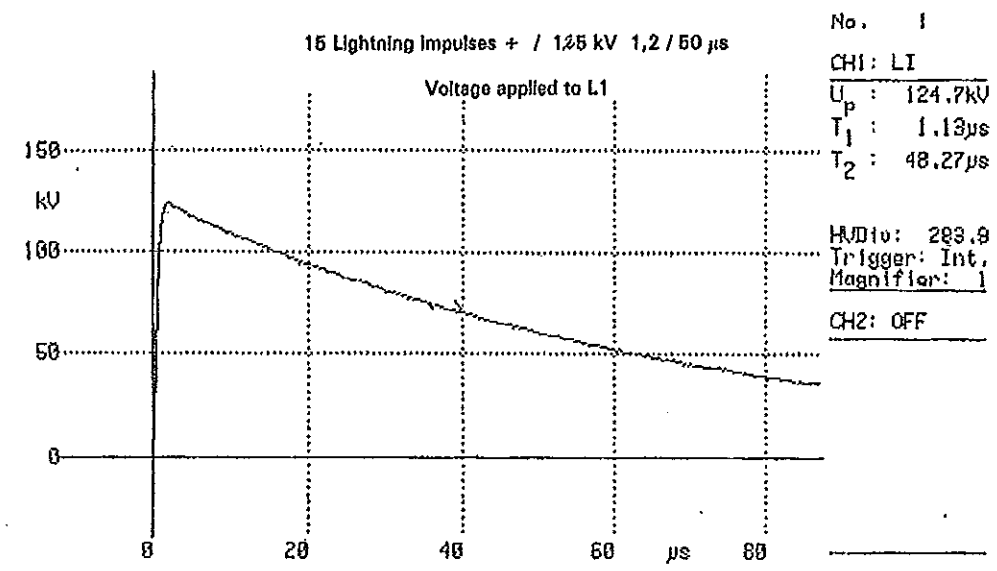
Voltage applied to L3

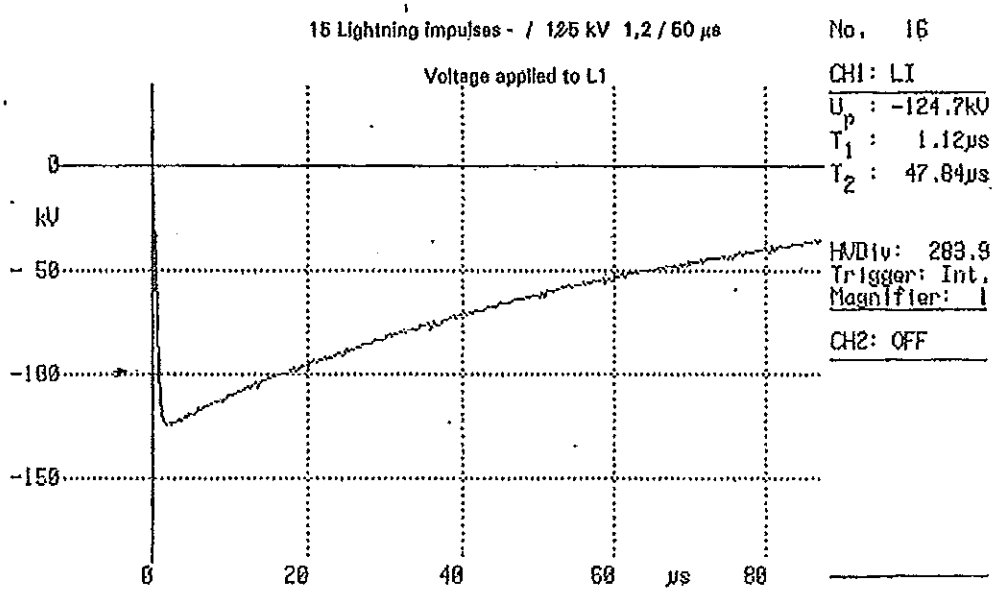


15 Lightning Impulses + / 145 kV 1,2 / 50 µs

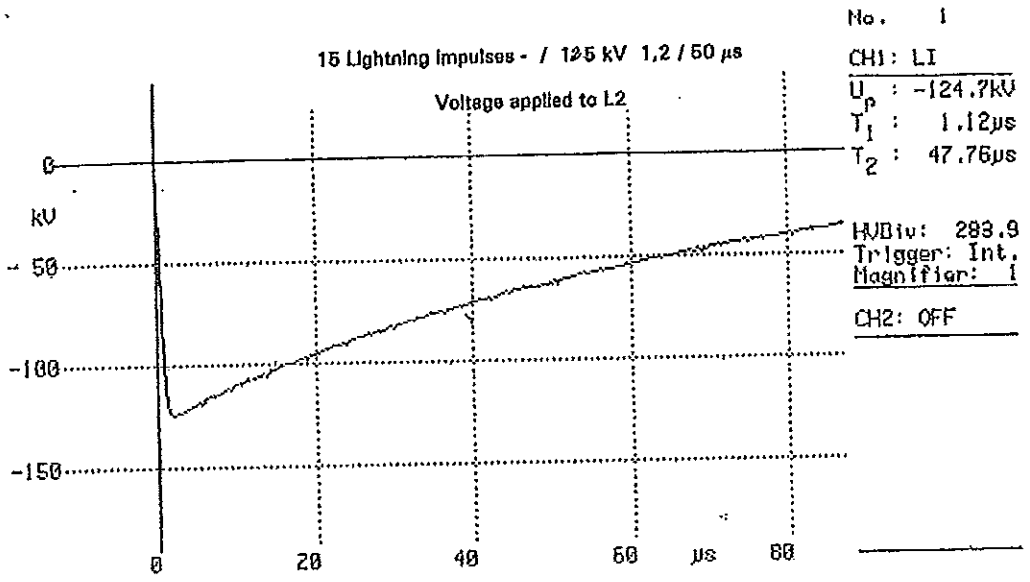
Voltage applied to L3

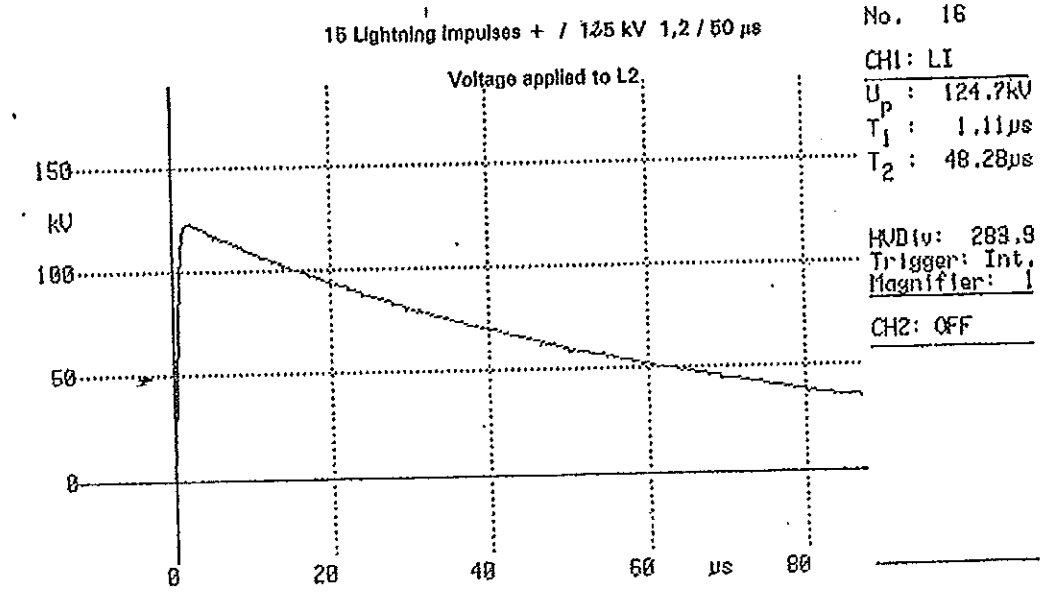


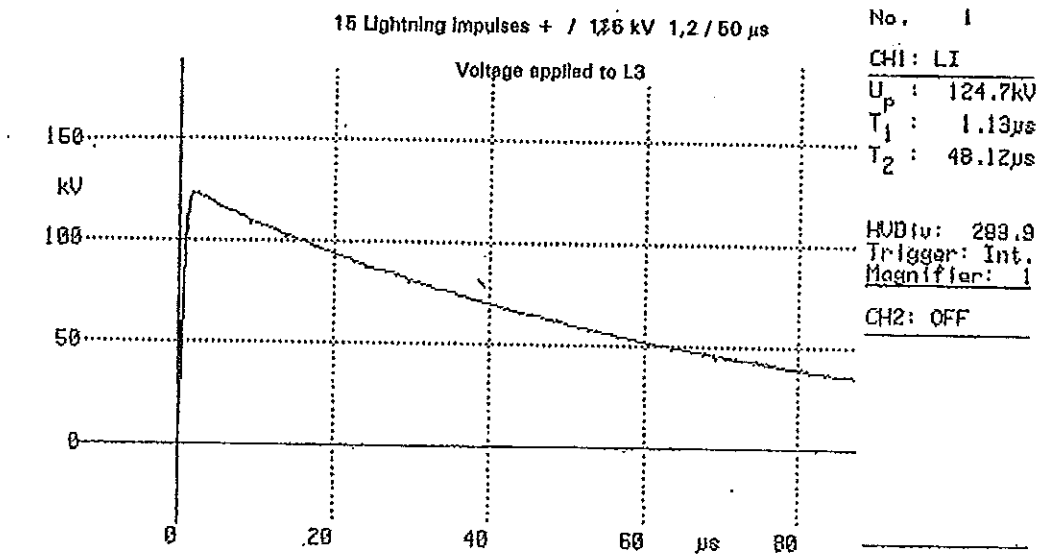

15 Lightning Impulses + / 125 kV 1,2 / 50 µs
Voltage applied to L1
No. 1
CH1: LI
Up : 124.7kV
T1 : 1.13µs
T2 : 48.27µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF
150
kV
100
50
0
0
20
40
60
µs
80

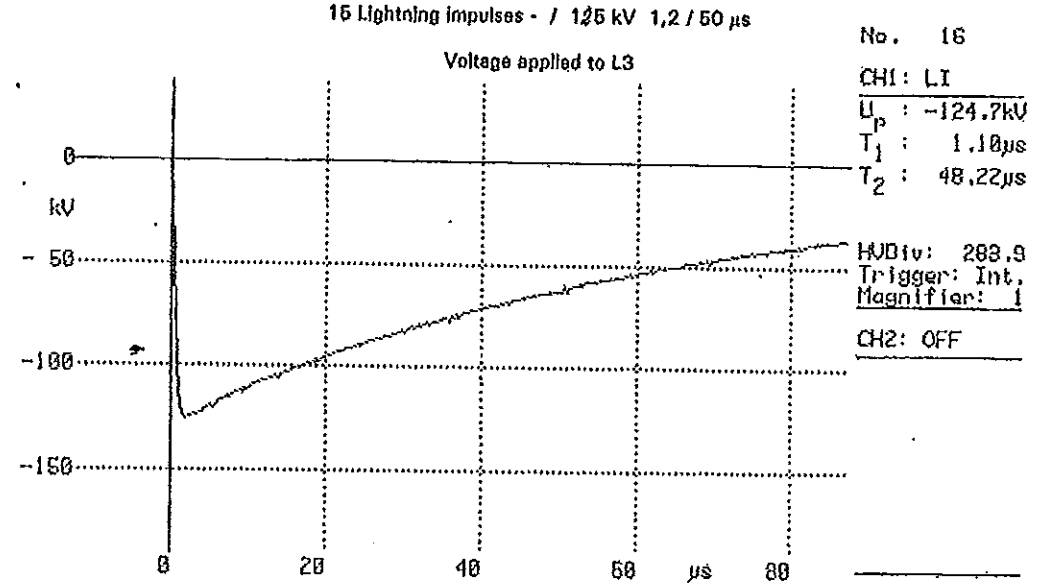

15 Lightning Impulses - / 125 kV 1,2 / 50 µs
Voltage applied to L1
No. 16
CH1: LI
Up : -124.7kV
T1 : 1.12µs
T2 : 47.84µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF
0
kV
- 50
-100
-150
0
20
40
60
µs
80

RETURNED


15 Lightning Impulses - / 125 kV 1,2 / 50 µs
Voltage applied to L2
No. 1
CH1: LI
Up : -124.7kV
T1 : 1.12µs
T2 : 47.76µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF
0
kV
-50
-100
-150
0
20
40
60
µs
80


15 Lightning Impulses + / 125 kV 1,2 / 50 µs
Voltage applied to L2
No. 16
CH1: LI
Up : 124.7kV
T1 : 1.11µs
T2 : 48.28µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF
150
kV
100
50
0
0
20
40
60
µs
80


15 Lightning impulses + / 125 kV 1,2 / 50 µs
Voltage applied to L3
150
kV
100
50
0
0
20
40
60
µs
80
No. 1
CH1: LI
Up : 124.7kV
T1 : 1.13µs
T2 : 48.12µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF


15 Lightning impulses - / 125 kV 1,2 / 50 µs
Voltage applied to L3
0
kV
- 50
-100
-150
0
20
40
60
µs
80
No. 16
CH1: LI
Up : -124.7kV
T1 : 1.10µs
T2 : 48.22µs
HVDiv: 283.9
Trigger: Int.
Magnifier: 1
CH2: OFF

EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

TEST REPORT
No. MT983086

Prefabricated panel Fluofix GC with SF6 three position switch disconnector ISFG

Mechanical Tests

Test regulations applied:

IEC 129 (1984)
IEC 265-1 (1983)
IEC 694 (1980)

Tests results:

The prefabricated panel Fluofix GC passed the Tests.

Date of tests: 3 to 8 October, 1998.

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

1 - TECHNICAL DATA

SF6 rotary three position switch disconnector

Type: ISFG
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Breaking capacity:
- Active charge: 630 A
- No-load transformer: 1250 kVA
- No-load cables: 16 A

Closing capacity: 63 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated peak withstand current: 40 kAp
Rated frequency: 50 Hz
SF6 pressure (20 °C): 0.3 bar rel.

Command

Type: CI1
Command with a motor kit, 110 Vdc type CI1M.

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Division.

3 - CLIENT

-

4 - TEST PERFORMED

4.1 - Service position

Mechanical operation test with 1000 close / open operations.

No of operating sequences	Control Voltage	Operating sequence
900	rated	C - 15s – O - 15s
50	minimum (85 % Un)	
50	maximum (110 % Un)	

Total:	1000

4.2 - Earth position

1000 close / open manual operations.

4.3 - Fuse holder

25 introduction / extraction manual operations.

4.4 - Measure of the resistance of the main circuit under 100 Adc

5 - TEST CONDITIONS

6 - TESTS RESULTS

No of operating sequences	0	1000
Pole A (μΩ)	34	33
Pole B (μΩ)	32	30
Pole C (μΩ)	31	31

During the 1000 operating cycles no malfunction as been detected in the switch disconnector.

EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

TEST REPORT
No. MT983088

Ring Main Unit Fluofix GC with SF6 three position switch disconnector type ISFG

Gas tightness test

Test regulations applied:

IEC 298 (1990).

Tests results:

The Ring Main Unit Fluofix GC passed the Tests.

Date of tests: 16th and 18th September, 3rd and 8th of October 1998

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

1 - TECHNICAL DATA OF SWITCHGEAR

Ring Main Unit

Type: Fluofix GC
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Rated peak withstand current: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated frequency: 50 Hz
Sealed pressure system
SF6 pressure (20 °C): 0.3bar rel.

With SF6 rotary three position switch disconnector

Type: ISFG
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Breaking capacity:
- Active charge: 630 A
- No-load transformer: 1250 kVA
- No-load cables: 16 A

Closing capacity: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated peak withstand current: 40 kAp
Rated frequency: 50 Hz

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Division

3 - TEST PERFORMED

Gas tightness test.
SF6 gas cumulative leakage measurement.

4 - TEST CONDITIONS

Service gas: sulphur hexafluoride (SF6)
Test gas: SF6
SF6 pressure: 0.3bar (rated)
Meter type: electron capture detector with H type sinter capable of the following sensitivities:
For SF6 gas sniffing test: 1 $x10^{-8}$ cm^3 / s
For SF6 gas cumulative leakage measurement: 0,01 ppm

The Fluofix GC main structure is a common welded steel tank, filled with sulphur hexafluoride (SF6) at 0.3 bar relative. Inside the tank are located the ISFG three-position switch disconnectors and the busbars.
According to IEC test regulation 298 annex GG, the following calculations were made:

Concerning formulae:

$$T = \frac{(Pr - Pm)*Vol}{Fp*365*24*60*60} \text{ years} \qquad Fp = \frac{(Pr - Pm)*Vol}{T} \text{ bar.cm}^3/\text{s}$$

$$Frel = \frac{Fp*365*24*60*60*100}{(Pr+1)*Vol} \text{ \%/year} \qquad Frel = \frac{(Pr - Pm)*100}{(Pr+1)*T} \text{ \%/year}$$

Where Pr (rated filling pressure) = 0,3 bar
Pm (minimum functional pressure) = 0,1 bar

For each Fluofix GC configuration, the values of the maximum permissible leakage rate (Fp) and relative leakage rate (Frel) were calculated for an estimated lifespan (T) of 30 years:

Fluofix GC Configuration	Fluofix SF6 volume (cm^3)	Fp ($bar*cm^3/s$)	Frel (%/year)
2IS + 1CIS	426,5 $x10^3$	9,0 $x10^{-5}$	0,51
2IS	261,7 $x10^3$	5,5 $x10^{-5}$	0,51
3IS + 1CIS	557,4 $x10^3$	1,2 $x10^{-4}$	0,51
2IS + 2CIS	591,4 $x10^3$	1,3 $x10^{-4}$	0,51
3IS	392,5 $x10^3$	8,3 $x10^{-5}$	0,51
1IS + 1CIS	261,7 $x10^3$	5,5 $x10^{-5}$	0,51

The SF6 gas-sniffing test would use the values of Fp for each of the Fluofix GC functions but for added security, the pass/fail level was lowered to 1,0 $x10^{-6}$ $bar*cm^3/s$.
For the new value of Fp, the estimated lifespan and relative leakage rate of each Fluofix GC configuration were calculated:

Fp = 1,0 $x10^{-6}$ $bar*cm^3/s$

Fluofix GC Configuration	Fluofix SF6 volume (cm^3)	Estimated lifespan (years)	Frel (%/year)
2IS + 1CIS	426,5 $x10^3$	2704	0.006
2IS	261,7 $x10^3$	1660	0.009
3IS + 1CIS	557,4 $x10^3$	3535	0.004
2IS + 2CIS	591,4 $x10^3$	3751	0.004
3IS	392,5 $x10^3$	2489	0.006
1IS + 1CIS	261,7 $x10^3$	1660	0.009

For the SF6 gas cumulative leakage measurement over a determined test time, it was used a gas tight flexible housing (see drawing on page 5) and the formula:

$$C = \frac{Fp * Tt * Po}{V1 - V2} \quad (ppm)$$

Where Tt is the cumulative leakage measurement test time (s)
Po is the atmospheric pressure value (bar)
V1 is the gas tight housing volume (cm^3)
V2 is the Fluofix GC volume (cm^3)

In order to obtain expected values within the measurable range, the test time was set to 9 hours (32400s), thus obtaining the following acceptance criteria:

Fluofix GC Configuration	Housing volume V1 (cm^3)	Fluofix volume V2 (cm^3)	Maximum admissible concentration C (ppm)
2IS + 1CIS	756,5 x10^3	426,5 x10^3	0,10
2IS	464,2 x10^3	261,7 x10^3	0,16
3IS + 1CIS	988,7 x10^3	557,4 x10^3	0,08
2IS + 2CIS	1049,0 x10^3	591,4 x10^3	0,07
3IS	696,2 x10^3	392,5 x10^3	0,11
1IS + 1CIS	464,2 x10^3	261,7 x10^3	0,16

As the maximum admissible concentration C has no great discrepancies, the mean value of C was calculated and used (C = 0,1 ppm).

5 - TESTS RESULTS

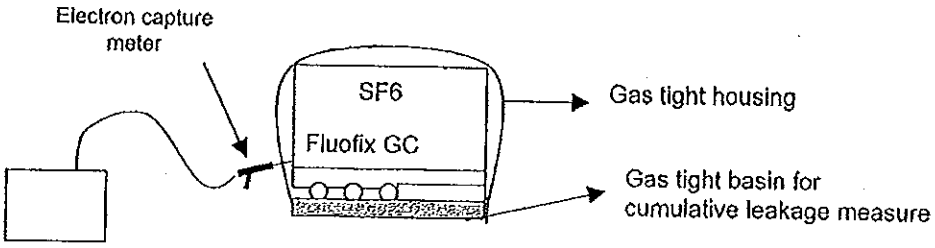
Cumulative leakage test:

SF6 gas leakage measurement:

Fluofix GC configuration	Test date	Test start time	Test finish time	C1 - start (ppm)	C2 - finish (ppm)
2IS + 1CIS	98.09.16	08:15	17:15	0.00	0.04
2IS	98.09.16	08:10	17:10	0.01	0.06
3IS + 1CIS	98.09.18	08:20	17:20	0.00	0.03
2IS + 2CIS	98.09.21	09:00	18:00	0.01	0.04
3IS	98.10.02	08:30	17:30	0.02	0.07
1IS + 1CIS	98.10.08	08:00	17:00	0.03	0.08

Fluofix GC Configuration	$\Delta C = C2 - C1$ (ppm)	Acceptance criteria	Test results
2IS + 1CIS	0.04	$\Delta C < 0.1$	Passed
2IS	0.05	$\Delta C < 0.1$	Passed
3IS + 1CIS	0.03	$\Delta C < 0.1$	Passed
2IS + 2CIS	0.03	$\Delta C < 0.1$	Passed
3IS	0.05	$\Delta C < 0.1$	Passed
1IS + 1CIS	0.05	$\Delta C < 0.1$	Passed

Test arrangements for cumulative leakage measurement



EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

TEST REPORT
No. MT983089

Ring Main Unit Fluofix GC with SF6 three position switch disconnector type ISFG

Kinematic Work Chain Test

Test regulations applied:

GE FND003 (1997)

Tests results:

The Ring Main Unit Fluofix GC passed the Tests.

Date of tests: 3rd of September 1998.

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

1 -TECHNICAL DATA OF SWITCHGEAR

Ring Main Unit

Type: Fluofix GC
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Rated peak withstand current: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated frequency: 50 Hz
Service gas: sulphur hexafluoride (SF6)
SF6 pressure (20 °C): 0.3bar rel.

With SF6 rotary three position switch disconnector

Type: ISFG
Serial no.: -
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Breaking capacity:
- Active charge: 630 A
- No-load transformer: 1250 kVA
- No-load cables: 16 A

Closing capacity: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated peak withstand current: 40 kAp
Rated frequency: 50 Hz
Command mechanism type CI1 for line switches
CI2 for transformer feeder switches
See related drawings on pages 4 and 5

2 -MANUFACTURER

EFACEC, Medium Voltage Switchgear Division

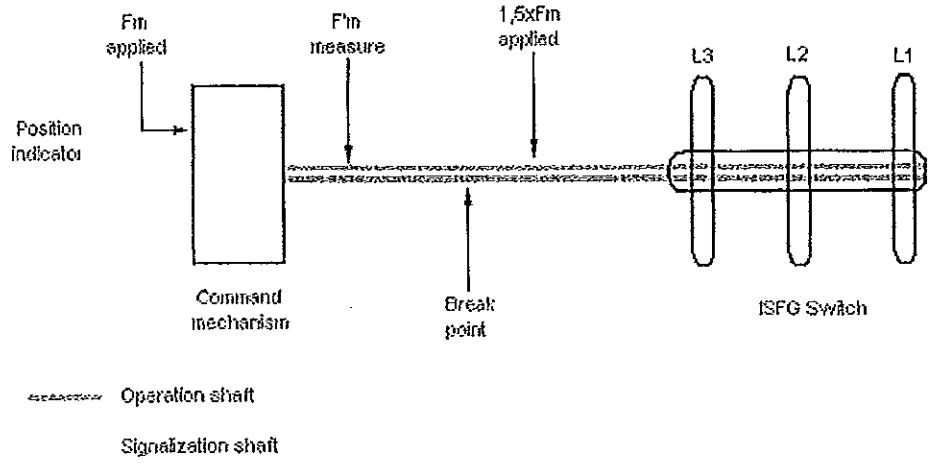
3 -TEST PERFORMED

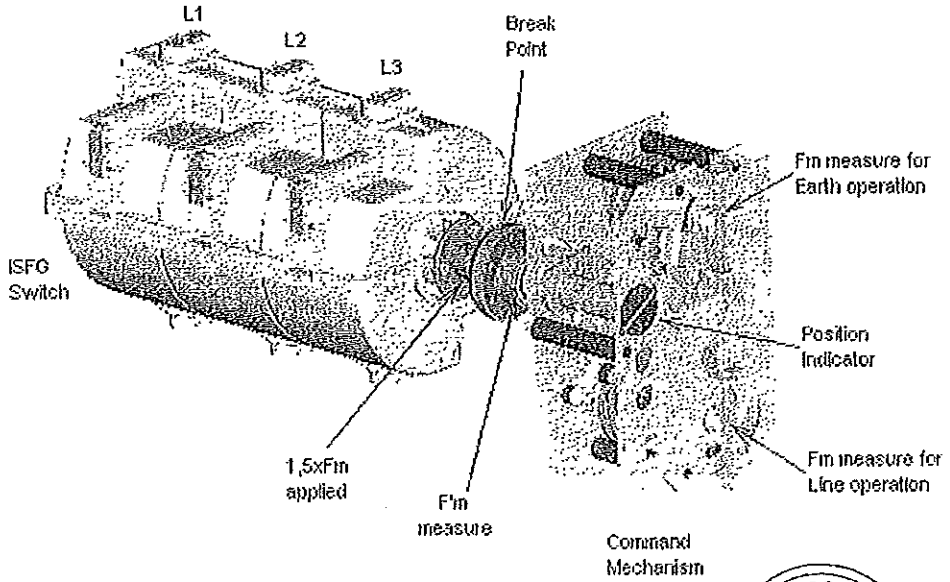
Kinematic work delivery chain force measurement and mechanical blockage resistance.

