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

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
60947-1 8.3.4.1.6	**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	$U_{r(1-2)}$ ☐ or $U_{r(1-N)}$ ☒	432.12 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☐ 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	$U_{r(1-2)}$ ☐ or $U_{r(1-N)}$ ☒	434.56 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☐ 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 60 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

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

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			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	237 s
		Ph_1	≤ 270 s	228 s
		Ph_2	≤ 270 s	221 s
		Ph_3	≤ 270 s	235 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
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

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		20040288.0011
	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		13.8 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		
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	0.08 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_{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	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	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	Cabling characteristics			
Table 9, 10	Cable		./. mm²	185 mm²
and 11	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

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
		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	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	443.07 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ or $U_{r(2-N)}$ ☐	443.52 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	$U_{r(1-2)}$ ☒ or $U_{r(1-N)}$ ☐	442.94 V
	(phase to phase or phase to neutral)	$U_{r(2-3)}$ ☒ 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_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 =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

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
	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			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

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			22 °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	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	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

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

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
	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_m	466.21 V
	Ratio between U_m and U_e	U_m/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_m	468.32 V
	Ratio between U_m and U_e	U_m/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		
	$2 \times U_e$, 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 =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	Cabling characteristics			
Table 9, 10	Cable		./. mm^2	./. mm^2
and 11	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 Table 9, 10 and 11	Cabling characteristics			
	Cable		./. mm^2	./. mm^2
	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

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_{rr}	≤ 6 mA	./. mA

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
	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	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.

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

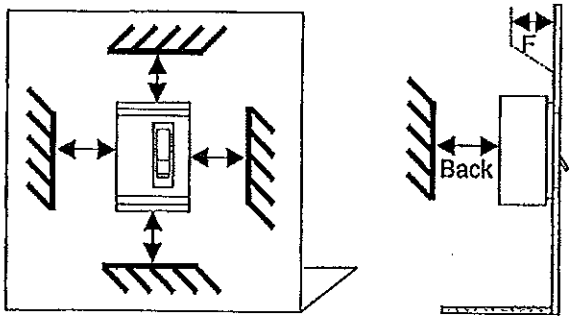
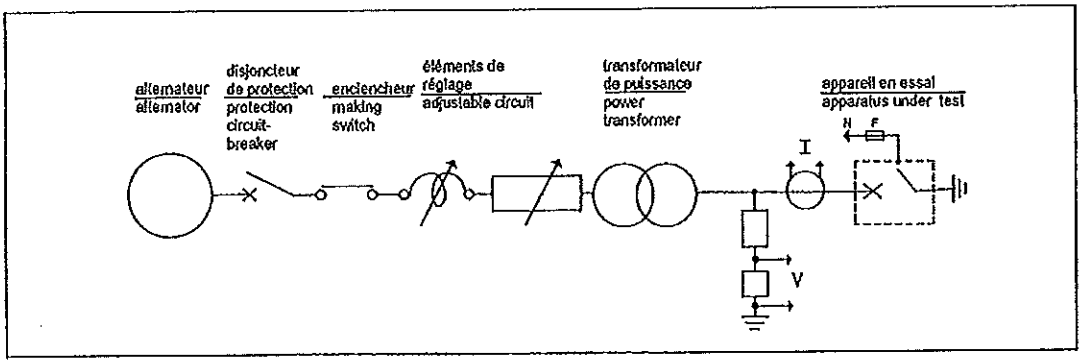
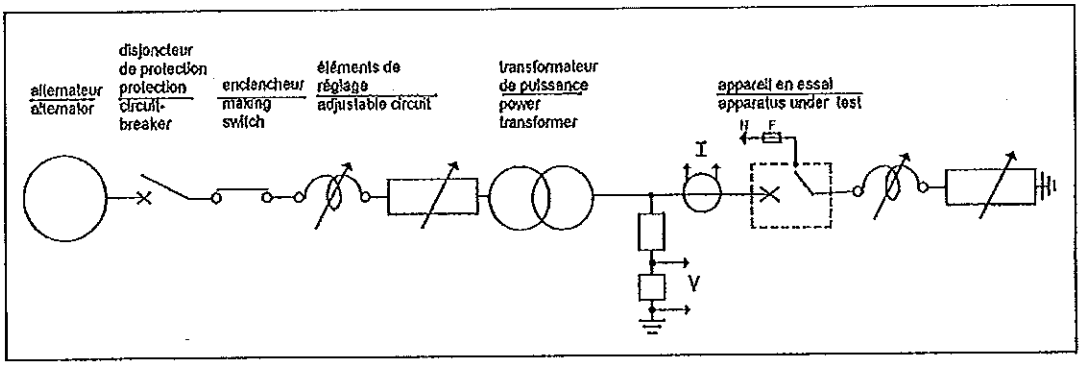
Standard and clause	Kind of tests and requirements		Test values Results
	SAFETY AREA AND DETECTION OF THE FAULT CURRENT		
60947-2	Characteristics of the metallic screen		
	- structure	woven wire mesh	./.
		perforated metal	./.
		expanded metal	Yes
	- ratio hole area / total area	0,45 - 0,65	./.
	- size 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

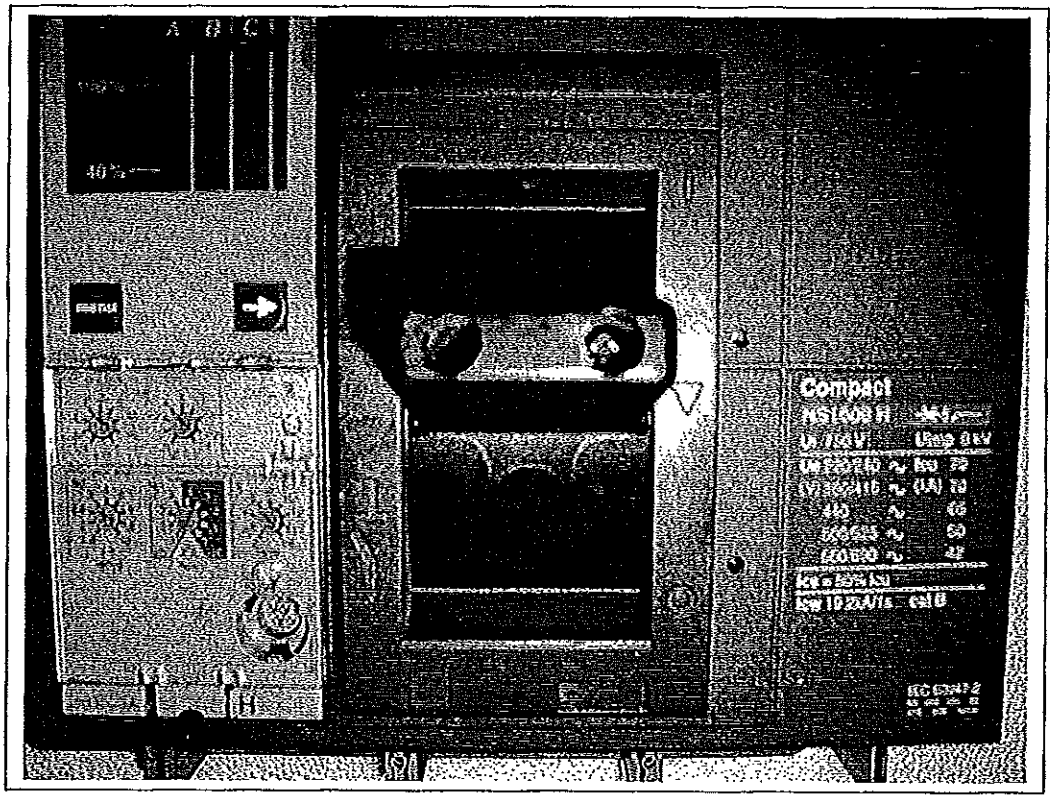
TEST OF RATED ULTIMATE SHORT-CIRCUIT BREAKING CAPACITY



VERIFICATION OF OPERATIONAL CAPABILITY



PHOTOGRAPHIE OF THE ASSEMBLY



APPENDIXES

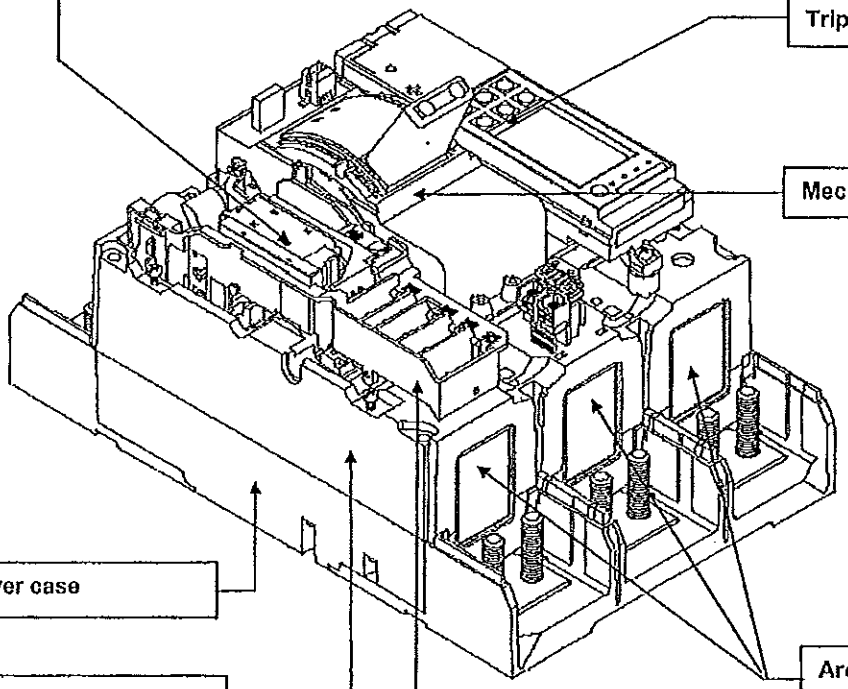
APPARATUS CHARACTERISTICS

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

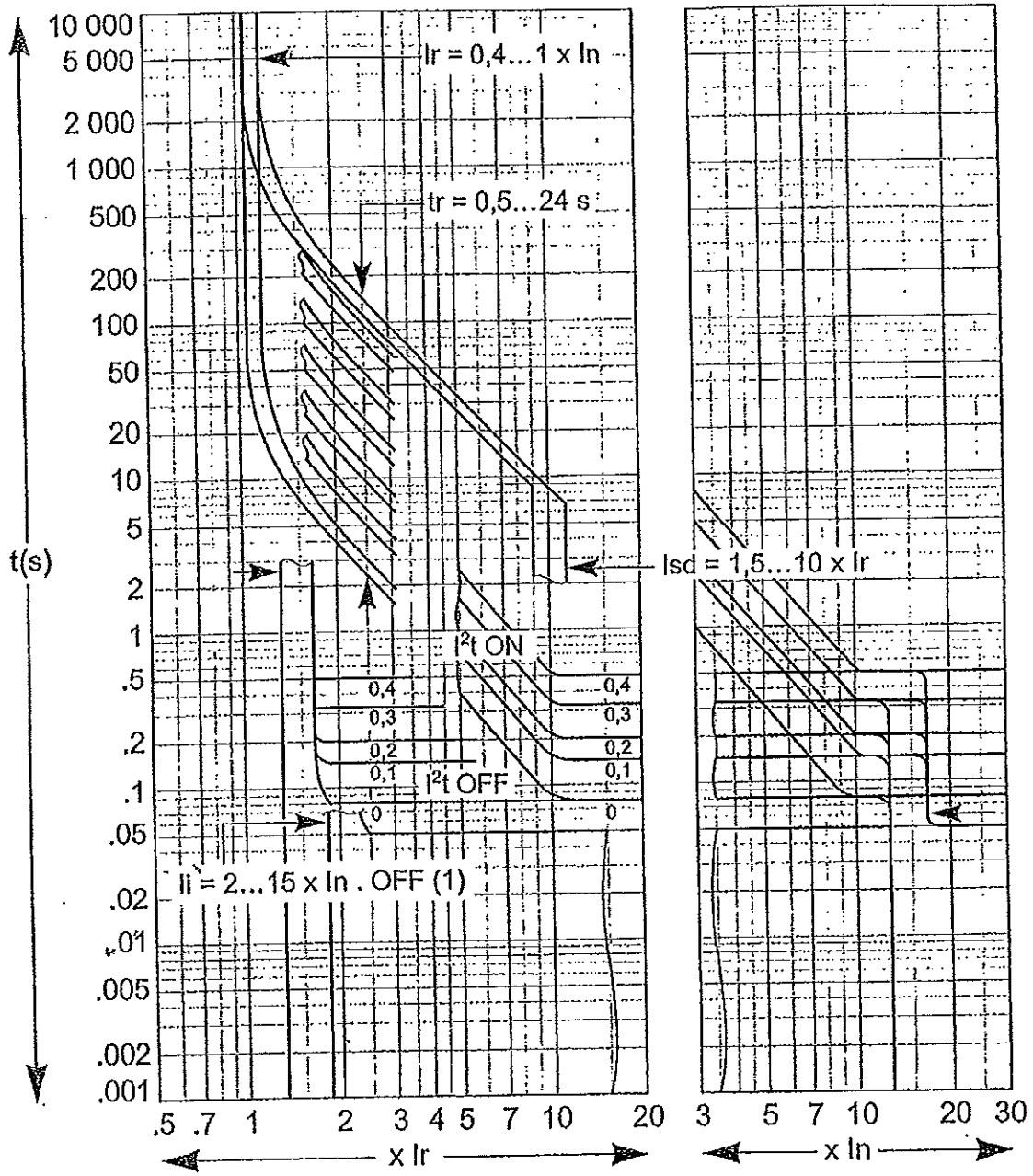
OSCILLOGRAMS

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



ВЯРНО С ОРИГИНАЛА



OFF (1)

In (A)	800	2000	4000	5000	6300
N1	42 kA				
H1	65 kA			100 kA	
H2	82 kA			100 kA	
H3		65 kA			
L1	97 kA				

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

Projet / Projet: Compact NS630b à NS1600

Dossier / Folder:

DISJONCTEUR FIXE ET DEBROCHABLE

Courbe de déclenchement pour déclencheurs Micrologic 5.0 , 6.0 , 7.0

GROUPE SCHNEIDER

Code diff. / Distrib. code

Unité / Département: DBTP

51156274AA

Ind/Rev: 0,1

Folio/Sheet: 1/1

ВЯРНО С ОРИГИНАЛА

150,00 ms

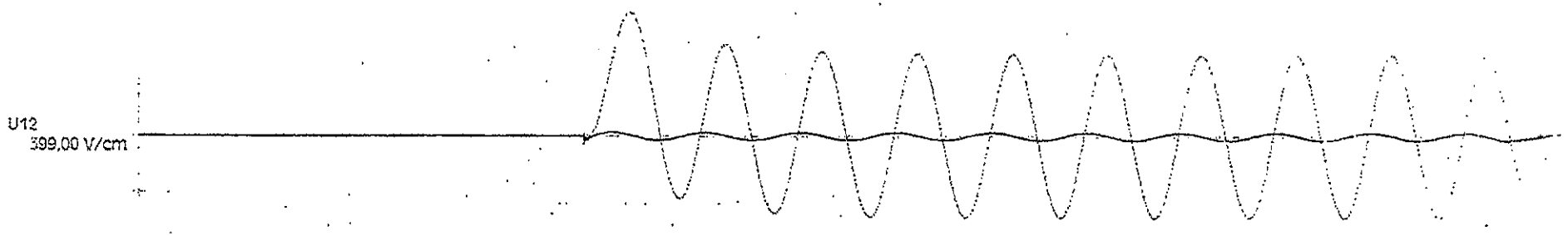
450,00 ms

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 КИМТЕХ БЪЛГАРИЯ

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

150,00 ms

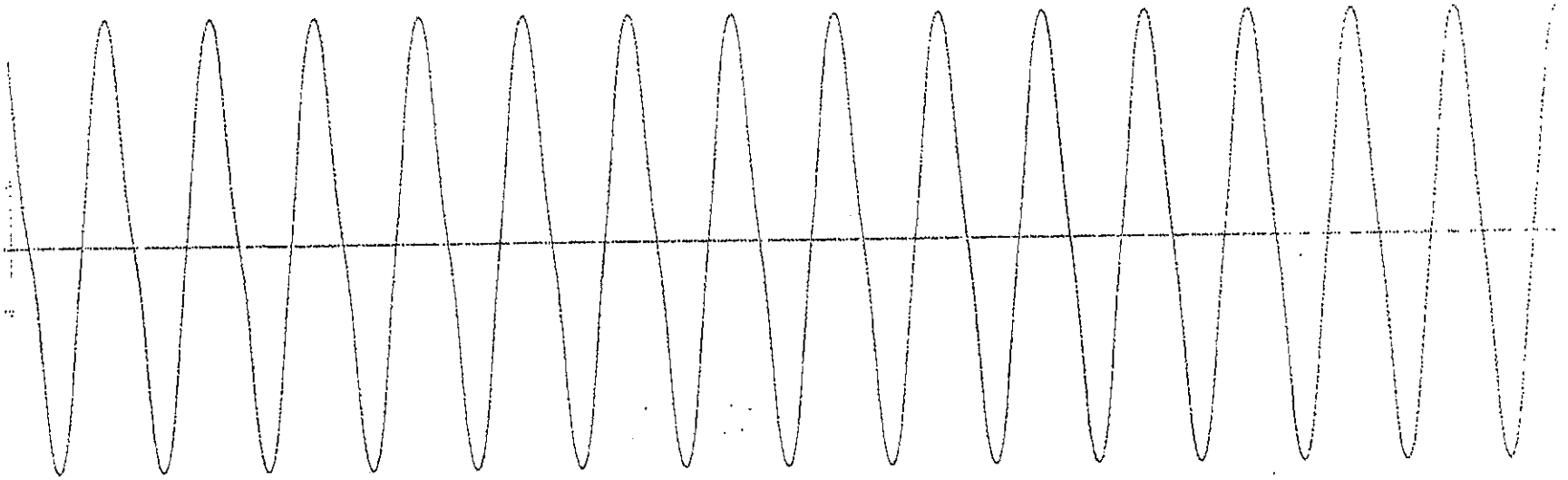
450,00 ms

12,00 ms/cm

10,00 ms

Calibration of the test circuit V

42kA 88kÂ 236V+5% cos0.25

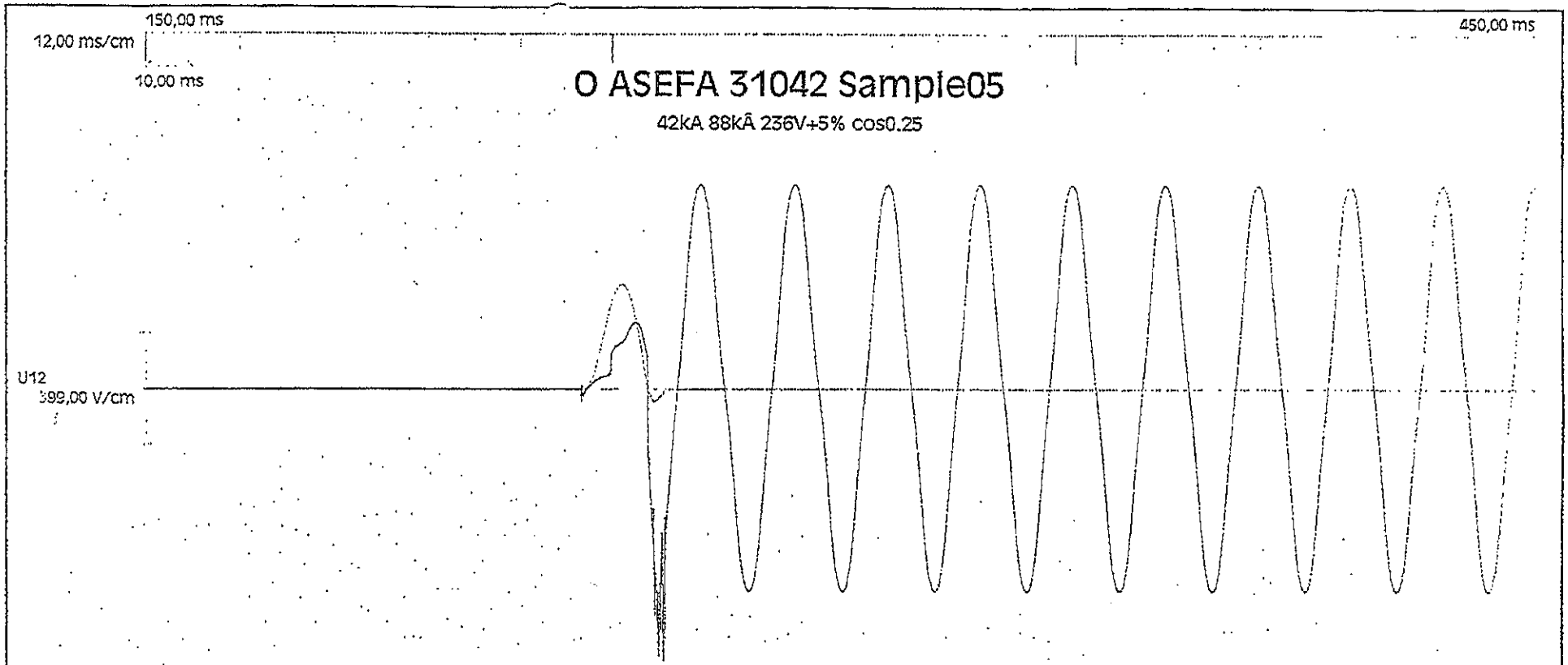


ВЯРНО С ОРИГИНАЛА

КИМТЕХ-БЪЛГАРИЯ-ЕООД КИМТЕХ БУРГАС

F01 20040283 - 0103

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



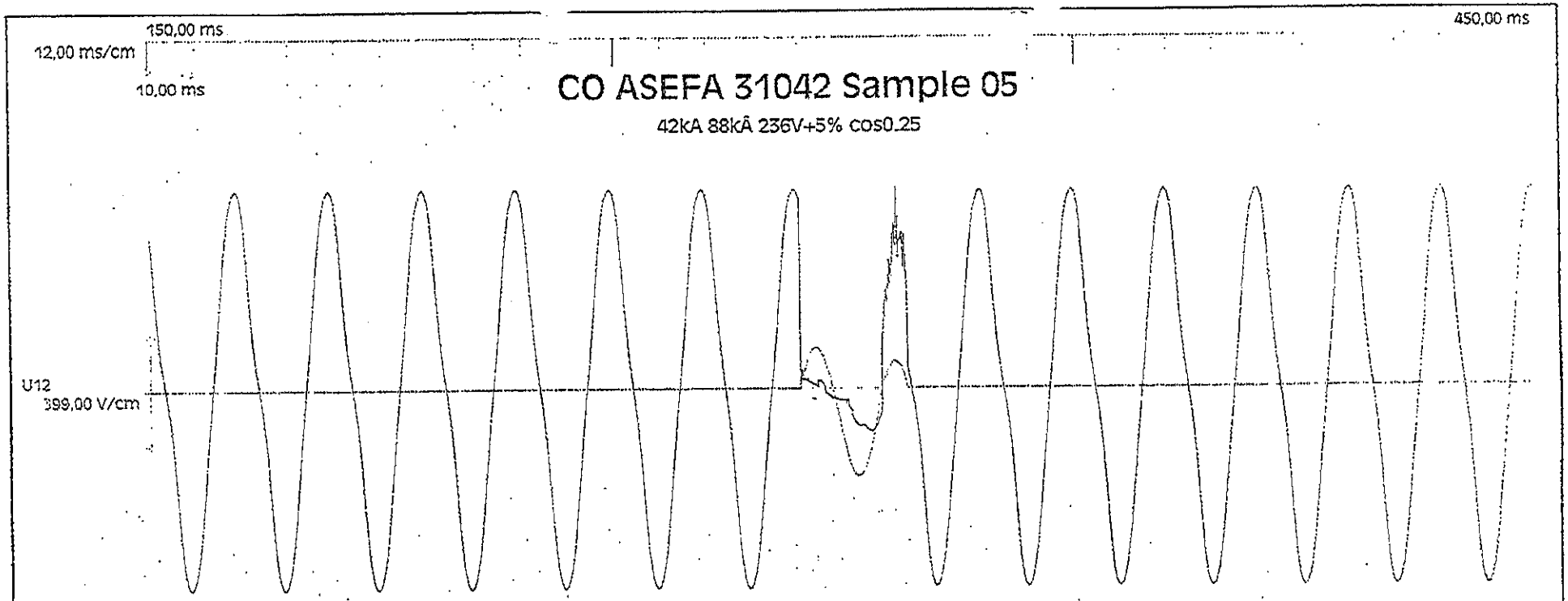
КИМТЕХ-БЪЛГАРИЯ-ООД КИМТЕХ БУРГАС

ВЯРНО С ОРИГИНАЛА

CATIE V.1.5.3.129 page 001

F01 20040283 - 0104

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



ВЯРНО С ОРИГИНАЛА

ХИМТЕХ-БЪЛГАРИЯ" ООД ХИМТЕХ БУРГАС

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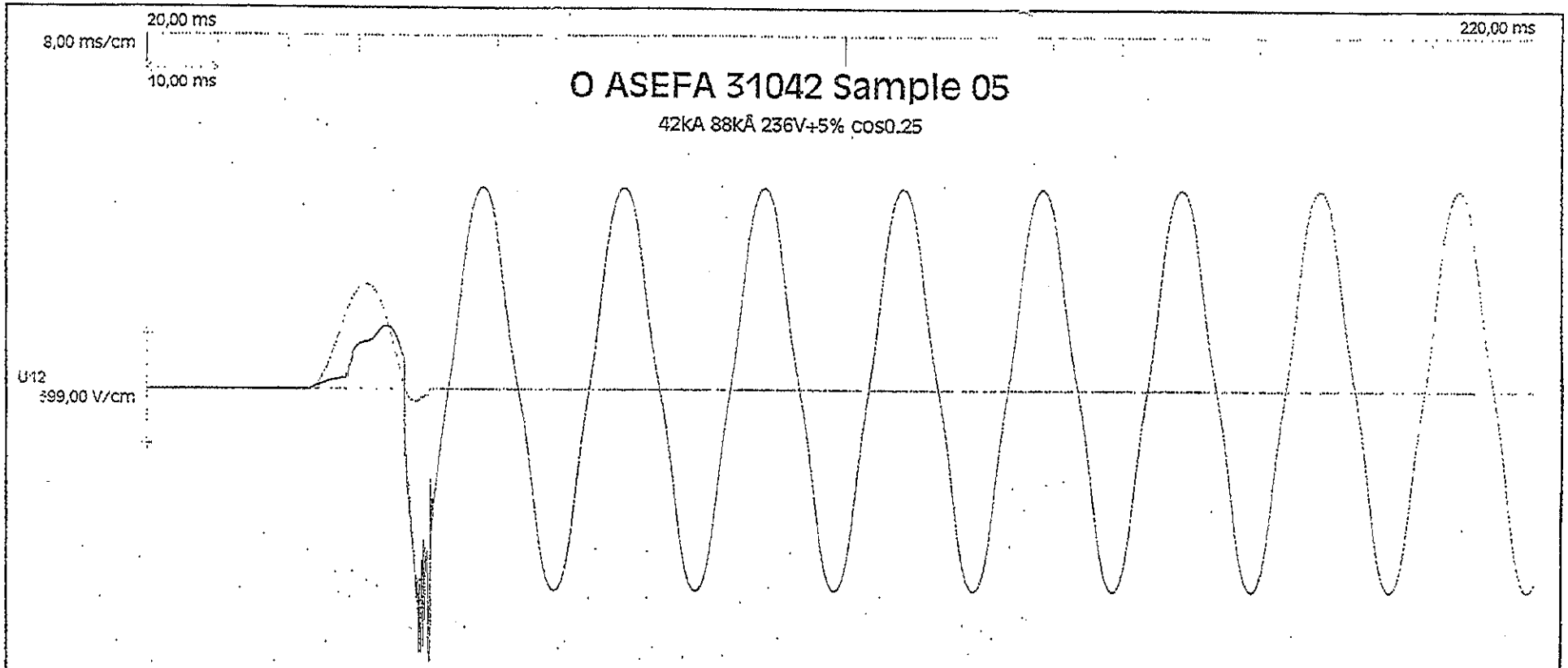
Effectué le 06/12/2004 18:03:36
Edité le 06/12/2004 18:09:46