4 -TEST CONDITIONS

5 -TESTS RESULTS

The Fluofix switch disconnector type ISFG is operated by a CI1 or CI2 type command mechanism through an operation shaft. The position indicator is of the rotative type, goes through the command mechanism and is operated by the main power contacts themselves through an independent signalization shaft. The kinetic work chain is arranged according to the next drawing:





The values of the force applied to the operating mechanism in order to work (Fm) were measured, along with the force delivered by the mechanical strain force limiter built in the command mechanism (F'm).

Operations	Force applied Fm (N/m)	Force delivered F'm (N/m)
Line switch closing	52	36
Line switch opening	54	35
Earth disconnector closing	53	38
Earth disconnector opening	54	36

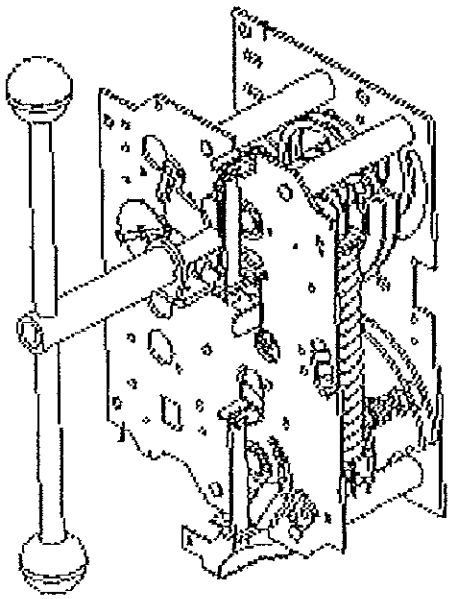
The ISFG switch L1 phase was then blocked and then applied a force 1,5 times greater than Fm

Operations	ISFG position	1,5 x Fm (N/m)
Line switch opening	Line closed and blocked	81
Earth disconnector closing	Earth open and blocked	80

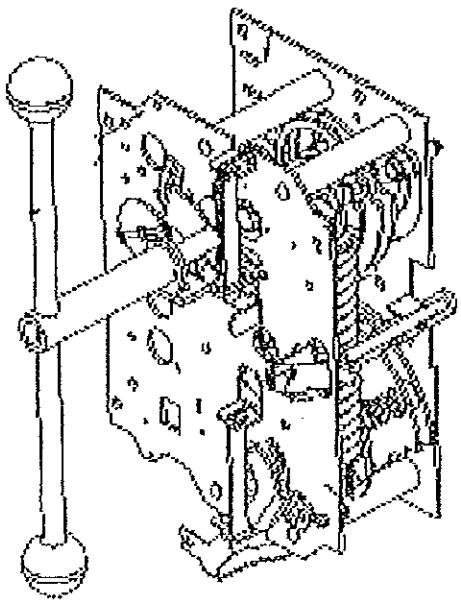
The force delivered by the mechanical strain force limiter (F'm) is of a lower value than the nominal force required to operate the mechanism (Fm) and this force is always less than 750N.

The ISFG switch and the position indicator mechanism withstands a force 1,5 times greater than Fm and there is no visible deformation of the power contacts or operating shaft.

CI1 command mechanism



CI2 command mechanism



Standard and clause	Kind of tests and requirements		Test values Results
8.3.5.2 8.3.6.4 8.3.7.6	**ADDITIONAL SEQUENCE OF SHORT-CIRCUIT OPERATIONS ON FOUR POLE CIRCUIT-BREAKERS**		
	Test made on the same sample as for the three-pole short-circuit or on a new sample	same/new	New
	Rated operational voltage U_e	690 V	
	Test voltage	$U_e/\sqrt{3}$	398 V
	Recovery voltage	1.05 x $U_e/\sqrt{3}$	418 V
	Rated ultimate short-circuit breaking capacity I_{cu}	25,2 kA	
	Rated short-time withstand current I_{cw}	19.2 kA	
	Short-circuit breaking capacity of the fourth pole (by arrangement) (not less than 60 % of I_{cu} or I_{cw} as applicable)		39 kA
Table 11	Power factor	0.25	0.25(+0,-0,05)
	Frequency	50 Hz	50 Hz
8.3.2.1	Control supply voltage	0.85 x U_s /. V	/. V
7.2.1.1.3	Maximum value of the closing time		/. ms
	Sequence of operation	O - t - CO	O - t - CO
	Circuit diagram		Page 66
	Calibration of the test circuit	Pageform 169	Next page
	Safety area	Pageform	Page 65
	Installation of the material tested	Pageform	Page 64
	Energization direction	Top/Bottom	Top
60947-1 Table 9, 10 and 11	Cabling characteristics		
	Cable	/. mm^2	/. mm^2
	Bar	/. x /. mm	100 x 10 mm
	Number	/.	1
	Length supply side	/. mm	500 mm
	load side	/. mm	500 mm
	Tightening torque		50 Nm

Standard and clause	Kind of tests and requirements		Test values Results
60947-1 8.3.4.1.5	**CALIBRATION OF THE TEST CRCUIT**		
	Oscillogram		20040283-0119 20040283-0122
	Applied voltage		448.56 V
	Frequency	50 Hz	50 Hz
	RMS current value at 20 ms	I_1 I_2 I_3	26.46 kA ./. kA ./. kA
	Average RMS. Value		26.46 kA
	Peak current maximum value		56.23 kA
	Power factor		0,2

Type test according to: IEC 60947-2, Test sequence III | Type: NS630bH to 1600H, Sample 31042.08

Standard and clause	Kind of tests and requirements		Test values Results
	OPERATION "O"		
	Oscillogram		20040283.0123
	Peak current value	i_1	54.67 kA
		I_2	./. kA
		I_3	./. kA
	Maximum total duration		19 ms
	Recovery voltage (phase to phase or phase to neutral)	$U_{r(1-2)}$ ☐ or $U_{r(1-N)}$ ☒	432.12 V
		$U_{r(2-3)}$ ☐ or $U_{r(2-N)}$ ☐	./. V
		$U_{r(3-1)}$ ☐ or $U_{r(3-N)}$ ☐	./. V
	Average value	U_{rm}	432.12 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.08
	Joule integral	Ph_1	19.5 $(kA)^2s$
		Ph_2	./. $(kA)^2s$
		Ph_3	./. $(kA)^2s$
	Melting of the fusible element	Yes/No	No
	Holes in the PE-sheet (if applicable)	Yes/No	No
	Cracks observed	Yes/No	No
	If Yes		Page ./.
	Time interval between operations	3 min	4 min
	OPERATION "CO1"		
	Oscillogram		20040283.0124
	Applied voltage		435.05 V
	Peak current value	i_1	53.75 kA
		I_2	./. kA
		I_3	./. kA
	Maximum total duration		18.05 ms
	Recovery voltage (phase to phase or phase to neutral)	$U_{r(1-2)}$ ☐ or $U_{r(1-N)}$ ☒	434.56 V
		$U_{r(2-3)}$ ☐ or $U_{r(2-N)}$ ☐	./. V
		$U_{r(3-1)}$ ☐ or $U_{r(3-N)}$ ☐	./. V
	Average value	U_{rm}	434.56 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.09
	Joule integral	Ph_1	18.72 $(kA)^2s$
		Ph_2	./. $(kA)^2s$
		Ph_3	./. $(kA)^2s$
7.2.1.1.3	Closing operation time		./. ms
	Melting of the fusible element	Yes/No	No
	Cracks observed	Yes/No	No
	if Yes		Page ./.

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF DIELECTRIC WITHSTAND		
	Test voltage		
	2 x U_e, min. 1000 V	1380 V	
8.3.3.5	Test sequence I		
8.3.4.3	Test sequence II		
8.3.5.3	Test sequence III		1380 V
8.3.6.5	Test sequence IV		
8.3.7.3	Test sequence V, stage 1		
8.3.7.7	Test sequence V, stage 2		
8.3.8.5	Combined test sequence		
B.10.3.1	Test sequence B.II		
A.5	Verification of discrimination		
A.6.3	Verification of back-up protection		
C.3	Individual pole short-circuit test sequence		
H.3	Test sequence for circuit-breakers for IT-systems		
8.3.3.2.2 a)	Application of the test voltage -Main circuit of the circuit-breaker -Isolating contacts of the withdrawable unit (if applicable)		
	Test duration	5 s	5 s

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF LEAKAGE CURRENT		
	For circuit-breakers suitable for isolation having an operational voltage U_e greater than 50 V.		
8.3.3.2	**- Main circuit of the circuit-breaker** **- Isolating contacts of a withdrawable unit (if applicable)**		
	Test voltage	1.1 x U_e =759 V	759 V
60947-1 7.2.7	Application of the test voltage		
	Leakage current		
8.3.3.2	Test sequence I (in new condition)	≤ 0.5 mA	./. mA
8.3.3.5	Test sequence I (after overload performance)	≤ 2 mA	./. mA
8.3.4.3	Test sequence II	≤ 2 mA	./. mA
8.3.5.3	Test sequence III	≤ 6 mA	0 mA
8.3.6.5	Test sequence IV	≤ 2 mA	./. mA
8.3.7.3	Test sequence V, stage 1	≤ 2 mA	./. mA
8.3.7.7	Test sequence V, stage 2	≤ 6 mA	./. mA
8.3.8.5	Combined test sequence	≤ 2 mA	./. mA
C.3	Individual pole short-circuit test sequence I_{su}	≤ 6 mA	./. mA
H.3	Individual pole short-circuit test sequence I_{IT}	≤ 6 mA	./. mA

Type test according to: IEC 60947-2
Test sequence III

Type: NS630bH to 1600H
Sample 31042.08

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm²	./. mm²
	Bar		100 x 5 mm	100 x 10 mm
	Number		2	1
	Length		./. mm	500 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			21.3 °C
	Correction factor (k = 1 for releases independent of ambient temperature)		k	1
	Current setting value		I_n	1600 A
	Test current			
	either k x 2.0 x I_n		./. A	./. A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		4000 A	4000 A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	126 s
		Ph1	≤ 270 s	131 s
		Ph2	≤ ./. s	./. s
		Ph3	≤ ./. s	./. s

Type test according to: IEC 60947-2, Test sequence III | Type: NS630bH to 1600H, Sample 31042.09

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY		
60947-1 Table 9, 10 and 11	Cabling characteristics	./. mm^2	./. mm^2
	Cable	100 x 5 mm	100 x 10 mm
	Bar	2	1
	Number	./. mm	500 mm
	Length		50 Nm
	Tightening torque		
	Reference temperature	40 °C ± 2 °C	22.5 °C
	Ambient temperature		1
	Correction factor (k = 1 for releases independent of ambient temperature)	k	1600 A
	Current setting value	I_n	
	Test current		
	either k x 2.0 x I_n	3200 A	3200 A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1	
8.3.5.1	Test sequence III	before 8.3.5.2	
8.3.6.1	Test sequence IV	before 8.3.6.2	
8.3.6.6	Test sequence IV	after 8.3.6.5	
8.3.7.4	Test sequence V	before 8.3.7.5	
8.3.8.1	Combined test sequence	before 8.3.8.2	
A.5	Verification of discrimination	before 8.3.5.2	
A.6.3	Verification of back-up protection	before 8.3.5.2	
	or k x 2.5 x I_n	./. A	./. A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5	
8.3.5.4	Test sequence III	after 8.3.5.3	
8.3.7.8	Test sequence V	after 8.3.7.7	
8.3.8.7	Combined test sequence	after 8.3.8.6	
A.5	Verification of discrimination	after 8.3.5.3	
A.6.3	Verification of back-up protection	after 8.3.5.3	
C.4	Individual pole short-circuit test sequence		
H.4	Test sequence for circuit-breakers for IT-systems		
	Tripping time (for twice the value of current setting on single pole)		
	Neutral	≤ 270 s	237 s
	Ph_1	≤ 270 s	228 s
	Ph_2	≤ 270 s	221 s
	Ph_3	≤ 270 s	235 s

Standard and clause	Kind of tests and requirements			Test values Results
8.3.5.2	**RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY**			
	Utilization category		B	
	Rated operational voltage U_e		415 V	
	Recovery voltage		1.05 x U_e	435.75 V
	Rated ultimate short-circuit breaking capacity		I_{cu}	70 kA
	Rated short-circuit making capacity		I_{cm}	154 kA
Table 11	Power factor		0.20	0.20
	Frequency		50 Hz	50 Hz
8.3.2.1	Control supply voltage		0.85 x U_s ./. V	./. V
7.2.1.1.3	Maximum value of the closing time			./. ms
	Sequence of operation		O - t - CO	O - t - CO
	Circuit diagram			Page 66
	Calibration of the test circuit		Pageform	Next page
	Safety area		Pageform	Page 65
	Installation of the material tested		Pageform	Page 64
	Energization direction		Top/Bottom	Top
8.3.2.1	Smallest individual enclosure (if applicable)			
	Type			./.
	Kind of material			./.
	Inside dimensions			
	Height			./. mm
	Width			./. mm
	Depth			./. mm
60947-1	Cabling characteristics			
Table 9, 10	Cable		./. mm²	./. mm²
and 11	Bar		100 x 5 mm	100 x 10 mm
	Number		2	1
	Length	supply side	./. mm	350 mm
		load side	./. mm	350 mm
	Tightening torque			50 Nm

Type test according to: IEC 60947-2
Test sequence III

Type: NS630bH to 1600H
Sample 31042.09

Standard and clause	Kind of tests and requirements		Test values Results
60947-1 8.3.4.1.5	**CALIBRATION OF THE TEST CRCUIT**		
	Oscillogram		20040288-0003 20040288-0007
	Applied voltage		440.17 V
	Frequency	50 Hz	50 Hz
	RMS current value at 20 ms	I_1 I_2 I_3	70.21 kA 70.99 kA 69.51 kA
	Average RMS. Value		70.23 kA
	Peak current maximum value		156.12 kA
	Power factor		0,17

Type test according to: IEC 60947-2, Test sequence III | Type: NS630bH to 1600H, Sample 31042.09

Standard and clause	Kind of tests and requirements		Test values Results
	OPERATION "O"		
	Oscillogram		20040288.0011
	Peak current value	i_1	123.58 kA
		I_2	111.73 kA
		I_3	66.26 kA
	Maximum total duration		12.8 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	443.07 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	443.15 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	443.16 V
	Average value	U_{rm}	443.13 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.06
	Joule integral	Ph_1	74.45 $(kA)^2s$
		Ph_2	63.58 $(kA)^2s$
		Ph_3	18.06 $(kA)^2s$
	Melting of the fusible element	Yes/No	No
	Holes in the PE-sheet (if applicable)	Yes/No	No
	Cracks observed	Yes/No	No
	If Yes		Page ./.
	Time interval between operations	3 min	3 min
	OPERATION "CO1"		
	Oscillogram		20040288.0012
	Applied voltage		450.46 V
	Peak current value	I_1	118.6 kA
		I_2	114.5 kA
		I_3	65.68 kA
	Maximum total duration		13.6 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	444.72 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	445.21 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	443.97 V
	Average value	U_{rm}	444.63 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.07
	Joule integral	Ph_1	67.25 $(kA)^2s$
		Ph_2	67.14 $(kA)^2s$
		Ph_3	20.07 $(kA)^2s$
7.2.1.1.3	Closing operation time		./. ms
	Melting of the fusible element	Yes/No	No
	Cracks observed	Yes/No	No
	If Yes		Page ./.

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF DIELECTRIC WITHSTAND		
	Test voltage		
	2 x U_e, min. 1000 V	1000 V	
8.3.3.5	Test sequence I		
8.3.4.3	Test sequence II		1000 V
8.3.5.3	Test sequence III		
8.3.6.5	Test sequence IV		
8.3.7.3	Test sequence V, stage 1		
8.3.7.7	Test sequence V, stage 2		
8.3.8.5	Combined test sequence		
B.10.3.1	Test sequence B.II		
A.5	Verification of discrimination		
A.6.3	Verification of back-up protection		
C.3	Individual pole short-circuit test sequence		
H.3	Test sequence for circuit-breakers for IT-systems		
8.3.3.2.2 a)	Application of the test voltage -Main circuit of the circuit-breaker -Isolating contacts of the withdrawable unit (if applicable)		
	Test duration	5 s	5 s

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF LEAKAGE CURRENT		
	For circuit-breakers suitable for isolation having an operational voltage U_e greater than 50 V.		
8.3.3.2	**- Main circuit of the circuit-breaker** **- Isolating contacts of a withdrawable unit (if applicable)**		
	Test voltage	1.1 x U_e =457 V	457 V
60947-1 7.2.7	Application of the test voltage		
	Leakage current		
8.3.3.2	Test sequence I (in new condition)	≤ 0.5 mA	./. mA
8.3.3.5	Test sequence I (after overload performance)	≤ 2 mA	./. mA
8.3.4.3	Test sequence II	≤ 2 mA	./. mA
8.3.5.3	Test sequence III	≤ 6 mA	0.08 mA
8.3.6.5	Test sequence IV	≤ 2 mA	./. mA
8.3.7.3	Test sequence V, stage 1	≤ 2 mA	./. mA
8.3.7.7	Test sequence V, stage 2	≤ 6 mA	./. mA
8.3.8.5	Combined test sequence	≤ 2 mA	./. mA
C.3	Individual pole short-circuit test sequence I_{su}	≤ 6 mA	./. mA
H.3	Individual pole short-circuit test sequence I_{tr}	≤ 6 mA	./. mA

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY		
60947-1 Table 9, 10 and 11	Cabling characteristics	./. mm^2	./. mm^2
	Cable	100 x 5 mm	100 x 5 mm
	Bar	2	2
	Number	./. mm	500 mm
	Length		50 Nm
	Tightening torque		
	Reference temperature	40 °C ± 2 °C	18.4 °C
	Ambient temperature		1
	Correction factor (k = 1 for releases independent of ambient temperature)	k	1600 A
	Current setting value	I_n	
	Test current		
	either k x 2.0 x I_n	./. A	./. A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1	
8.3.5.1	Test sequence III	before 8.3.5.2	
8.3.6.1	Test sequence IV	before 8.3.6.2	
8.3.6.6	Test sequence IV	after 8.3.6.5	
8.3.7.4	Test sequence V	before 8.3.7.5	
8.3.8.1	Combined test sequence	before 8.3.8.2	
A.5	Verification of discrimination	before 8.3.5.2	
A.6.3	Verification of back-up protection	before 8.3.5.2	
	or k x 2.5 x I_n	4000 A	4000 A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5	
8.3.5.4	Test sequence III	after 8.3.5.3	
8.3.7.8	Test sequence V	after 8.3.7.7	
8.3.8.7	Combined test sequence	after 8.3.8.6	
A.5	Verification of discrimination	after 8.3.5.3	
A.6.3	Verification of back-up protection	after 8.3.5.3	
C.4	Individual pole short-circuit test sequence		
H.4	Test sequence for circuit-breakers for IT-systems		
	Tripping time (for twice the value of current setting on single pole)		
	Neutral	≤ 270 s	124 s
	Ph_1	≤ 270 s	130 s
	Ph_2	≤ 270 s	128 s
	Ph_3	≤ 270 s	126 s

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm^2	185 mm^2
	Bar		40 x 5 mm	./. x ./. mm
	Number		2	1
	Length		./. mm	500 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			22 °C
	Correction factor (k = 1 for releases Independent of ambient temperature)		k	1
	Current setting value		I_n	630*0.4=252A
	Test current			
	either k x 2.0 x I_n		504 A	504 A
8.3.5.1	Test sequence II (I_{cs} = I_{cu})	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		./. A	./. A
8.3.5.4	Test sequence II (I_{cs} = I_{cu})	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	207 s
		Ph_1	≤ 270 s	212 s
		Ph_2	≤ 270 s	225 s
		Ph_3	≤ 270 s	217 s

Type test according to: IEC 60947-2 Test sequence III | Type: NS630bH to 1600H Sample 31042.10

Standard and clause	Kind of tests and requirements		Test values Results
8.3.5.2	**RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY**		
	Utilization category	B	
	Rated operational voltage U_e	415 V	
	Recovery voltage	1.05 x U_e	435.75 V
	Rated ultimate short-circuit breaking capacity	I_{cu}	70 kA
	Rated short-circuit making capacity	I_{cm}	154 kA
Table 11	Power factor	0,20	0.20(+0,-0,05)
	Frequency	50 Hz	50 Hz
8.3.2.1	Control supply voltage	0.85 x U_s ./. V	./. V
7.2.1.1.3	Maximum value of the closing time		./. ms
	Sequence of operation	O - t - CO	O - t - CO
	Circuit diagram		Page 66
	Calibration of the test circuit	Pageform	Next page
	Safety area	Pageform	Page 65
	Installation of the material tested	Pageform	Page 64
	Energization direction	Top/Bottom	Top
8.3.2.1	Smallest individual enclosure (if applicable)		
	Type		./.
	Kind of material		./.
	Inside dimensions		
	Height		./. mm
	Width		./. mm
	Depth		./. mm
60947-1 Table 9, 10 and 11	Cabling characteristics		
	Cable	./. mm^2	./. mm^2
	Bar	40 x 5 mm	40 x 5 mm
	Number	2	2
	Length supply side	./. mm	350 mm
	Length load side	./. mm	350 mm
	Tightening torque		50 Nm

Standard and clause	Kind of tests and requirements		Test values Results
60947-1 8.3.4.1.5	**CALIBRATION OF THE TEST CRCUIT**		
	Oscillogram		20040288-0003 20040288-0007
	Applied voltage		440.17 V
	Frequency	50 Hz	50 Hz
	RMS current value at 20 ms	I_1 I_2 I_3	70.21 kA 70.99 kA 69.51 kA
	Average RMS. Value		70.23 kA
	Peak current maximum value		156.12 kA
	Power factor		0,17

Standard and clause	Kind of tests and requirements		Test values Results
	OPERATION "O"		
	Oscillogram		20040288.0013
	Peak current value	I_1	122.69 kA
		I_2	114.04 kA
		I_3	69.83 kA
	Maximum total duration		13,45 ms
	Recovery voltage (phase to phase or phase to neutral)	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	443.07 V
		$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	443.52 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	443.19 V
	Average value	U_{rm}	443.26 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.06
	Joule integral	Ph_1	75.29 $(kA)^2s$
		Ph_2	67.36 $(kA)^2s$
		Ph_3	20.94 $(kA)^2s$
	Melting of the fusible element	Yes/No	No
	Holes in the PE-sheet (if applicable)	Yes/No	No
	Cracks observed	Yes/No	No
	if Yes		Page ./.
	Time interval between operations	3 min	3 min
	OPERATION "CO1"		
	Oscillogram		20040288.0014
	Applied voltage		448.34 V
	Peak current value	I_1	70.71 kA
		I_2	109.66 kA
		I_3	123.37 kA
	Maximum total duration		14,4 ms
	Recovery voltage (phase to phase or phase to neutral)	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	442.94 V
		$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	442.13 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	442.98 V
	Average value	U_{rm}	442.68 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.06
	Joule integral	Ph_1	27.23 $(kA)^2s$
		Ph_2	49.66 $(kA)^2s$
		Ph_3	79.18 $(kA)^2s$
7.2.1.1.3	Closing operation time		./. ms
	Melting of the fusible element	Yes/No	No
	Cracks observed	Yes/No	No
	if Yes		Page ./.

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF DIELECTRIC WITHSTAND		
	Test voltage		
	2 x U_o, min. 1000 V	1000 V	
8.3.3.5	Test sequence I		
8.3.4.3	Test sequence II		
8.3.5.3	Test sequence III		1000 V
8.3.6.5	Test sequence IV		
8.3.7.3	Test sequence V, stage 1		
8.3.7.7	Test sequence V, stage 2		
8.3.8.5	Combined test sequence		
B.10.3.1	Test sequence B.II		
A.5	Verification of discrimination		
A.6.3	Verification of back-up protection		
C.3	Individual pole short-circuit test sequence		
H.3	Test sequence for circuit-breakers for IT-systems		
8.3.3.2.2 a)	Application of the test voltage -Main circuit of the circuit-breaker -Isolating contacts of the withdrawable unit (if applicable)		
	Test duration	5 s	5 s

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF LEAKAGE CURRENT		
	For circuit-breakers suitable for isolation having an operational voltage U_e greater than 50 V.		
8.3.3.2	**- Main circuit of the circuit-breaker** **- Isolating contacts of a withdrawable unit (if applicable)**		
	Test voltage	1.1 x U_e =457 V	457 V
60947-1 7.2.7	Application of the test voltage		
	Leakage current		
8.3.3.2	Test sequence I (in new condition)	≤ 0.5 mA	./. mA
8.3.3.5	Test sequence I (after overload performance)	≤ 2 mA	./. mA
8.3.4.3	Test sequence II	≤ 2 mA	./. mA
8.3.5.3	Test sequence III	≤ 6 mA	0.05 mA
8.3.6.5	Test sequence IV	≤ 2 mA	./. mA
8.3.7.3	Test sequence V, stage 1	≤ 2 mA	./. mA
8.3.7.7	Test sequence V, stage 2	≤ 6 mA	./. mA
8.3.8.5	Combined test sequence	≤ 2 mA	./. mA
C.3	Individual pole short-circuit test sequence I_{su}	≤ 6 mA	./. mA
H.3	Individual pole short-circuit test sequence I_{IT}	≤ 6 mA	./. mA

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm²	185 mm²
	Bar		40 x 5 mm	./. x ./. mm
	Number		2	1
	Length		./. mm	500 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			20.6 °C
	Correction factor (k = 1 for releases independent of ambient temperature)		k	1
	Current setting value		I_n	630*0.4=252A
	Test current			
	either k x 2.0 x I_n		./. A	./. A
8.3.5.1	Test sequence II (I_{cs} = I_{cu})	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		630 A	630 A
8.3.5.4	Test sequence II (I_{cs} = I_{cu})	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	131 s
		Ph_1	≤ 270 s	136 s
		Ph_2	≤ 270 s	127 s
		Ph_3	≤ 270 s	127 s

Type test according to: IEC 60947-2, Test sequence III | Type: NS630bH to 1600H, Sample 31042.11

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY		
60947-1 Table 9, 10 and 11	Cabling characteristics	./. mm^2	./. mm^2
	Cable	100 x 5 mm	100 x 5 mm
	Bar	2	2
	Number	./. mm	500 mm
	Length		50 Nm
	Tightening torque		
	Reference temperature	40 °C ± 2 °C	22 °C
	Ambient temperature		1
	Correction factor (k = 1 for releases independent of ambient temperature)	k	1600 A
	Current setting value	I_n	
	Test current		
	either k x 2.0 x I_n	3200 A	3200 A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1	
8.3.5.1	Test sequence III	before 8.3.5.2	
8.3.6.1	Test sequence IV	before 8.3.6.2	
8.3.6.6	Test sequence IV	after 8.3.6.5	
8.3.7.4	Test sequence V	before 8.3.7.5	
8.3.8.1	Combined test sequence	before 8.3.8.2	
A.5	Verification of discrimination	before 8.3.5.2	
A.6.3	Verification of back-up protection	before 8.3.5.2	
	or k x 2.5 x I_n	./. A	./. A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5	
8.3.5.4	Test sequence III	after 8.3.5.3	
8.3.7.8	Test sequence V	after 8.3.7.7	
8.3.8.7	Combined test sequence	after 8.3.8.6	
A.5	Verification of discrimination	after 8.3.5.3	
A.6.3	Verification of back-up protection	after 8.3.5.3	
C.4	Individual pole short-circuit test sequence		
H.4	Test sequence for circuit-breakers for IT-systems		
	Tripping time (for twice the value of current setting on single pole)		
	Neutral	≤ 270 s	228 s
	Ph_1	≤ 270 s	204 s
	Ph_2	≤ 270 s	215 s
	Ph_3	≤ 270 s	226 s

Standard and clause	Kind of tests and requirements			Test values Results
8.3.5.2	**RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY**			
	Utilization category		B	
	Rated operational voltage U_e		440 V	
	Recovery voltage		1.05 x U_e	462 V
	Rated ultimate short-circuit breaking capacity		I_{cu}	65 kA
	Rated short-circuit making capacity		I_{cm}	143 kA
Table 11	Power factor		0.20	0.20
	Frequency		50 Hz	50 Hz
8.3.2.1	Control supply voltage		0.85 x U_s ./. V	./. V
7.2.1.1.3	Maximum value of the closing time			./. ms
	Sequence of operation		O - t - CO	O - t - CO
	Circuit diagram			Page 66
	Calibration of the test circuit		Pageform	Next page
	Safety area		Pageform	Page 65
	Installation of the material tested		Pageform	Page 64
	Energization direction		Top/Bottom	Top
8.3.2.1	Smallest individual enclosure (if applicable)			
	Type			./.
	Kind of material			./.
	Inside dimensions			
	Height			./. mm
	Width			./. mm
	Depth			./. mm
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm²	./. mm²
	Bar		100 x 5 mm	100 x 10 mm
	Number		2	1
	Length	supply side	./. mm	350 mm
		load side	./. mm	350 mm
	Tightening torque			50 Nm

Type test according to: IEC 60947-2 | Type: NS630bH to 1600H
Sample 31042.11

Standard and clause	Kind of tests and requirements		Test values Results
60947-1 8.3.4.1.5	**CALIBRATION OF THE TEST CRCUIT**		
	Oscillogram		20040288-0015 20040288-0018
	Applied voltage		474.23 V
	Frequency	50 Hz	50 Hz
	RMS current value at 20 ms	I_1 I_2 I_3	66.54 kA 66.80 kA 64.32 kA
	Average RMS. Value		65.89 kA
	Peak current maximum value		139.08 kA
	Power factor		0,17

Standard and clause	Kind of tests and requirements		Test values Results
	OPERATION "O"		
	Oscillogram		20040288.0019
	Peak current value	I_1	113.30 kA
		I_2	100.34 kA
		I_3	73.62 kA
	Maximum total duration		14.5 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	466.08 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	466.46 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	466.07 V
	Average value	U_{rm}	466.21 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.05
	Joule integral	Ph_1	65.85 $(kA)^2s$
		Ph_2	51.57 $(kA)^2s$
		Ph_3	20.68 $(kA)^2s$
	Melting of the fusible element	Yes/No	No
	Holes in the PE-sheet (if applicable)	Yes/No	No
	Cracks observed	Yes/No	No
	If Yes		Page ./.
	Time interval between operations	3 min	3 min
	OPERATION "CO1"		
	Oscillogram		20040288.0020
	Applied voltage		474.53 V
	Peak current value	I_1	109.61 kA
		I_2	97.03 kA
		I_3	77.15 kA
	Maximum total duration		20.25 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	468.37 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	468.39 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	468.21 V
	Average value	U_{rm}	468.32 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.06
	Joule integral	Ph_1	59.66 $(kA)^2s$
		Ph_2	47.00 $(kA)^2s$
		Ph_3	22.24 $(kA)^2s$
7.2.1.1.3	Closing operation time		./. ms
	Melting of the fusible element	Yes/No	No
	Cracks observed	Yes/No	No
	If Yes		Page ./.

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF DIELECTRIC WITHSTAND		
	Test voltage		
	2 x U_e, min. 1000 V	1000 V	
8.3.3.5	Test sequence I		
8.3.4.3	Test sequence II		
8.3.5.3	Test sequence III		1000 V
8.3.6.5	Test sequence IV		
8.3.7.3	Test sequence V, stage 1		
8.3.7.7	Test sequence V, stage 2		
8.3.8.5	Combined test sequence		
B.10.3.1	Test sequence B.II		
A.5	Verification of discrimination		
A.6.3	Verification of back-up protection		
C.3	Individual pole short-circuit test sequence		
H.3	Test sequence for circuit-breakers for IT-systems		
8.3.3.2.2 a)	Application of the test voltage -Main circuit of the circuit-breaker -Isolating contacts of the withdrawable unit (if applicable)		
	Test duration	5 s	5 s

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF LEAKAGE CURRENT		
	For circuit-breakers suitable for isolation having an operational voltage U_e greater than 50 V.		
8.3.3.2	**- Main circuit of the circuit-breaker** **- Isolating contacts of a withdrawable unit (if applicable)**		
	Test voltage	1.1 x U_e =484 V	484 V
60947-1 7.2.7	Application of the test voltage		
	Leakage current		
8.3.3.2	Test sequence I (in new condition)	≤ 0.5 mA	./. mA
8.3.3.5	Test sequence I (after overload performance)	≤ 2 mA	./. mA
8.3.4.3	Test sequence II	≤ 2 mA	./. mA
8.3.5.3	Test sequence III	≤ 6 mA	0.5 mA
8.3.6.5	Test sequence IV	≤ 2 mA	./. mA
8.3.7.3	Test sequence V, stage 1	≤ 2 mA	./. mA
8.3.7.7	Test sequence V, stage 2	≤ 6 mA	./. mA
8.3.8.5	Combined test sequence	≤ 2 mA	./. mA
C.3	Individual pole short-circuit test sequence I_{su}	≤ 6 mA	./. mA
H.3	Individual pole short-circuit test sequence I_{IT}	≤ 6 mA	./. mA

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm^2	./. mm^2
	Bar		100 x 5 mm	100 x 5 mm
	Number		2	2
	Length		./. mm	500 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			18.4 °C
	Correction factor (k = 1 for releases independent of ambient temperature)		k	1
	Current setting value		I_n	1600 A
	Test current			
	either k x 2.0 x I_n		./. A	./. A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		4000 A	4000 A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	137 s
		Ph_1	≤ 270 s	136 s
		Ph_2	≤ 270 s	132 s
		Ph_3	≤ 270 s	134 s

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm²	./. mm²
	Bar		100 x 5 mm	100 x 5 mm
	Number		2	2
	Length		./. mm	500 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			22.5 °C
	Correction factor (k = 1 for releases independent of ambient temperature)		k	1
	Current setting value		I_n	1600 A
	Test current			
	either k x 2.0 x I_n		3200 A	3200 A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		./. A	./. A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	223 s
		Ph_1	≤ 270 s	230 s
		Ph_2	≤ 270 s	222 s
		Ph_3	≤ 270 s	227 s

Standard and clause	Kind of tests and requirements			Test values Results
8.3.5.2	**RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY**			
	Utilization category		B	
	Rated operational voltage U_e		690 V	
	Recovery voltage		1.05 x U_e	724.5 V
	Rated ultimate short-circuit breaking capacity		I_{cu}	42 kA
	Rated short-circuit making capacity		I_{cm}	88.2 kA
Table 11	Power factor		0.25	0.25(+0,-0,05)
	Frequency		50 Hz	50 Hz
8.3.2.1	Control supply voltage		0.85 x U_s ./. V	./. V
7.2.1.1.3	Maximum value of the closing time			./. ms
	Sequence of operation		O - t - CO	O - t - CO
	Circuit diagram			Page 66
	Calibration of the test circuit		Pageform	Next page
	Safety area		Pageform	Page 65
	Installation of the material tested		Pageform	Page 64
	Energization direction		Top/Bottom	Bottom
8.3.2.1	Smallest individual enclosure (if applicable)			
	Type			./.
	Kind of material			./.
	Inside dimensions			
	Height			./. mm
	Width			./. mm
	Depth			./. mm
60947-1	Cabling characteristics			
Table 9, 10	Cable		./. mm²	./. mm²
and 11	Bar		100 x 5 mm	100 x 10 mm
	Number		2	1
	Length	supply side	./. mm	500 mm
		load side	./. mm	500 mm
	Tightening torque			50 Nm

Standard and clause	Kind of tests and requirements		Test values Results
60947-1 8.3.4.1.5	**CALIBRATION OF THE TEST CRCUIT**		
	Oscillogram		20040283-0141 20040283-0150
	Applied voltage		735,65 V
	Frequency	50 Hz	50 Hz
	RMS current value at 20 ms	I_1 I_2 I_3	42.00 kA 42.32 kA 43.26 kA
	Average RMS. Value		42.49 kA
	Peak current maximum value		91.48 kA
	Power factor		0,21

Type test according to: IEC 60947-2, Test sequence III | Type: NS630bH to 1600H, Sample 31042.12

Standard and clause	Kind of tests and requirements		Test values Results
	OPERATION "O"		
	Oscillogram		20040283.0161
	Peak current value	I_1	59.64 kA
		I_2	71.74 kA
		I_3	82.66 kA
	Maximum total duration		21.05 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	732.16 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	720.65 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	735.93 V
	Average value	U_{rm}	729.58 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.05
	Joule integral	Ph_1	22.48 $(kA)^2s$
		Ph_2	27,82 $(kA)^2s$
		Ph_3	43.40 $(kA)^2s$
	Melting of the fusible element	Yes/No	No
	Holes in the PE-sheet (if applicable)	Yes/No	No
	Cracks observed	Yes/No	No
	if Yes		Page ./.
	Time interval between operations	3 min	4 min
	OPERATION "CO1"		
	Oscillogram		20040283.0162
	Applied voltage		764.24 V
	Peak current value	I_1	77.04 kA
		I_2	49.95 kA
		I_3	75.50 kA
	Maximum total duration		18.4 ms
	Recovery voltage	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	736.72 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	727.47 V
		$U_{r(3-1)}$ ☒ or $U_{r(3-N)}$ ☐	728.68 V
	Average value	U_{rm}	730.96 V
	Ratio between U_{rm} and U_e	U_{rm}/U_e	1.05
	Joule integral	Ph_1	36.63 $(kA)^2s$
		Ph_2	18.67 $(kA)^2s$
		Ph_3	31.43 $(kA)^2s$
7.2.1.1.3	Closing operation time		./. ms
	Melting of the fusible element	Yes/No	No
	Cracks observed	Yes/No	No
	if Yes		Page ./.

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF DIELECTRIC WITHSTAND		
	Test voltage		
	2 x U_e, min. 1000 V	1380 V	
8.3.3.5	Test sequence I		
8.3.4.3	Test sequence II		
8.3.5.3	Test sequence III		1380 V
8.3.6.5	Test sequence IV		
8.3.7.3	Test sequence V, stage 1		
8.3.7.7	Test sequence V, stage 2		
8.3.8.5	Combined test sequence		
B.10.3.1	Test sequence B.II		
A.5	Verification of discrimination		
A.6.3	Verification of back-up protection		
C.3	Individual pole short-circuit test sequence		
H.3	Test sequence for circuit-breakers for IT-systems		
8.3.3.2.2 a)	Application of the test voltage -Main circuit of the circuit-breaker -Isolating contacts of the withdrawable unit (if applicable)		
	Test duration	5 s	5 s

Standard and clause	Kind of tests and requirements		Test values Results
	VERIFICATION OF LEAKAGE CURRENT		
	For circuit-breakers suitable for isolation having an operational voltage U_e greater than 50 V.		
8.3.3.2	**- Main circuit of the circuit-breaker** **- Isolating contacts of a withdrawable unit (if applicable)**		
	Test voltage	1.1 x U_e =759 V	759 V
60947-1 7.2.7	Application of the test voltage		
	Leakage current		
8.3.3.2	Test sequence I (In new condition)	≤ 0.5 mA	./. mA
8.3.3.5	Test sequence I (after overload performance)	≤ 2 mA	./. mA
8.3.4.3	Test sequence II	≤ 2 mA	./. mA
8.3.5.3	Test sequence III	≤ 6 mA	0.5 mA
8.3.6.5	Test sequence IV	≤ 2 mA	./. mA
8.3.7.3	Test sequence V, stage 1	≤ 2 mA	./. mA
8.3.7.7	Test sequence V, stage 2	≤ 6 mA	./. mA
8.3.8.5	Combined test sequence	≤ 2 mA	./. mA
C.3	Individual pole short-circuit test sequence I_{su}	≤ 6 mA	./. mA
H.3	Individual pole short-circuit test sequence I_{IT}	≤ 6 mA	./. mA

Standard and clause	Kind of tests and requirements			Test values Results
	VERIFICATION OF OVERLOAD RELEASES ON EACH POLE SEPARATELY			
60947-1 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm²	./. mm²
	Bar		100 x 5 mm	100 x 5 mm
	Number		2	2
	Length		./. mm	3000 mm
	Tightening torque			50 Nm
	Reference temperature		40 °C ± 2 °C	
	Ambient temperature			19.9 °C
	Correction factor (k = 1 for releases Independent of ambient temperature)		k	1
	Current setting value		I_n	1600 A
	Test current			
	either k x 2.0 x I_n		./. A	./. A
8.3.5.1	Test sequence II ($I_{cs} = I_{cu}$)	before 8.3.4.1		
8.3.5.1	Test sequence III	before 8.3.5.2		
8.3.6.1	Test sequence IV	before 8.3.6.2		
8.3.6.6	Test sequence IV	after 8.3.6.5		
8.3.7.4	Test sequence V	before 8.3.7.5		
8.3.8.1	Combined test sequence	before 8.3.8.2		
A.5	Verification of discrimination	before 8.3.5.2		
A.6.3	Verification of back-up protection	before 8.3.5.2		
	or k x 2.5 x I_n		4000 A	4000 A
8.3.5.4	Test sequence II ($I_{cs} = I_{cu}$)	after 8.3.4.5		
8.3.5.4	Test sequence III	after 8.3.5.3		
8.3.7.8	Test sequence V	after 8.3.7.7		
8.3.8.7	Combined test sequence	after 8.3.8.6		
A.5	Verification of discrimination	after 8.3.5.3		
A.6.3	Verification of back-up protection	after 8.3.5.3		
C.4	Individual pole short-circuit test sequence			
H.4	Test sequence for circuit-breakers for IT-systems			
	Tripping time (for twice the value of current setting on single pole)			
		Neutral	≤ 270 s	120 s
		Ph_1	≤ 270 s	118 s
		Ph_2	≤ 270 s	127 s
		Ph_3	≤ 270 s	132 s

INSTALLATION

The apparatus is set up on a metallic structure, in individual enclosure, fixed on insulated bars. The safety perimeter is materialised by a metallic enclosure (see next page) connected to the neutral by a fuse.

The apparatus are operated with an air actuator.

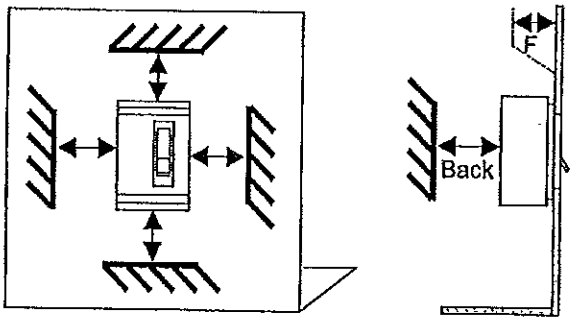
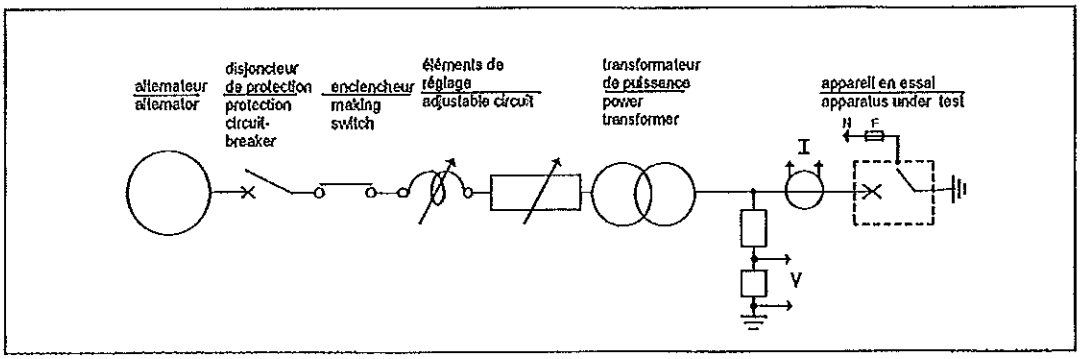
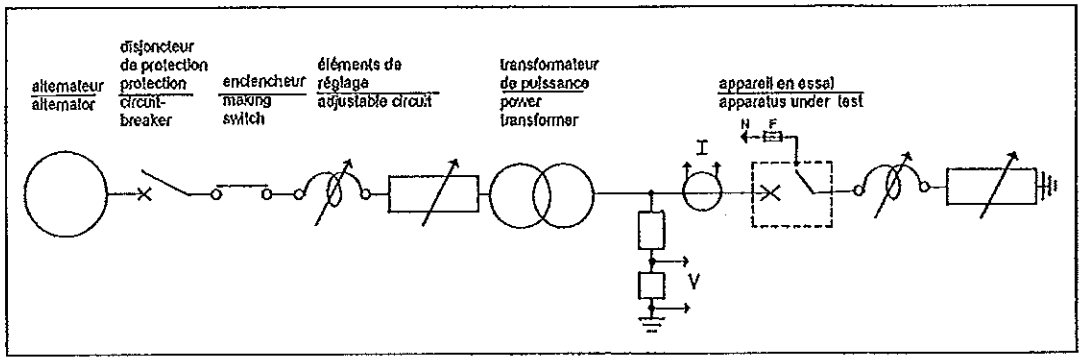
Standard and clause	Kind of tests and requirements		Test values Results
	SAFETY AREA AND DETECTION OF THE FAULT CURRENT		
60947-2	Characteristics of the metallic screen		
	- structure	woven wire mesh	./.
		perforated metal	./.
		expanded metal	Yes
	- ratio hole area / total area	0,45 - 0,65	./.
	- size of hole	≤ 30 mm²	./. mm²
	- coating	bare	./.
		conductive plating	yes
			Top : 120 mm Left : 10 mm Right : 10 mm Bottom : 120 mm Front : 0 mm Back : 0 mm
	Detection of the fault current		
	- prospective fault current in the fusible element circuit		50 A
	- fusible element		
	. diameter of copper wire		0.1 mm
	. length		100 mm
	or		
	. equivalent fusible element		/

DIAGRAM OF THE TEST CIRCUIT

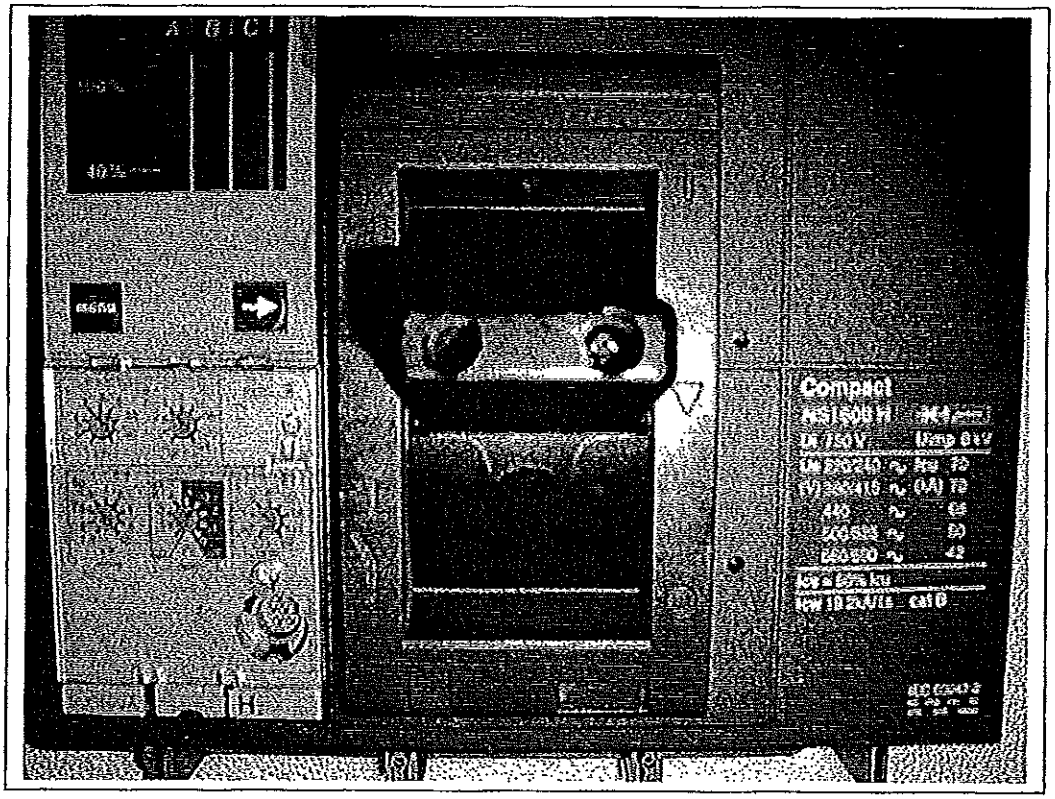
TEST OF RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY