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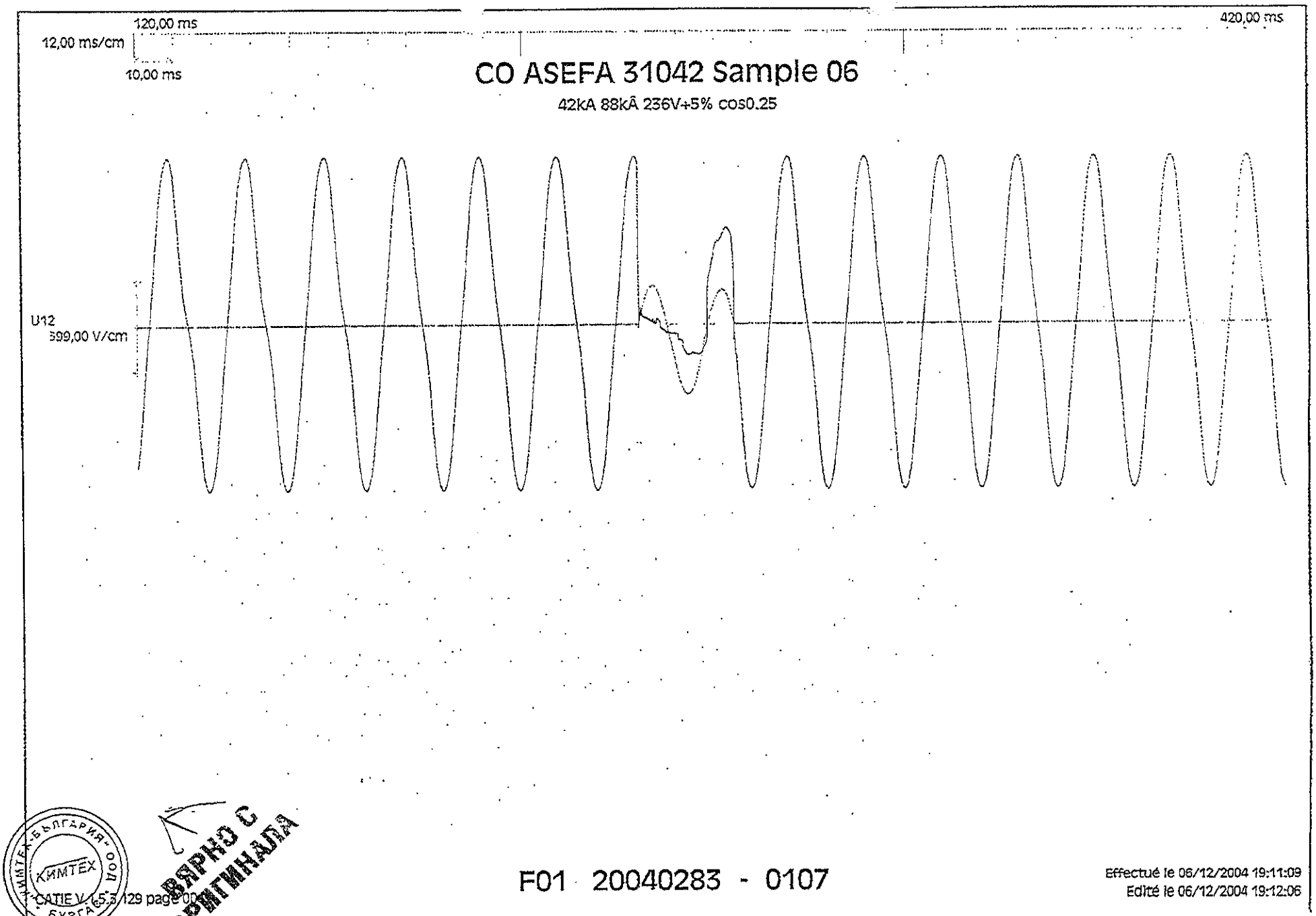
Effectué le 06/12/2004 19:07:47
Edité le 06/12/2004 19:12:55



F01 20040283 - 0107

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

100,00 ms

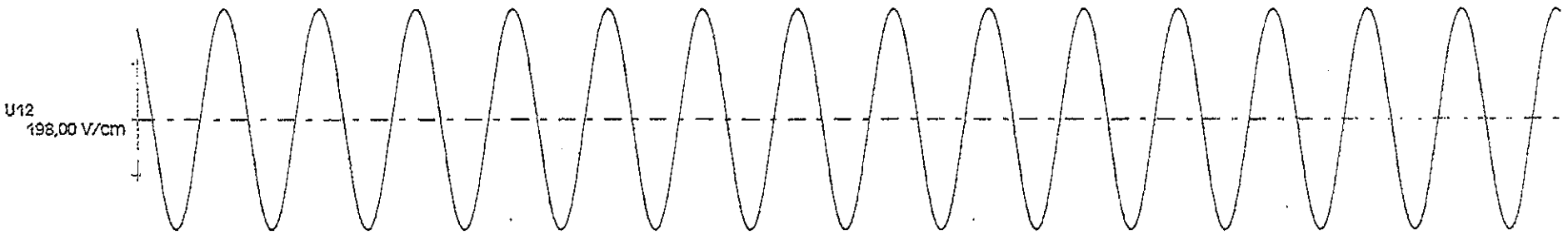
400,00 ms

12,00 ms/cm

10,00 ms

Calibr. test circuit Voltage

cir mono: 39kA 82kÄ 254V+5% cos0.25

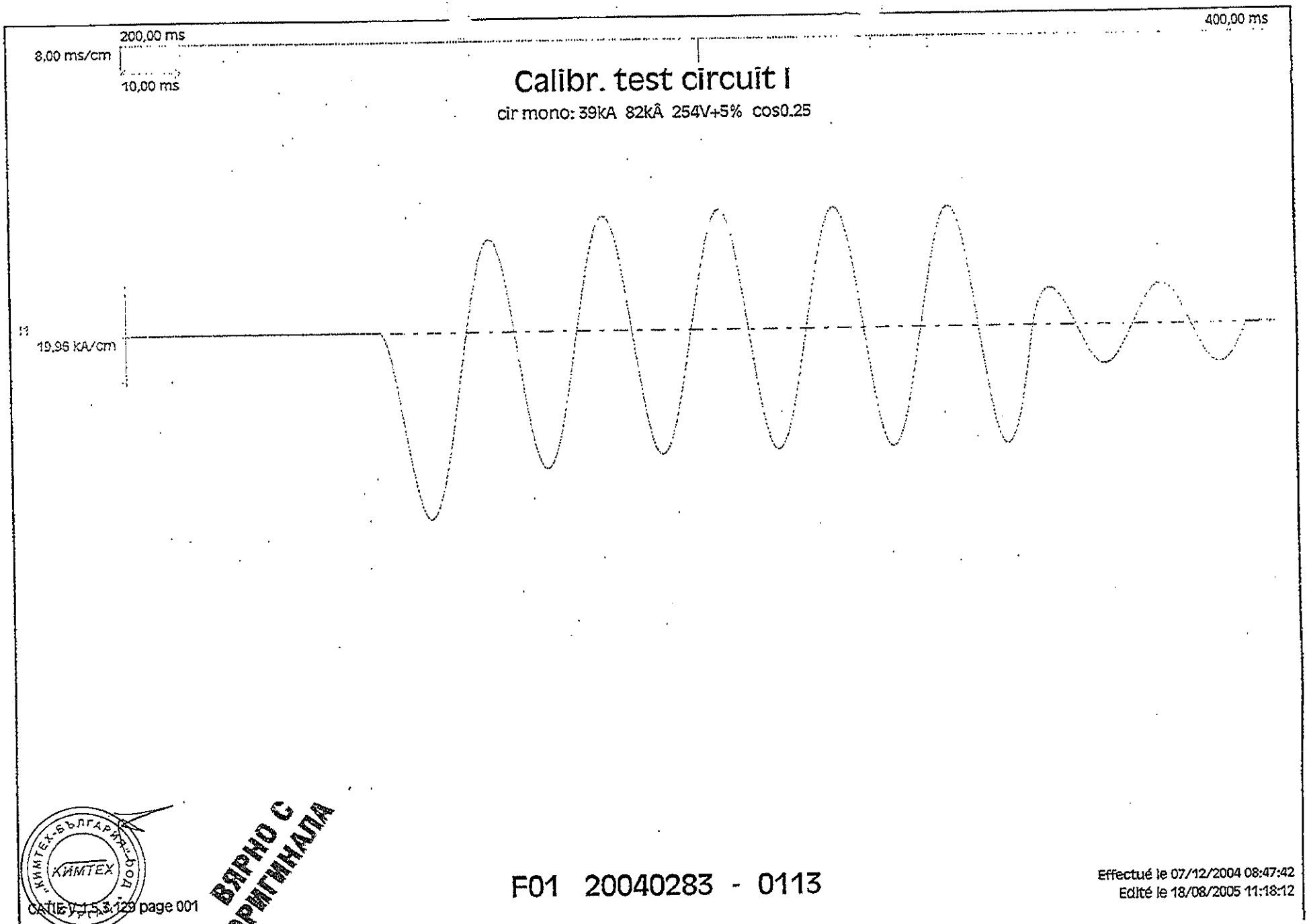


ХИМТЕХ-БЪЛГАРИЯ-ООД ХИМТЕХ БУРГАС

ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0108

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



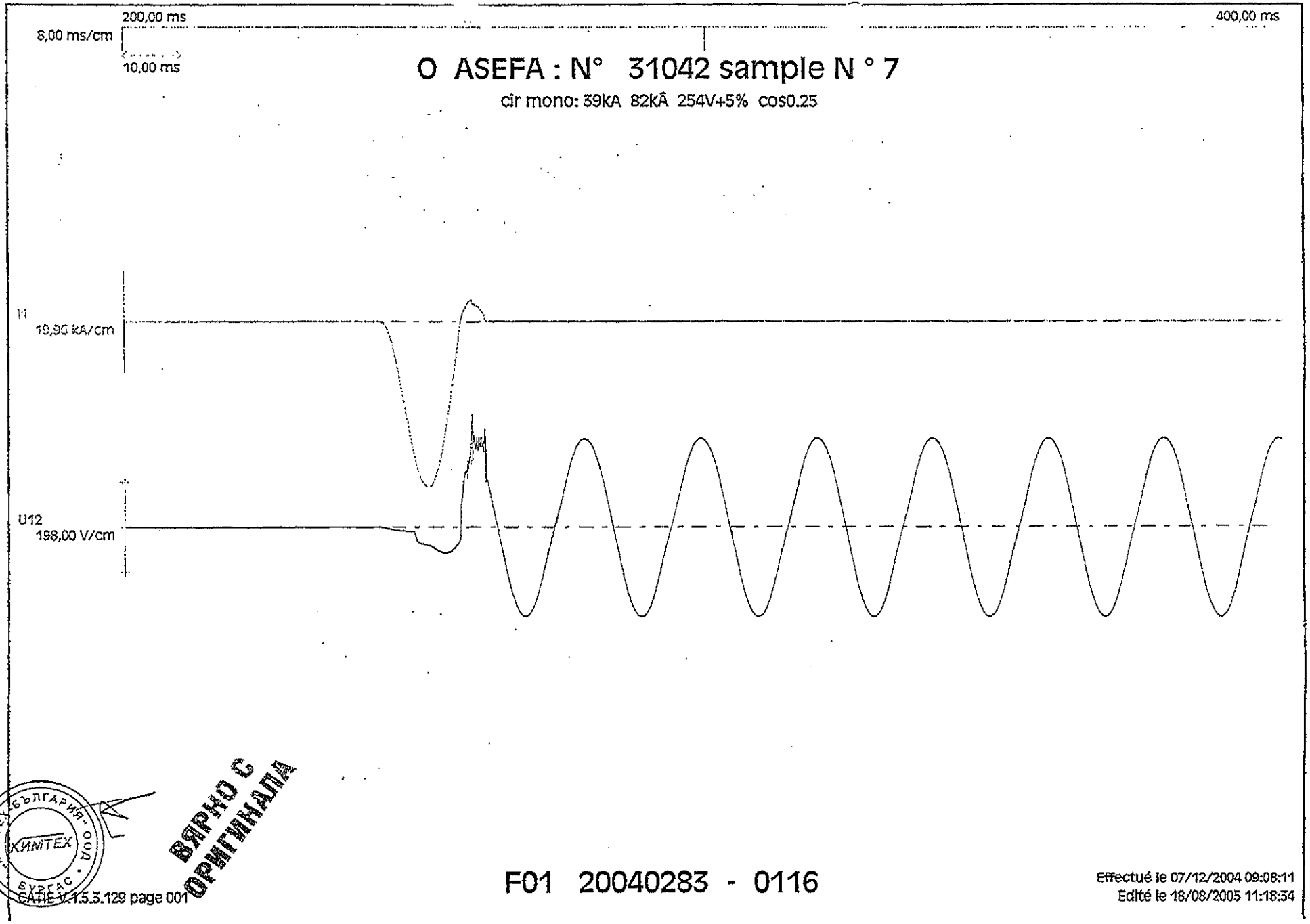
ХИМТЕХ-БЪЛГАРИЯ-ООД ХИМТЕХ

ВЯРНО С ОРИГИНАЛА

CalTEV-1.5.3.129 page 001

F01 20040283 - 0113

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



ВЯРНО С ОРИГИНАЛА

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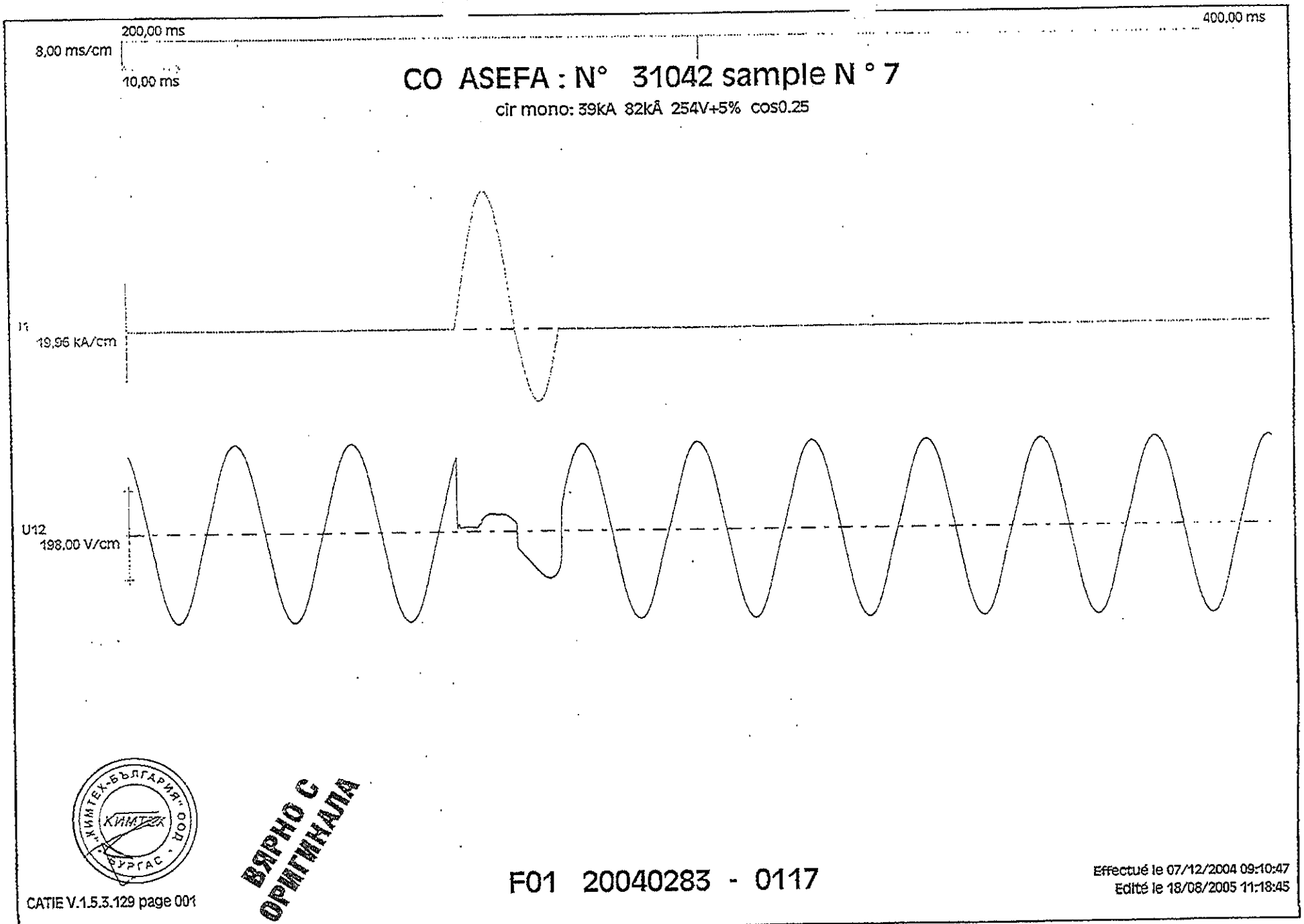
Effectué le 07/12/2004 09:08:11
Edité le 18/08/2005 11:18:34



"КИМТЕХ-БЪЛГАРИЯ" ООД
КИМТЕХ
БУРГАС

ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0117

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

200,00 ms

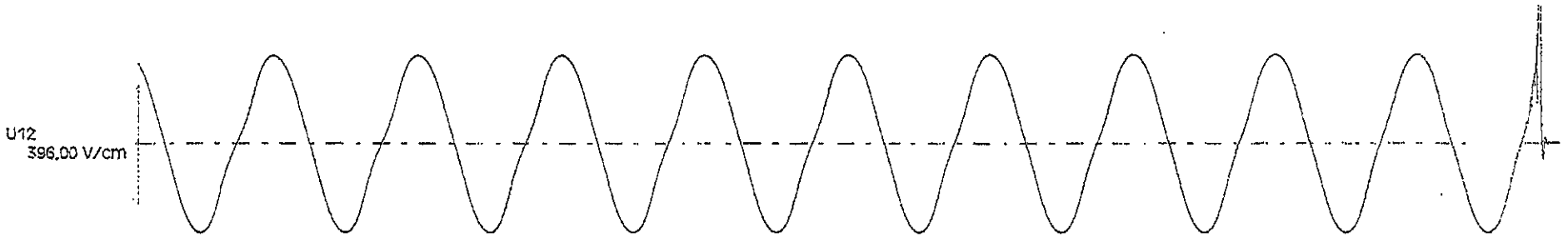
8,00 ms/cm

10,00 ms

400,00 ms

Calibr. test circuit Voltage

cir mono: 25.2kA 53kÂ 398V+5% cos0.25



ВЯРНО С ОРИГИНАЛА

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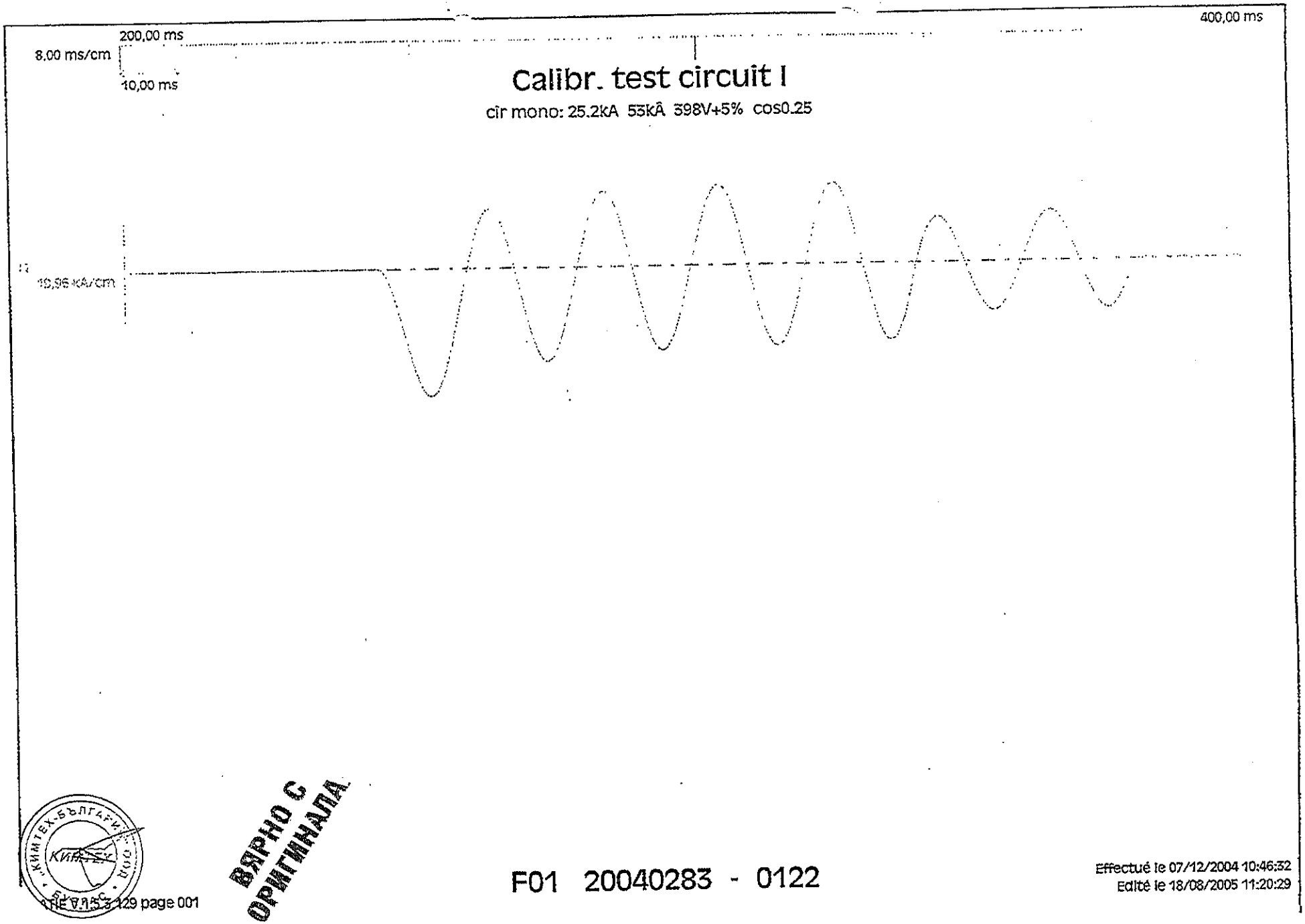
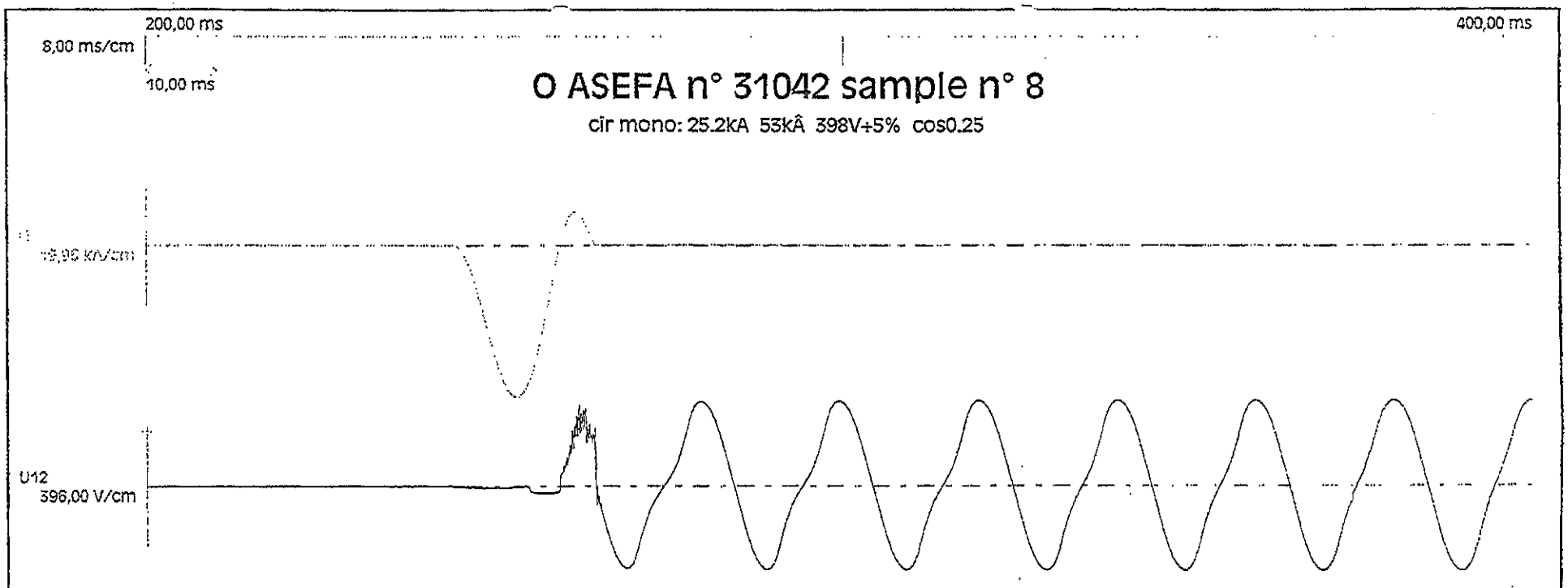
Effectué le 07/12/2004 10:13:41
Edité le 18/08/2005 11:19:57



ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0122

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



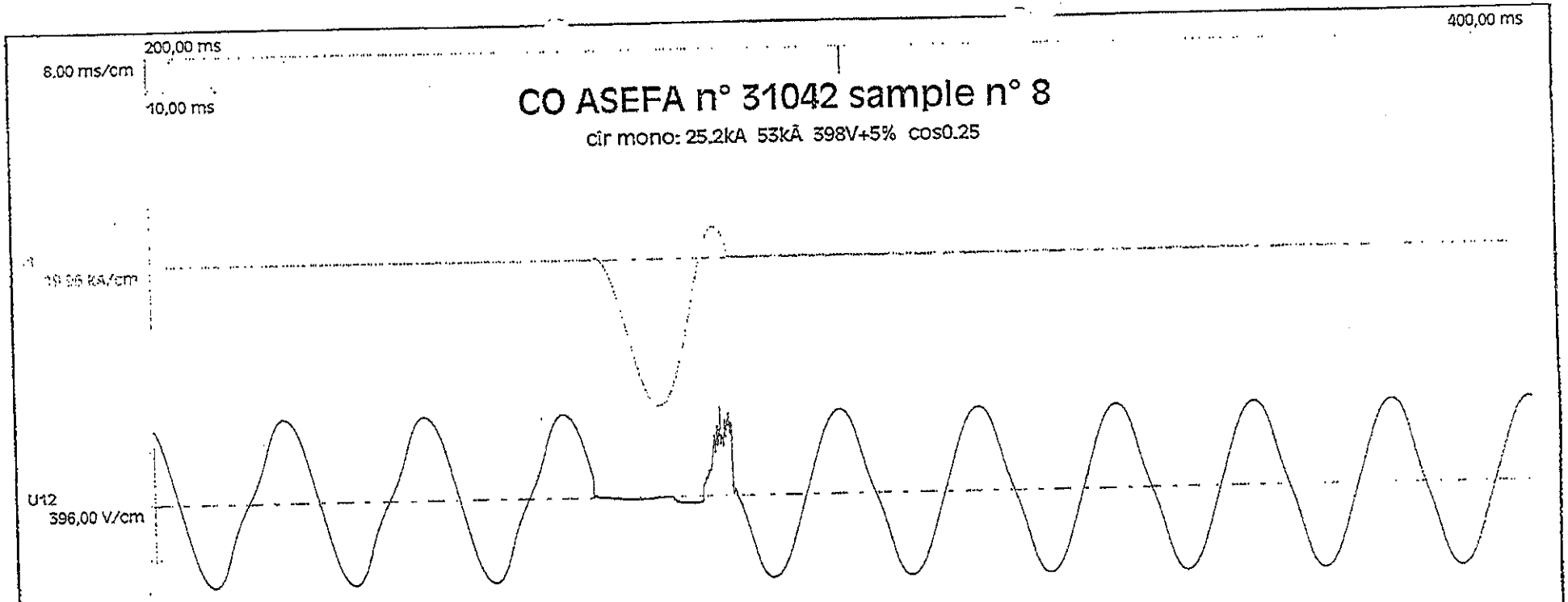
ВЯРНО С ОРИГИНАЛА

"КИМТЕХ-БЪЛГАРИЯ" ООД КИМТЕХ БУРГАС

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



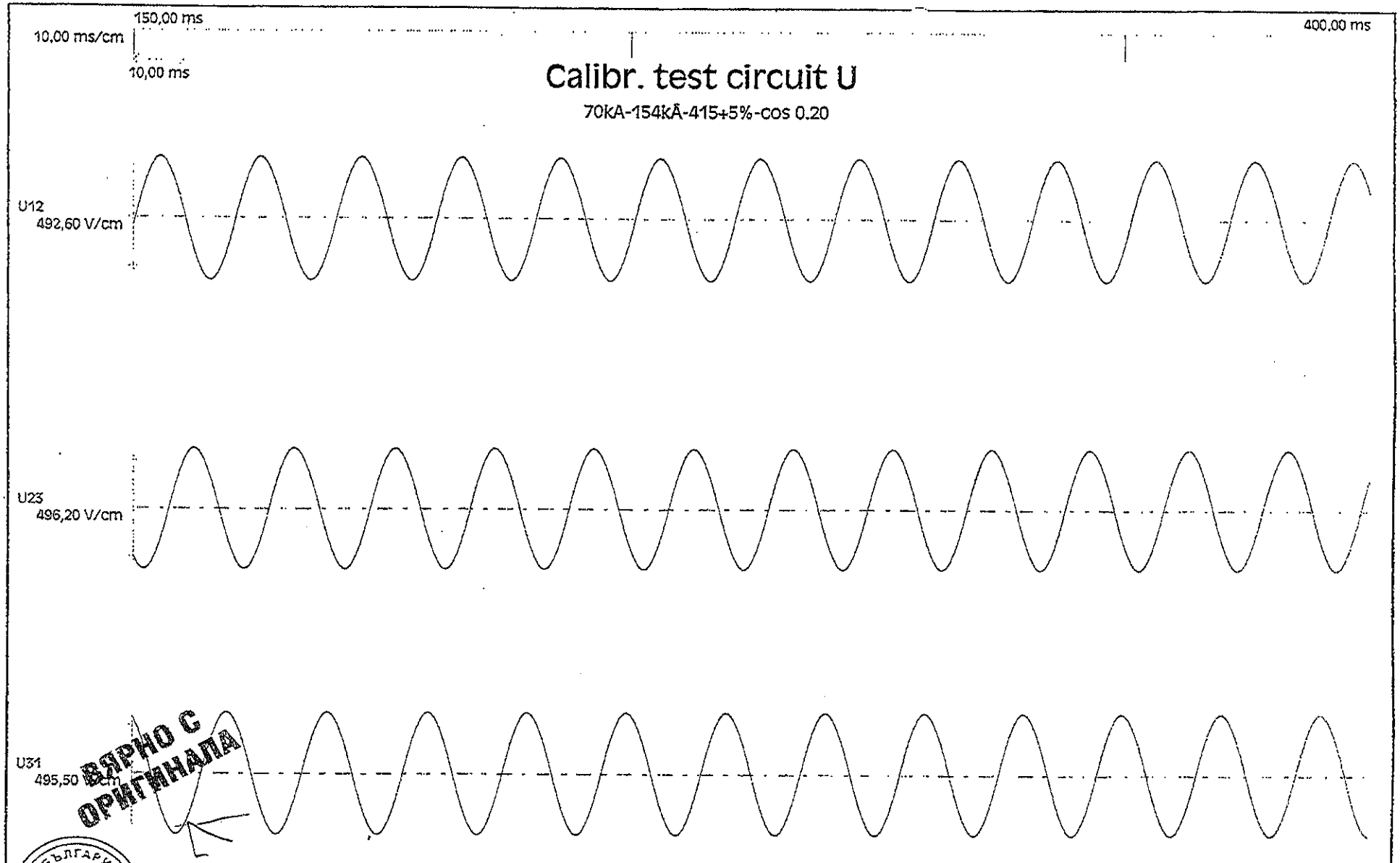
ВЯРНО С ОРИГИНАЛА

КИМТЕХ БЪЛГАРИЯ ООД КИМТЕХ БУРГАС

CATIE V.1.5.3.129 page 001

F01 20040283 - 0124

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



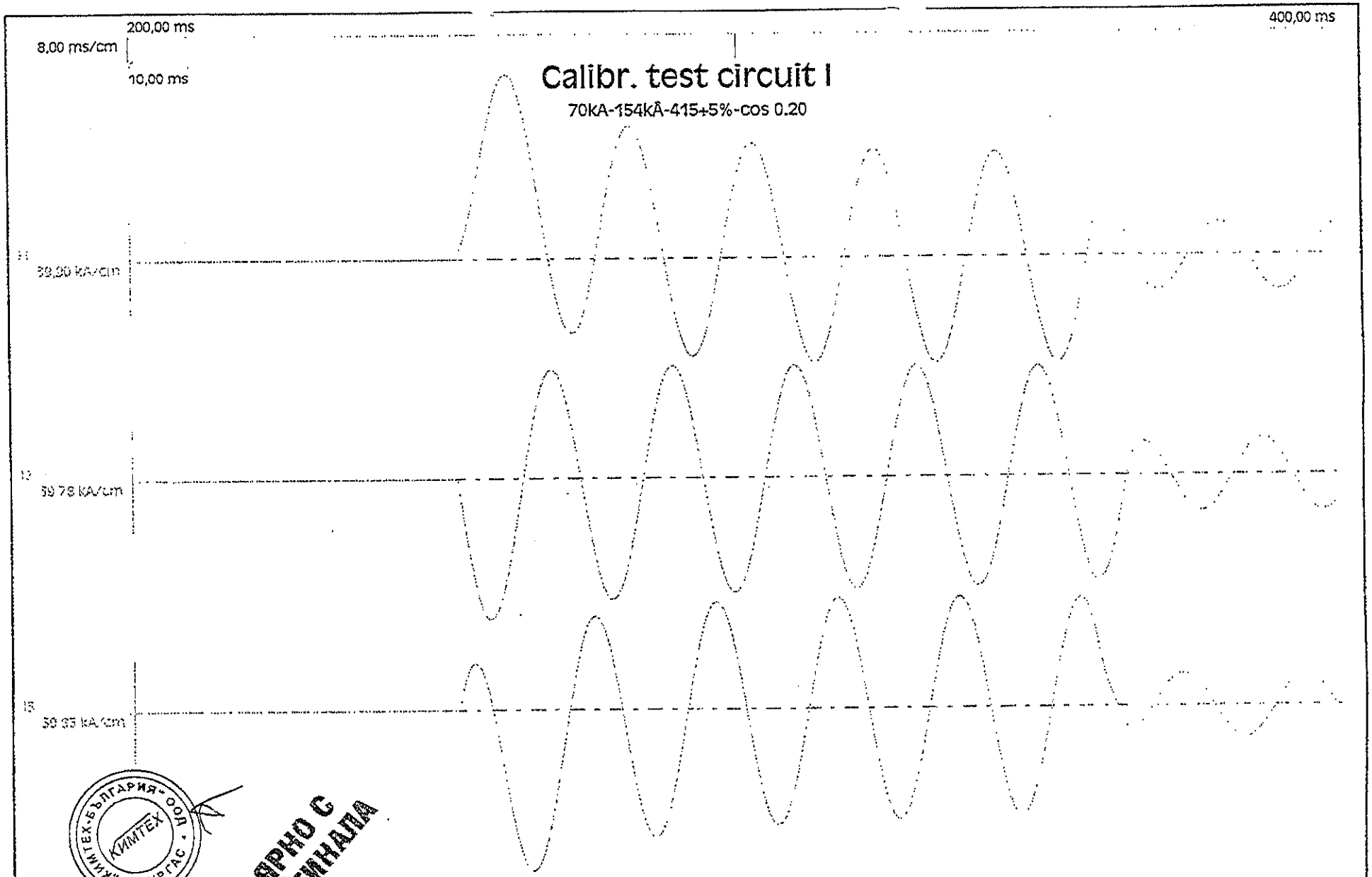
ВЯРНО С ОРИГИНАЛА

ХИМТЕХ-БЪЛГАРИЯ-ООД ХИМТЕХ БУРГАС

CATIE-V.4.5.3.129 page 001

VOLTA 20040288 - 0003

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



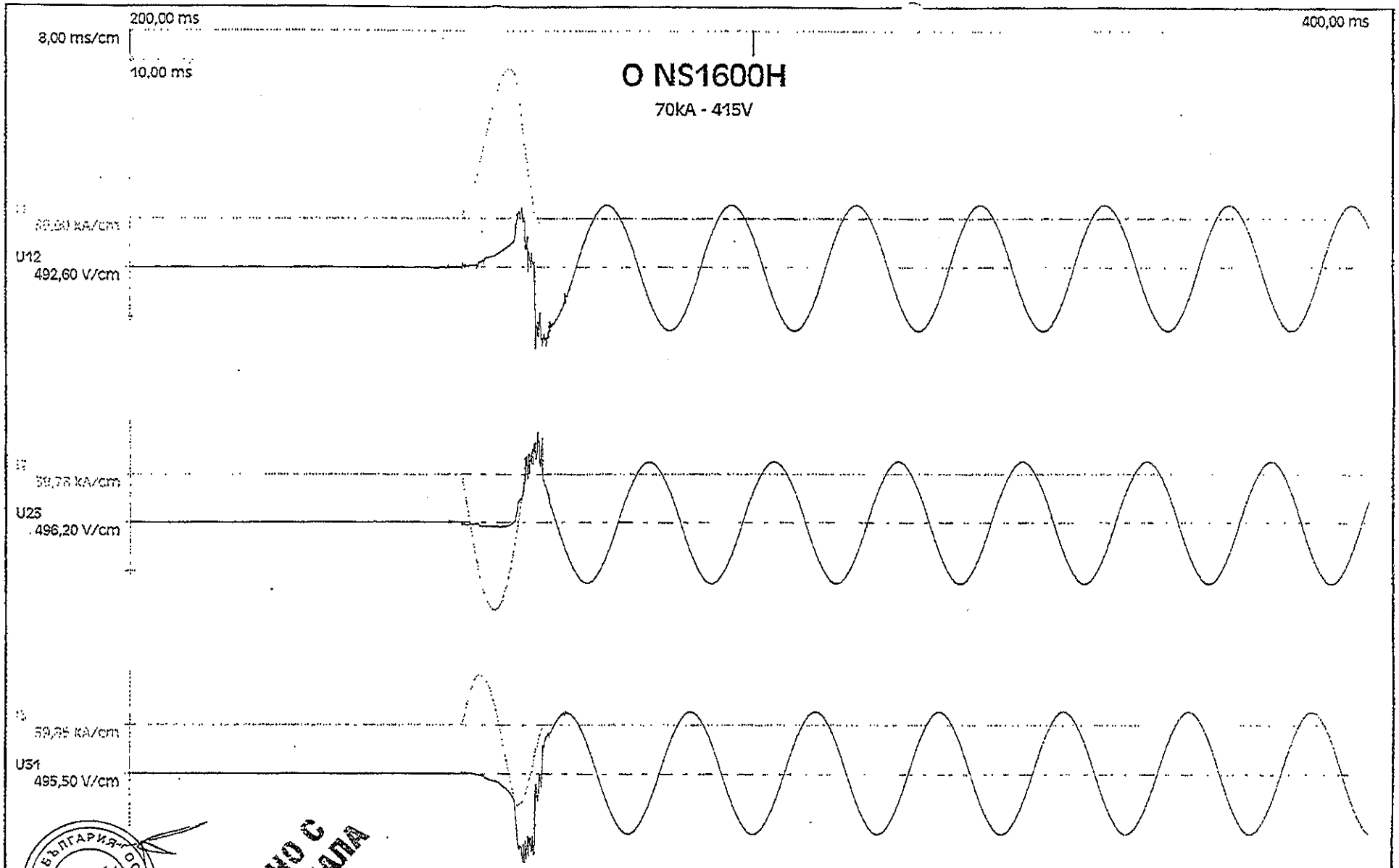
ХИМТЕХ-БЪЛГАРИЯ-ООД "ХИМТЕХ" - БУРГАС

ВЯРНО С ОРИГИНАЛА

F01 20040288 - 0007

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

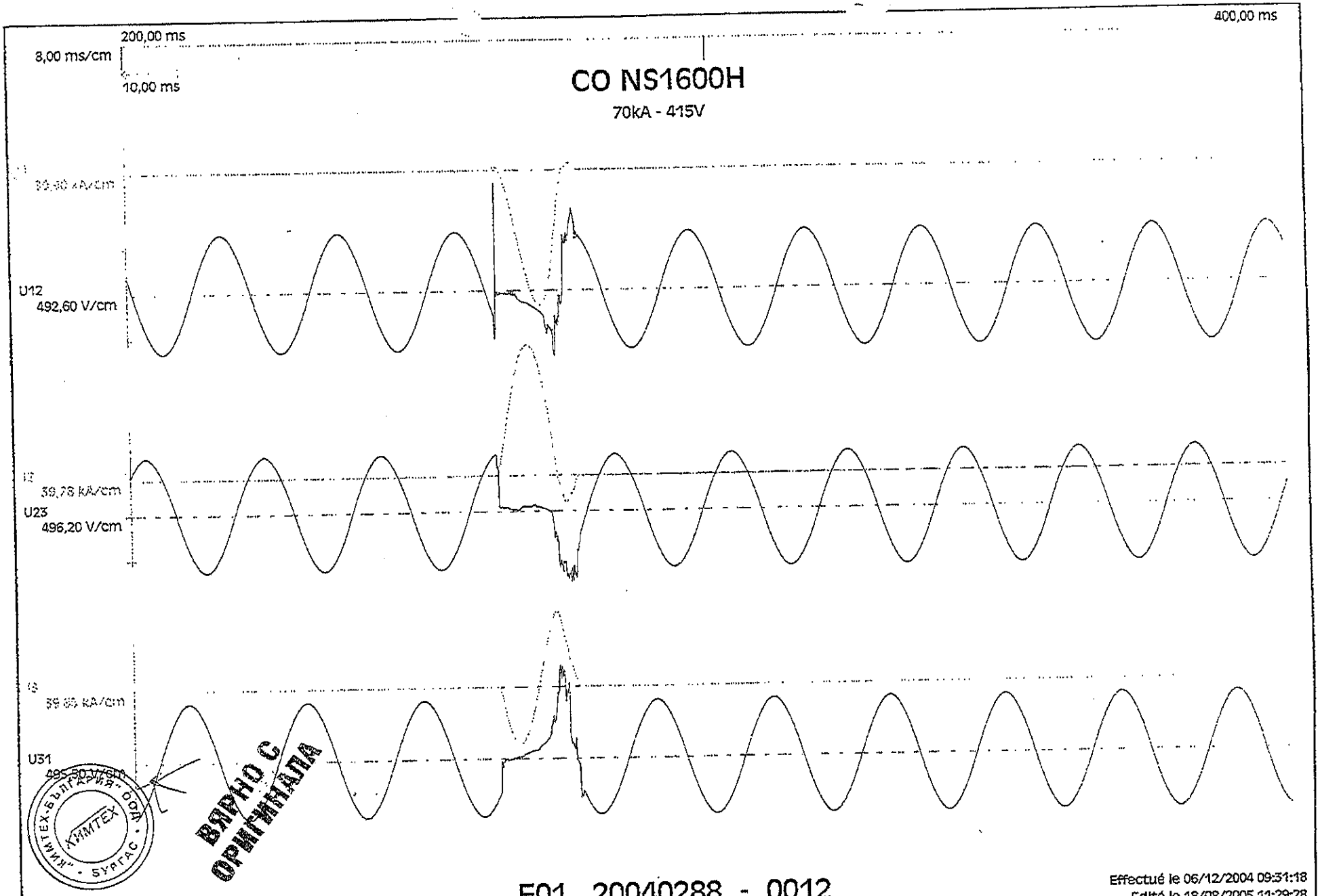
CATIE V.1.5.3.129 page 001



ВЯРНО С ОРИГИНАЛА

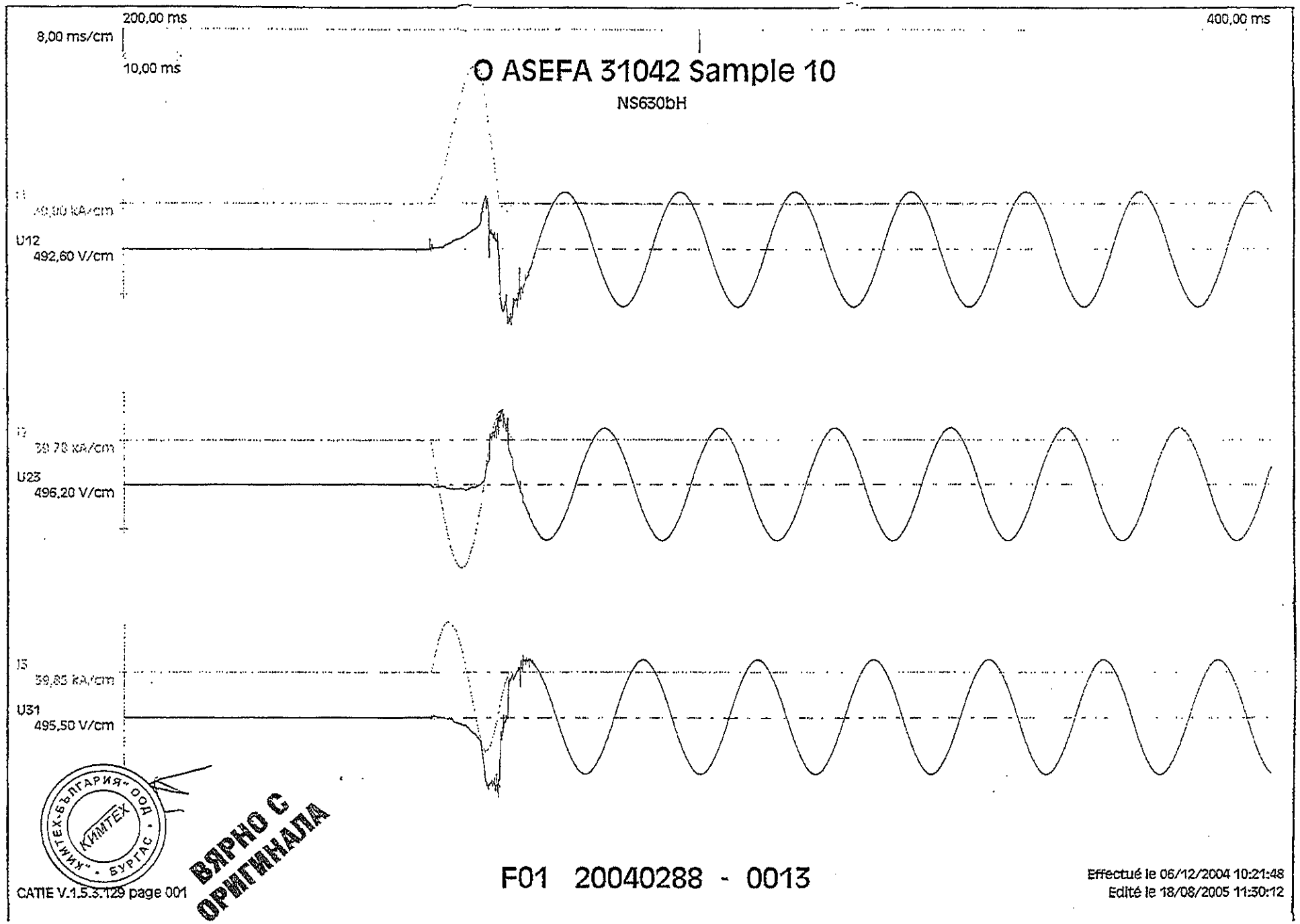
F01 20040288 - 0011

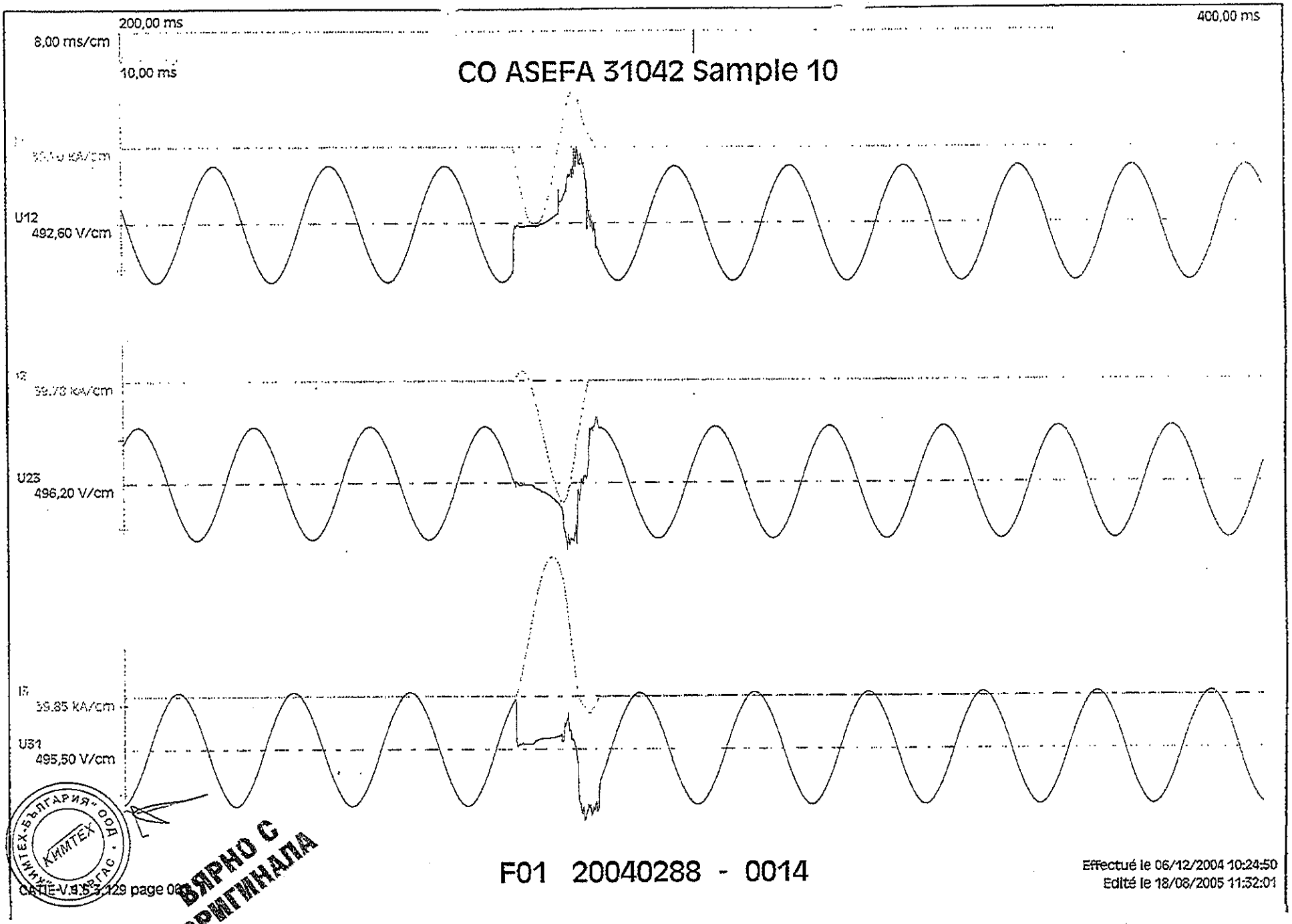
Effectué le 06/12/2004 09:28:17
Edité le 18/08/2005 11:28:59