VERIFICATION OF OPERATIONAL CAPABILITY



PHOTOGRAPHIE OF THE ASSEMBLY



APPENDIXES

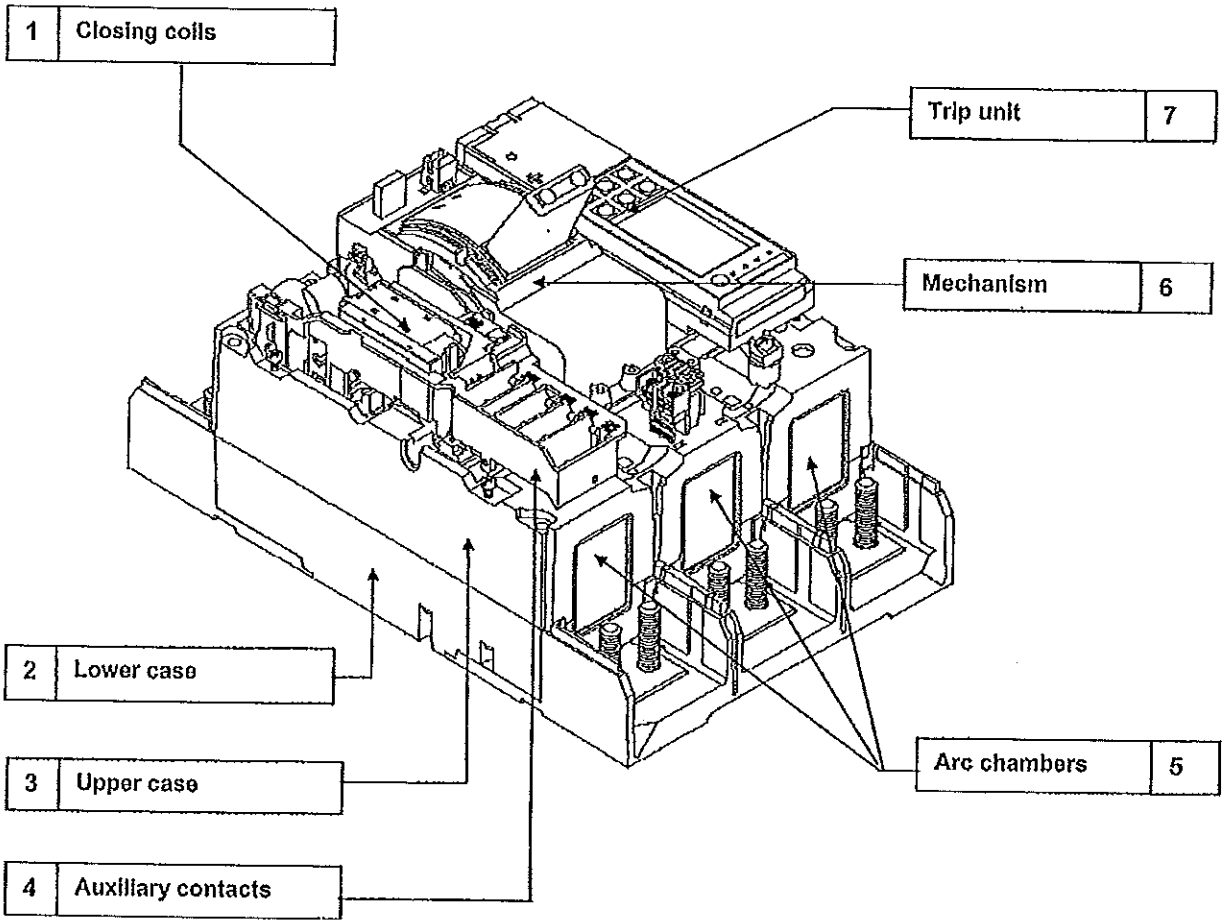
APPARATUS CHARACTERISTICS

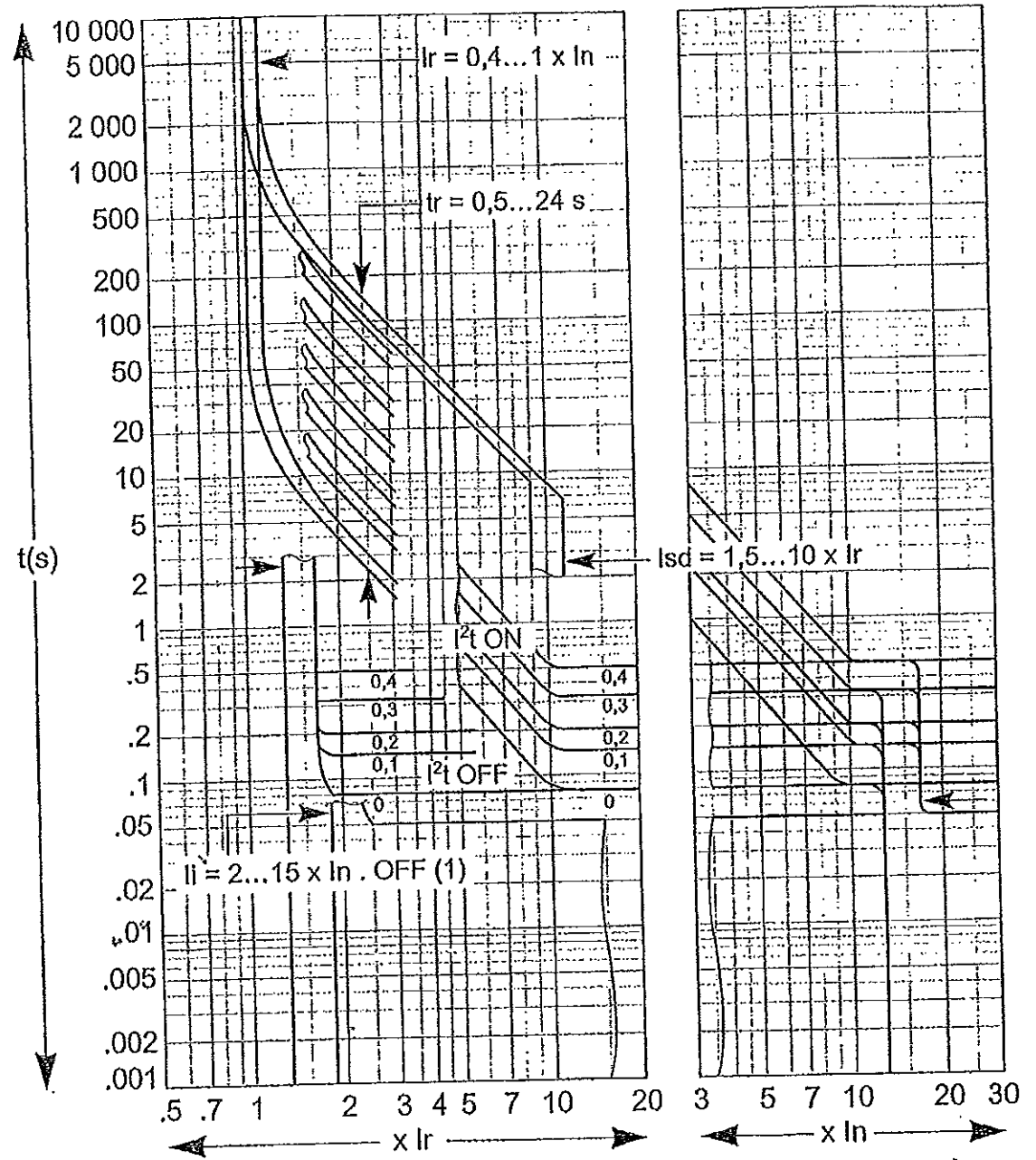
General view circuit-breaker	GHD 1189100 Indice B
Tripping curve Micrologic 5.0A	51156273AA 1/1

OSCILLOGRAMS

Calibration voltage	20040283 – 0102
Calibration current	20040283 – 0103
ASEFA 31 042.05 Opening	20040283 – 0104
ASEFA 31 042.05 Closing/Opening 1	20040283 – 0105
ASEFA 31 042.06 Opening	20040283 – 0106
ASEFA 31 042.06 Closing/Opening 1	20040283 – 0107
Calibration voltage	20040283 – 0108
Calibration current	20040283 – 0113
ASEFA 31 042.07 Opening	20040283 – 0116
ASEFA 31 042.07 Closing/Opening 1	20040283 – 0117
Calibration voltage	20040283 – 0119
Calibration current	20040283 – 0122
ASEFA 31 042.08 Opening	20040283 – 0123
ASEFA 31 042.08 Closing/Opening 1	20040283 – 0124
Calibration voltage	20040288 – 0003
Calibration current	20040288 – 0007
ASEFA 31 042.09 Opening	20040288 – 0011
ASEFA 31 042.09 Closing/Opening 1	20040288 – 0012
ASEFA 31 042.10 Opening	20040288 – 0013
ASEFA 31 042.10 Closing/Opening 1	20040288 – 0014
Calibration voltage	20040288 – 0015
Calibration current	20040288 – 0018
ASEFA 31 042.11 Opening	20040288 – 0019
ASEFA 31 042.11 Closing/Opening 1	20040288 – 0020
Calibration voltage	20040283 – 0141
Calibration current	20040283 – 0150
ASEFA 31 042.12 Opening	20040283 – 0161
ASEFA 31 042.12 Closing/Opening 1	20040283 – 0162

GENERAL VIEW - FIGURE 1





OFF (1)

In (A)	800	2000	4000	5000	6300
N1	42 kA				
H1	52 kA			100 kA	
H2	82 kA			100 kA	
H3		65 kA			
L1	42 kA				

Ind / Rev	Date / Date	Modification / Modification	JOUBERT Nom/Name	Visa	GRELIER Nom/Name	Visa	Archiv/ Microfil.
02	09/06/99	Rajout des crans 0 à 0,4	Préparé/Issued by		Préparé/Issued by		

Projet / Projet: Compact NS630b à NS1600

Dossier / Folder:

GROUPE SCHNEIDER

Code diff. / Distrib. code

Unité / Département: DBTP

DISJONCTEUR FIXE ET DEBROCHABLE

Courbe de déclenchement pour déclencheurs Micrologic 5.0 , 6.0 , 7.0

5 1 1 5 6 2 7 4 A A	Ind/Rev 0 1	Folio/Sheet 1

150,00 ms

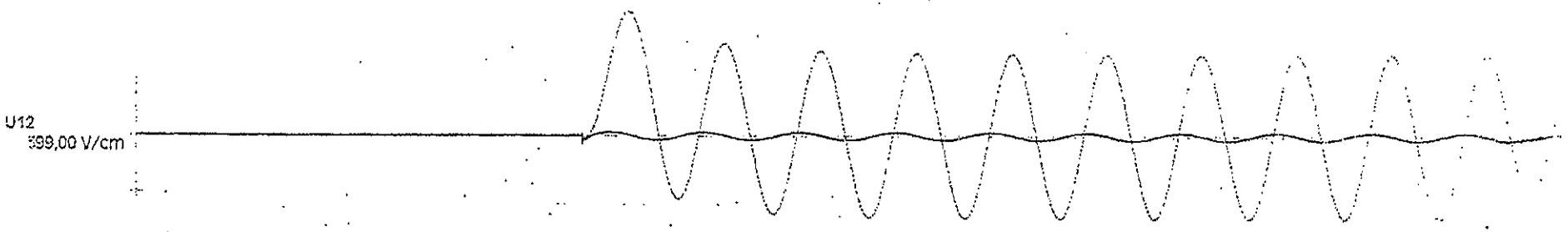
450,00 ms

12,00 ms/cm

10,00 ms

Calibration of the test circuit Current

42kA 88kÂ 236V+5% cos0.25



ВЯРНО С ОРИГИНАЛА

КИМТЕХ БЪЛГАРИЯ ООД

F01 20040283 - 0102

CATIE V.1.5.3.129 page 001

Effectué le 06/12/2004 17:12:28
Edité le 06/12/2004 17:33:53

450,00 ms

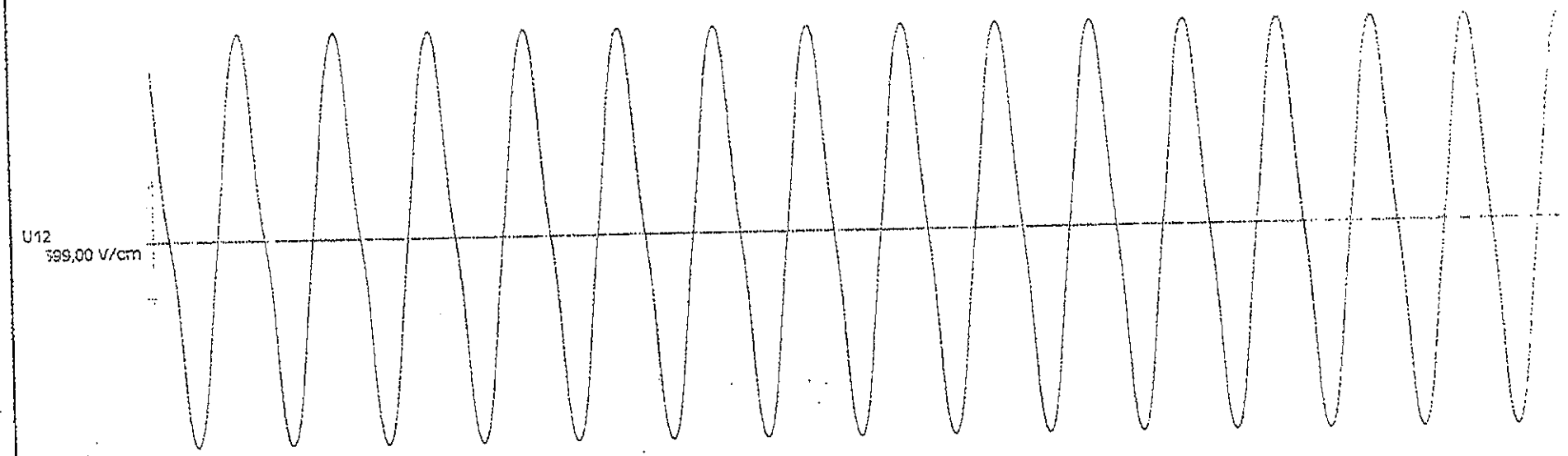
150,00 ms

12,00 ms/cm

10,00 ms

Calibration of the test circuit V

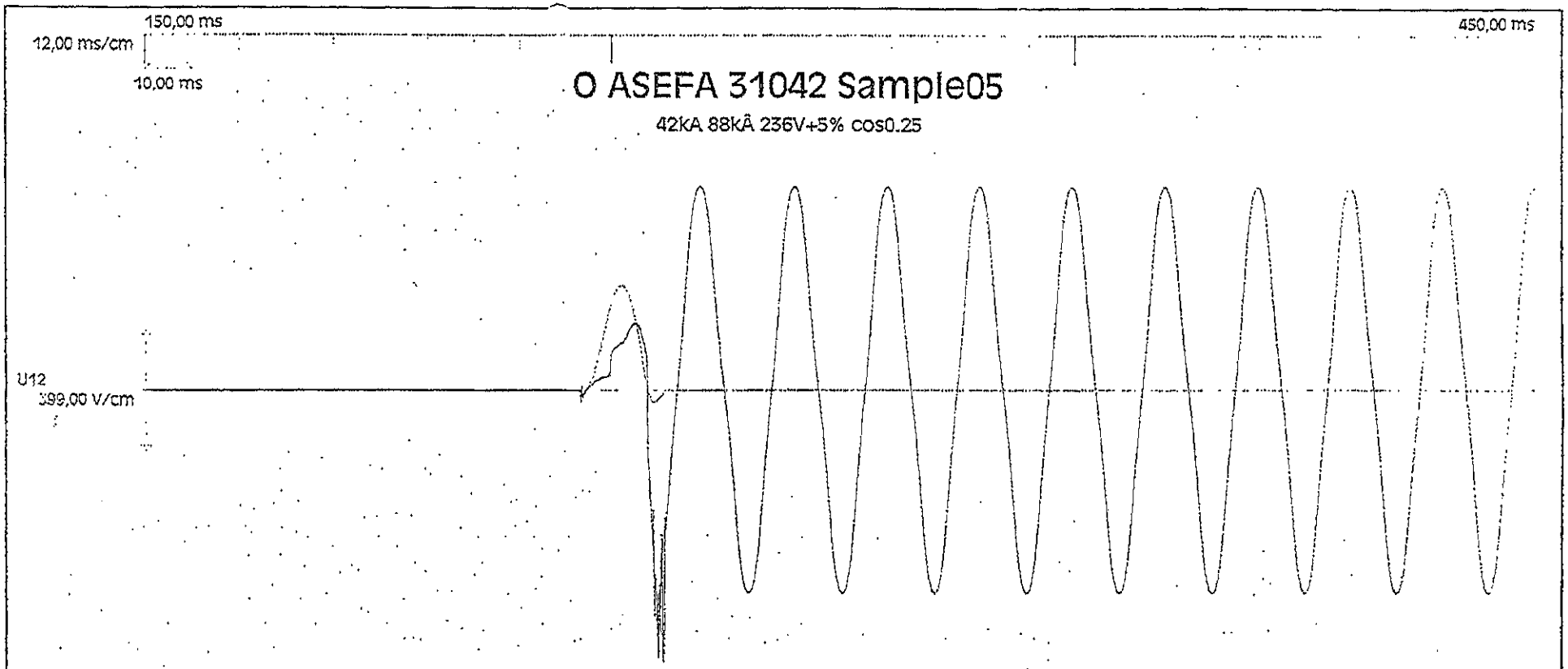
42kA 88kÃ 236V+5% cos0.25



ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0103

Effectué le 06/12/2004 17:28:35
Edité le 06/12/2004 17:32:59



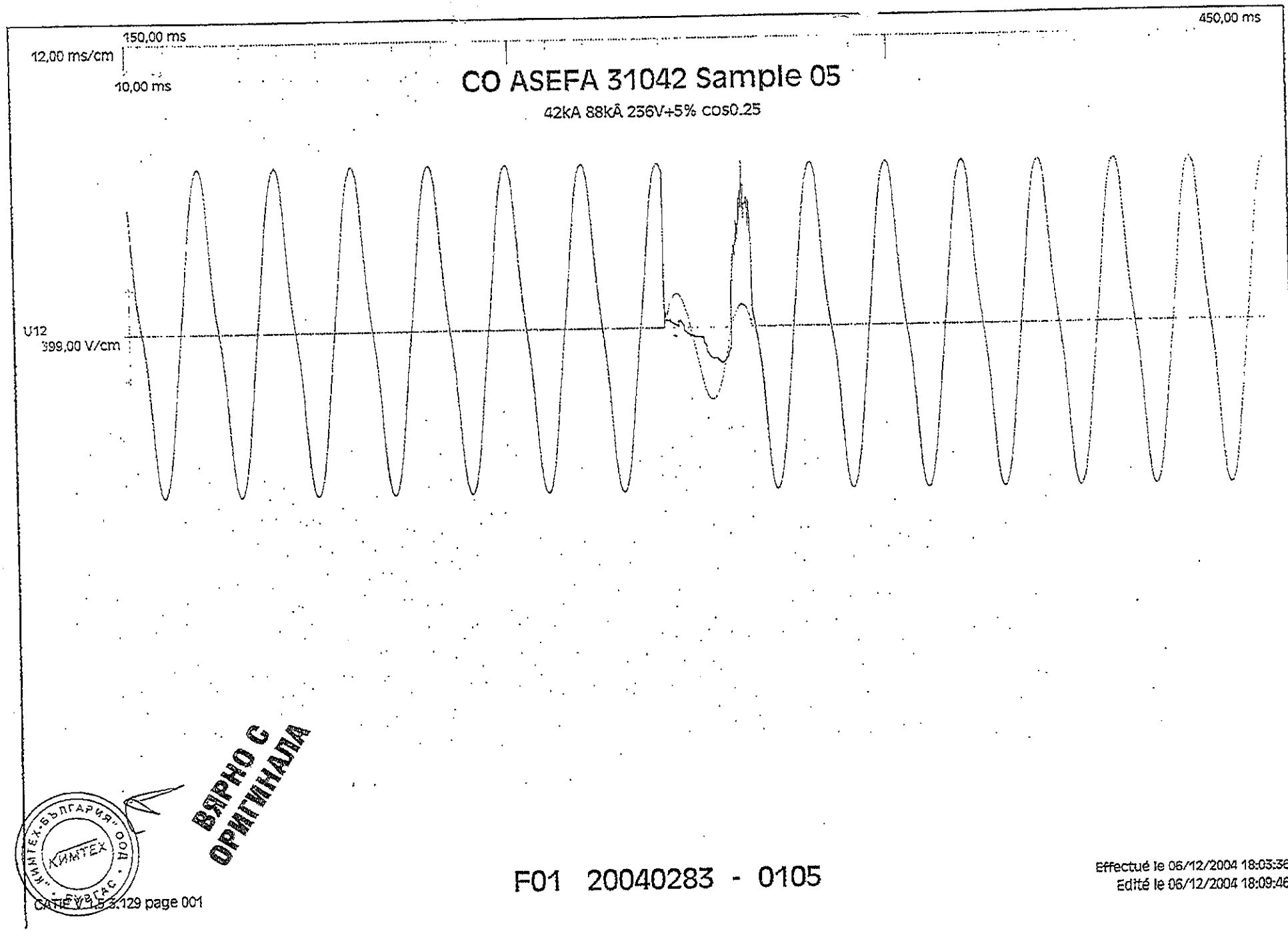
ХИМТЕХ-БЪЛГАРИЯ-ЕООД · БУРГАС · ХИМТЕХ

ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0104

CATIE V.1.5.3.129 page 001

Effectué le 06/12/2004 17:53:48
Edité le 06/12/2004 18:10:37

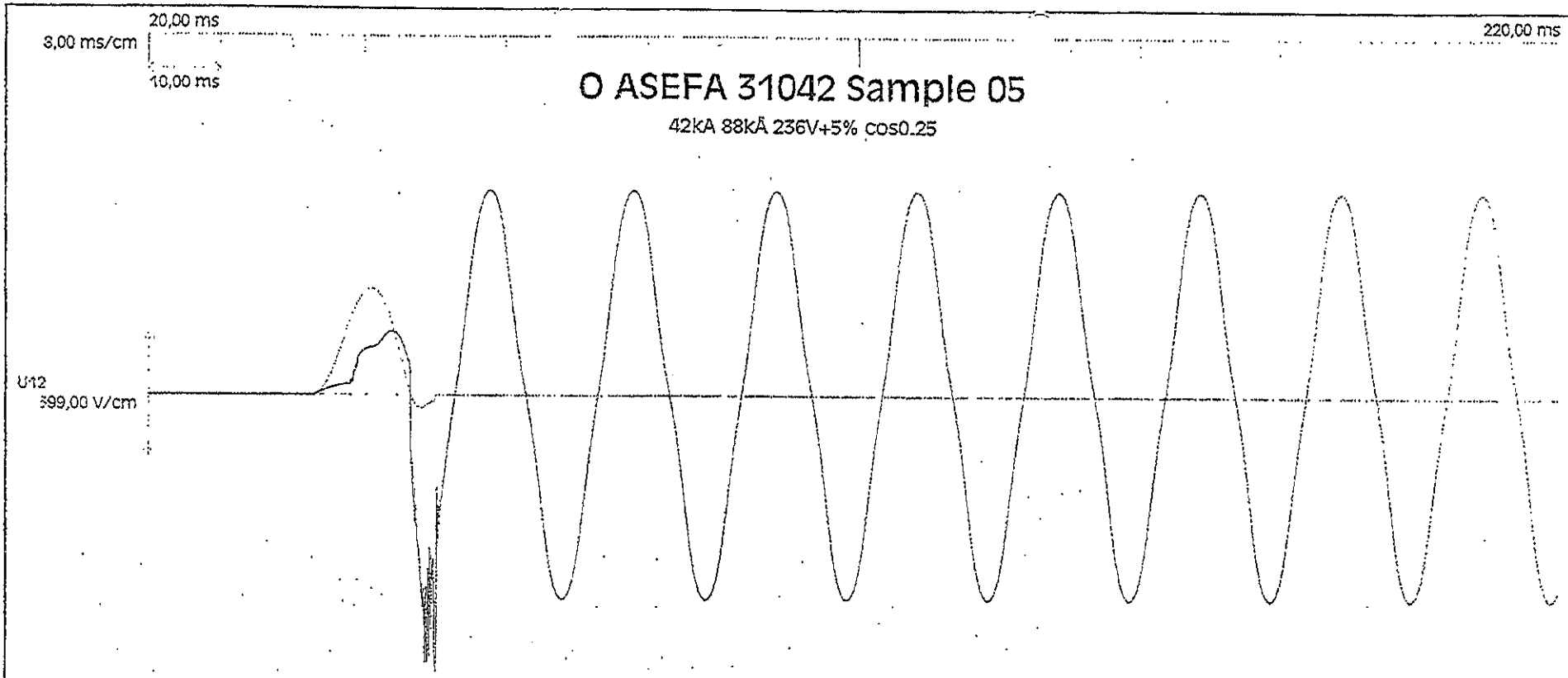


ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0105

Effectué le 06/12/2004 18:03:36
Edité le 06/12/2004 18:09:46

CATIEV1.5 3.129 page 001

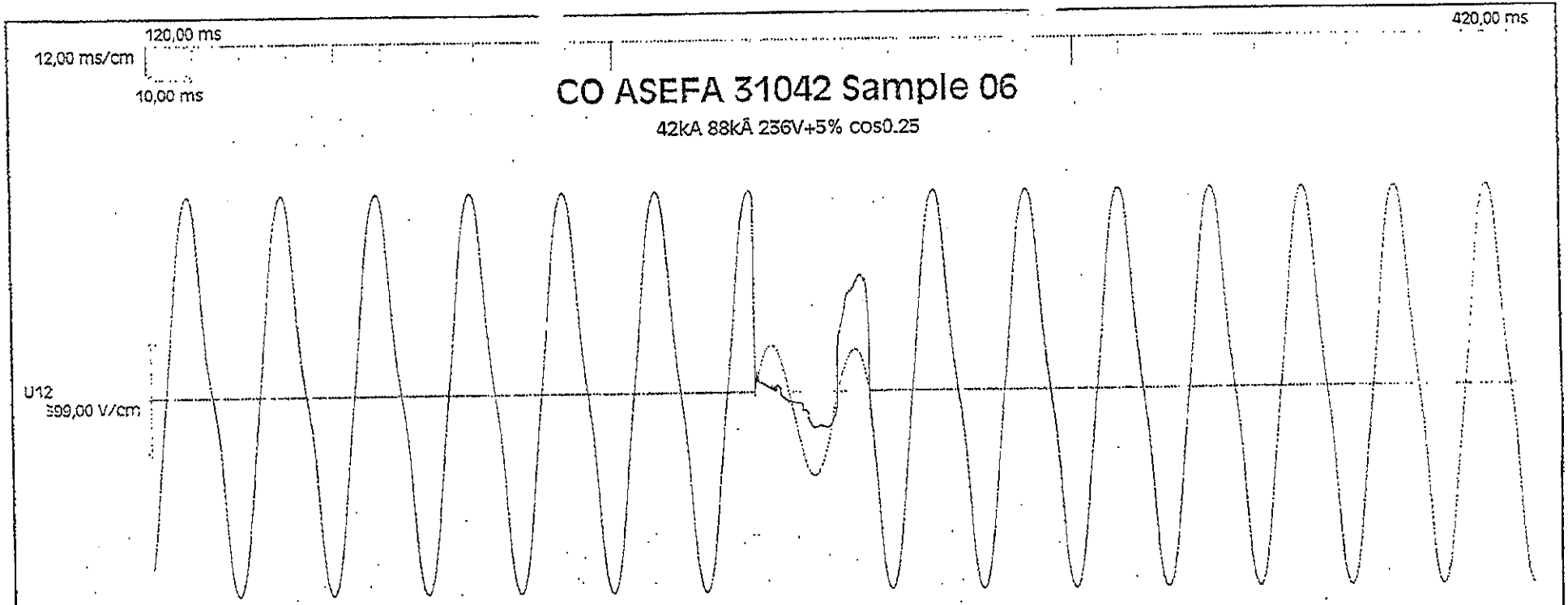


ВЯРНО С ОРИГИНАЛА

CATIE V.1.5.3.129 page 001

F01 20040283 - 0106

Effectué le 06/12/2004 19:07:47
Edité le 06/12/2004 19:12:55



F01 20040283 - 0107

Effectué le 06/12/2004 19:11:09
Edité le 06/12/2004 19:12:06

100,00 ms

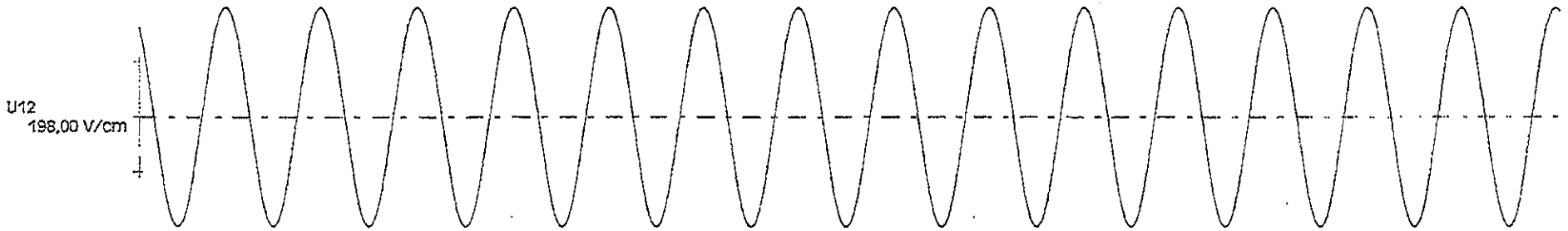
400,00 ms

12,00 ms/cm

10,00 ms

Calibr. test circuit Voltage

cir mono: 39kA 82kÂ 254V+5% cos0.25



F01 20040283 - 0108

Effectué le 07/12/2004 07:59:18
Edité le 18/08/2005 11:17:08

400,00 ms

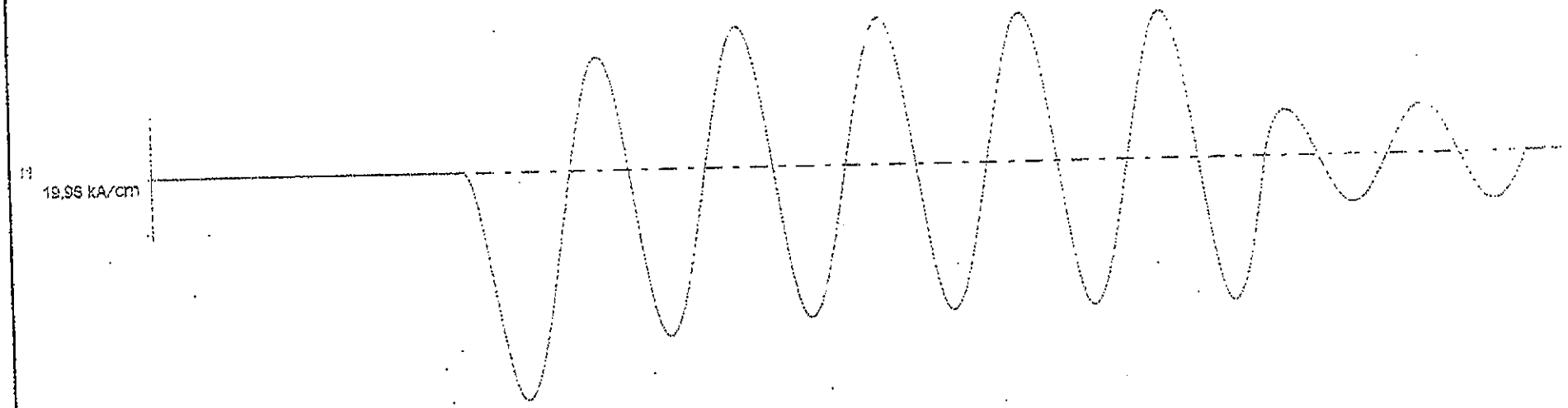
200,00 ms

8,00 ms/cm

10,00 ms

Calibr. test circuit I

cir mono: 39kA 82kÅ 254V+5% cos0.25



ХИМТЕХ-БЪЛГАРИЯ-ЛОГ ХИМТЕХ

ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0113

Effectué le 07/12/2004 08:47:42
Edité le 18/08/2005 11:18:12

200,00 ms

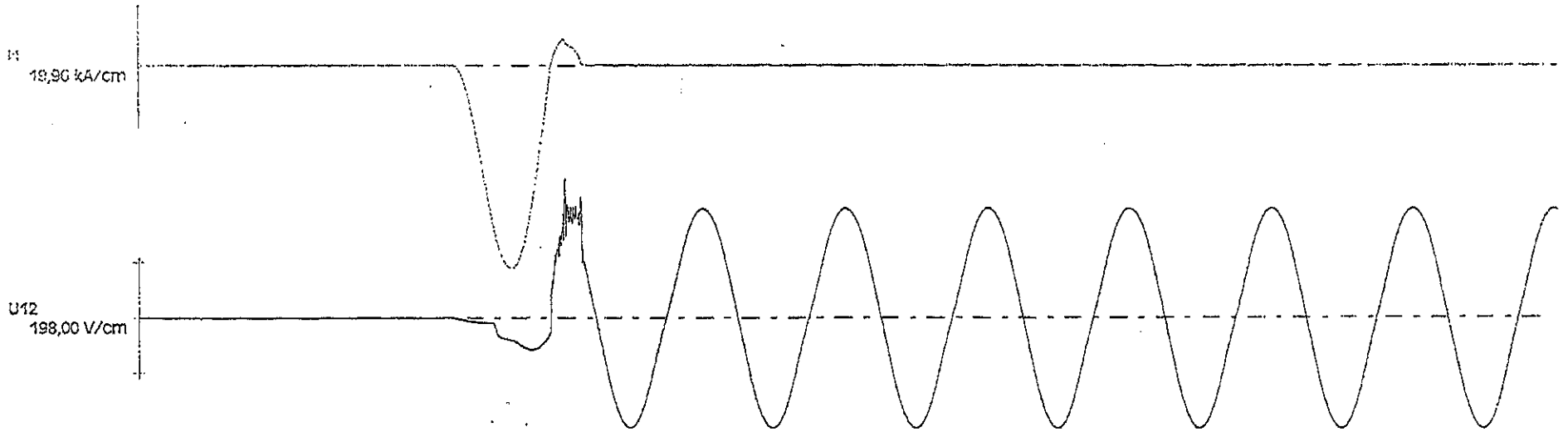
400,00 ms

8,00 ms/cm

10,00 ms

O ASEFA : N° 31042 sample N ° 7

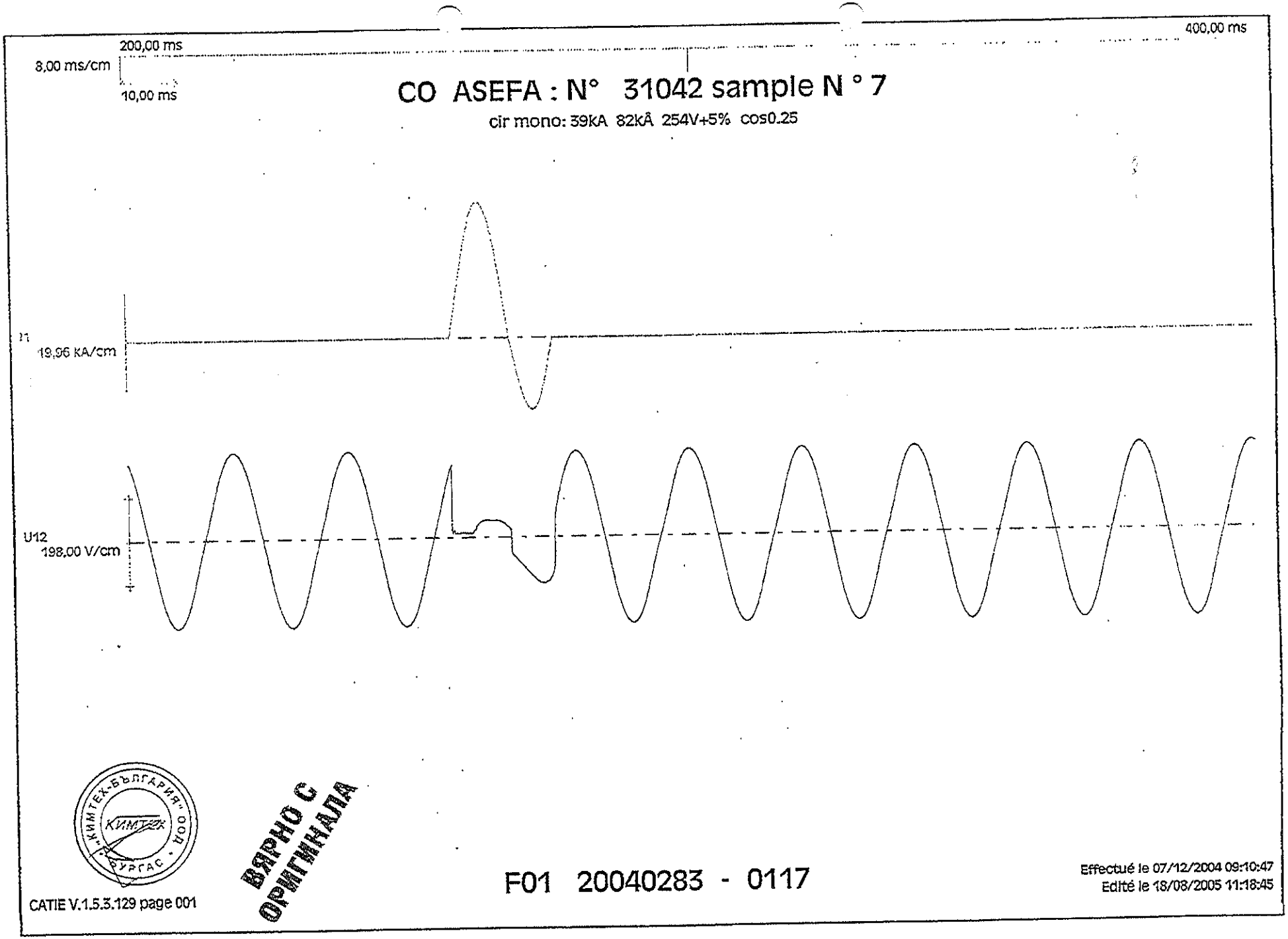
cir mono: 39kA 82kÂ 254V+5% cos0.25



ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0116

Effectué le 07/12/2004 09:08:11
Edité le 18/08/2005 11:18:34



ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0117

Effectué le 07/12/2004 09:10:47
Edité le 18/08/2005 11:18:45

CATIE V.1.5.3.129 page 001

200,00 ms

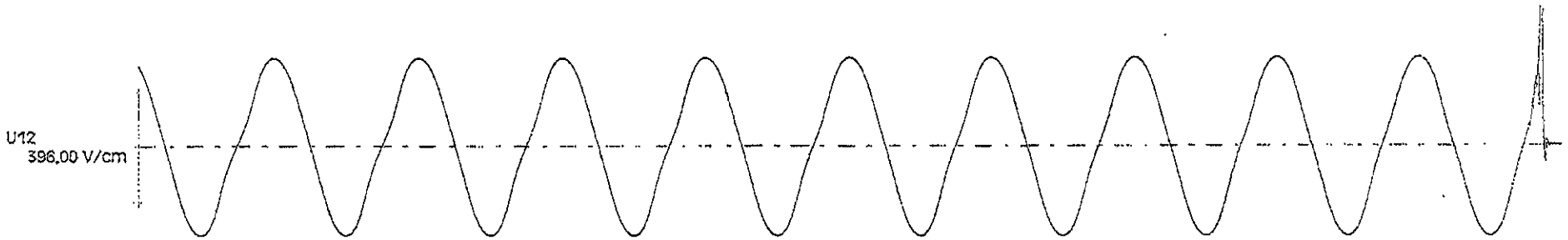
400.00 ms

8,00 ms/cm

10,00 ms

Calibr. test circuit Voltage

cir mono: 25.2kA 53kÂ 398V+5% cos0.25



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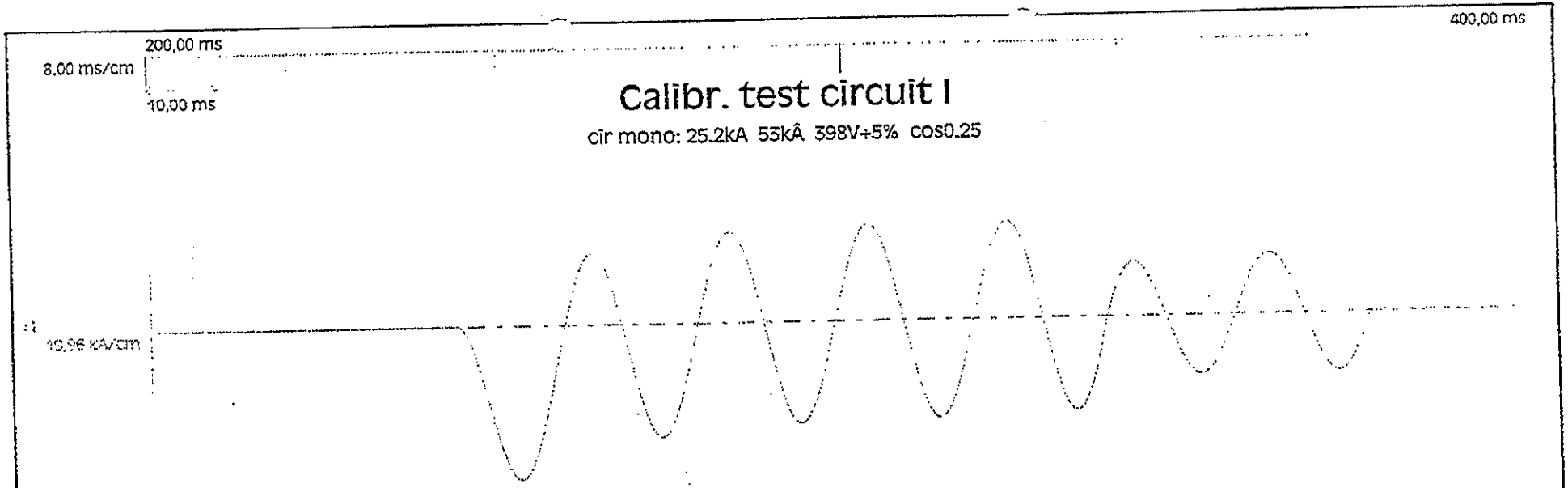
Effectué le 07/12/2004 10:13:41
Edité le 18/08/2005 11:19:57



F01 20040283 - 0122

Effectué le 07/12/2004 10:46:32
Edité le 18/08/2005 11:20:29

200,00 ms

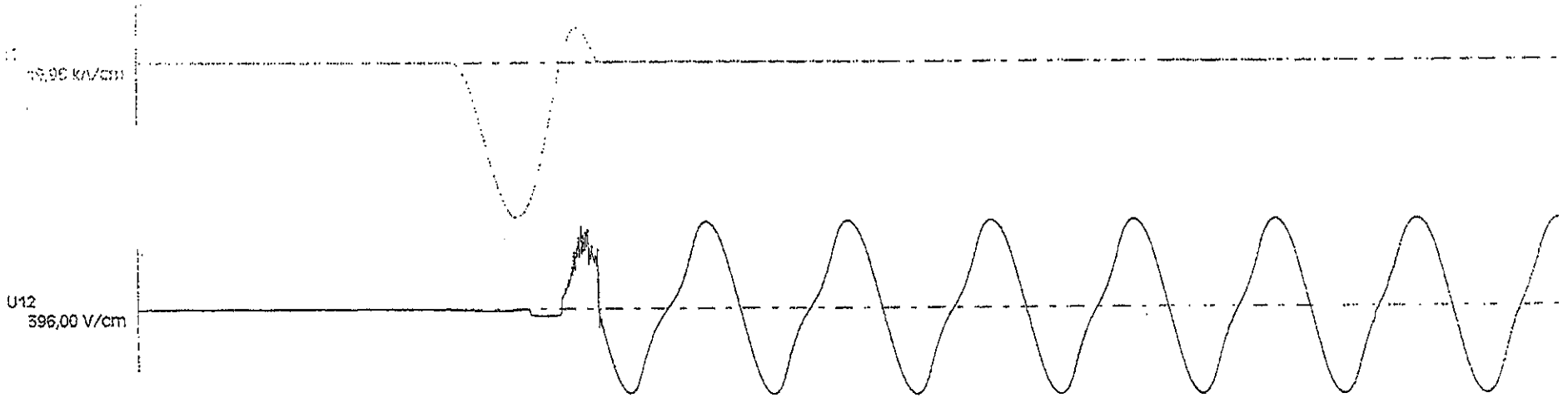
400,00 ms

8,00 ms/cm

10,00 ms

O ASEFA n° 31042 sample n° 8

cir mono: 25.2kA 53kÂ 398V+5% cos0.25



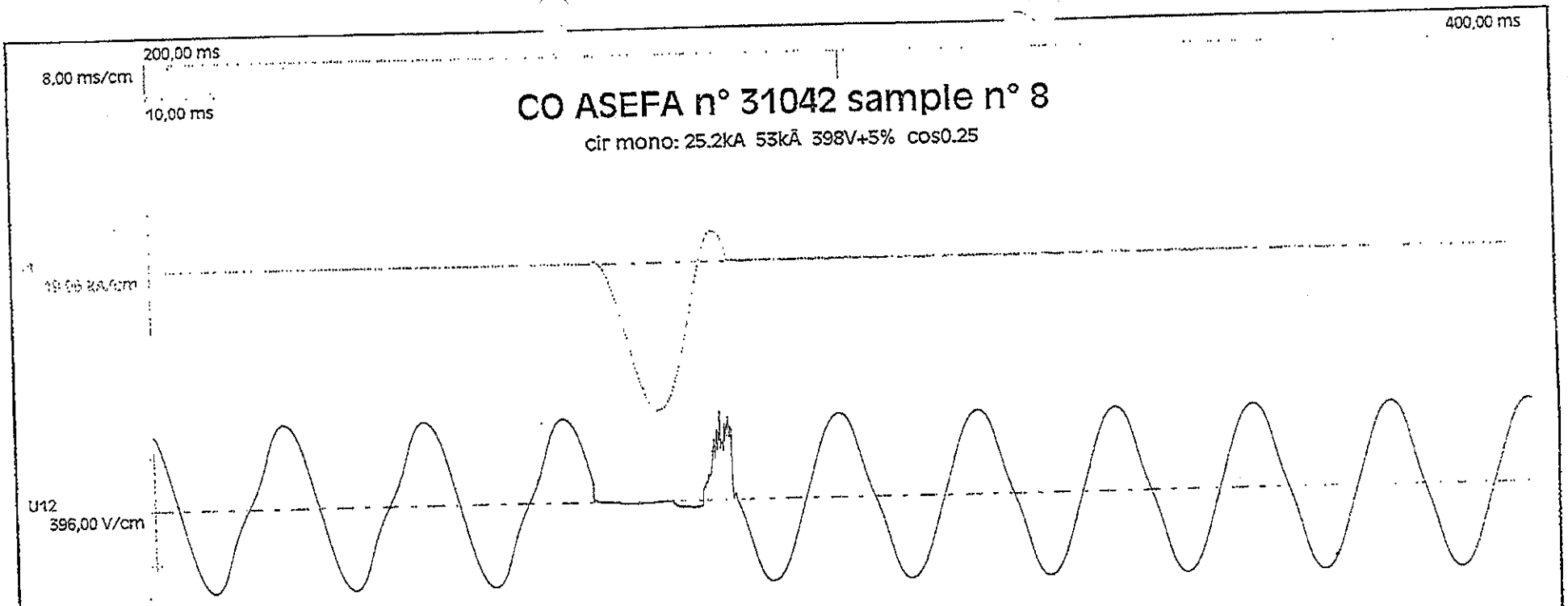
ВЯРНО С ОРИГИНАЛА

КИМТЕХ-БЪЛГАРИЯ-ООД - БУРГАС - КИМТЕХ

F01 20040283 - 0123

CATIE V.1.5.3.129 page 001

Effectué le 07/12/2004 10:58:47
Edité le 18/08/2005 11:20:51

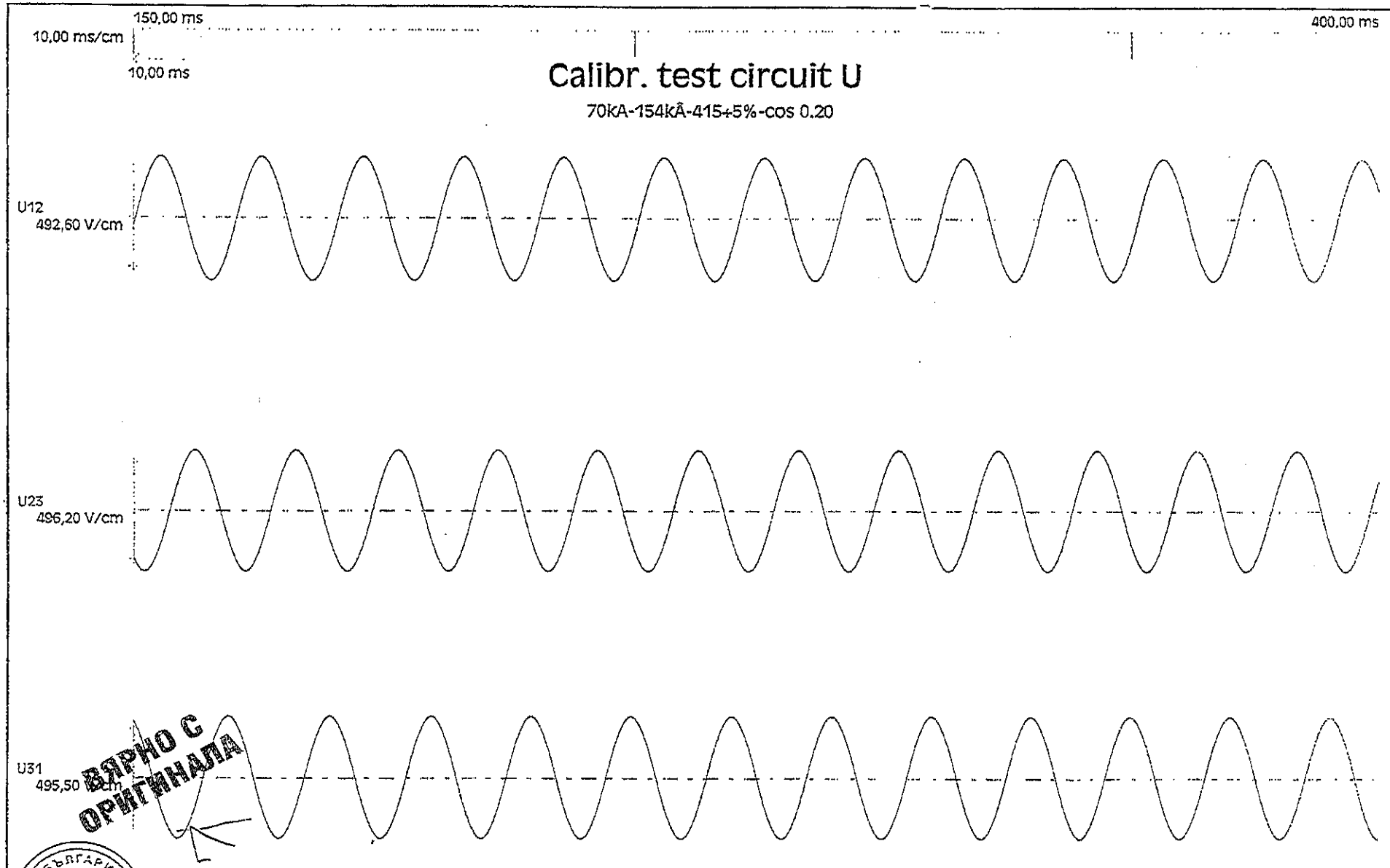


ВЯРНО С ОРИГИНАЛА

"КИМТЕХ-БЪЛГАРИЯ" ООД КИМТЕХ БУРГАС

F01 20040283 - 0124

Effectué le 07/12/2004 11:02:15
Edité le 18/08/2005 11:21:15



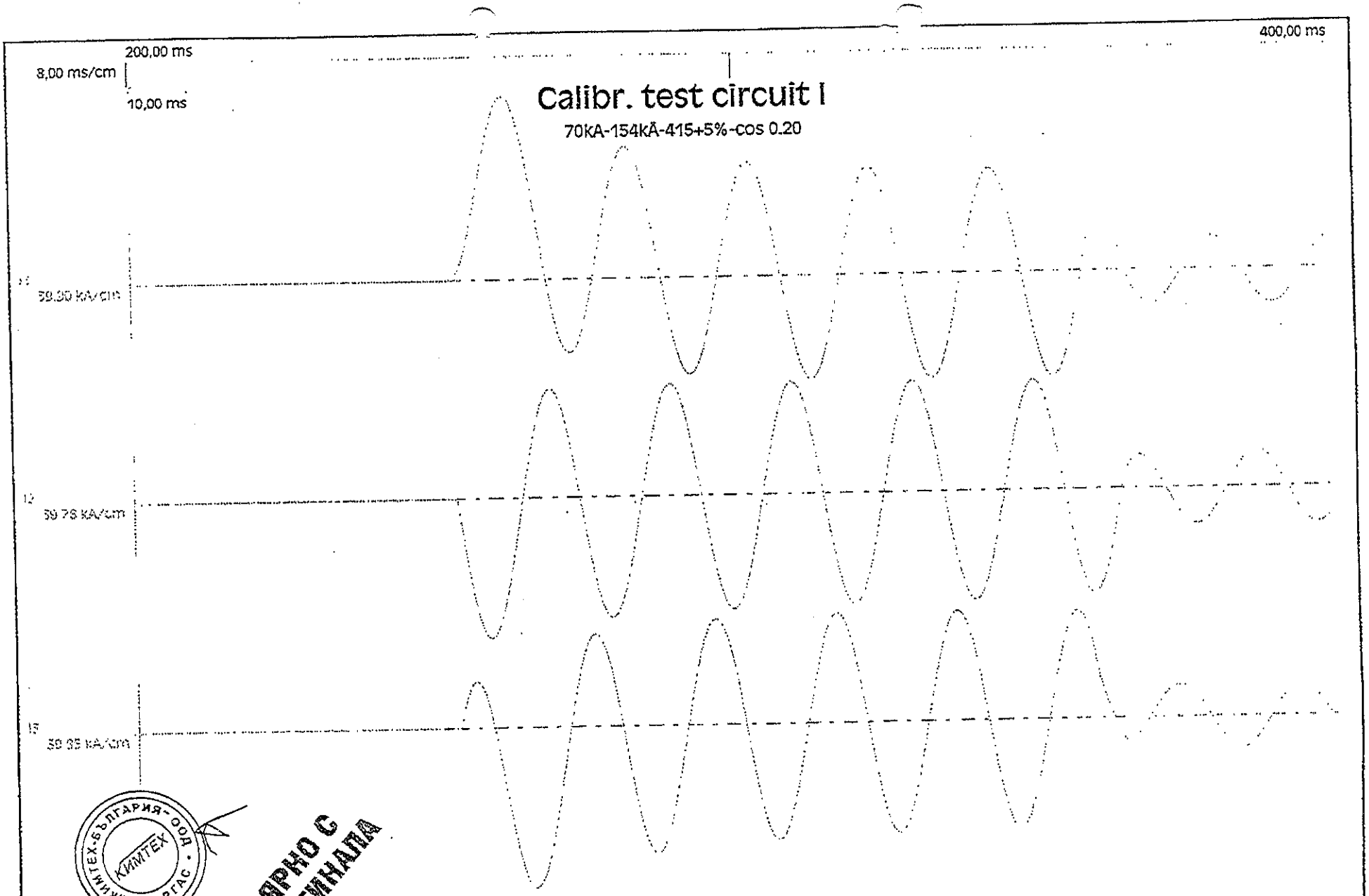
ВЯРНО С ОРИГИНАЛА

"ХИМТЕХ-БЪЛГАРИЯ" ООД ХИМТЕХ БУРГАС

CATIE V4.5.3.129 page 001

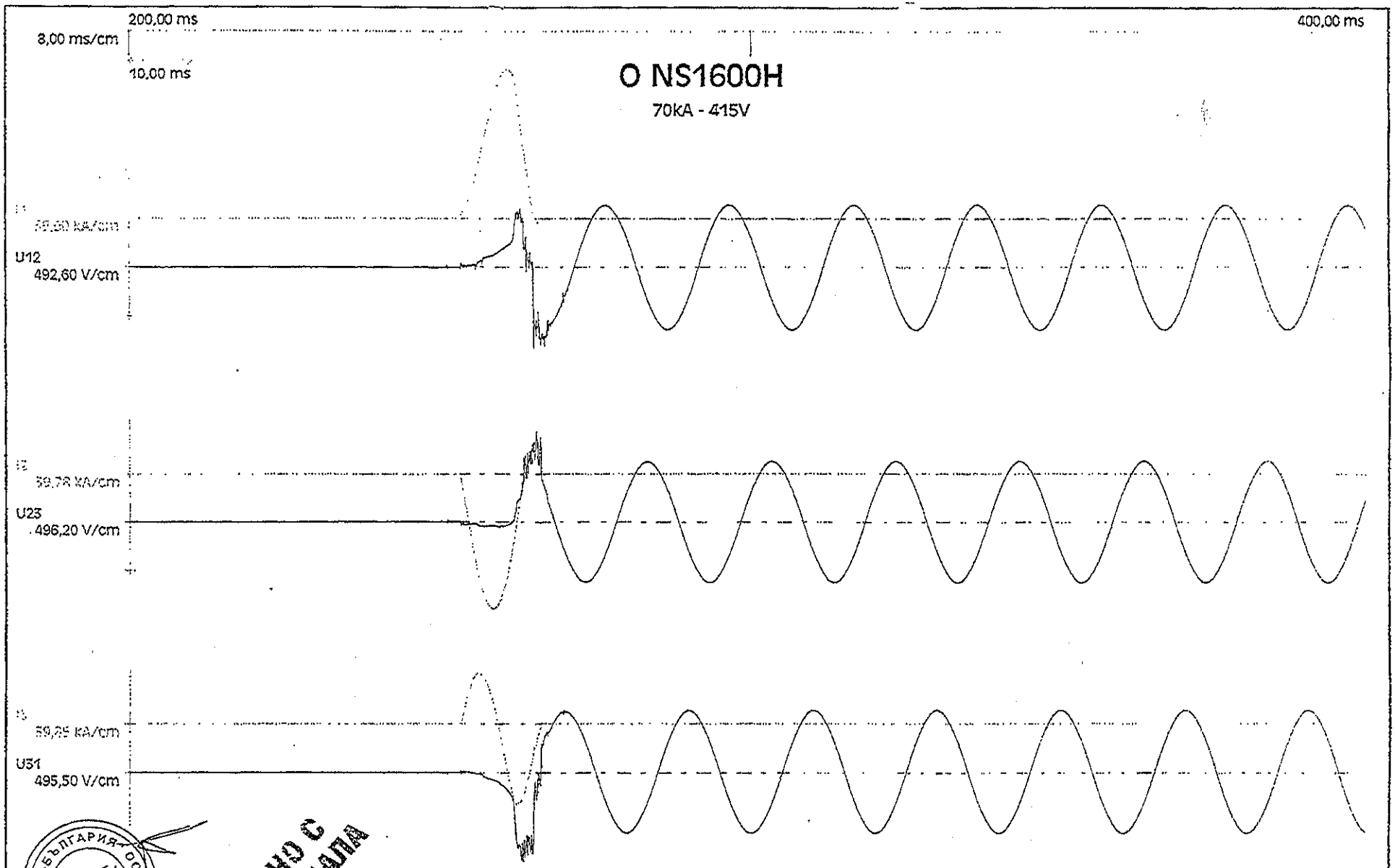
VOLTA 20040288 - 0003

Effectué le 06/12/2004 07:19:29
Edité le 18/08/2005 11:27:52



F01 20040288 - 0007

Effectué le 06/12/2004 07:53:04
Edité le 18/08/2005 11:28:12

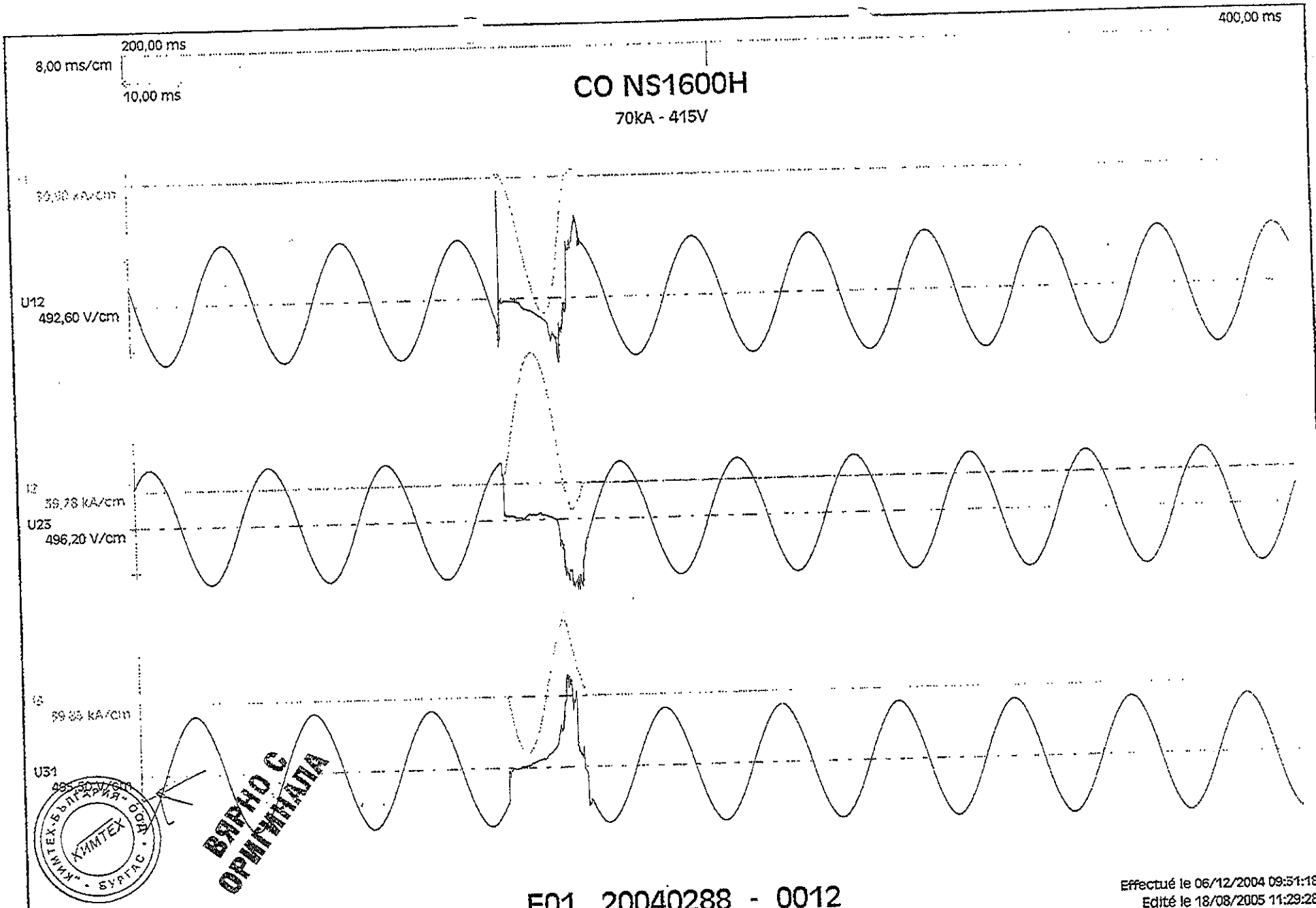


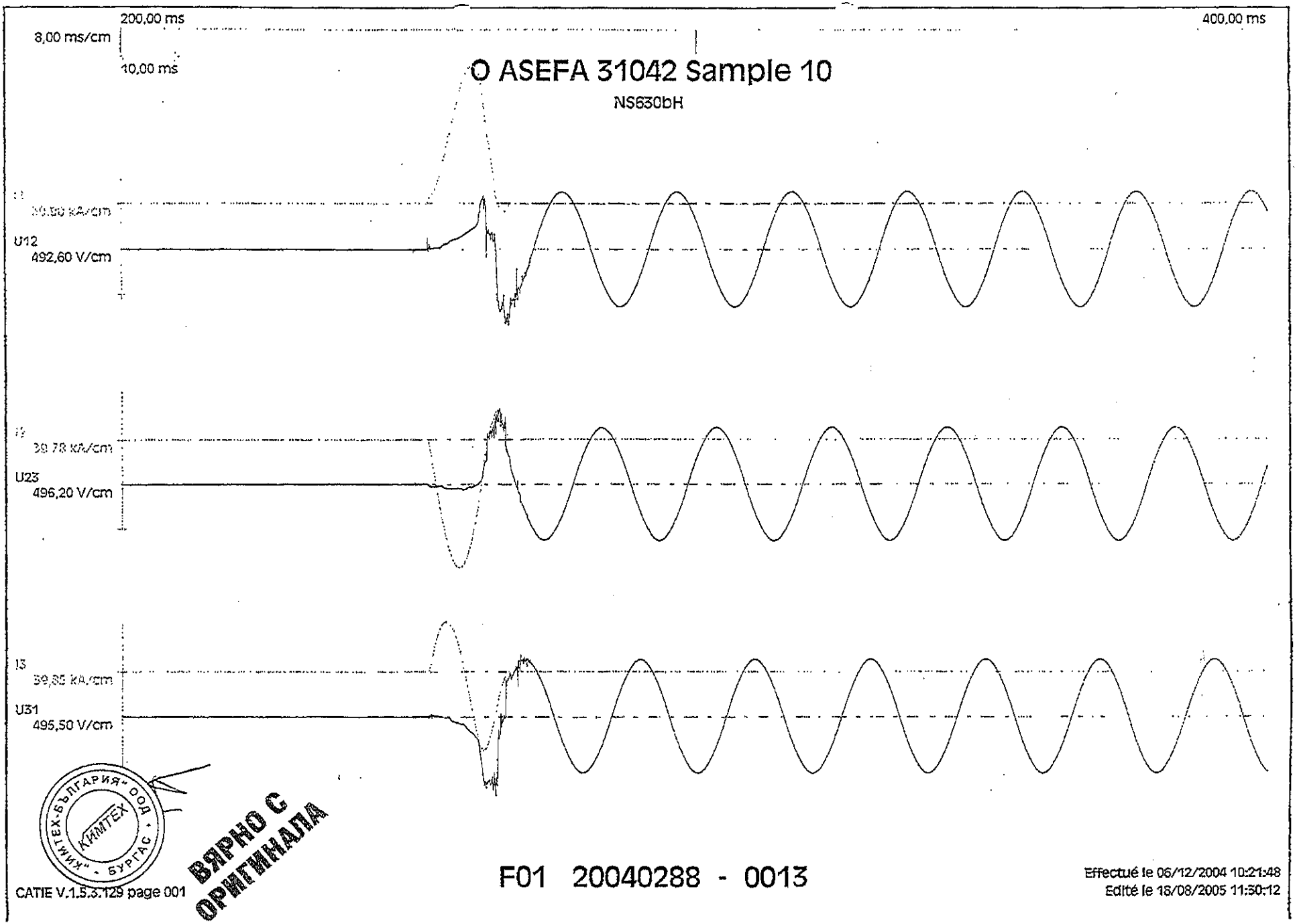