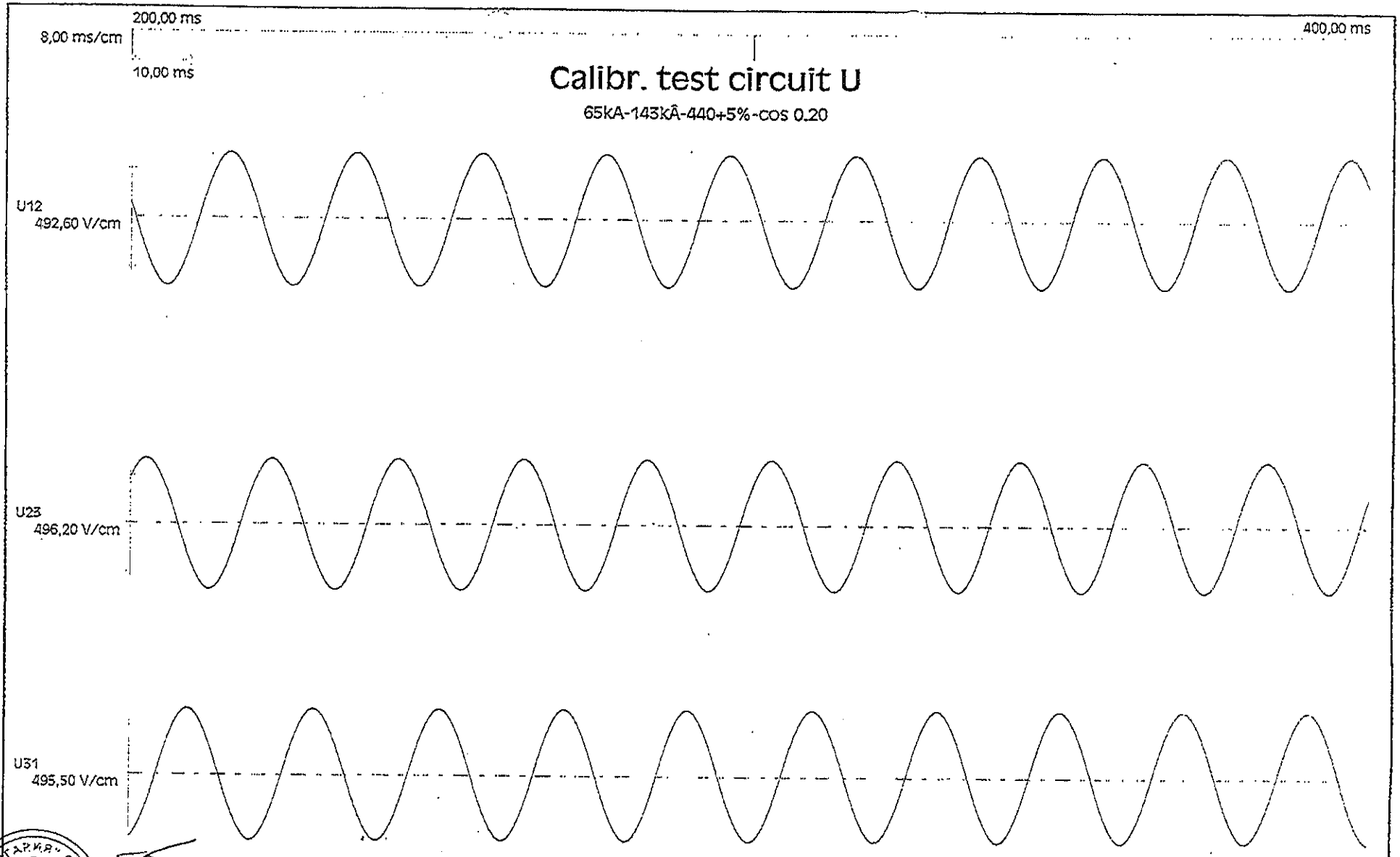


ВЯРНО С ОРИГИНАЛА

ХИМТЕХ-БЪЛГАРИЯ" ООД ХИМТЕХ БУРГАС





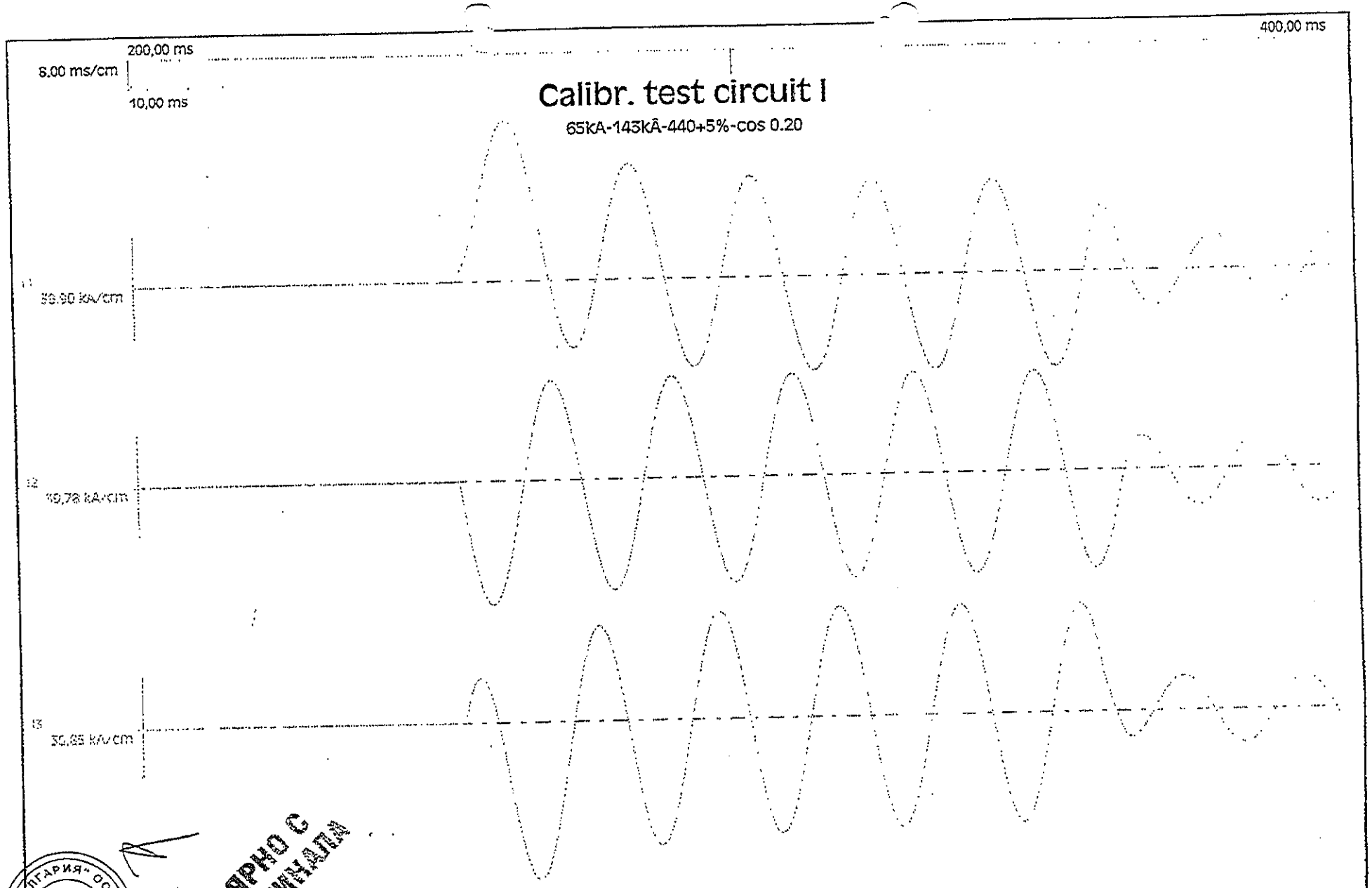


ХИМТЕХ-БЪЛГАРИЯ-ООД ХИМТЕХ БУРГАС

ВЯРНО С ОРИГИНАЛА

VOLTA 20040288 - 0015

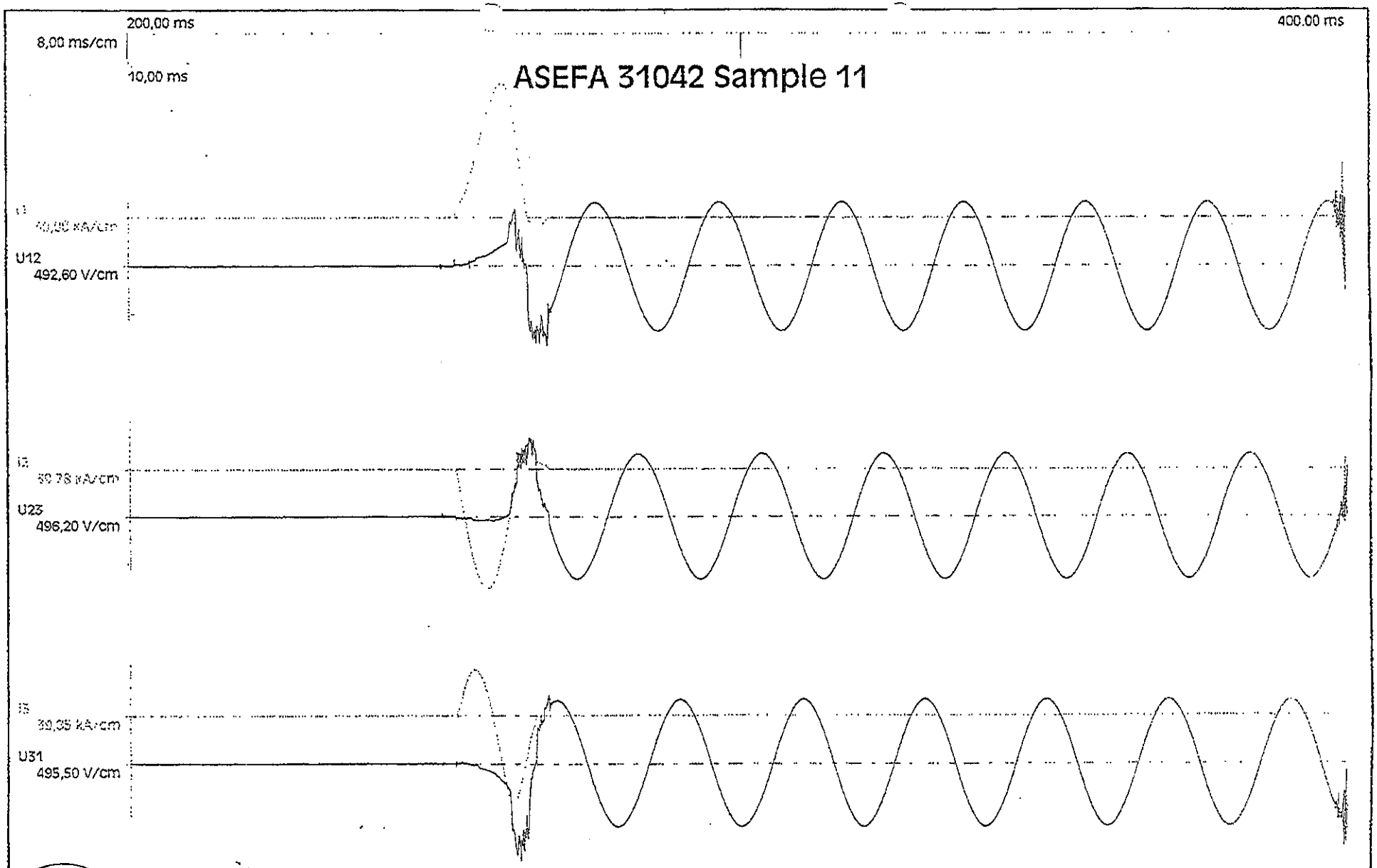
Effectué le 06/12/2004 11:16:11
Edité le 18/08/2005 11:32:35