ВЯРНО С ОРИГИНАЛА

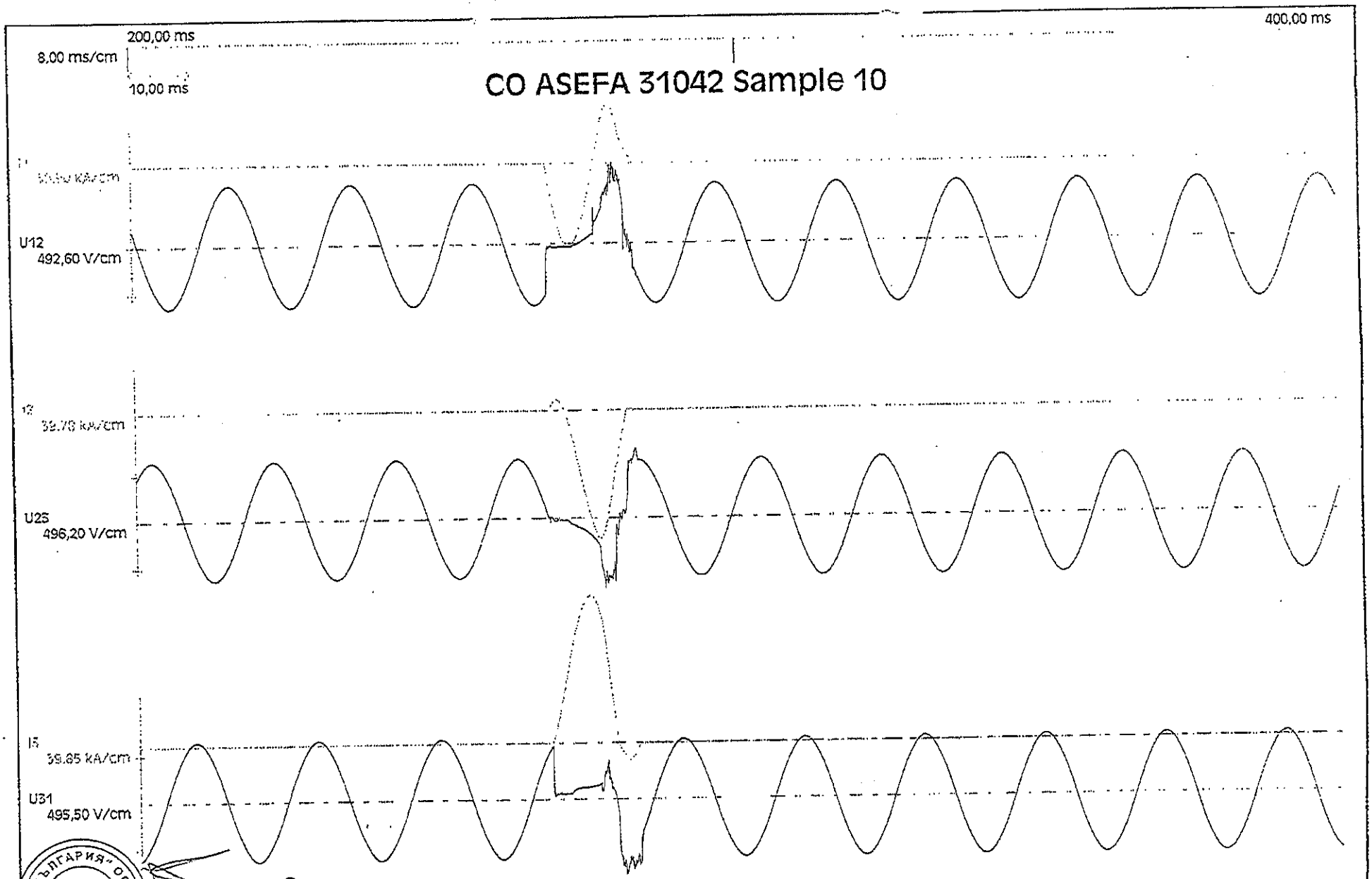
F01 20040288 - 0011

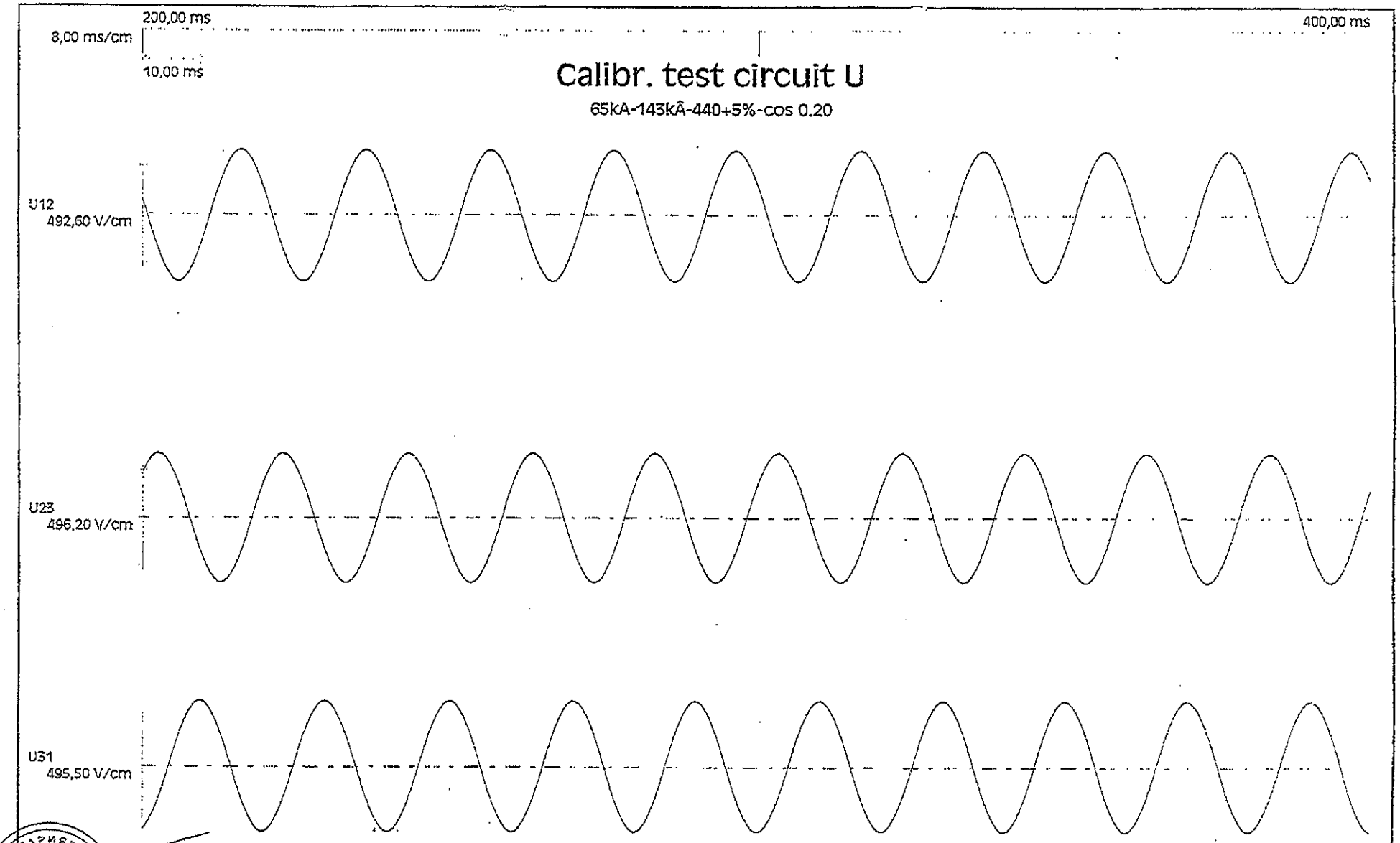
CATIE V.1.5.3.129 page 001

Effectué le 06/12/2004 09:28:17
Edité le 18/08/2005 11:28:59


400,00 ms
200,00 ms
8,00 ms/cm
10,00 ms
CO NS1600H
70kA - 415V
U12
492,60 V/cm
I2
39,78 kA/cm
U23
496,20 V/cm
I3
39,85 kA/cm
U31
ВЯРНО С ОРИГИНАЛА
F01 20040288 - 0012
Effectué le 06/12/2004 09:51:18
Edité le 18/08/2005 11:29:28
CATIE V.1.5.3.129 page 001



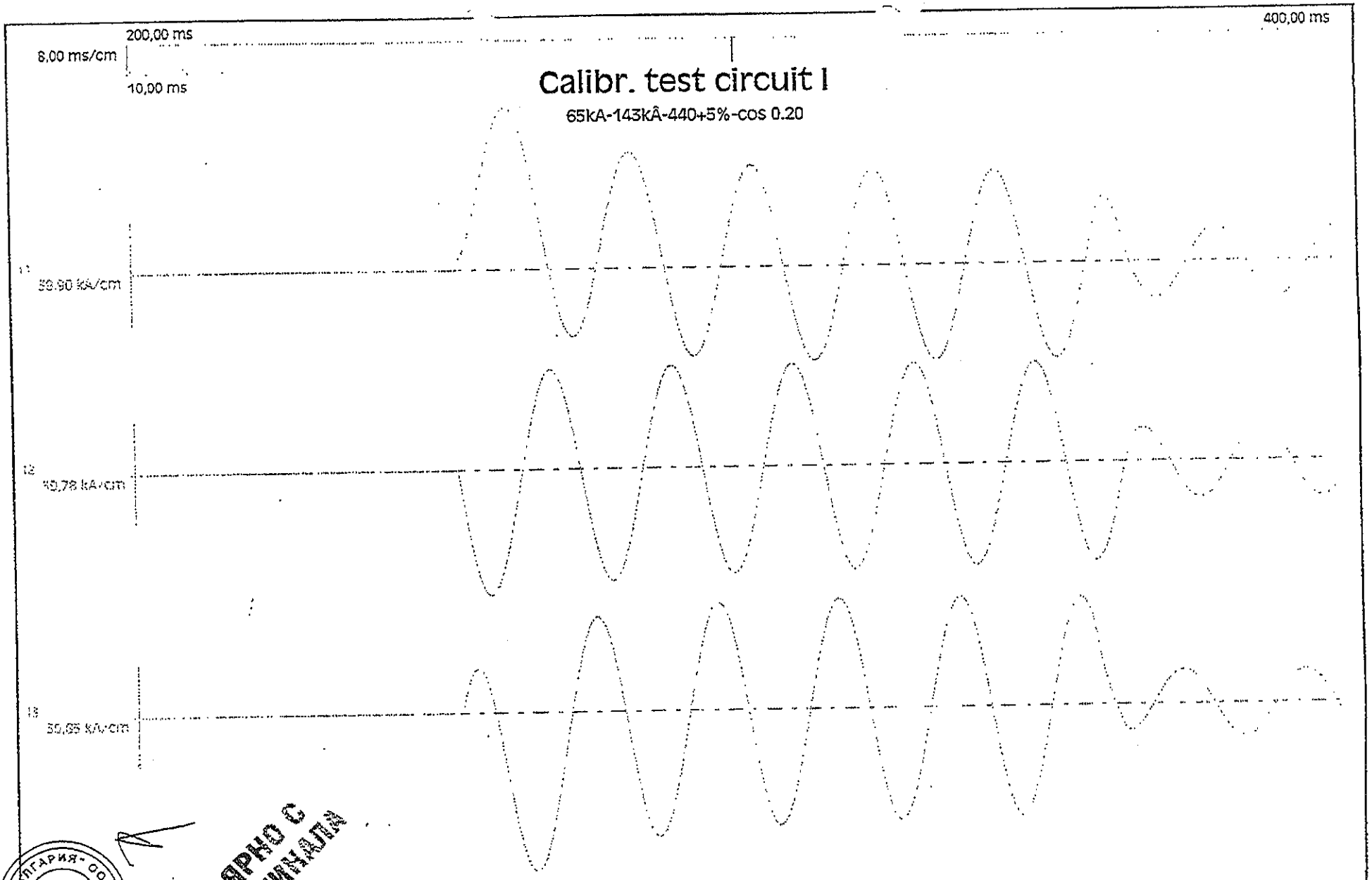




ВЯРНО С ОРИГИНАЛА

VOLTA 20040288 - 0015

Effectué le 06/12/2004 11:16:11
Edité le 18/08/2005 11:32:35



ВЯРНО С ОРИГИНАЛА

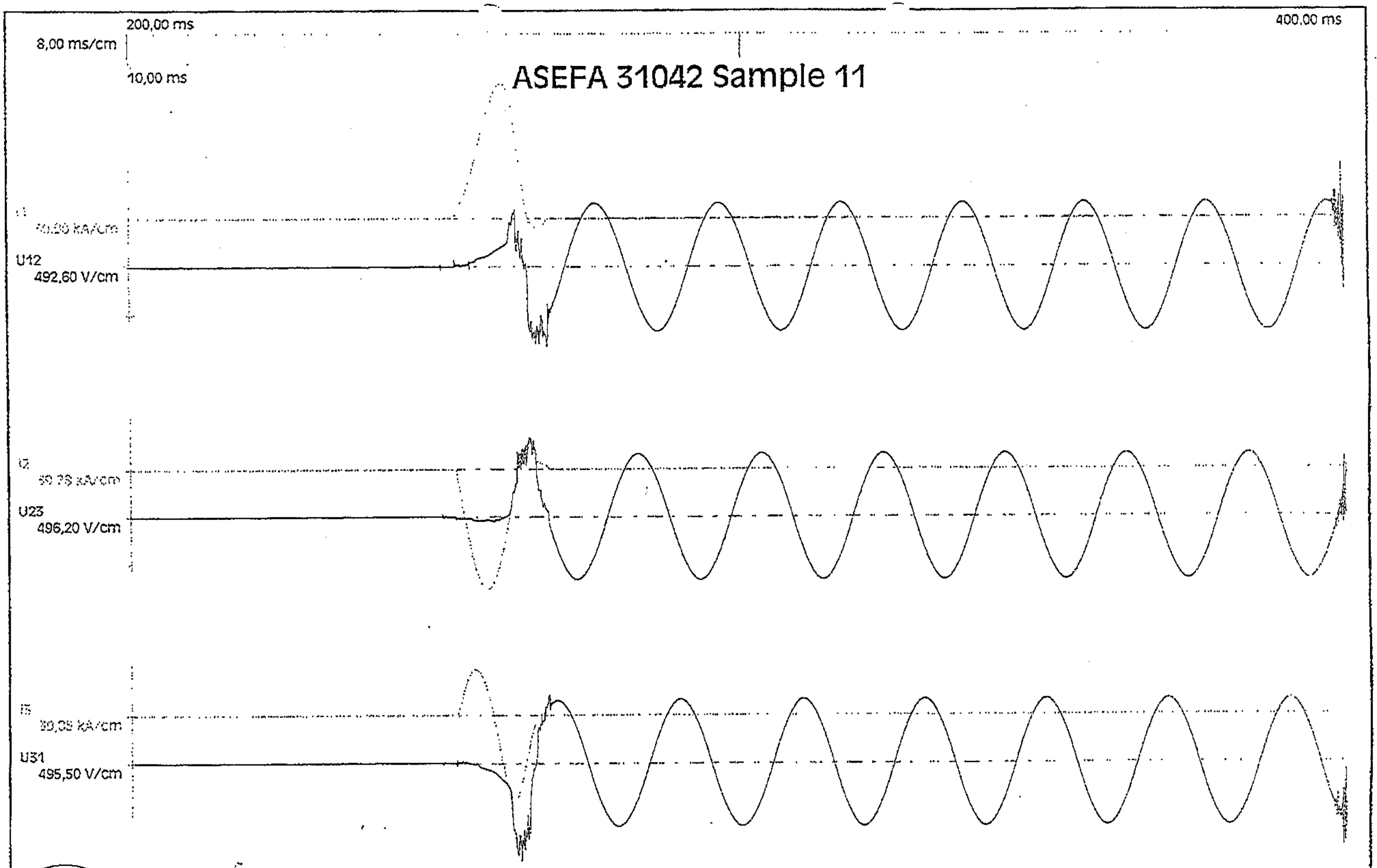
КИМТЕХ-БЪЛГАРИЯ-ООД КИМТЕХ ВАРНА

CATIE 8.1.5.3.129 page 001

VOLTA 20040288 - 0018

Effectué le 06/12/2004 11:58:38
Edité le 18/08/2005 11:32:49

ASEFA 31042 Sample 11



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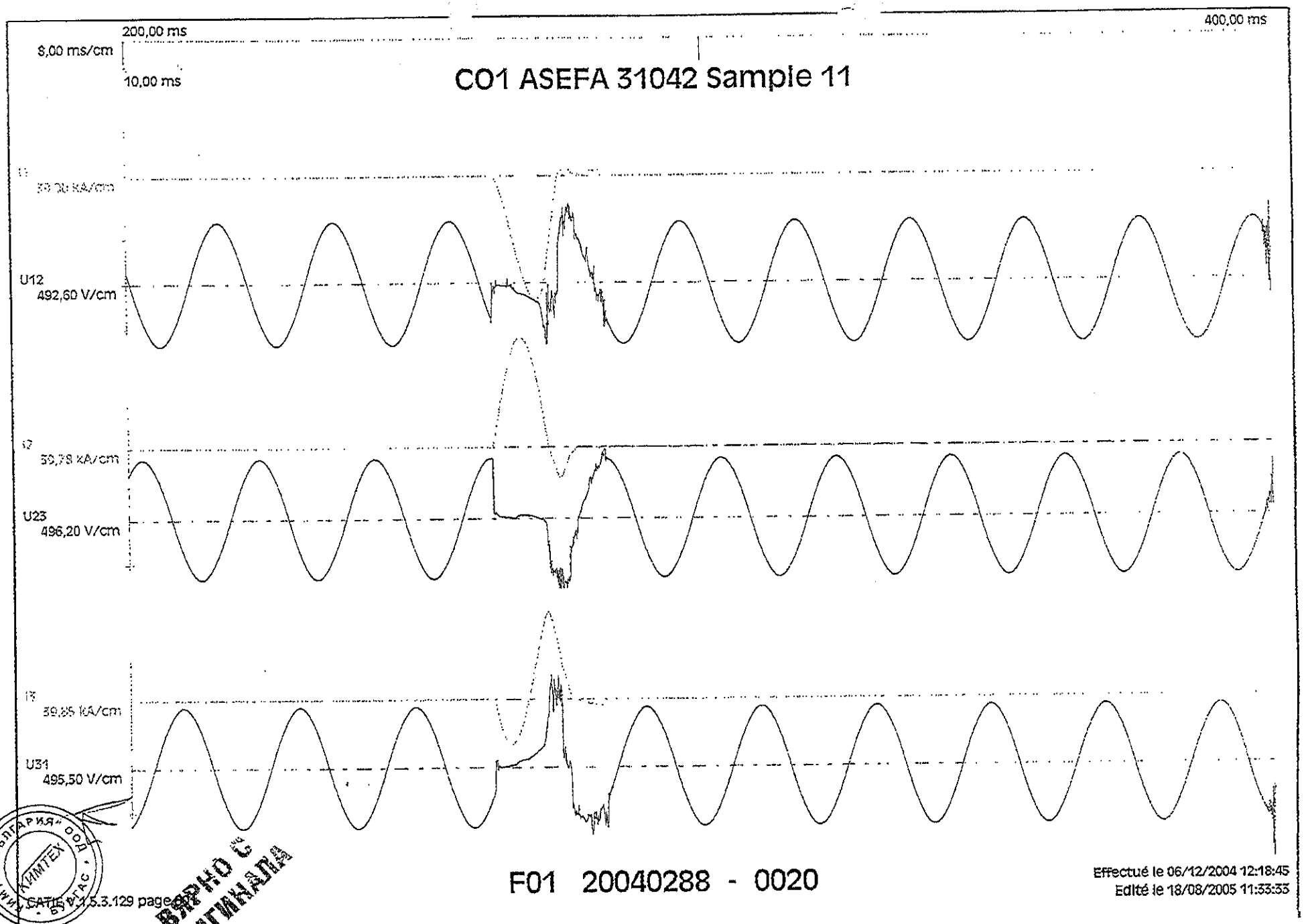
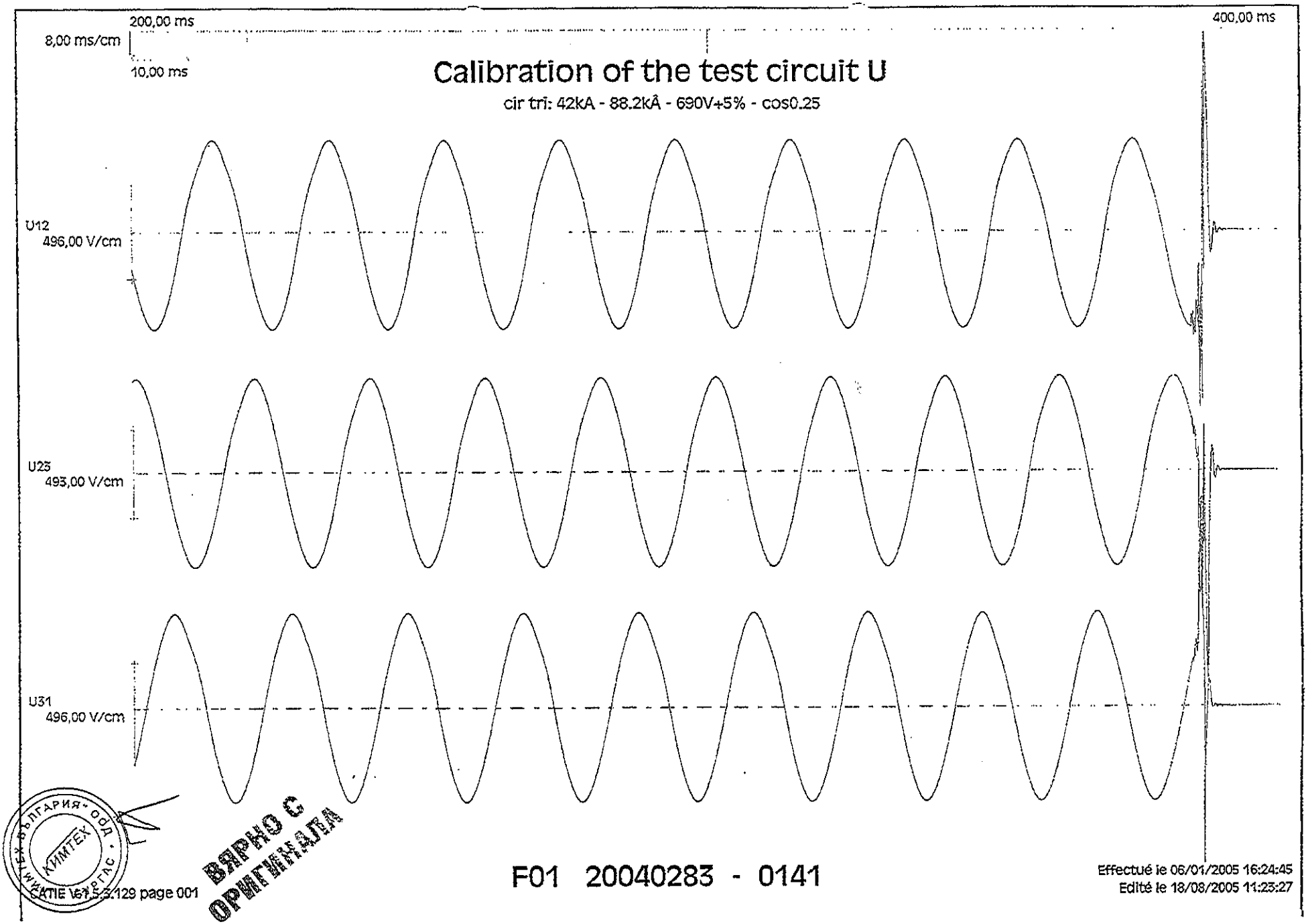
Effectué le 06/12/2004 12:15:38
Edité le 18/08/2005 11:55:06