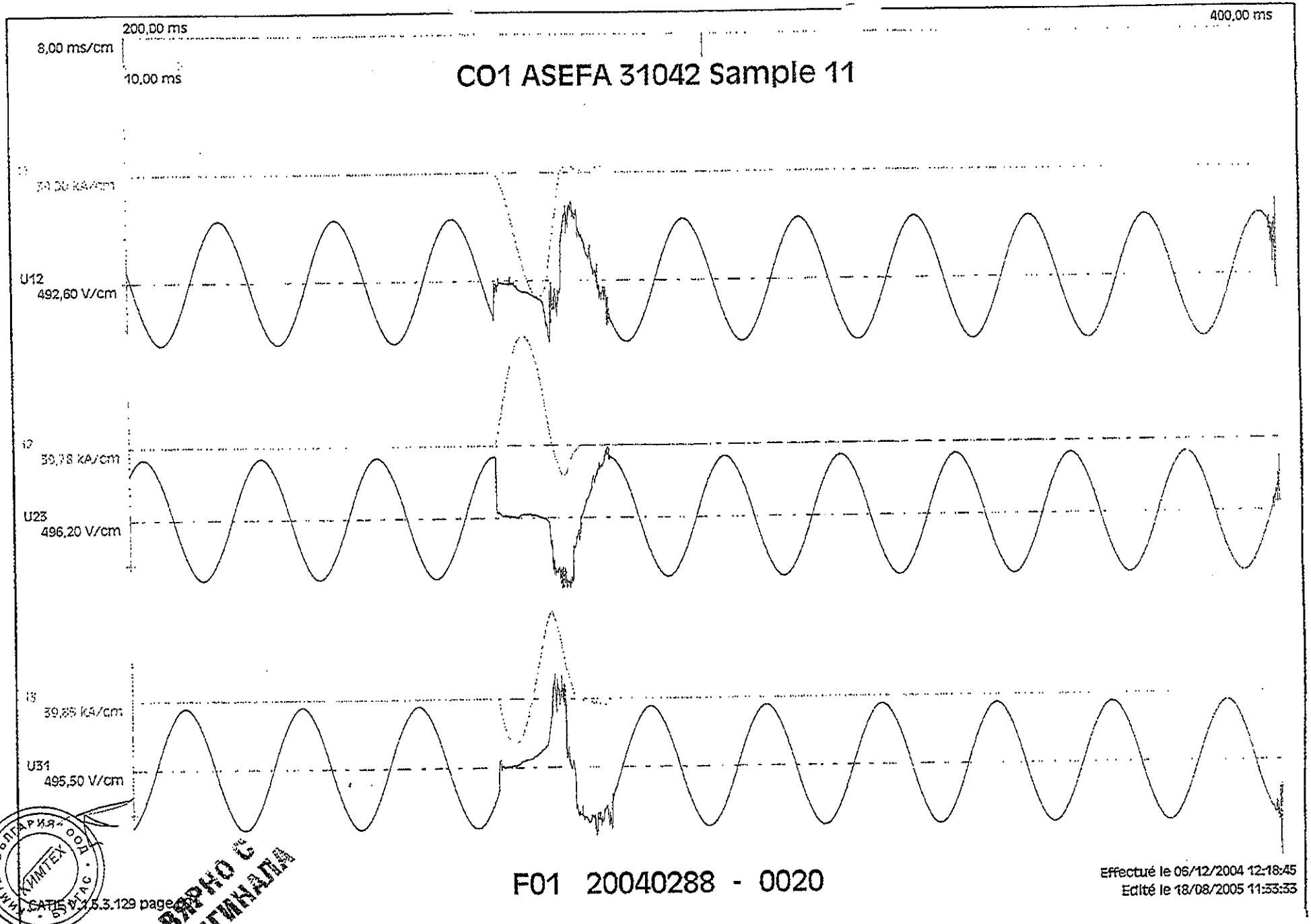


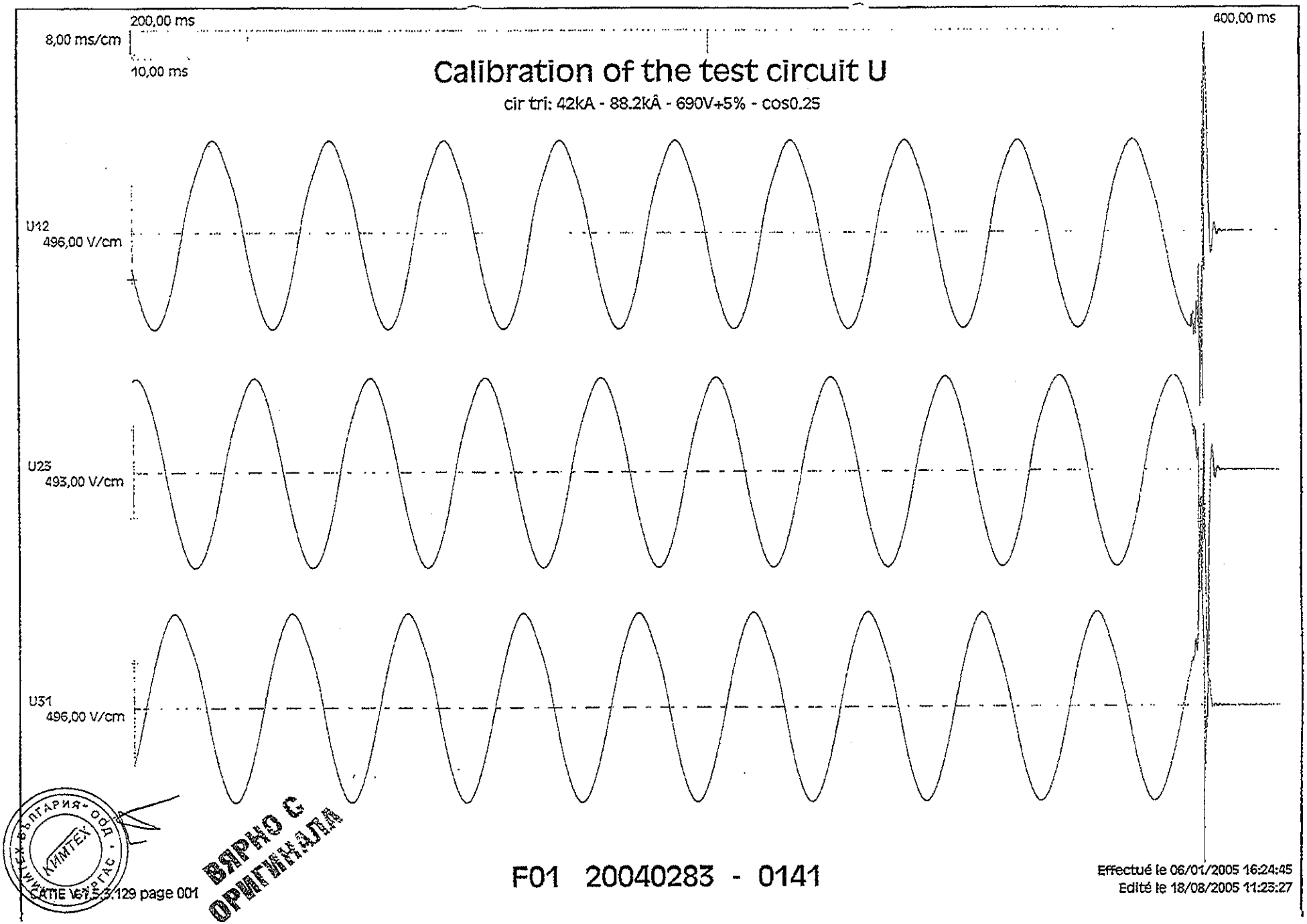
ВЯРНО С ОРИГИНАЛА

VOLTA 20040288 - 0018

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



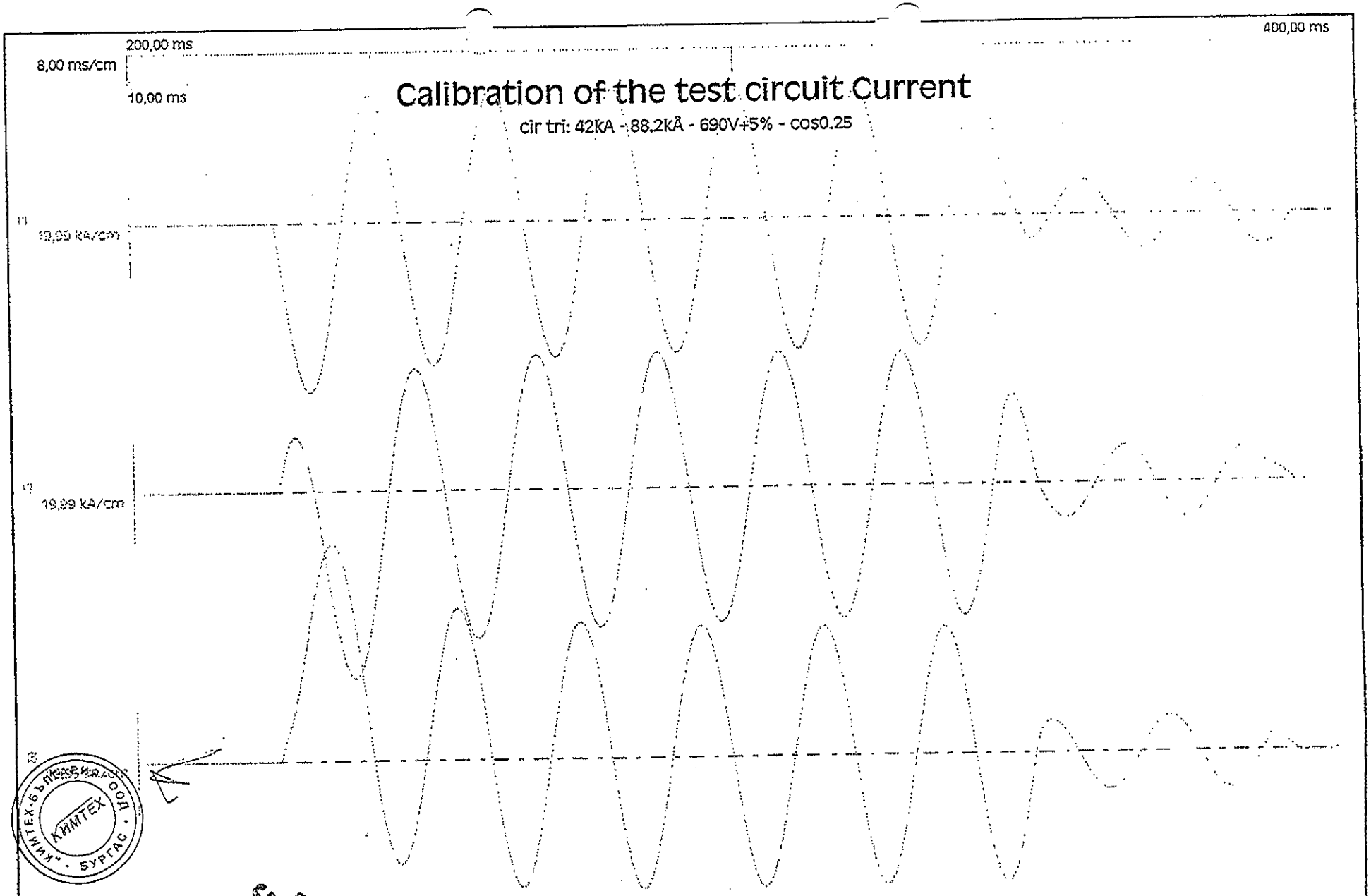




ВЯРНО С ОРИГИНАЛА

F01 20040283 - 0141

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

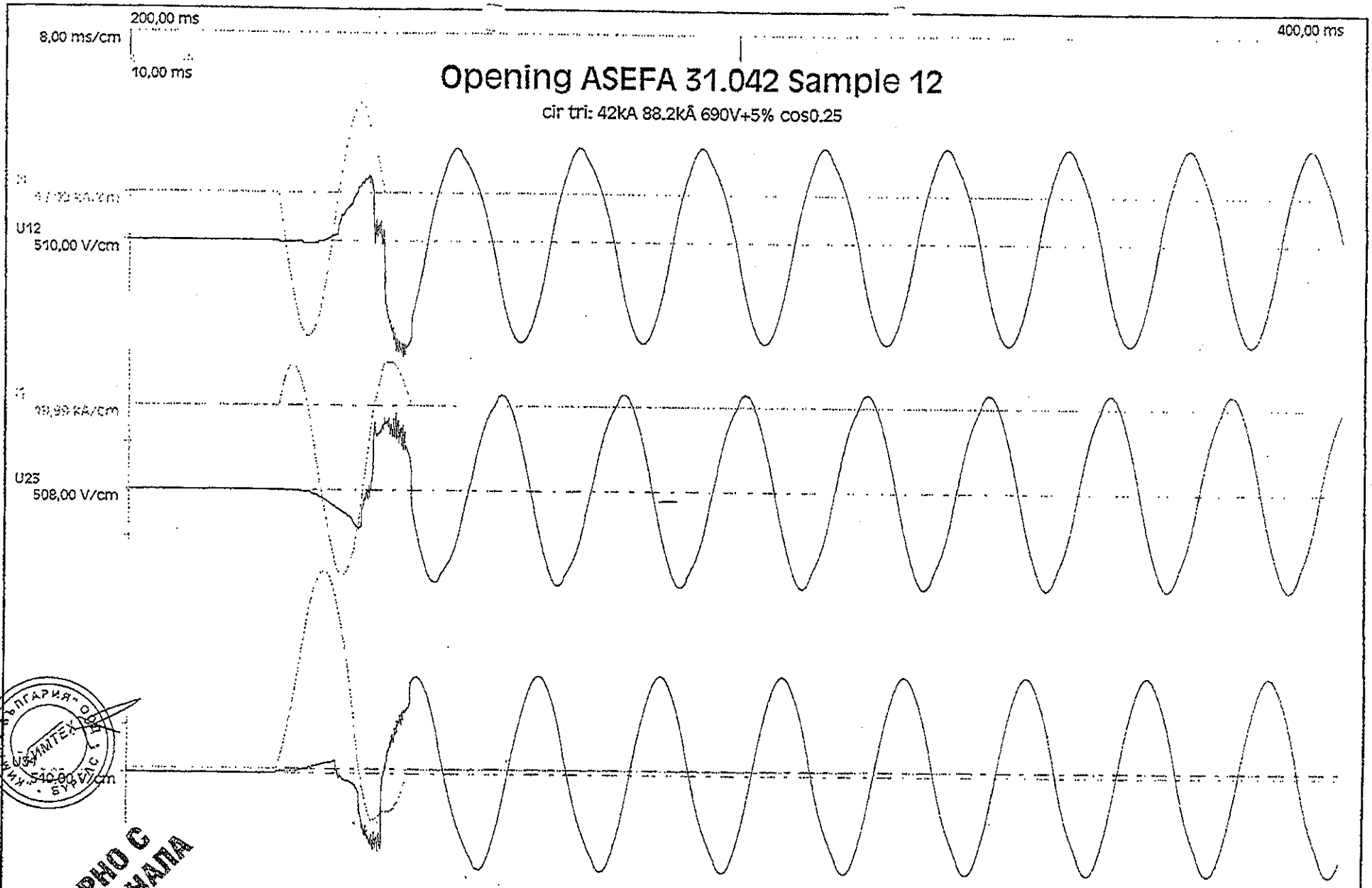


КИМТЕХ-Б ООД · БУРГАС

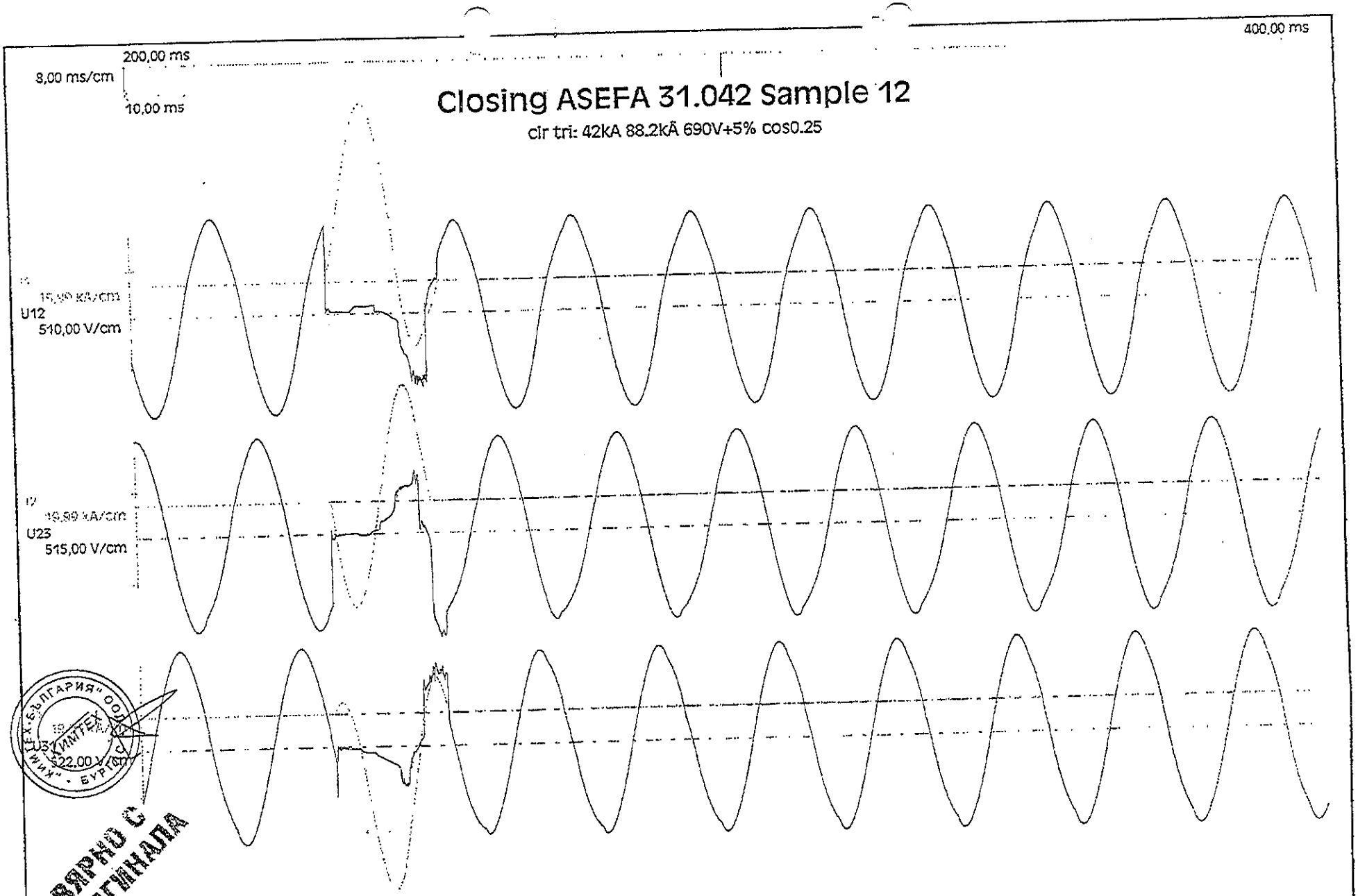
ВЕРНО С ОРИГИНАЛА

F01 20040283 - 0150

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



CATIE V[illegible]129 page 001


200,00 ms
400,00 ms
8,00 ms/cm
10,00 ms
Closing ASEFA 31.042 Sample 12
cir tri: 42kA 88.2kA 690V+5% cos0.25
U12
510,00 V/cm
U23
515,00 V/cm
U31
522,00 V/cm
ВЯРНО С ОРИГИНАЛА
F01 20040283 - 0162
Effectué le 10/01/2005 09:28:17
Edité le 18/08/2005 11:25:17
CATIE V.1.5.3.129 page 001

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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 *

ВЕРНО С ОРИГИНАЛА

"ТЕХНИКА-БЪЛГАРИЯ" ООД ТЕХНИКА

B ACCRÉDITATION

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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

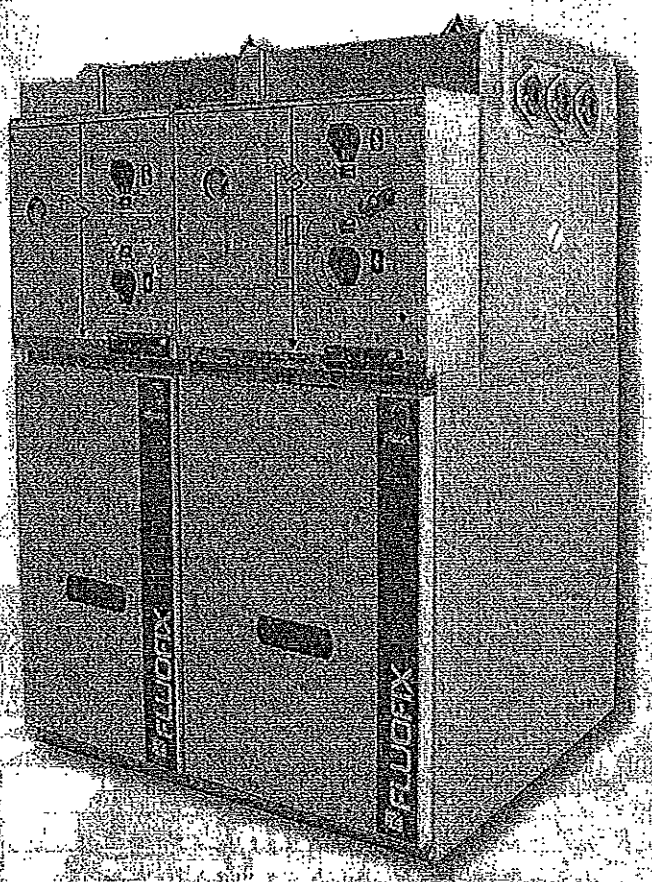
Le Président
du Comité de section :

Le Directeur du COFRAC :

RMU isolado em SF6

SF6 insulated RMU

Aparelhagem de Média Tensão
Medium Voltage Switchgear



Características gerais

- Quadro compacto com isolamento em SF6
- Equipado com interruptor seccionador de corte em SF6
- Com disjuntor de corte no vácuo
- Desenvolvido segundo a Norma Internacional CEI 62271-200
- Insensível às condições ambientais
- Versão compacta ou modular
- Resistente ao arco interno
- Vida eléctrica e mecânica acrescidas (classe E_3 M_2)
- Tanque em inox

General characteristics

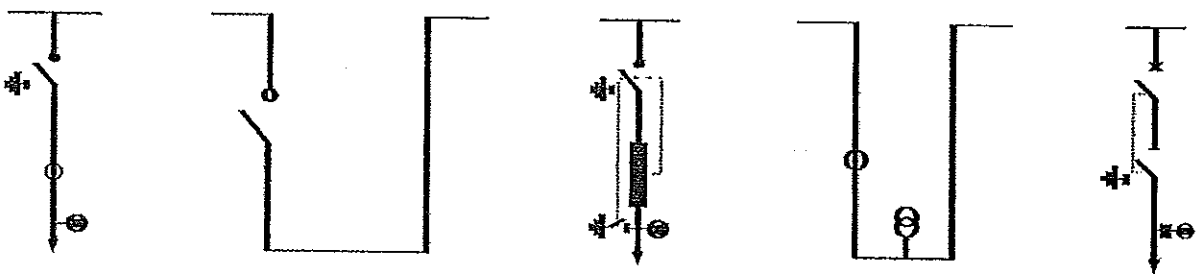
- SF6 insulated compact switchgear
- Equipped with SF6 switch disconnector
- Equipped with vacuum circuit breaker
- Developed according the International Standard CEI 62271-200
- Insensitive to environmental conditions
- Modular or compact version
- Internal arc resistant
- Increased mechanical and electrical life (class E_3 M_2)
- Stainless steel tank

efacec

Características técnicas | Technical data

Características eléctricas / Electrical Data					
Tensão nominal / Rated voltage	kV	12	17.5	24	36
Nível de isolamento/Insulation level - ao choque/lightning impulse (1,2/50 µs)	kV pico/kV peak	28	38	50	70
- à frequência industrial/power frequency (50 Hz/1 min)	kV eficaz/kV r.m.s.	75	95	125	170
Corrente nominal / Rated current	A	até/up to 630	até/up to 630	até/up to 630	até/up to 630
Corrente nominal de curta duração / Rated short time current	kA eficaz / kA r.m.s.	16/20 (3s); 25 (1s)	16 (3s); 20 (1s)	16 (3s); 20 (1s)	16 (3s); 20 (1s)
Corrente de fecho sobre curto circuito / Short circuit making current	kA pico / kA peak	50/63	40/50	40/50	40/50
Temperatura ambiente / Ambient temperature	°C	-5/+40 (outras, sob pedido/other, under request)			
Dimensões (2 IS+1 CIS) / Dimensions (2 IS+1 CIS)					
Altura / Height	mm	1275			1728
Largura / Width	mm	1190			1350
Profundidade / Deep	mm	727			900

Funções típicas | Typical functions



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Delegação/Office:
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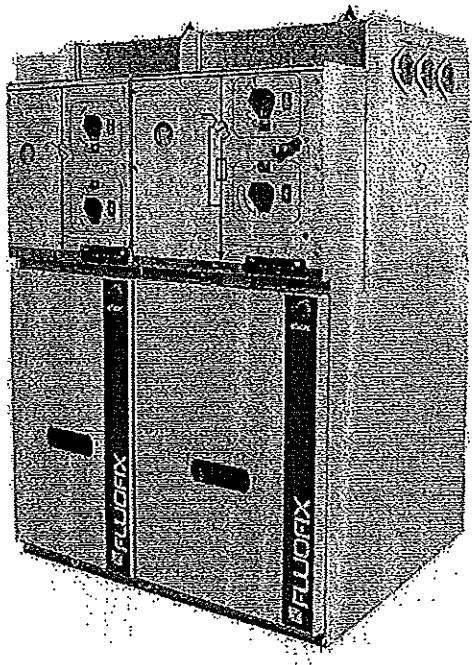


FLUOFIX GC

Компактно разпределително устройство тип RMU изолирано в елегаз SF6

ИНСТРУКЦИИ ЗА ПОЛЗВАНЕ
N°453030009

ВЯРНО С ОРИГИНАЛА

„КИМТЕХ-БЪЛГАРИЯ" ООД

СЪДЪРЖАНИЕ

1. ОСНОВНИ ТЕХНИЧЕСКИ ХАРАКТЕРИСТИКИ

Номинално напрежение	12 kV	17,5 kV	24 kV	36 kV
Изолационно ниво				
С промишлена честота (50Hz - 1 мин.)	28 kV	38 kV	50 kV	70 kV
Импулсно (1,2 / 50µs)	75 kV	95 kV	125 kV	170 kV
Номинален ток				
На шините	630 A	630 A	630 A	630 A
Вход/ изход	400 A 630 A	400 A 630 A	400 A 630 A	400 A 630 A
Защита с предпазител	200 A	200 A	200 A	200 A
Защита с прекъсвач	400 A 630 A	400 A 630 A	400 A 630 A	400 A 630 A
Ток при късо съединение	16 kA (3s) 20 kA (1s)	16 kA (3s) 20 kA (1s)	16 kA (3s) 20 kA (1s)	16 kA (3s) 20 kA (1s)
Изключвателна способност	40 kA 50 kA	40 kA 50 kA	40 kA 50 kA	40 kA 50 kA
Честота	50 Hz	50 Hz	50 Hz	50 Hz
Вътрешна дъга (IAC A-FL)	Até 20kA 1s	Até 20kA 1s	Até 20kA 1s	Até 20kA 1s
Околна температура	-5 a 40 °C	-5 a 40 °C	-5 a 40 °C	-5 a 40 °C
Номинално напрежение на запълване (при 20°C)	0,3 bar rel	0,3 bar rel	0,3 bar rel	0,3 bar rel
Категория загуба на непрекъснатост на услугата	LSC 2A (в съответствие със CEI 62271-200)			
Клас изолационни стени	PI (в съответствие със CEI 62271-200)			
Индекс на защита (CEI 60529 и EN 50102)	IP65 (отделение за средно напрежение) IP3XC (отделение на механизма за управление) IP 3XC (кабелно отделение) IK09 (отделение за средно напрежение) IK08			

Размери на модулните единици до 24 kV

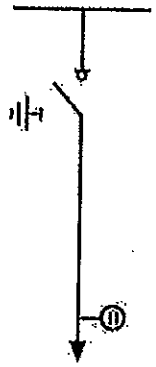
Единица	Ширина (mm)	Височина (mm)	Дълбочина (mm)	Тегло (kg)
IS	370	1279	727	125
CIS	450	1279	727	155
DC	450	1279	727	155
SB	450	1279	727	115
M	750	1279	892	140
2IS+CIS	1190	1279	727	300
2IS+SB	1190	1279	727	290
3IS	1110	1279	727	270
2IS+DC	1190	1279	727	300
2IS+2CIS	1640	1279	727	400
3IS+CIS	1560	1279	727	380
3IS+2CIS	2010	1279	727	500
4IS	1480	1279	727	360

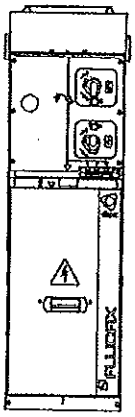
Размери на модулните единици от 36 kV

Единица	Ширина (mm)	Височина (mm)	Дълбочина (mm)	Тегло (kg)
IS	450	1729	900	230
CIS	450	1729	900	250
SB	450	1729	900	185
M	1000	1729	1155	225
2IS+CIS	1350	1729	900	480
2IS+SB	1350	1729	900	465
3IS	1350	1729	900	430
2IS+2CIS	1800	1729	900	640
3IS+CIS	1800	1729	900	610
4IS	1800	1729	900	575

2. МОДУЛНИ ЕДИНИЦИ

2.1 Модулна единица IS

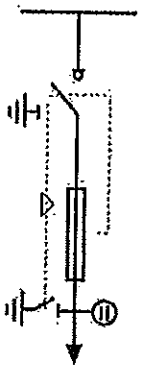


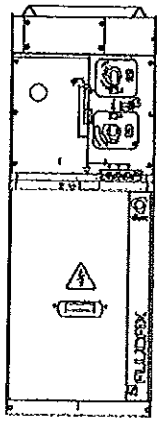


Функция Разединител (IS)

Единица за вход/ изход на проводници, оборудвана с разединител ISFG (механизъм за управление CI1).

2.2 Модулна единица CIS

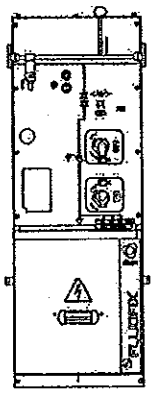




Функция Защита на трансформатор (CIS)

Единица за защита на трансформатор, оборудвана с държач за предпазители и разединител ISFG (механизъм за управление CI2).

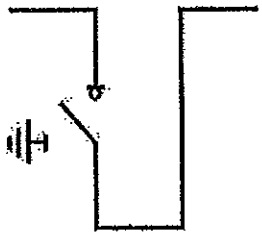
2.3 Модулна единица DC

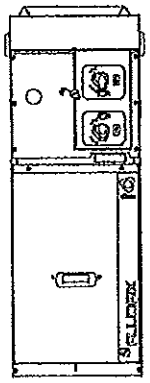


Функция Защита на проводници (DC)

Единица за защита на проводници, оборудвана с вакуумен прекъсвач DIVAC (механизъм за управление CDV) и с разединител ISFG (механизъм за управление CI1).

2.4 Модулна единица SB

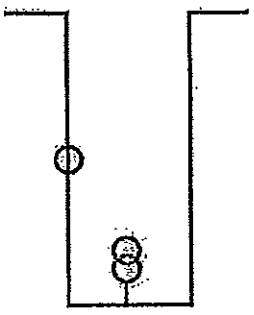


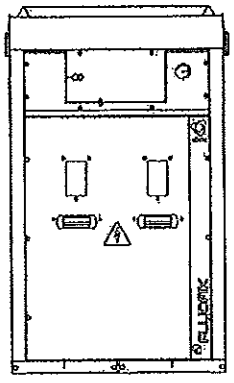


Функция Изключване на шини (SB)

Единица за изключване на шини, оборудвана с разединител ISFG (механизъм за управление CI1).

2.5 Модулна единица M





Функция Измерване (M)

Единица за измерване. Може да бъде оборудвана с токови и мощностни трансформатори.

2.6 Модулна единица CD

Функция Директен вход (CD)
Единицата позволява да се осъществи директен вход или изход с проводници.

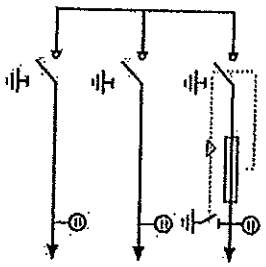
3. КОМПАКТНИ ЕДИНИЦИ

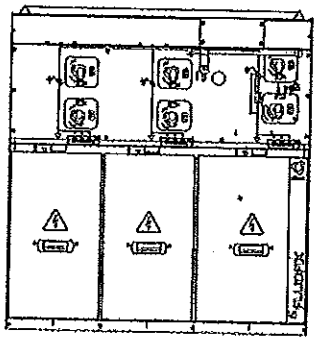
Наличните компактни конфигурации на Fluofix GC са получени чрез комбиниране на следните основни функции:

- Функция вход/ изход с разединител (Функция IS)
- Функция защита на трансформатор чрез предпазители (Функция CIS)
- Функция директен вход/ изход (Функция CD)
- Функция кабелна защита чрез прекъсвач (Функция DC)
- Функция изключване на шини (Функция SB)

Компактните единици Fluofix GC могат да бъдат разширяеми или не разширяеми.

3.1 Модулна единица 2IS+CIS

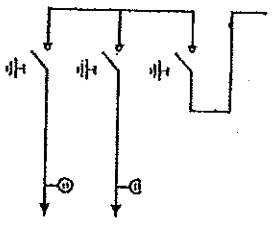


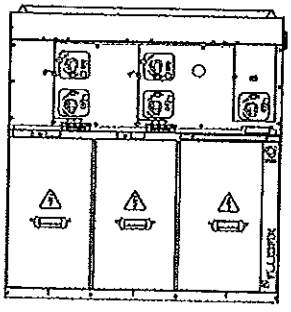


Компактна единица 2IS+CIS

Компактна единица с 2 функции Разединител (IS) и 1 функция Защита на трансформатор чрез предпазители (CIS).

3.2 Модулна единица 2IS+SB



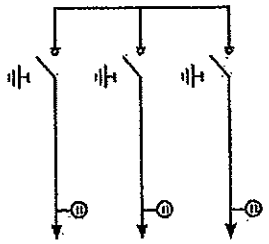


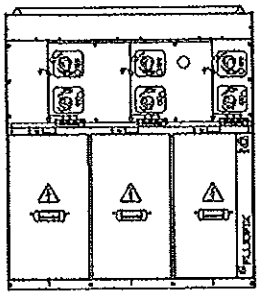
Компактна единица 2IS+SB

Компактна единица с 2 функции Разединител (IS) и 1 функция Изключване на шини (SB).

Единицата е разширяема в дясната страна.

3.3 Модулна единица 3IS

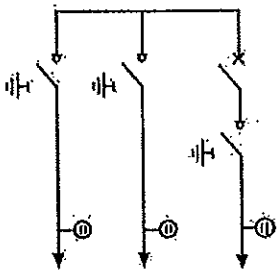


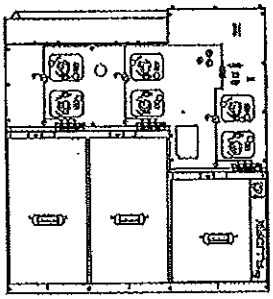


Компактна единица 3IS

Компактна единица с 3 функции Разединител (IS).

3.4 Модулна единица 2IS+DC

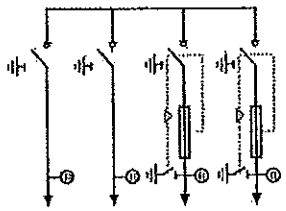


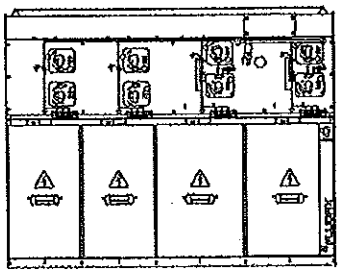


Компактна единица 2IS+DC

Компактна единица с 2 функции Разединител (IS) и 1 функция Защита на проводници чрез прекъсвач (DC).

3.5 Модулна единица 2IS+2CIS





Компактна единица 2IS+2CIS

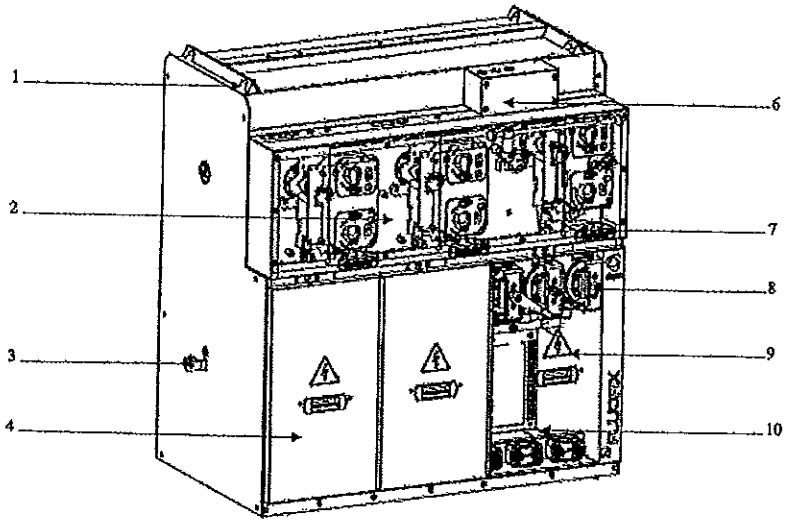
Компактна единица с 2 функции Разединител (IS) и 2 функции Защита на трансформатор чрез предпазители (CIS).

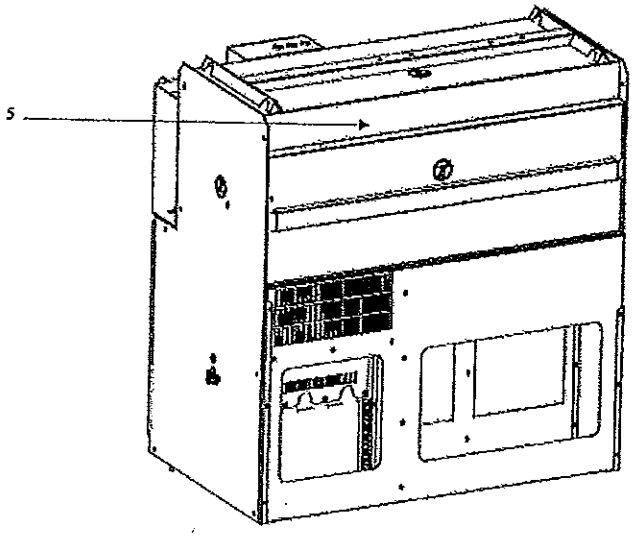
3.6 Други конфигурации

Други конфигурации могат да бъдат предоставени по поръчка.

4. ОБЩО ОПИСАНИЕ НА МОДУЛНИТЕ ЕДИНИЦИ

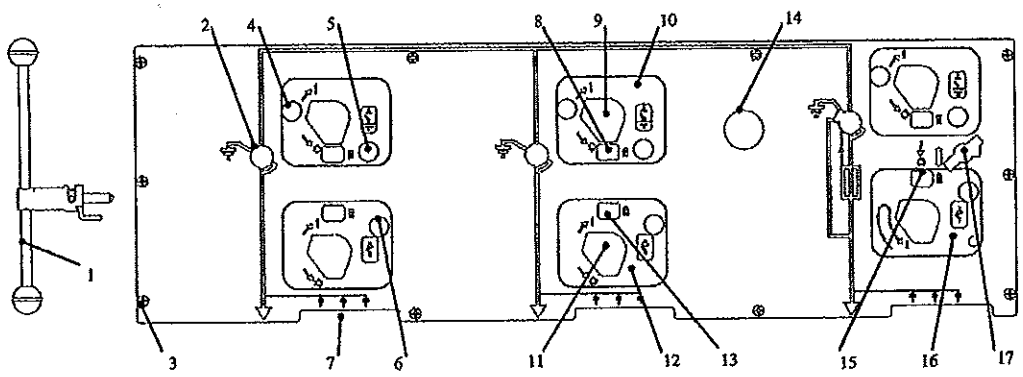
1- Аксесоари за повдигане на модула
2- Отделение на механизмите за управление
3- Свързване на заземителната мрежа
4- Панел за достъп до кабелите
5- Непроницаем корпус от неръждаема стомана
6- Отделение за ниско напрежение
7- Индикатор за наличие на напрежение
8- Държач за предпазители с изолация от епоксидна смола
9- Панел за достъп до предпазителите
10- Кабели за средно напрежение





5. ОБЩО ОПИСАНИЕ НА МЕХАНИЗМИТЕ ЗА УПРАВЛЕНИЕ

1 - Ръчка за управление на прекъсвач или заземител
2 - Индикатор за положението на прекъсвача
3 - Винтове за закрепване на предния панел
4 - Заключалка за блокиране на заземителя на положение "отворено" (по желание)
5 - Заключалка за блокиране на заземителя на положение "затворено" (по желание)
6 - Заключалка за блокиране на прекъсвач на положение "отворено" (по желание)
7 - Индикатор за наличие на напрежение
8 - Отвор за поставяне на ключе за блокиране управлението на заземителя
9 - Отвор за вкарване на ръчката за управление на заземителя
10 - Механизъм за управление на заземителя
11 - Отвор за вкарване на ръчката за управление на прекъсвача
12 - Механизъм за управление на прекъсвача (Механизъм за управление тип CI1 на Функция IS)
13 - Отвор за поставяне на ключе за блокиране управлението на прекъсвача
14 - Манометър за измерване налягането на елегаза (SF6)
15 - Блокиращ превключвател при вкарване на ръчката
16 - Механизъм за управление на прекъсвача (механизъм за управление тип CI2 на Функция CIS)
17 - Бутон за ръчно отваряне на прекъсвача (само за Функции CIS с CI2)



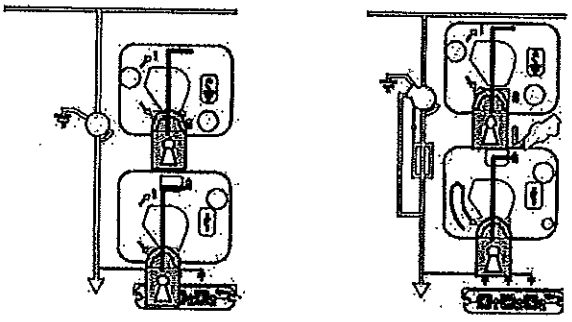
	Принцип на действие	Примери за приложение
CI1(M)	Механизъм за управление тип "Tumbler". Затварянето и отварянето се извършват ръчно или електрически, посредством моторизирана система със скорост, независеща от действието на оператора.	Използван при Функция IS. Основно оборудване при Функциите "вход/ изход" (Дежурно инсталиране или махане на част от мрежа) CI1M позволява дистанционно управление на разединителя ISFG.
CI2(M)	Механизъм за управление тип "Tumbler", оборудван със система за задържане само при отварянето. Операторът извършва ръчно операцията по затваряне, последвана от операция на зареждане на механизма. По този начин механизмът за управление може да извърши операция по отваряне за съкратено време (<100 ms) чрез действието на електромагнит, патрон на предпазител или бутон.	Използван при Функция CIS. Изключване на прекъсвача чрез стопяване на един или повече предпазители (защита от натоварване чрез комбинирани предпазители). Изключване на прекъсвача чрез задействане на защитни релета на трансформаторите. Отваряне на прекъсвача.