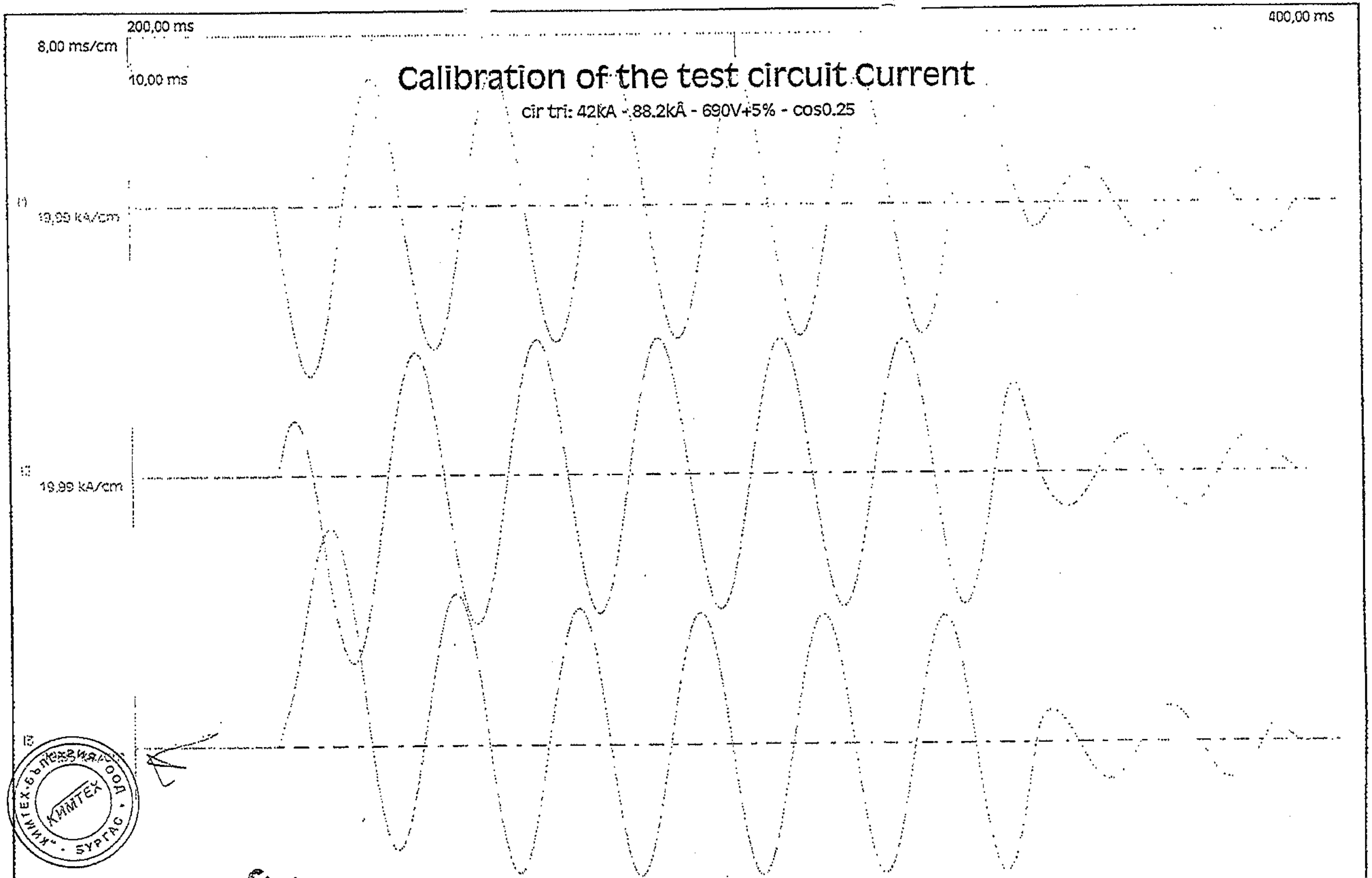


F01 20040283 - 0141

Effectué le 06/01/2005 16:24:45
Edité le 18/08/2005 11:23:27

Calibration of the test circuit Current

cir tri: 42kA - 88.2kÂ - 690V+5% - cos0.25

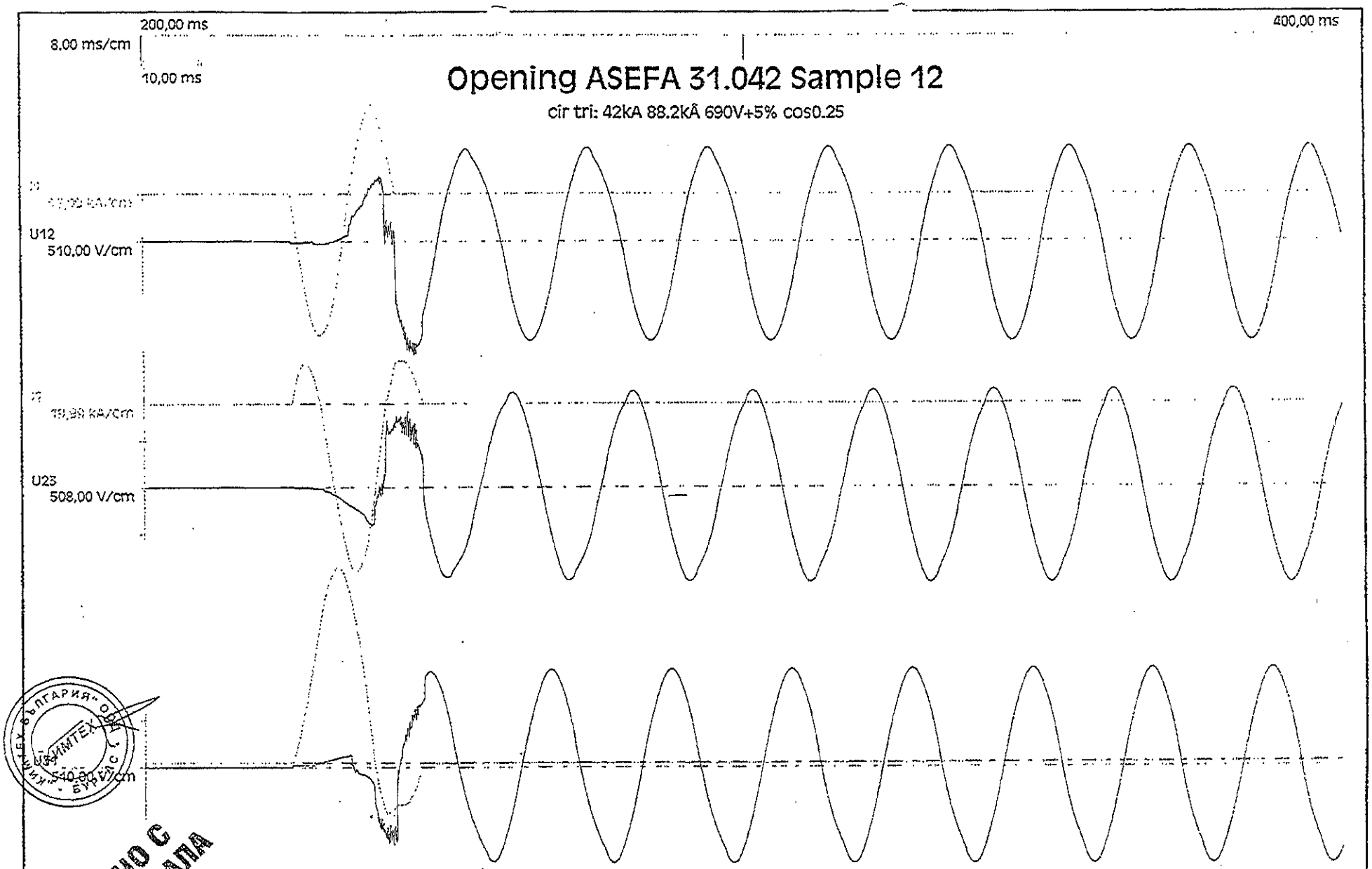


F01 20040283 - 0150

Effectué le 06/01/2005 17:36:20
Edité le 18/08/2005 11:23:45

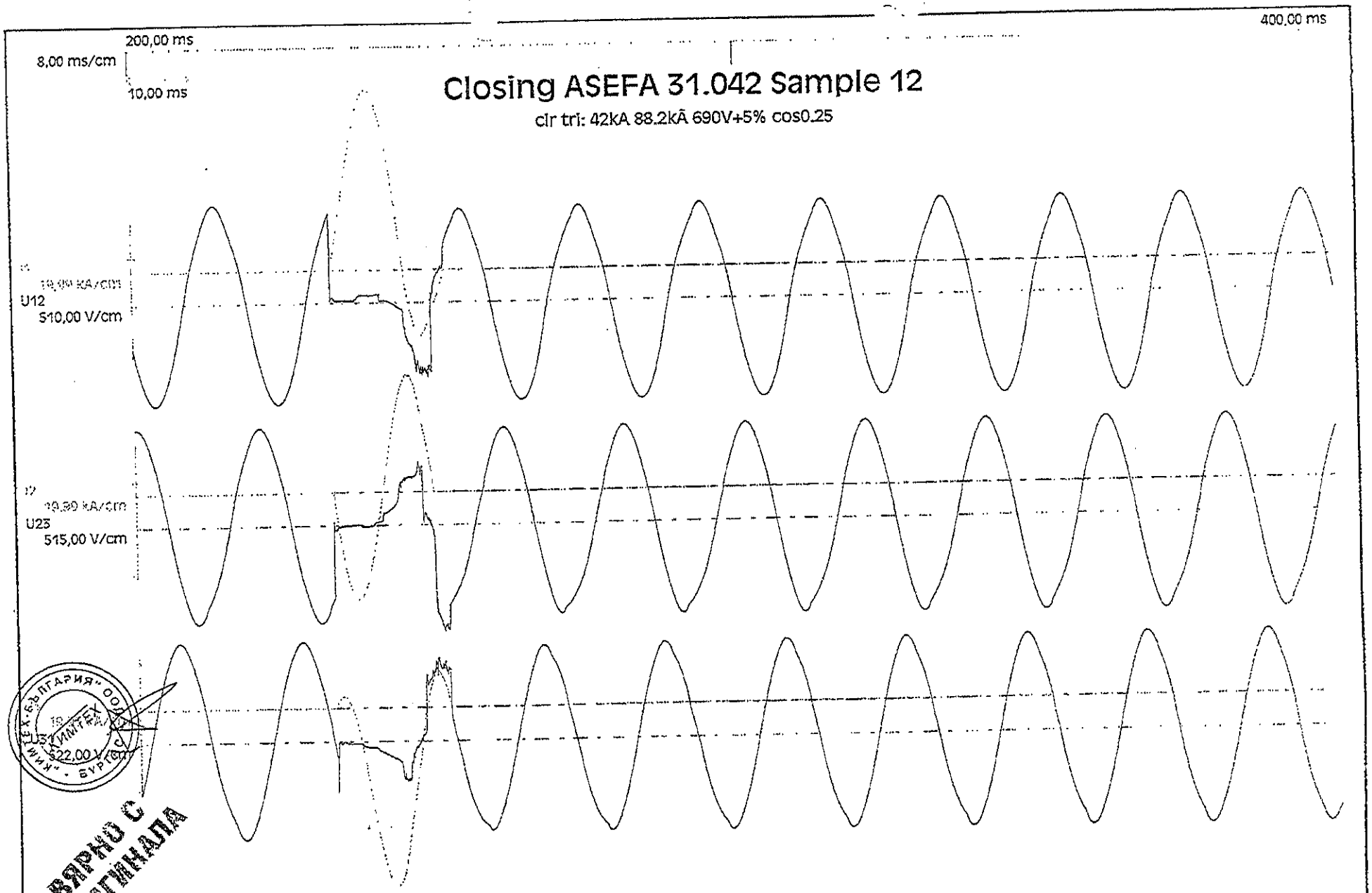
CATIE V.1.5.3.129 page

ВЯРНО С ОРИГИНАЛА



ВЯРНО С ОРИГИНАЛА

CATIE V[illegible]3.129 page 001



ВЯРНО С ОРИГИНАЛА

Kimtech
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1113 гр. София
ул. Акад. Георги Бончев № 20

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tyco Electronics
кабели, трансформатори,
електрооборудване

тел: 02 9733373
факс: 02 9733370
web:www.kimtech.bg
e-mail: office@kimtech.bg

Списък на проведените изпитвания на Триполюсни автоматични прекъсвачи НН с лят корпус, от 160 А до 1250 А, с електронна защита, категория А

1. Капацитет на пробив при номинално късо съединение;
2. Претоварване;,
3. Диелектрична якост;
4. Ток на утечка;

13.01.2016г.

Подпис и печат

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Превод от френски на български език

COFRAC

Френски комитет за акредитация
Сертифициране на индустриални продукти и услуги

ДИПЛОМА ЗА АКРЕДИТАЦИЯ

Настоящият документ удостоверява, че

ASEFA

Бул. Женерал Льоклер 33 – 92260 ФОНТЬОНЕ О РОЗ, Седекс

е акредитирано съгласно норма NF EN 45011 и правилата за прилагане на Френския комитет за акредитация относно

Сертифициране посредством проби на устройства тип електрически и/или електронни под номер 5-0037

Обхватът и валидността на акредитацията са уточнени в удостоверението или влязлото в сила изменение. По време на този период, организацията се ангажира да спазва във всеки момент изискванията на акредитацията.

Издадено в Париж на 15 декември 2002 година

Председател на секционен комитет: подпис не се чете

Директор на Френски комитет за акредитация: подпис не се чете

Долуподписаният, Светомир Радков Минчев, удостоверявам верността на извършения от мен превод от френски на български език на настоящия документ: Акредитация. Преводът се състои от 1 страница.

Подпис:
Светомир Радков Минчев

„АГЕНЦИЯ ГРЕГ" ООД СОФИЯ

ВЯРНО С ОРИГИНАЛА

„БЪЛГАРИЯ" ООД

D'ACCREDITATION

cofrac

CERTIFICATION PRODUITS INDUSTRIELS & SERVICES

Diplôme d'Accréditation

Ce document atteste que :

ASEFA

33, avenue du Général Leclerc – 92260 FONTENAY AUX ROSES Cedex

est accréditée selon la norme NF EN 45011 et les règles d'application du COFRAC pour la

Certification par essai de type des dispositifs électriques et/ou électroniques

sous le numéro 5-0037

La portée et la validité de l'accréditation sont précisées dans l'attestation ou l'avenant en vigueur qui lui a été délivré. Durant cette période, l'organisme s'engage à respecter à tout moment les exigences de l'accréditation.

Fait à Paris, le 15 décembre 2002

Le Président
du Comité de section

Le Directeur du COFRAC

KEMA

HIGH-POWER LABORATORY
Utrechtseweg 310 – 6812 AR Arnhem – The Netherlands

710–98

REPORT OF PERFORMANCE

CLIENT	EFACEC ENERGIA Máquinas e Equipamentos Eléctricos,S.A. S. Mamede de Infesta, Portugal
MANUFACTURER	EFACEC ENERGIA Máquinas e Equipamentos Eléctricos,S.A. S. Mamede de Infesta, Portugal
APPARATUS	A three-phase SF_6 switch as part of an SF_6-insulated ring main unit type Fluofix GC-T
DESIGNATION	ISFG

RATINGS ASSIGNED BY THE MANUFACTURER

Voltage	24	kV	Making current at	24 kV	40	kApeak
Normal current	630	A	Short-time current:			
Frequency	50	Hz	Peak value		40	kApeak
Number of poles	3		rms value	16 kA	during	3 s
Breaking current at 24 kV:			SF_6-insulation pressure at 20° C		1.3	bar(abs)
Mainly active load	630	A				
Cable-charging	25	A				
Closed loop	630	A				
First-pole-to-clear factor	1.5					

The tests have been carried out in accordance with the client's instructions.

Date of tests: 19th November 1998

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with test results and the oscillograms

THIS REPORT CONSISTS OF:

Pages	13
Circuit diagrams	1
Oscillograms	9
Drawings	14
Photographs	6
Addition sheet	B70E

KEMA Nederland B.V.

QUALIFIED BY STERCAD

A.L.J. Jansen

Arnhem, 5th January 1999

TYPE OF TEST	COMPONENT	POSITION	PAGE
No-load test	Switch S1	Line position	4
Short-circuit making test			5
No-load test			6
Short-circuit making test			7
No-load test			8
No-load test		Earth position	9
Short-circuit making tests			10
No-load test			11
Short-circuit making test			12
No-load test			13

The tests were witnessed by:

Name	Company
Carvalho, M. Martins, J. Martins, M.	EFACEC ENERGIA, Máquinas e Equipamentos Eléctricos, S.A., S. Mamede de Infesta, Portugal

The tests were observed by:

Name	Company
Bronsveld, A.J.	KEMA, Arnhem, The Netherlands

Drawings

The manufacturer has guaranteed that the equipment submitted for tests has been manufactured in accordance with the following drawings.
KEMA has verified that these drawings adequately represent the equipment tested.

EMT598697 Rev. 0
EMT598696 Rev. 0
EMT598692 sheet 1 of 2 Rev. 0
EMT598692 sheet 2 of 2 Rev. 0
EMT598695 Rev. 0
EMT598698 Rev. 0
AMT598140 Rev. 0
DMT598138 Rev. 0
DMT598139 Rev. 0
EMT598006 Rev. 0
DMT598008 Rev. 0
EMT695514 Rev. 0
CMT695129 Rev. b
DMT696014 Rev. 0

Photographs

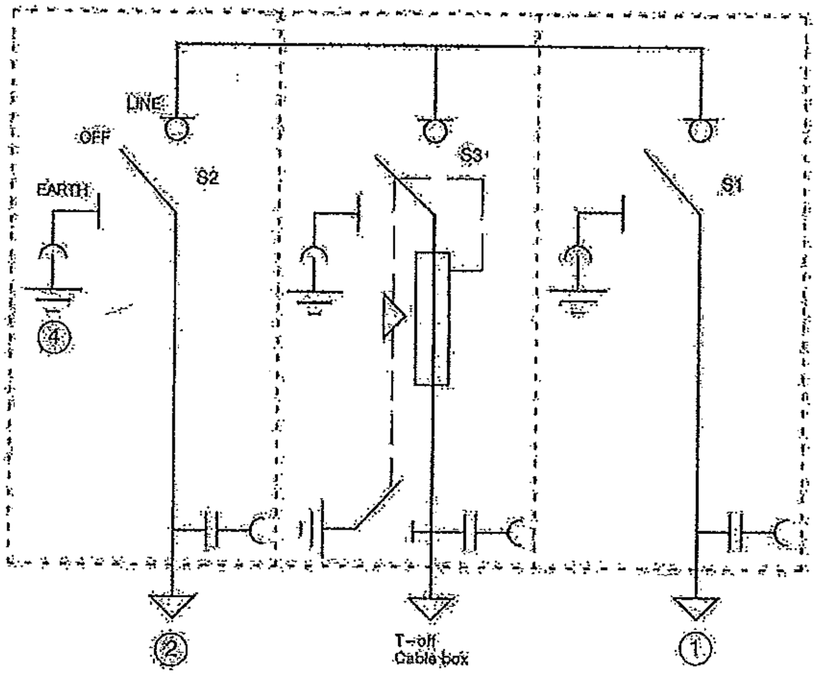
858405
858406
858806 to 858809.

Note:

On request of the client the test parameters of this report were based on a rated voltage of 12 kV and a rated making current of 63 kApeak.

TEST ARRANGEMENT

RMU



S1, S2, S3: ISFG three-position switch-disconnector (line / open / earth)

KEMA

REPORT 710–98	TABLE WITH TEST CIRCUITS				PAGE 3	
TEST CIRCUIT	S08					
Number of phases	3					
Power frequency Hz	50					
Generator neutral	not earthed					
Transformer connections	Δ/Δ					
Short-circuit point	earthed					
Circuit impedance Ω	0.296					
Power factor	<0.1					
TRV control elements added: Capacitance in parallel C_1 μF						
TRV control elements added: Resistance in series R_i Ω						
TRV control elements added: Resistance in parallel R_j Ω						
TRV control elements added: Inductance in parallel with R_j L_1 mH						
TRV control elements added: Time delay Capacitance C_d nF						
TRV control elements added: Standard circuit						
Prospective TRV: TRV peak value u_c kV						
Prospective TRV: Time co-ordinate t_3 μs						
Prospective TRV: Time delay t_d μs						
Prospective TRV: Based on kV rms						
Prospective TRV: Depression						
Prospective TRV: Rate-of-rise kV/μs						

TABLE WITH NO-LOAD TEST RESULTS

REPORT 710-98 | PAGE 4

Data of mechanism: Independent manual closing (springs). For test purposes operated by robot.

SF_6 insulation pressure at 20 °C: 6,3 bar(abs)

Condition before tests: Unit previously subjected to making and breaking tests. Right-hand switch (S1) new and under test. Switch closing to line position. Photograph 858405.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs)			Remarks
981119. 4037	C								1,3			

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Note: Where phase values are given they are to be read: L1 L2 L3

TABLE WITH TEST RESULTS

REPORT 710 - 98 | TYPE OF TESTS REQUESTED: Short-circuit making test | TEST CIRCUIT S08 | PAGE 5

Condition before tests: Unit in same condition.
Right-hand switch (S1) closing to line position.
Supply to right-hand cable terminals.
Short-circuit on left-hand cable terminals. Switch (S2) in line position.
Unit earthed via an earth fault current indicating CT.
For schematic presentation of test arrangement see sheet 2.

SF6 insulation pressure at 20 °C 1.3 bar(abs)

Date and test	Operation and time interval	Test quantities: Applied voltage between phases kV	Test quantities: Making current peak kA	Test quantities: Breaking current: D.c. component (< 20% if no value is given) %	Test quantities: Breaking current: Phase value kA	Test quantities: Recovery voltage: Phase value kV	Test quantities: Recovery voltage: Between phases kV	Test quantities: Recovery voltage: TRV peak kV	Performance data: Arc duration ms	Performance data: Opening time ms	Performance data: Break time ms	Performance data: Make time ms	Current duration ms			Physical behaviour: Emission of: Flame	Gas	Oil	Remarks
981119: 4041	C	12.0	44.5 51.9 64.0		23.1 22.6 23.2 23.9								205			none	none		Switch closed.

Condition after tests: Switch could be opened easily. See no-load test 981119-4042 on next sheet.

Note: Where phase values are given they are to be read: L1 L2 L3 Average values on the 4th line.

TABLE WITH NO-LOAD TEST RESULTS

REPORT 710-98 PAGE 6

Data of mechanism: Independent manual closing (springs). For test purposes operated by robot.

SF_6-insulation pressure at 20 °C: 1.3 bar(abs)

Condition before tests: Unit in same condition. Right-hand switch (S1) under test. Switch opening from line position.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs)			Remarks
981119 4042	O								1.3			

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Note: Where phase values are given they are to be read: L1 L2

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TABLE WITH TEST RESULTS

REPORT 710–98	TYPE OF TESTS REQUESTED: Short–circuit making test	TEST CIRCUIT S08	PAGE 7

Condition before tests: Unit in same condition.
Right–hand switch (S1) closing to line position.

SF6–insulation pressure at 20 °C 1.3 bar(abs)

Date and test	Operation and time interval	Test quantities: Applied voltage between phases kV	Test quantities: Making current peak kA	Test quantities: Breaking current: D.c. component (<20% if no value is given) %	Test quantities: Breaking current: Phase value kA	Test quantities: Recovery voltage: Phase value kV	Test quantities: Recovery voltage: Between phases kV	Test quantities: Recovery voltage: TRV peak kV	Performance data: Arc duration ms	Performance data: Opening time ms	Performance data: Break time ms	Performance data: Make time ms	Current duration ms			Physical behaviour: Emission of: Flame	Physical behaviour: Emission of: Gas	Physical behaviour: Emission of: Oil
981119, 4043	C	12.0	63.5 59.6 39.3		23.1 22.6 23.2 23.0								205			none	none	
																Remarks: Switch closed.		

Condition after tests: Switch could be opened easily. See no–load test 981119–4044 on next sheet.

Note: where phase values are given they are to be read: L3 L2 L1 Average values on the 4th line

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ВЯРНО С ОРИГИНАЛА

TABLE WITH NO-LOAD TEST RESULTS

REPORT: 710-98 | PAGE: 8

Data of mechanism: Independent manual closing (springs).
For test purposes operated by robot.

SF6-insolation pressure at 20 °C: 1.3 bar(abs)

Condition before tests: Unit in same condition. Right-hand switch (S1) under test. Switch opening from line position.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure Bar	SF6 insulation pressure at 20 °C bar(abs)			Remarks
961119 4044	O								1.3			

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Note: Where phase values are given they are to be read: L1
L2
L3

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TABLE WITH NO-LOAD TEST RESULTS

REPORT 7.10-98 PAGE 5

Data of mechanism: Independent manual closing (springs).
For test purposes operated by robot.

SF_6-insulation pressure at 20 °C 1.3 bar(abs)

Condition before tests: Unit in same condition. Right-hand switch (S1) under test. Switch closing to earth position.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs.)			Remarks
981119 4045	C								1.3			

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Note: Where phase values are given they are to be read: L1
L2
L3

КИМТЕХ-БЪЛГАРИЯ ООД БУРГАС

ВЯРНО С ОРИГИНАЛА

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TABLE WITH TEST RESULTS

REPORT 710-98 | TYPE OF TESTS REQUESTED: Short-circuit making test | TEST CIRCUIT S08 | PAGE T0

Condition before tests: Switch in same condition.
Right-hand switch (S1) closing to earth position.
Supply to right-hand cable terminals.

SF_6-insulation pressure at 20 °C: 1.3 bar(abs)

Date and test	Operation and time interval	Test quantities: Applied voltage between phases (kV)	Making current peak (kA)	Breaking current: D.c. component (<20% if no value is given) (%)	Breaking current: Phase value (kA)	Recovery voltage: Phase value (kV)	Recovery voltage: Between phases (kV)	TRV peak (kV)	Performance data: Arc duration (ms)	Opening time (ms)	Break time (ms)	Make time (ms)	Current duration (ms)			Physical behaviour – Emission of: Flame	Gas	Oil
981119 4047	C	12.1	46.1 52.7 65.5		23.1 22.6 23.2 23.0								220			none	none	
																Remarks: Switch closed.		

Condition after tests: Switch could be opened easily after test 981119-4047. See no-load operation 981119-4048 on next sheet.

Note: When phase values are given they are to be read: L3 L2 L1 Average values on the 4th line

ВЯРНО С ОРИГИНАЛА

„КИМТЕКС-БЪЛГАРИЯ" ООД БУРГАС

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TABLE WITH NO-LOAD TEST RESULTS

REPORT: 710-98 | PAGE: 11

Data of mechanism: Independent manual closing (springs).
For test purposes operated by robot.

SF6-insulation pressure at 20 °C: 1,3 bar(abs)

Condition before tests: Unit in same condition. Right-hand switch (S1) under test. Switch opening from earth position.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF6 insulation pressure at 20 °C bar(abs)			Remarks
981119 4048	O								1,3			

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Note: Where phase values are given they are to be read: L1
L2
L3

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TABLE WITH TEST RESULTS

REPORT 710-98 | TYPE OF TESTS REQUESTED: Short-circuit making test | TEST CIRCUIT: S08 | PAGE: 12

Condition before tests: Switch in same condition.
Right-hand switch (S1) closing to earth position.

SF_6-insulation pressure at 20 °C 1.3 bar(abs)

Date and test	Operation and time interval	Test quantities: Applied voltage between phases (kV)	Making current peak (kA)	Breaking current: D.c. component (< 20% if no value is given) (%)	Breaking current: Phase value (kA)	Recovery voltage: Phase value (kV)	Recovery voltage: Between phases (kV)	Recovery voltage: TRV peak (kV)	Performance data: Arc duration (ms)	Performance data: Opening time (ms)	Performance data: Break time (ms)	Performance data: Make time (ms)	Current duration (ms)			Physical behaviour: Emission of: Flame	Physical behaviour: Emission of: Gas	Physical behaviour: Emission of: Oil
981119 4049	C	12.1	65.6 52.2 48.4		23.1 22.6 23.2 23.0								230			none	none	
																Remarks: Switch closed.		

Condition after tests: Switch could be opened easily. See no-load test 981119-4050 on next sheet.

Note: When phase values are given they are to be read: L3
L2
L1
Average values on the 4th line.

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TABLE WITH NO-LOAD TEST RESULTS

REPORT 710-98 | PAGE 13

Data of mechanism: Independent manual closing (springs).
For test purposes operated by robot.

SF_6-insulation pressure at 20 °C 1,3 bar(abs)

Condition before tests: Unit in same condition. Right-hand switch (S1) under test. Switch opening from earth position.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs)			Remarks
981119. 4050	O								1.3			(1)

Data of travel recorder: Attached to main contact shaft. Non-linear with contact travel.

Condition after tests: Photograph 858406.
Fixed and moving contacts line position: moderately burnt. Fixed and moving contacts earth position: moderately burnt. Photographs 858808 to 858809.

(1) No oscillogram due to failure of recorder.

Note: Where phase values are given they are to be read: L1 L2 L3

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