Принцип на действие на механизма "Tumbler"
Задействането на ръчката натяга пружината, докато се достигне състояние извън равновесие. При това положение пружината се освобождава като се отпуска рязко, независимо от оператора.

6. ПРЕДЛАГАНИ ОПЦИИ ЗА МЕХАНИЗМИТЕ ЗА УПРАВЛЕНИЕ

6.1 Заключване с катинар

Този тип заключване се състои в използването на катинари, които не позволяват достъпа до отвора за вкарване на ръчката. Всички прекъсвачи и разединители са подготвени за поставянето на катинари.

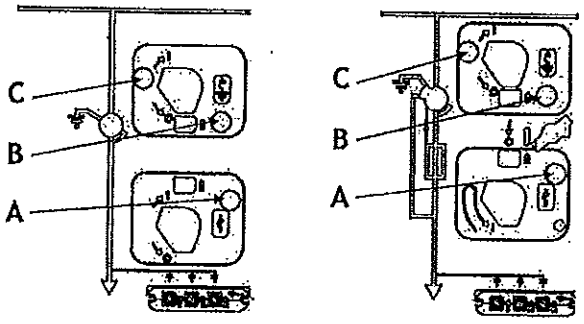


6.2 Заключване със заключалка

Този вид заключване се състои в използване на заключалки, които не позволяват достъп до отвора за вкарване на ръчката. Всяка ключалка има по един ключ, който може да бъде изваден само при заключено положение.

Възможно е (по желание) да се поставят 3 ключалки, с които да се осъществят следните блокировки:

- A - Прекъсвач на положение "отворен"
- B - Заземител на положение "отворен"
- C - Заземител на положение "затворен"



6.3 Електрическо оборудване

Командното управлението на разединителите и прекъсвачите може да бъде оборудвано с моторизирани съоръжения, първична намотка, микропроцесори за сигнализация или други съоръжения, подходящи за дистанционното управление на модулната единица.

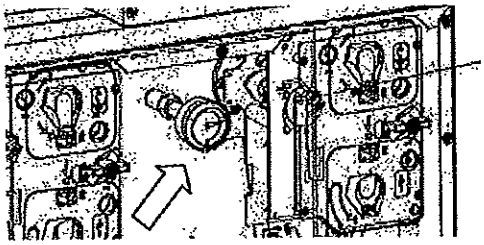
Ако е нужно (по желание), може да се добави допълнително отделение за ниско напрежение, даващо възможност да се инсталира друго необходимо оборудване.

7. СИСТЕМА ЕЛЕГАЗ SF6

FLUOFIX GC е капсуловано до живот съоръжение (съгласно стандарт IEC 62271). Непропускливостта на това съоръжение е осигурено чрез различни рутинни тестове. Очакваният му експлоатационен живот е 30 години.

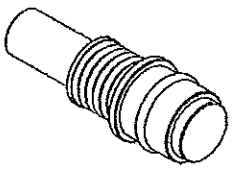
Непроницаемият корпус от неръждаема стомана на FLUOFIX GC се пълни с елегаз (SF6) при относително налягане от 0,3 бара. Винаги когато е необходимо, премахнете SF6 от вътрешността на корпуса (корпусът е проектиран така че да издържа на абсолютен вакуум), като препоръчителната процедура е следната:

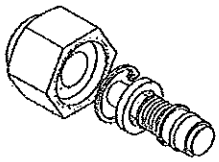
- Отстранете капака на механизма за управление.
- Отстранете индикатора на налягане (инсталиран е върху вентила).
- Вентилът ще стане тогава достъпен.



Характеристики на вентила, използван в корпусите FLUOFIX GC:

Производител: DILO
Модел: Ref. 3-408-R008 AL
Размер: DN6
Вентилът трябва да е устойчив на разпадащ се елегаз (SF6).



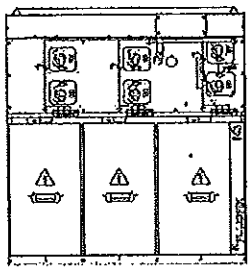


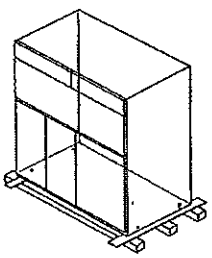
8. ИЗПРАЩАНЕ

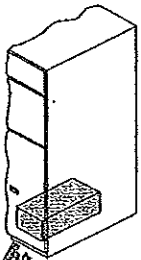
Модулните единици FLUOFIX GC се изпращат с прекъсвач в положение "отворен" и заземител в положение "затворен".

Модулните единици FLUOFIX GC се изпращат всяка поотделно върху дървен палет (закрепен с четири винта и покрит с прозрачно фолио).

Аксесоарите за монтаж и свързване на модулните единици FLUOFIX GC се доставят в отделна опаковка.





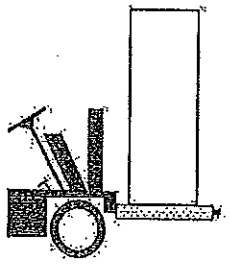


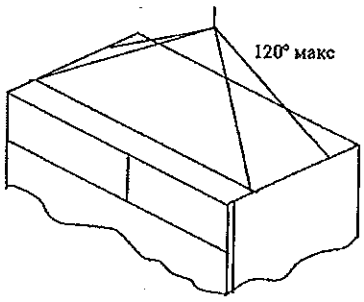
9. ПОЛУЧАВАНЕ

Установете кои са получените модулни единици и се уверете във:

- Функцията съгласно краткото описание
- Табелката с характеристики
- Доброто състояние на оборудването

Уверете се, че е налице опаковката с допълнителното оборудване. При установяване на нередности трябва да ги отбележите в разписката за доставка.



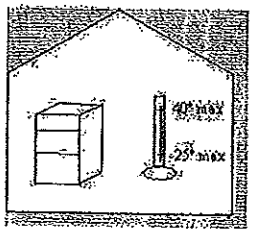


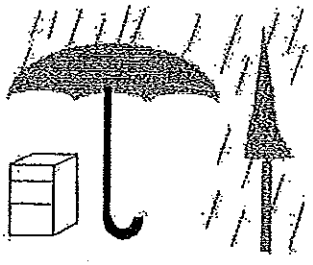
Пакетите трябва да останат закрепени върху дървения палет до момента на монтирането им.

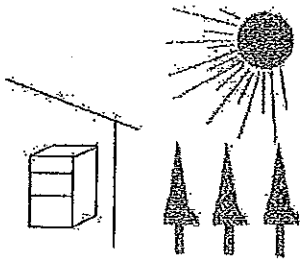
Пакетите трябва да се преместват с помощта на следните уреди:

- Мостов кран
- Хидравличен високоповдигач

За да се осигури безопасността на маневриращото лице и на самото оборудване, модулните единици трябва да бъдат транспортирани странично (не ги движете напред).







Пакетите трябва да се съхраняват в оригиналната им опаковка, да се пазят от прах, водни пръски и такива от химикали, в добре проветрявано и сухо помещение при температура от -25° C до +40° C.

10. ИНСТАЛИРАНЕ

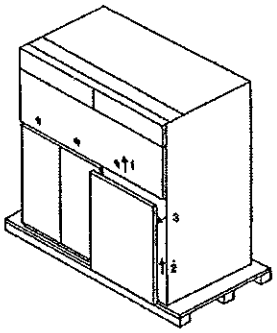
10.1 Подготовка на пода

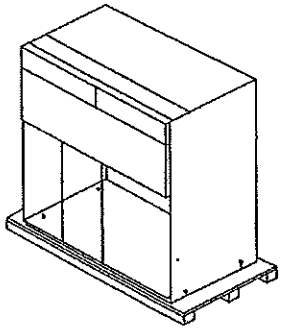
Подът трябва да притежава минимална гладкост от 2mm/m с цел монтажът да се улесни и да се постигне добър краен вид.

10.2 Разопаковане

Когато пакетите са близо до мястото, където ще се извърши монтажът, в следния ред:

- Отстранете прозрачното фолио.
- Отворете вратата на кабелното отделение (уверете се, че заземителите са затворени).
- Махнете четирите винта, поддържайки пакета върху основата (ключ № 17).
- Внимателно завъртете модулната единица, с цел да освободите основата и да я поставете на земята следвайки инструкцията за движение.



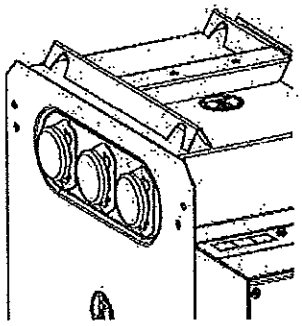


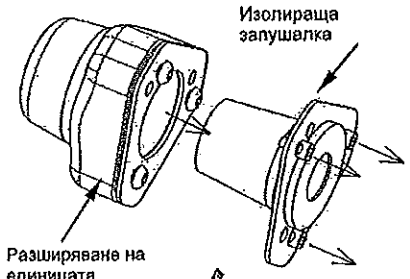
10.3 Монтаж на място

- Отстранете предната врата на кабелното отделение
- Поставете модулната единица и проверете дали стои вертикално, ако е необходимо изравнете
- Закрепете я към пода

10.4 Съединяване на разширяеми модулни единици

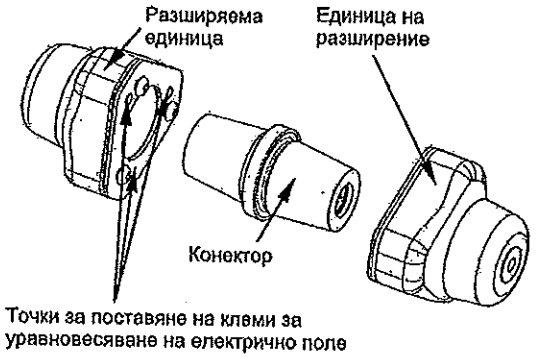
Разширяемите единици могат да се комбинират единствено и само с други разширяеми единици.
Разширяемите единици се доставят със защитна, изолираща запушалка. Запушалката трябва просто да бъде извадена, за да се свържат 2 единици.

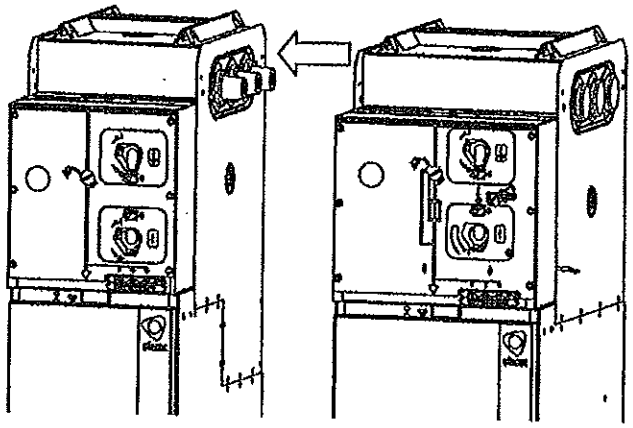


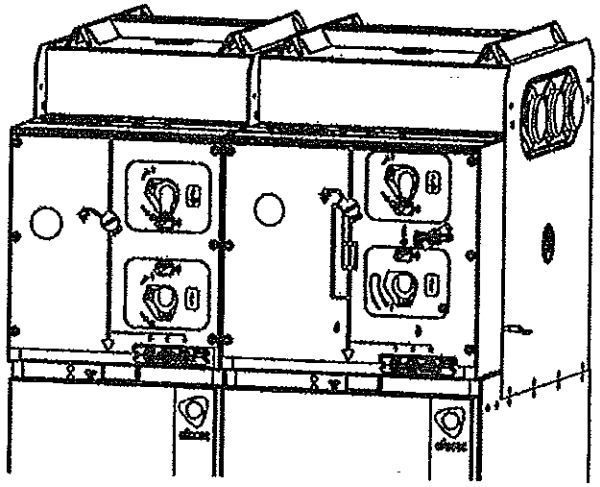


За да свържете 2 разширяеми единици е необходимо:

- Да отстраните изолиращата запушалка
- Да поставите клеми за уравновесяване на електрично поле (по 3 във всяка единица)
- Да поставите разширителния конектор.



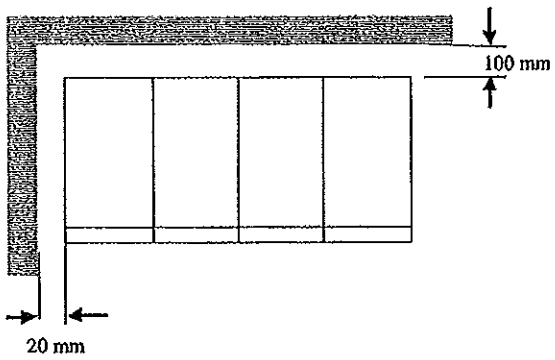




Забележка:
Почистете и поставете силикон върху повърхността на разширителния конектор и модулните единици, за да улесните операцията.

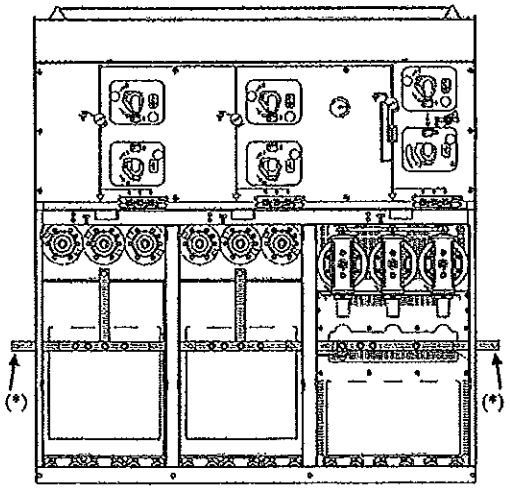
10.5 Закрепване към пода

Разгледайте плана за разполагане на модулните единици, където е дадена конфигурацията, общите размери и препоръчаните точки за закрепване към пода.
Модулните единиците се закрепят към пода посредством винтове M8 (4 точки на закрепване на крайните клетки).



10.6 Свързване на заземителната мрежа

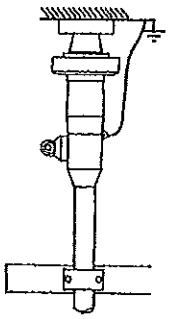
Всички компоненти NORMAFIX (шини, кабелни връзки, предпазители и др.) са свързани помежду си и са заземени посредством обща мрежа. Вижте на диаграмата на долната фигура точката на свързване на общата шина.



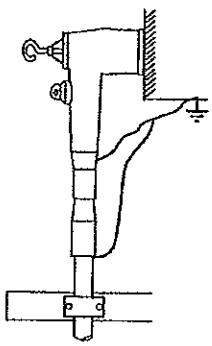
(*) - Точки на свързване на общата шина

10.7 Свързване на кабелите

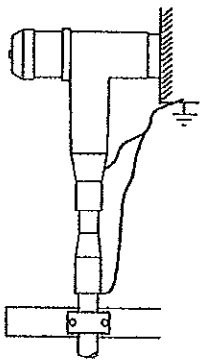
FLUOFIX GC е проектиран, за да бъдат използват разглобяеми, предварително оформени (екранирани и не екранирани) или термосвиваеми конектори от следните видове:



Прав конектор



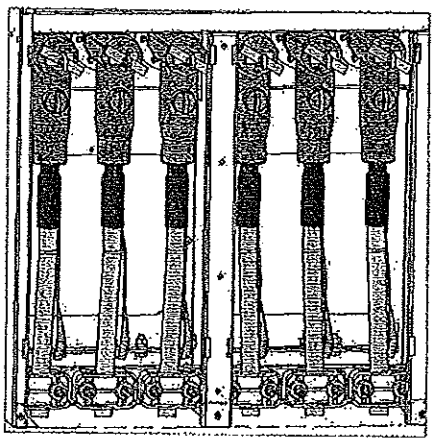
Г-образен конектор

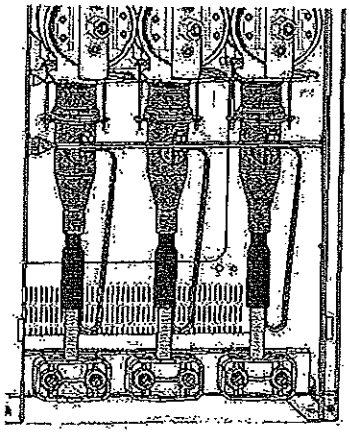


Т-образен конектор

Т-образни конектори за втулки 400/630A на Функциите "вход/ изход". Конекторите трябва да бъдат съвместими с изолирани медни или алуминиеви проводници. Могат да бъдат използвани конектори Raychem RSTI, Euromold K400 или подобни.

Прави или Г-образни конектори за втулки 200A. Конекторите трябва да бъдат съвместими с изолирани медни или алуминиеви проводници. Могат да бъдат използвани конектори Raychem RSES или RSSS, Euromold K158LR или K152SR, или подобни.





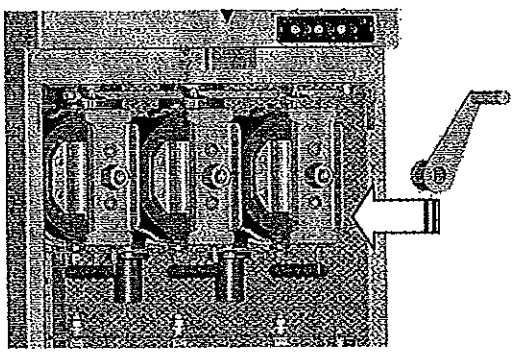
Изборът на кабели и конектори е отговорност на клиента. Кабелите и конекторите трябва да бъдат съвместими с оборудването на FLUOFIX GC.

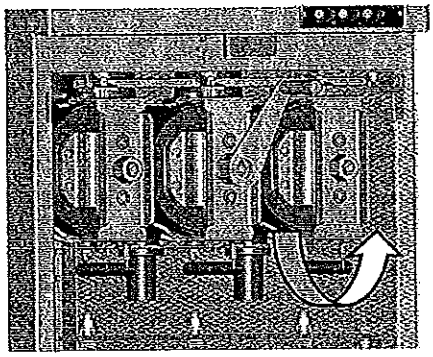
Използвайте конектори с характеристики, отговарящи на стандартите DIN 47636 и EDF HN52-S-61.

Следвайте инструкциите на производителя на конектори при инсталирането на кабелните конектори.

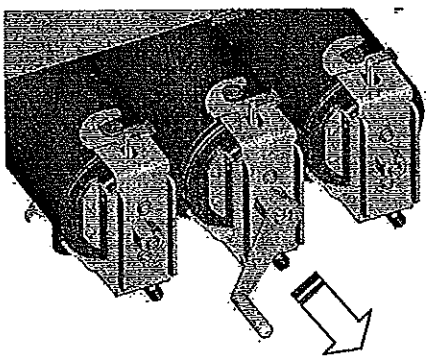
10.8 Монтиране на предпазителите

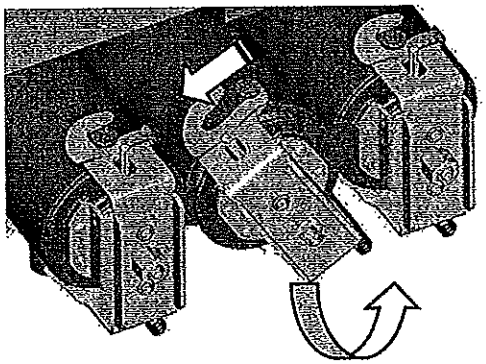
Отворете вратичката на отделението за предпазителите.
(Заземителят трябва да бъде затворен).
Свалете капачката на държача за предпазители, завъртайки ръчката в посока обратна на часовниковата стрелка.



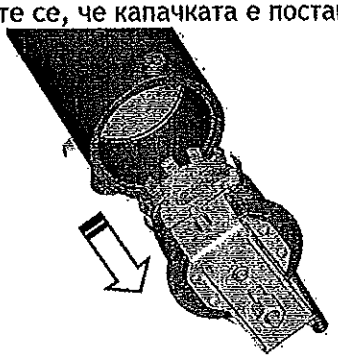


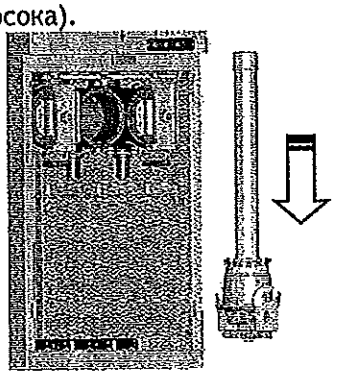
Махнете ръчката и завъртете с ръка капачката в посока обратна на часовниковата стрелка. Капачката на държача за предпазители ще се освободи.





Поставете предпазителя в капачката на държача (посока на патрона: към капачката).
Поставете обратно капачката (заедно с предпазителя), следвайки обратния ред на действие.
(Уверете се, че капачката е поставена в правилната посока).





Забележка: Почистете коничната повърхност на капачката (не е необходимо да използвате силикон).

10.9 Определяне размерите на предпазителите

Предпазители тип High Rupture Capacity (HRC) *"Backup-fuses"*, произведени съгласно стандарт CEI 60282 / DIN 43625.

При максимална околна температура от 40° C, максималната загуба на мощност е **55 W.**

Мощност на трансформатора	Първично напрежение на трансформатора					
kVA	Номинален ток (A) I_N (**)					

(*) При определянето на вида предпазител трябва се вземе под внимание допустимата загуба на напрежение (посочена в листовката на предпазителите).

(**) Когато (I_N е при -5°C ≤ T ≤ +40°C) и мощността на трансформатора е > 1000 kVA, максималният свръхток е 1.2 IS.

11. ПУСКАНЕ В ДЕЙСТВИЕ

11.1 Задължителни проверки

- Проверете дали са свързани правилното шината, кабелите, заземяванията и помощните нисковолтови вериги.
- Проверете дали са монтиране правилно предпазителите, дефлекторите на шините и кабелите и на панелите на кабелното отделение.
- Проверете дали индикаторът за налягане е в положение зелено.

11.2 Комутационни операции с апарата

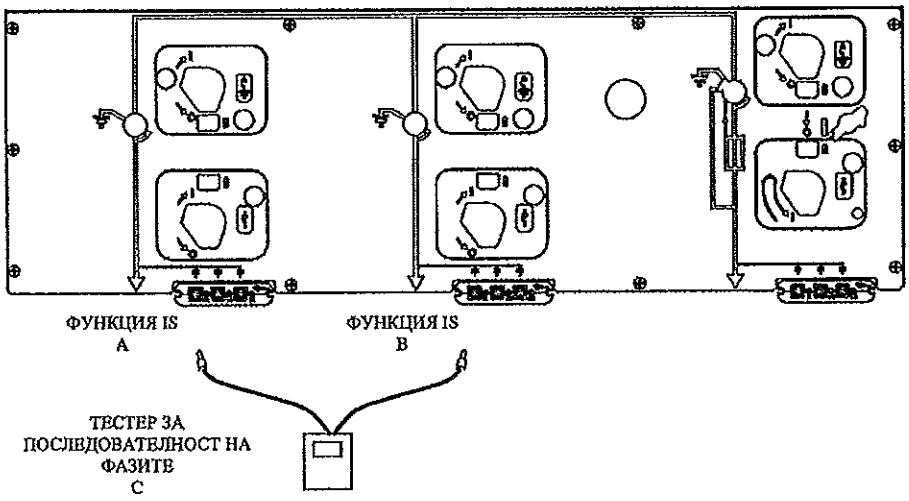
- Проверете правилното функциониране на апарата и блокировките, като включите и изключите няколко пъти прекъсвачите и разединителите.

11.3 Захранване на входните кабели

- Проверете дали всички разединители са в положение "отворен".

11.4 Проверка за наличие на напрежение

- След като кабелите на Функция IS "A" са захранени, проверете дали светят индикаторите за наличие на напрежение L1, L2 и L3, монтирани на командното табло.
- Пуснете захранването на кабелите на Функция IS "B" и проверете дали светят индикаторите за наличие на напрежение.



11.5 Проверка на последователността на фазите при Функциите "Вход"

Проверете последователността на фазите, използвайки подвижното тестващо устройство "C", като за целта:

- Вкарайте клема "C" в точката за тестване на устройство L3 на функция "A"
- Вкарайте клема "C" в точката за тестване на устройство L3 на функция "B"

Ако има последователност:
- Лампичките на контролните устройства L3 на функциите са със слаба светлина.
- Лампичката на подвижното устройство "C" светва.

Ако няма последователност:
- Лампичките на контролното устройство L3 на функциите "A" и "B" светват.
- Лампичката на подвижното устройство "C" изгасва.

Повторете същите операции за фазите L1 и L2.

Забележка: За да проверите правилното функциониране на подвижното устройство за проверка на последователност на фази, свържете двете му клеми с двете фази от същата клетка: лампичката трябва да светне.

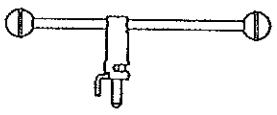
11.6 Захранване на шината и на комбинираната защита от предпазители

- Затворете прекъсвача(ите) на входната(ите) клетка(и).
- Затворете прекъсвача(ите) на изходната(ите) клетка(и).
- Проверете дали индикаторите за наличие на напрежение L1, L2 и L3 на последната клетка светят.

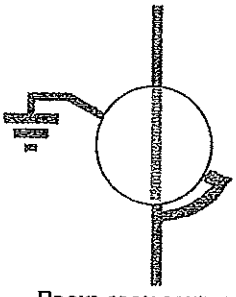
12. ПРИНЦИП НА РАБОТА

12.1. Опериране с механизмите за управление

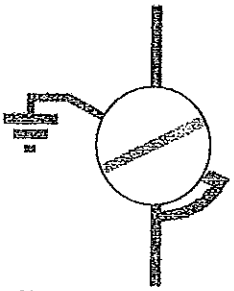
Пакетите с модулите се изпращат с прекъсвач в положение "отворен" и заземител в положение "затворен". Моторизирано задвижване не може да се осъществи ако ръчката за ръчно управление е поставена.



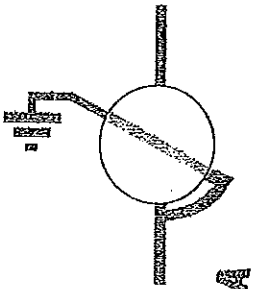
Механизмът се задейства с помощта на блокираща заден ход ръчка, чиято функция е да не позволи на прекъсвача да премине в положение "отворен" веднага след като е бил в положение "затворен".



Прекъсвач затворен
Заземител отворен



Прекъсвач отворен
Заземител отворен

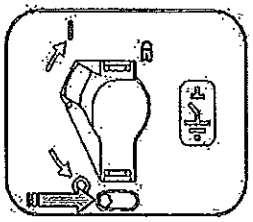


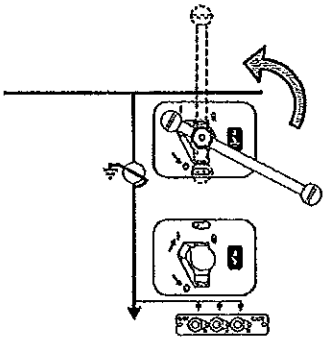
Прекъсвач отворен
Заземител затворен

12.2. Отваряне на заземителя (приложимо при двата вида механизми на управление: CI1 е CI2)

- Тази операция е възможна единствено ако заземителят е затворен.
- Преместете превключвателя на механизма за блокиране на заден ход.
- Вкарайте ръчката в отвора за управление на заземителя.
- Отворете заземителя, повдигайки ръчката до положение отворено в посока обратна на часовниковата стрелка.

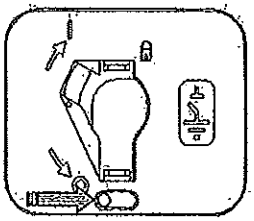
Това действие ще позволи да се затвори предния панел с кабелите и да се освободи позицията на отворения прекъсвач.

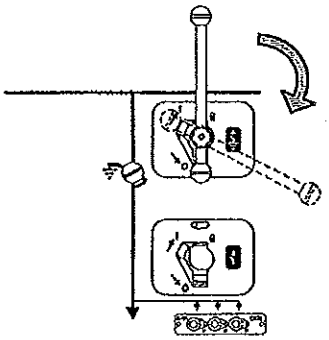




12.3. Затваряне на заземителя (приложимо при двата вида механизми на управление: CI1 е CI2)

- Тази операция е възможна единствено ако прекъсвачът и в положение "отворен".
- Вкарайте ръчката в отвора за управление на заземителя.
- Уверете се че кабелите не са под напрежение (вижте индикаторите за наличие на напрежение).
- Затворете заземителя, повдигайки ръчката до крайно положение в посока на часовниковата стрелка.



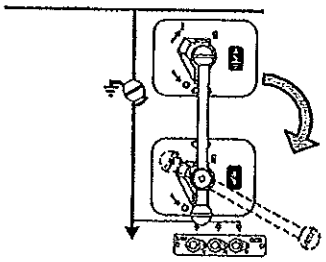


При тази операция:

- заземителят се затваря.
- панелът за достъп до кабелите се отваря.
- прекъсвачът се блокира в положение "отворен".

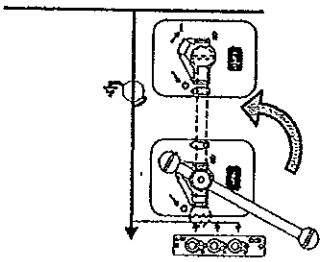
12.4. Затваряне на прекъсвача (механизми на управление CI1 - Функция вход/ изход)

- Тази операция е възможна единствено ако заземителят е в положение "отворен".
- Вкарайте ръчката в отвора за управление на прекъсвача.
- Завъртете ръчката до крайно положение в посока на часовниковата стрелка - прекъсвачът се затваря рязко.
- Механизмът за управление на заземителя се блокира в положение "отворен".



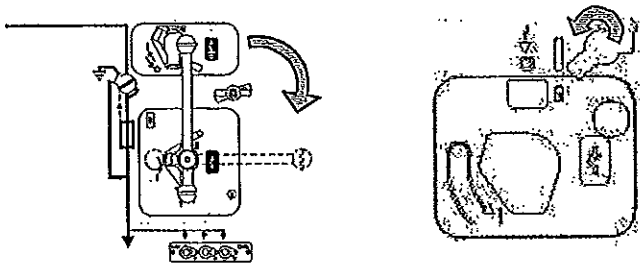
12.5. Отваряне на прекъсвача (механизъм на управление CI1 - Функция вход/ изход)

- Тази операция е възможна единствено ако заземителят е в положение "затворен".
- Вкарайте ръчката в отвора за управление на прекъсвача.
- Завъртете ръчката до положение отворено в посока обратна на часовниковата стрелка в положение "отворен" - прекъсвачът се отваря рязко.
- Механизмът за управление на заземителя тогава се отблокира.



12.6. Затваряне на прекъсвача и зареждане за отваряне (механизъм на управление CI2 - функция Защита на трансорматор)

- Тази операция е възможна единствено ако заземителят е в положение "отворен".
- Вкарайте ръчката в отвора за управление на прекъсвача.
- Завъртете с ръка в посока на часовниковата стрелка до крайно положение.
- Прекъсвачът се затваря и ръчката не може да бъде махната.



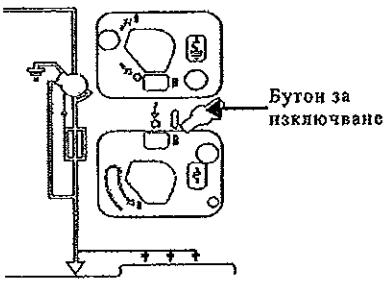
Внимание, задължителна операция след затварянето на ISFG:

- Завъртете задължително ръчката в посока обратна на часовниковата стрелка, за да заредите пружината.
- След това може да се махне ръчката. Прекъсвачът тогава е вече готов за отваряне (завъртете ключа в посока обратна на часовниковата стрелка).

12.7. Отваряне на прекъсвача (механизъм на управление CI2 - функция Защита на трансорматор)

Операцията на отваряне на прекъсвача може да бъде извършена:

- Ръчно (бутон на механизма за управление)
- Чрез първична намотка (по желание)
- С предпазители (механично задвижване на предпазителите)



13. СЪХРАНЕНИЕ

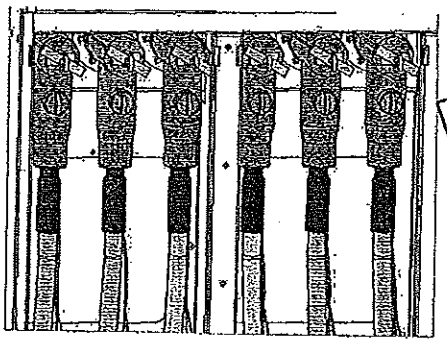
Fluofix GC е продукт, който не се нуждае от поддръжка, след като вече всички активни части и основната верига се намират във вътрешността на резервоара, пълен с елегаз (SF6).
При все това, след продължително изключване от режим на работа или винаги, когато има прекъсване на режима на работа, се препоръчва извършването на някои операции:

- Визуална проверка, за да се уверите в доброто състояние на съоръжението.
- Проверка на правилното функциониране на механизмите за управление и на блокировките.
- Проверка на правилното поставяне на кабелните конектори.

14. ТЕСТВАНЕ НА КАБЕЛИ

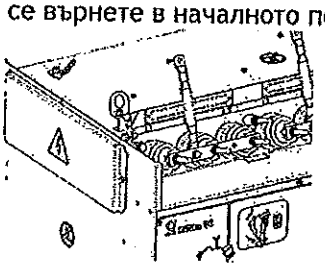
Ред за извършване на тестването на кабели

- Отворете разединителя.
- Затворете заземителя.
- Отстранете панела за достъп до кабелното отделение.
- Инжектирайте напрежение директно в кабелния конектор (производителите на конектори разполагат с допълнителни съоръжения за тестване на кабели).
- След края на тестването се върнете в началното положение.



По желание, единиците Fluofix могат да бъдат оборудвани със специални изпитателни гнезда за тестване на кабели (виж рисунката). Те позволяват кабелите да се тестват без да има пряк достъп до кабелните конектори.

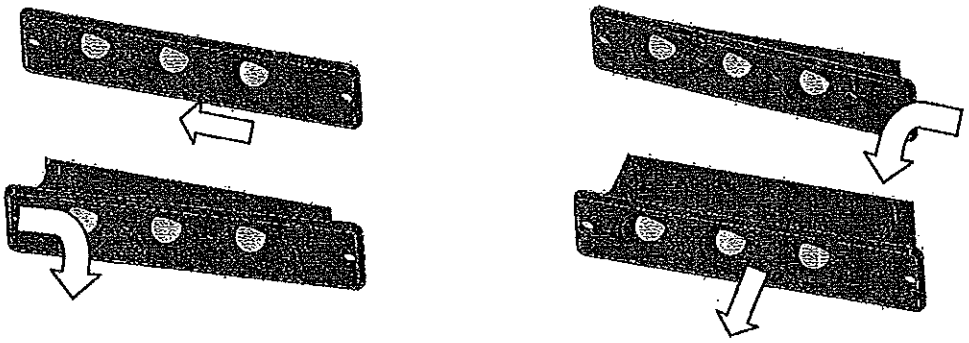
- Отворете разединителя.
- Затворете заземителя.
- Отстранете заземителните шини, които са съединени на късо с изпитателните гнездата.
- Инжектирайте напрежение, за да тествате кабелите.
- След края на тестването се върнете в началното положение.



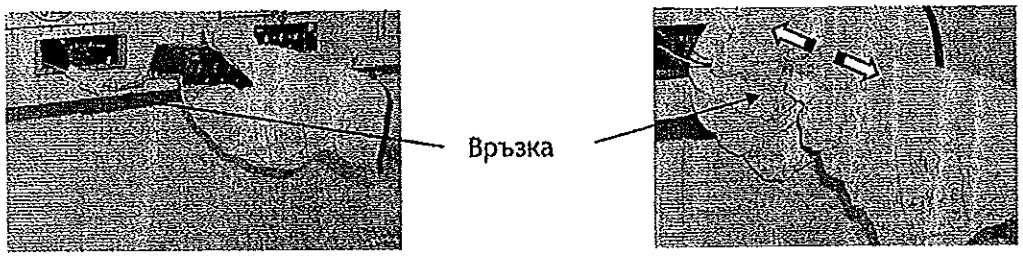
15. ПОДМЯНА

15.1 Подмяна на сигналните лампи за наличие на напрежение

За да подмените сигналните лампии за наличие на напрежение, следвайте реда, посочен на илюстрациите. Не са необходими инструменти.



След като отстраните индикатора на напрежението, прекъснете връзката.
Свържете наново индикатора на напрежението и го поставете отново на мястото му.
Ако единицата е под напрежение, индикаторът ще светне веднага.



15.2 Подмяна на предпазители

За да подмените предпазителите, следвайте инструкциите, посочени в точка 10.8 от "Монтаж на предпазители".

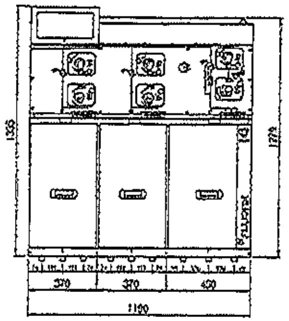
Препоръчва се едновременна подмяна на трите предпазителя.

16. РЕЗЕРВНИ ЧАСТИ

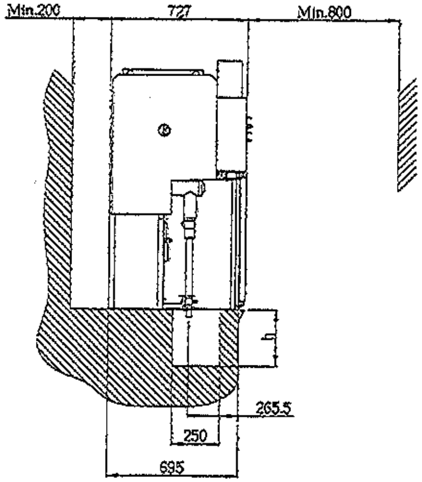
Препоръчват се следните резервни части:

- Лампи за индикатора на напрежение
- Предпазители (ако е приложимо)
- Първична намотка (ако е приложимо)

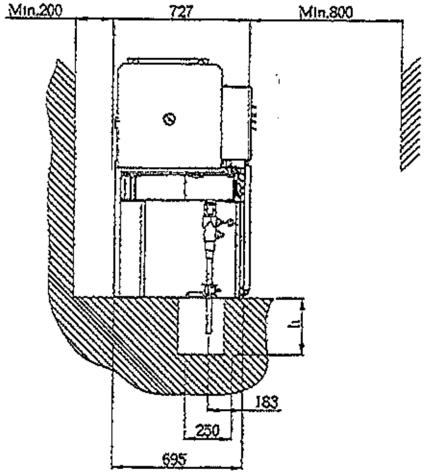
FRONTAL VIEW



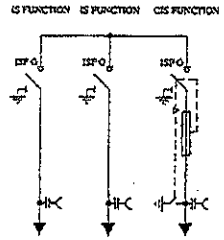
SIDE VIEW
IS FUNCTION (SWITCH DISCONNECTOR)



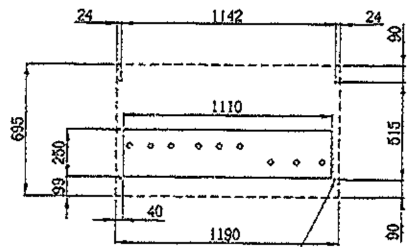
SIDE VIEW
CIS FUNCTION (TRANSFORMER PROTECTION)



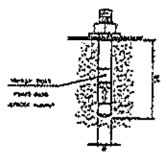
SINGLE LINE DIAGRAM



LAY-OUT



Floor setting to be executed outside to cubicle with gauge



CABLES (DRY INSULATEUR)	SECTION (mm2)	BENDING RADIUS	h
SINGLE	< = 50	370	400
SINGLE	70 < X < 120	440	450
SINGLE	120 a 150	450	500
SINGLE	185 a 240	600	550
THREE	< = 150	550	660
THREE	150 a 185	650	770
THREE	185 a 240	840	900

Tolerâncias gerais ISO 2768-m ou APES 98025

General Tolerances: ISO 2768-m or APES 98025

Scale / Escala	1/25
Mat.:	-
Prot.:	-
Projected by / Projectado por	C.Jorge
Drawn by / Desenhado por	N.Sel
Date / Data	2013-07-30
Approved by / Aprovado por	P.Lima
Date / Data	2013-07-30
Weight / Peso	-
Area / Área	-
Used in / Usado em	AP1301336A1 E1820... Fluofix GC 24kV-630A-16kA/3s

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AMT - Aparelhagem de Média Tensão, S.A.

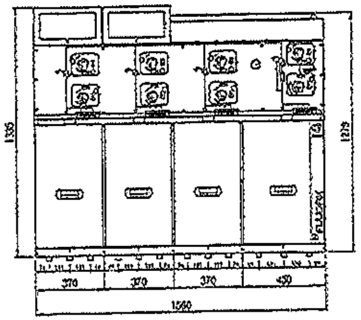
Tender in CEZ for kisoks
EFACEC Central Europe Limited S.R.L.
Arrangement & Installation

-	AP1301336A1_1	A3	Page / Pág. 1/1

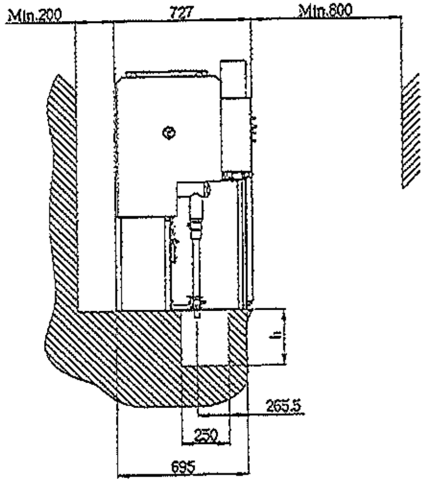
Revision / Revisão

Index / Índice	Number / Número	Date / Data
-	-	-

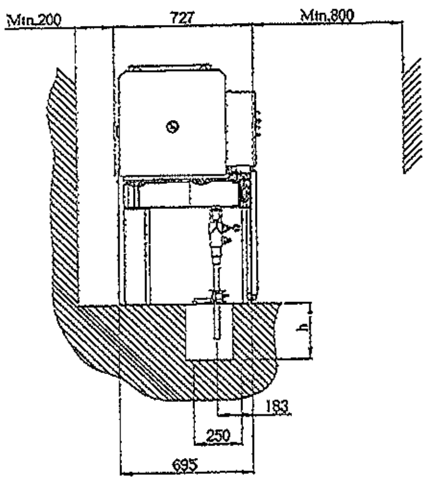
FRONTAL VIEW



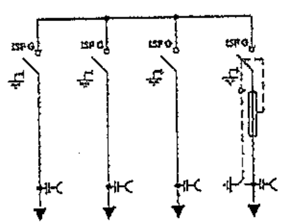
SIDE VIEW
IS FUNCTION (SWITCH DISCONNECTOR)



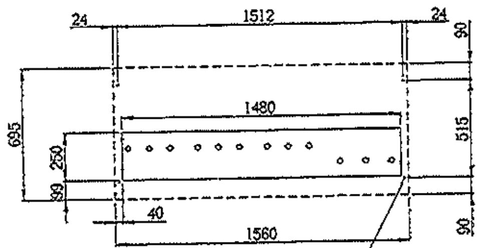
SIDE VIEW
CIS FUNCTION (TRANSFORMER PROTECTION)



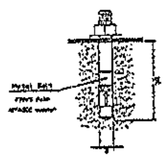
SINGLE LINE DIAGRAM



LAY-OUT



Floor setting to be executed outside to cubicle with gauge



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Tolerâncias gerais: ISO 2768-m ou APES 98025

General Tolerances: ISO 2768-m or APES 98025

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Scale / Escala	1/25
Mat.:	-
Projected by / Projectado por	C.Jorge
Drawn by / Desenhado por	W.Sol
Date / Data	2013-07-30
Approved by / Aprovado por	P.T.Lima
Date / Data	2013-07-30
Weight / Peso	-
Area / Área	-

Used in / Usado em: AP1301336A1, E1820..., FluoGix GC 24kV-630A-16kA/3s

Proj.: -

Tender in CEZ for kisoks
EFACEC Central Europe Limited S.R.L.
Arrangement & Installation

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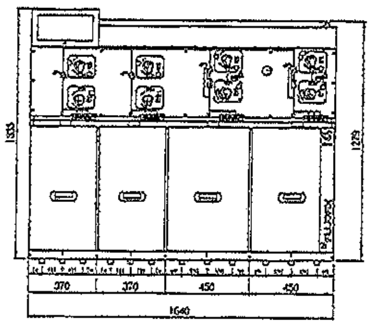
Index / Índice	Number / Número	Format	Page / Pág.
-	AP1301336A1_2	A3	1/1

Revision / Revisão

Index / Índice	Number / Número	Date / Data
-	-	-

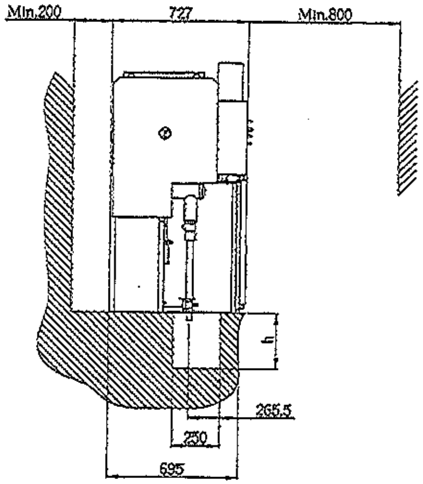
„КИМТЕХ-БЪЛГАРИЯ" ООД • БУРГАС • КИМТЕХ

FRONTAL VIEW



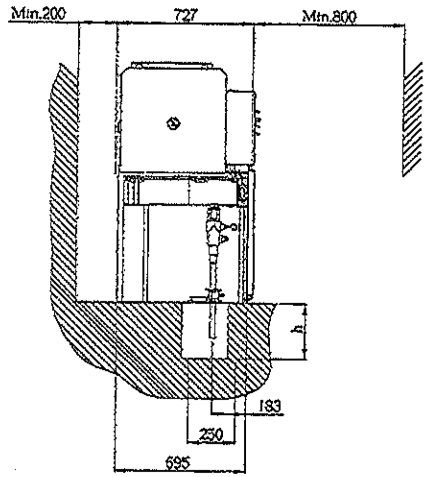
SIDE VIEW

IS FUNCTION (SWITCH DISCONNECTOR)

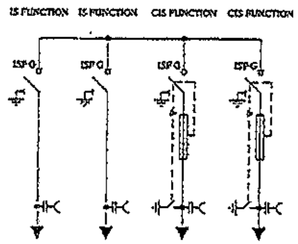


SIDE VIEW

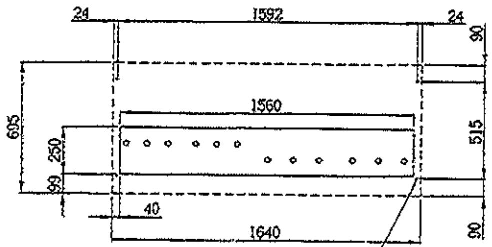
CIS FUNCTION (TRANSFORMER PROTECTION)



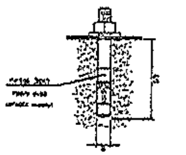
SINGLE LINE DIAGRAM



LAY-OUT



Floor setting to be executed cubicle to cubicle with gauge



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Tolerâncias gerais ISO 2768-m ou APES 98025 | General Tolerances ISO 2768-m or APES 98025

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Scale / Escala	1/25	Mat.: -	Prot.: -
Projected by / Projectado por	C.Jorge	Used in / Usado em: AP1301336A1, E1820..., Fluofix GC 24kV-630A-16kA/3s	Article / Artigo: -
Drawn by / Desenhado por	N.Sol		Quality Level / Nível de Qual.: -
Date / Data	2013-07-30		
Approved by / Aprovado por	P.Lima		
Date / Data	2013-07-30		
Weight / Peso	-		
Area / Área	-		

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Tender in CEZ for kisoks
EFACEC Central Europe Limited S.R.L.
Arrangement & Installation

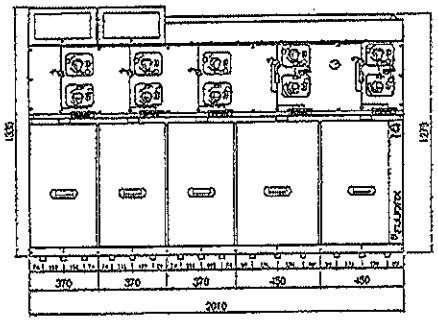
-	AP1301336A1_3	A3	Page / Pág 1/1

Revision / Revisão

Index / Índice	Number / Número	Date / Data
-	-	-

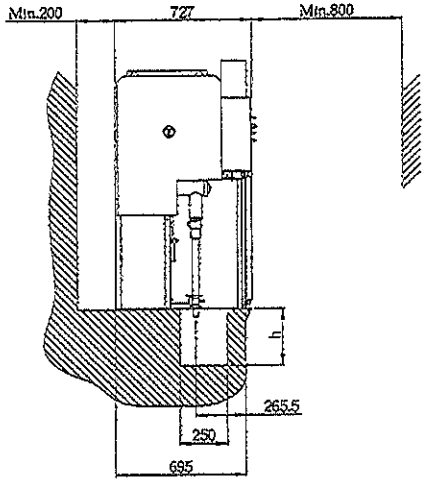
КИМТЕХ-БЪЛГАРИЯ ООД БУРГАС

FRONTAL VIEW



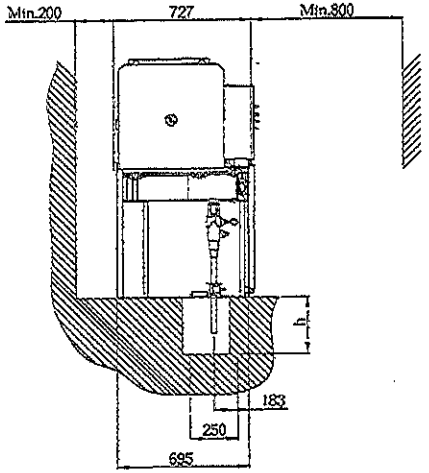
SIDE VIEW

IS FUNCTION (SWITCH DISCONNECTOR)

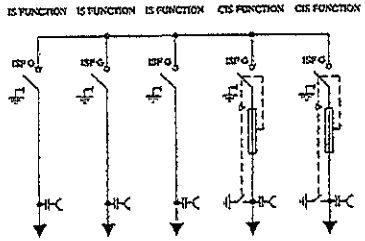


SIDE VIEW

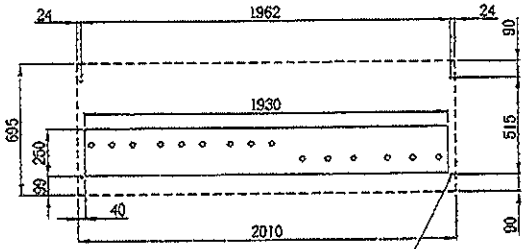
CIS FUNCTION (TRANSFORMER PROTECTION)



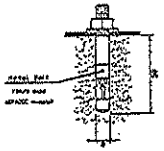
SINGLE LINE DIAGRAM



LAY-OUT



Floor setting to be executed outside to cubicle with gauge



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THREE	150 a 185	650	770
THREE	185 a 240	840	900

Scale / Escala	1/25
Mat.:	-
Prot.:	-
Vistar Draw.. / Des. Sinhar:	-
Projected by / Projectado por	C.Jorge
Drawn by / Desenhado por	RCSet
Date / Data	2013-07-30
Approved by / Aprovado por	P.C.Lima
Date / Data	2013-07-30
Weight / Peso	-
Area / Area	-
Used on / Usado em	AP1301336A1
	E1820 _
	Fluofrix GC 24kV-630A-16kA/3s
Article / Artigo	-
Quality Level / Nível de Qual.	-

Tender in CEZ for kisoks

EFACEC Central Europe Limited S.R.L.

Arrangement & Installation

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-	AP1301336A1_4	A3	Page / Pág. 1/1

Revision / Revisão

Index / Indice	Number / Número	Date / Data
-	-	-

ТОВА ОБОРУДВАНЕ СЪДЪРЖА
ФЛУОРИРАНИ ПАРНИКОВИ ГАЗОВЕ
ПО ПРОТОКОЛА ОТ КИОТО.

СЕРЕН ХЕКСАФУОРИД SF6.

ХЕРМЕТИЧНА СИСТЕМА ПОД НАЛЯГАНЕ СПОРЕД IEC 62271-1
SF6 газа съдържащ се в тази електрическа система
трябва да бъде рециклиран и не изпуснат в атмосферата.

Масата в килограми на газа е написана на табелата с данните.

FLUOFIX GC

Efacec

Сериен N:

IEC 62271-1/100/102/200					
Ur:	kV	Fr:	Hz	Ud:	kV
Ik:	kA	tk:	s	Ip:	kA
Ir:	A	Up:	Kv	Pre:	Mpa
Ua:					
Чертеж:					
Поз:					
Маса на SF6 газ:					
IAC					
О.Н. / Прод./Номер					
Година на производство:					

ВЯРНО С ОРИГИНАЛА

„КИМТЕХ-БЪЛГАРИЯ" ООД БУРГАС КИМТЕХ

THIS EQUIPMENT CONTAINS
FLUORINATED GREENHOUSE GASES
COVERED BY THE KYOTO PROTOCOL

SULPHUR HEXAFLUORIDE GAS (SF6)

Sealed pressure system acc. IEC 62271-1.

SF6 gas contained in this electrical equipment shall be recovered and not released into the atmosphere.

Mass in kilograms referred to in the nameplate.

efacec

FLUOFIX GC

S/N:

IEC 62271-1/100/102/200

Ur:	kV	fr:	Hz	Ud:	kV
Ik:	kA	tk:	s	Ip:	kA
Ir:	A	Up:	kV	Pre:	MPa
Ua:					

Wiring Diagram:

Pos.:

Mass of SF6 gas

IAC:

O.F. / P/N:

Manufacturing Year:

Кимтех България ООД
1113 гр. София
ул. Акад. Георги Бончев № 20

официален дистрибутор на 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 КРУ с SF6 12/24(25)kV

1. Температурен тест.
2. Вътрешна дъга
3. Механични тестове и на късо съединение
4. Краткотраен и пиков ток
5. Диелектрични
6. Издръжливост - механични тестове
7. Ниво на защита
8. Включвателна и изключвателна способност
9. Включвателна и изключвателна способност на късо съединение
10. Разни

13.01.2016г.

Подпис и печат:

Test Report

CESI

Approved

Client	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Address of the Client	Apartado 1018 - 4466 - 952 S. Mamede de Infesta - PORTUGAL
Tested samples/items	A.C. three-phase SF6 gas-insulated metal-enclosed switchgear (RMU) for indoor application
Tests carried out	Arcing due to internal fault

Standards/Specifications	IEC 62271-200 (2003)
Tests date	**from** December 3, 2008 **to** December 3, 2008

No. of pages	13	**No. of pages annexed**	4
Issue date	April 29, 2009		
Prepared	QED - Beccarini Pierangelo		
Verified	QED - Arneodo Giorgio, PPR - Ronchi Daniele		
Approved	LAP - Il Responsabile - Nicolini Roberto		

CESI S.p.A.
Energy Division
Technical Area Components
"Testing Laboratories"
Manager

CESI
Centro Elettrotecnico
Sperimentale Italiano
Giacinto Motta spa

Via R. Rubattino 54
20134 Milano - Italia
Telefono +39 022125.1
Fax +39 0221255440
http://www.cesi.it

Capitale sociale 8 550 000 Euro
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

Tests witnessed by

Mr. M. Martins	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Mr. E. Barbosa	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Mr. L. Pinto	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A

Identification of the object Not requested.

The drawings ref. No.A9012486 No.1 and 2 have been annexed to this document on the request of the Client. CESI has not checked the details of these drawings.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: A8035509

The measurement uncertainties of the test results reported in the document are the following:
voltage: ± 5 % ; current: ± 5 % ; time: ± 5 % ; temperature: ± 2 °C
The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

ВЯРНО С ОРИГИНАЛА

ВЯРНО С ОРИГИНАЛА

Rated characteristics of the tested object assigned by the Client

Metal-enclosed switchgear	
Manufacturer	EFACEC Energia, Máquinas e Equipamentos Eléctricos, SA
Type	Fluofix GC
Serial number	S18002990
Voltage	24 kV
Insulation level	
Lightning impulse withstand voltage	125/145 kV
Power frequency withstand voltage	50/60 kV
Frequency	50 Hz
Normal current	630 A
Short-time withstand current	16 kA
Peak withstand current	40 kA
Short-circuit duration	3 s
Internal fault : Short-circuit current	16 kA
Internal fault : Short-circuit duration	0,5 s
Internal fault : Classification IAC (initials for Internal Arc Classified)	AF
Pressure of SF6 gas for interruption and insulation	0,13 MPa abs.
Functional unit : Busbar compartment	
Number of phases	3
Number and section of the busbars	1 // 32 x 5 mm^2
Voltage	24 kV
Normal current	630 A
Short-time withstand current	16 kA
Short-circuit duration	3 s
Functional unit : Feeder cable compartment	

Arcing due to internal fault

Purpose of the test

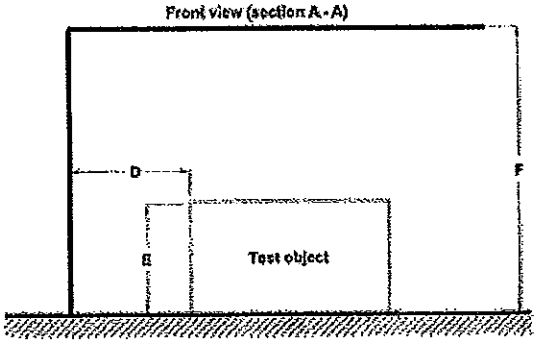
The purpose of the test is to assess the behaviour of the apparatus under arcing stress due to an internal fault at the light of the criteria listed in Annex A of IEC 62271-200.

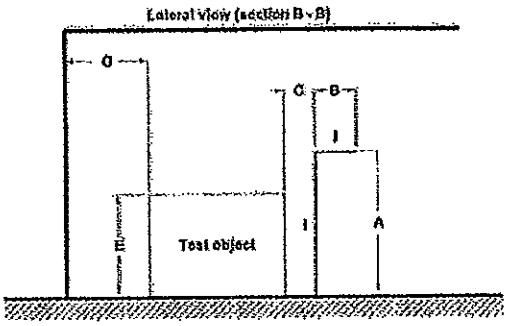
Test arrangement

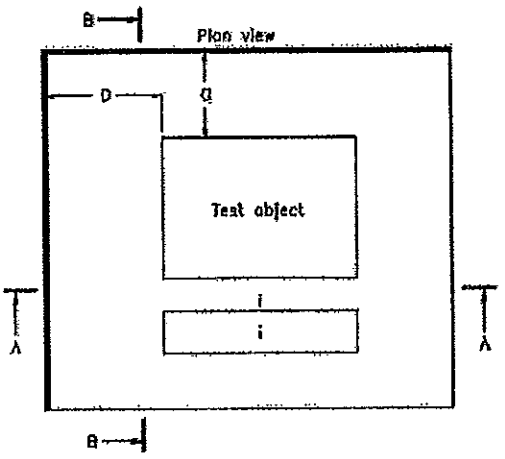
The test arrangement (choice of the functional units, their number, equipment, position in the room and place of the initiation of the arc) was indicated by the client.

The complete board was placed in the hall in observance of the dimensions of the actual installation in service.

The room was represented by the floor, the ceiling and two perpendicular walls, as shown in the following figures:







i : Position of indicators

A : 200 cm
B : 50 cm
C : 30 cm
D : 10 cm
E : 128 cm
F : 250 cm
G : 10 cm

The indicators for observing the thermal effects of the gases were fitted vertically, placed up to a height of 2 m and at distance of 30 cm from the metal enclosure.

Other indicators were placed horizontally at a height of 2 m above the floor and between 30 cm and 80 cm from the enclosure.

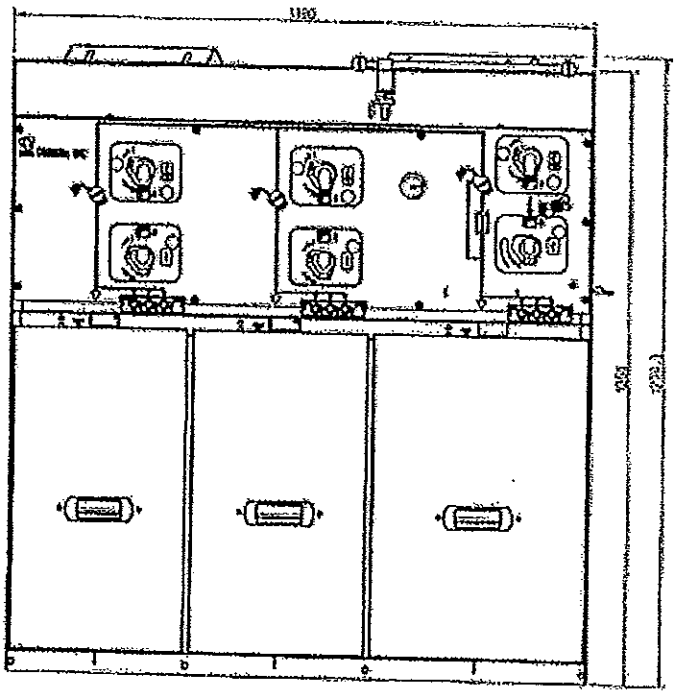
The indicators used during the tests consisted of pieces of black cretonne (150 g/m^2), fitted in frames of steel sheet having dimensions 150 mm × 150 mm.

High speed motion pictures

During the test, pictures were taken by high speed video camera.

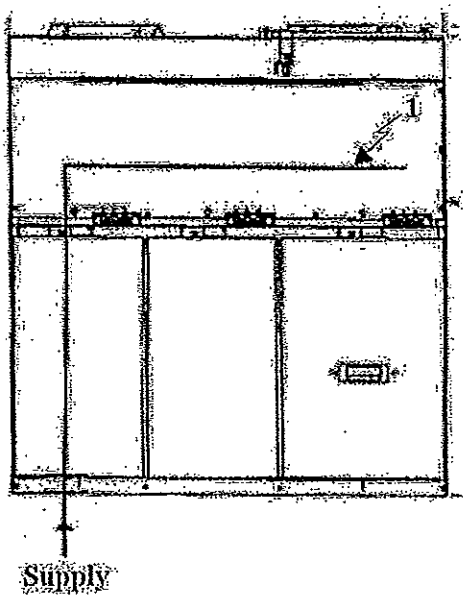
Arcing due to internal fault

Composition of the tested object



Arcing due to internal fault

Test procedure (Supply points and arc initiation points)



ВЯРНО С ОРИГИНАЛА

Three-phase arcing due to internal fault test with 16,5 kA for 1,02 s

Test circuit : See D0010 Supply circuit : Insulated Power factor : <0,15 Frequency : 50 Hz Enclosure of the apparatus : Earthed

Test arrangement : See page 5

Test procedure : See page 7

Supply point of the apparatus : Cable compartment, left unit

Arc initiation point : **1** - (Busbar compartment)

The arc was initiated among the phases by means of metallic wire of 0,5 mm in diameter

The SF6 gas was replaced by air at atmospheric pressure

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
2	1	16,5	43,0

Condition of the apparatus before the tests: new.

Date: December 3, 2008

Test	Oscillogram		Functional unit under test	Compartment under test	Applied voltage Phase to phase	Duration	Test current				Maximum overpressure	Photos		Notes
							rms value	Average	Peak value			before the test	after the test	
No.	No.	Sheets	No.	-	kV	s	kA	kA	kA	Phase	Bar	No.	No.	No.
1	4	1	-	Busbar compartment	20,5	1,02	16,5 16,5 16,5	16,5	43,0	T	-	1 - 2	3	-

Condition of the apparatus after the tests: see next page.

Assessment of the test (Based on IEC 62271-200)

Test	Criterion (Fulfilled – See note No. – Not applicable)				
No.	No.1	No.2	No.3	No.4	No.5
1	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled

The following criteria listed in the mentioned Standard have been allowed for the assessment of arcing effects:

Criterion No.1

Correctly secured doors and covers do not open. Deformations are accepted, provided that no part comes as far as the position of the indicators or the walls (whichever is the closest) in every side. The switchgear and controlgear do not need to comply with its IP code after the test.
To extend the acceptance criterion to an installation mounted closer to the wall than tested (refer to item a) of A.3.2), two additional conditions shall be met:
- the permanent deformation is less than the intended distance to the wall;
- exhausting gases are not directed to the wall.

Criterion No.2

- No fragmentation of the enclosure occurs within the time specified for the test.
- Projections of small parts, up to an individual mass of 60 g, are accepted.

Criterion No.3

Arcing does not cause holes in the accessible sides up to a height of 2 m.

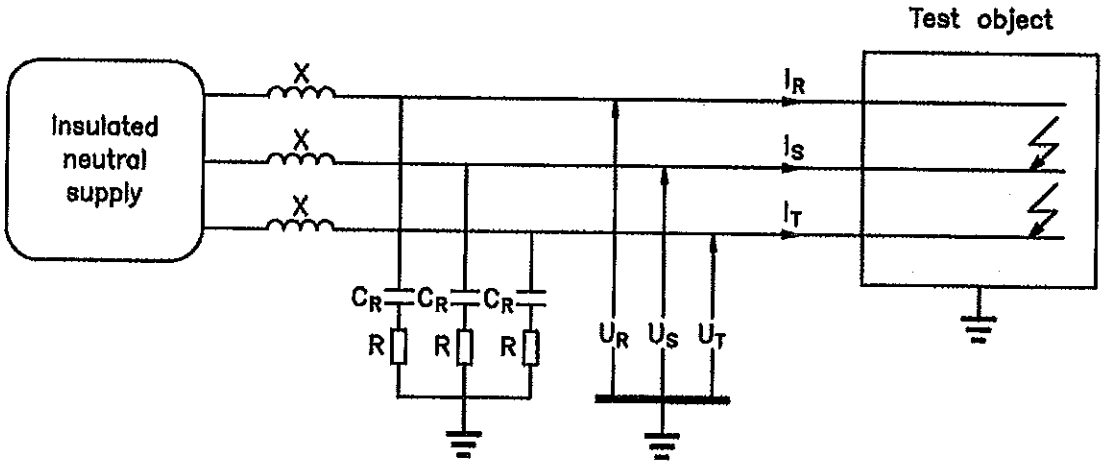
Criterion No.4

Indicators do not ignite due to the effect of hot gases.
Should they start to burn during the test, the assessment criterion may be regarded as having been met, if proof is established of the fact that the ignition was caused by glowing particles rather than hot gases. Pictures taken by high-speed cameras, video or any other suitable means can be used by the test laboratory to establish evidence.
Indicators ignited as a result of paint or stickers burning are also excluded.

Criterion No.5

The enclosure remains connected to its earthing point. Visual inspection is generally sufficient to assess compliance. In case of doubt, the continuity of the earthing connection shall be checked (refer to 6.6, point b)).

Test circuit D0010



Symbols used in this diagram are the same as those on the oscillograms.

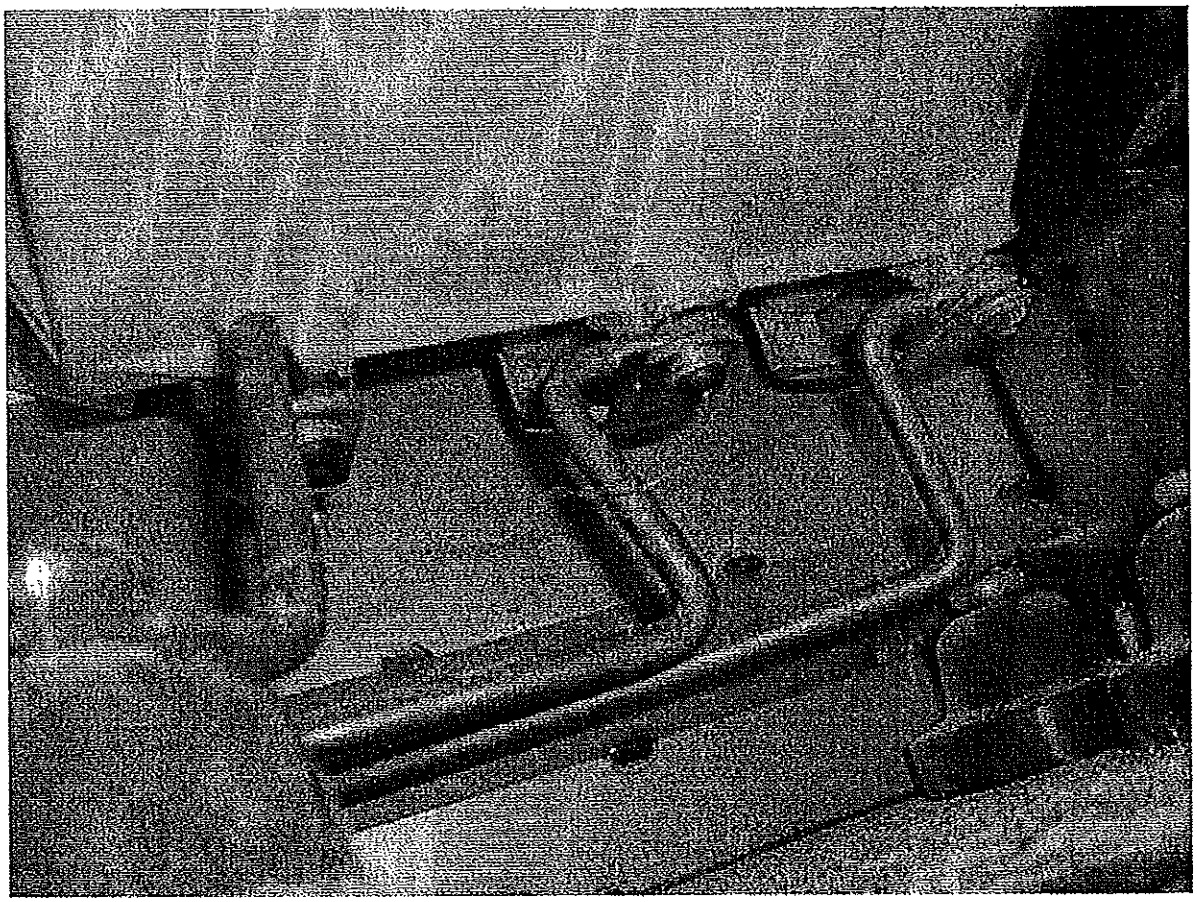


Photo No.1

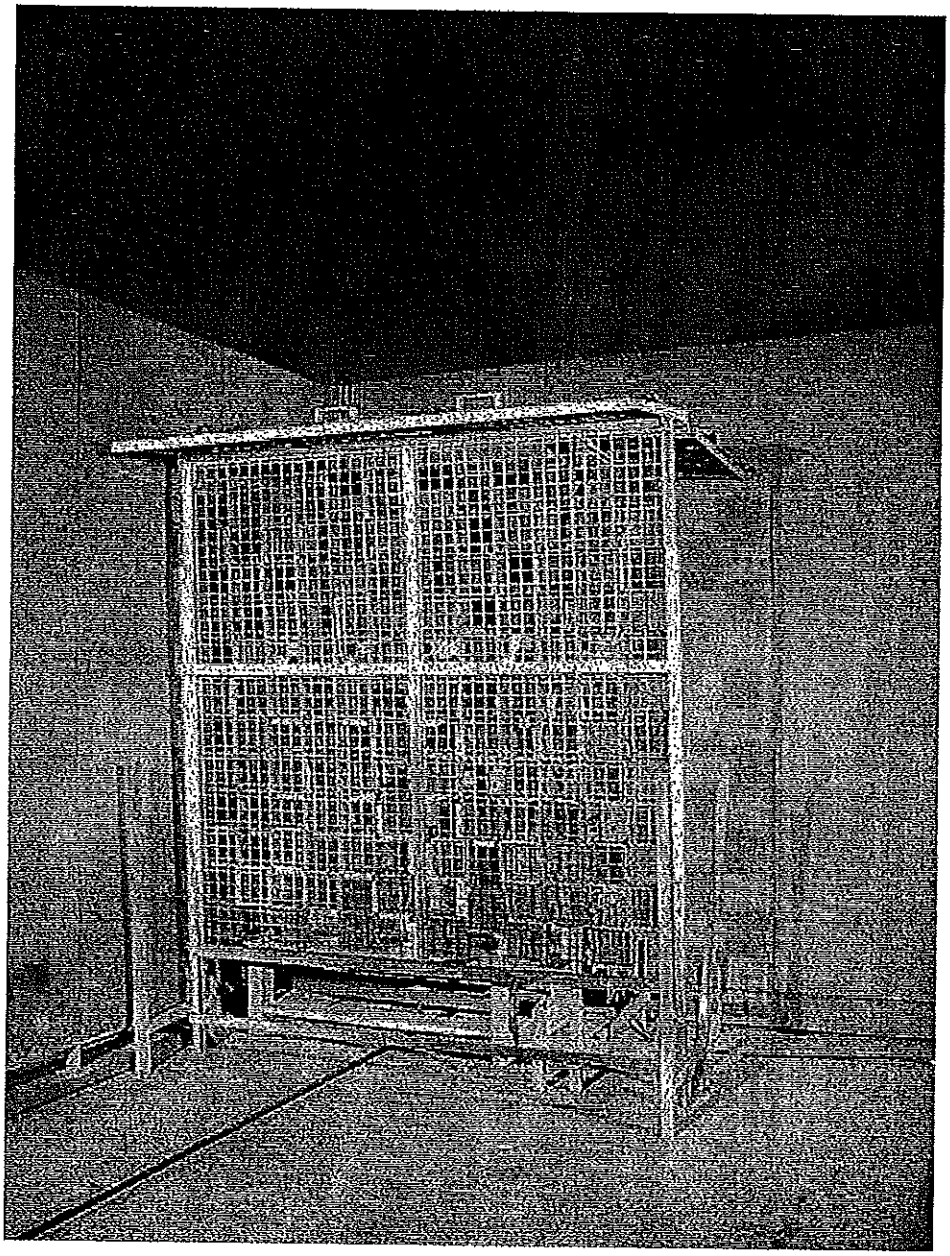


Photo No.2

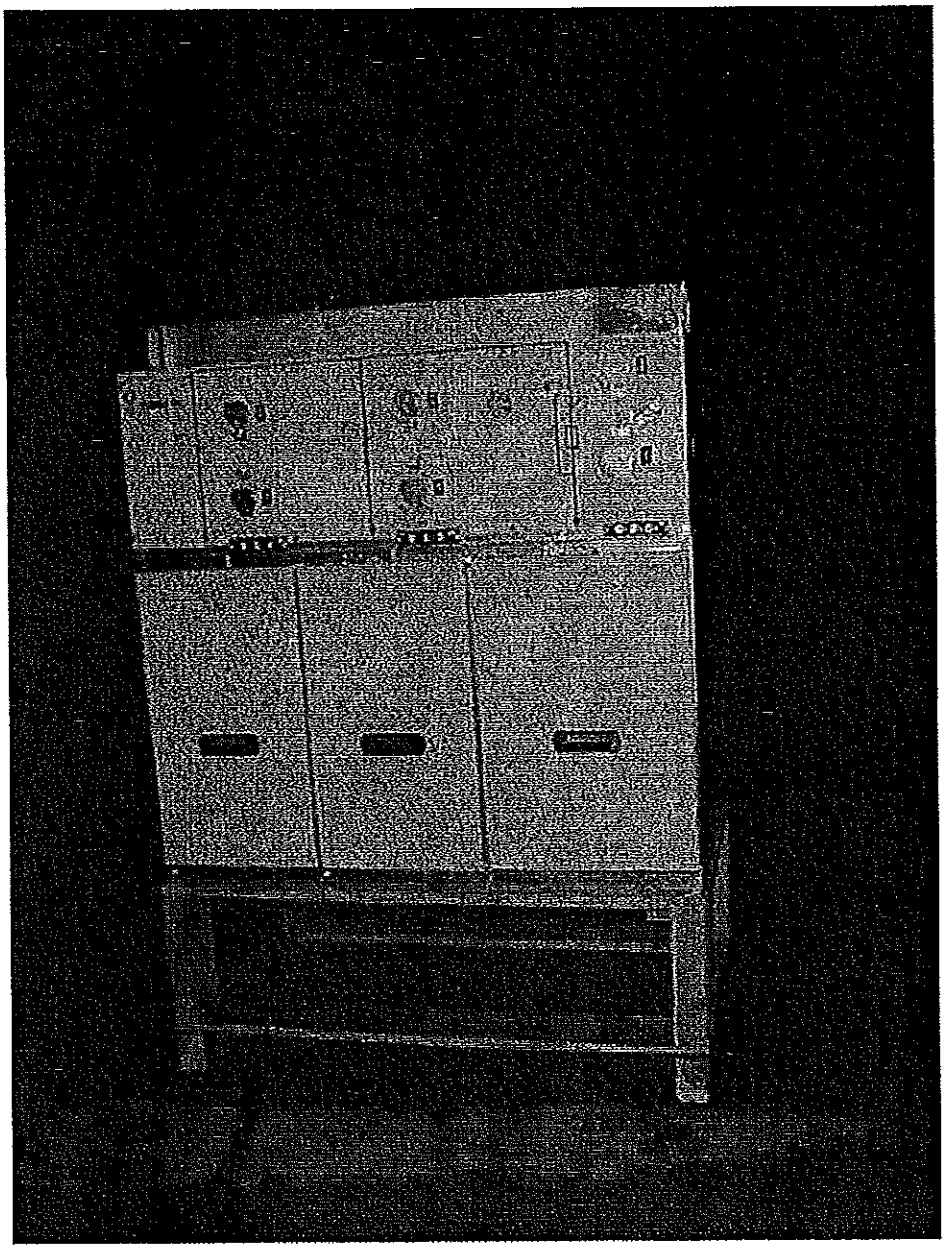
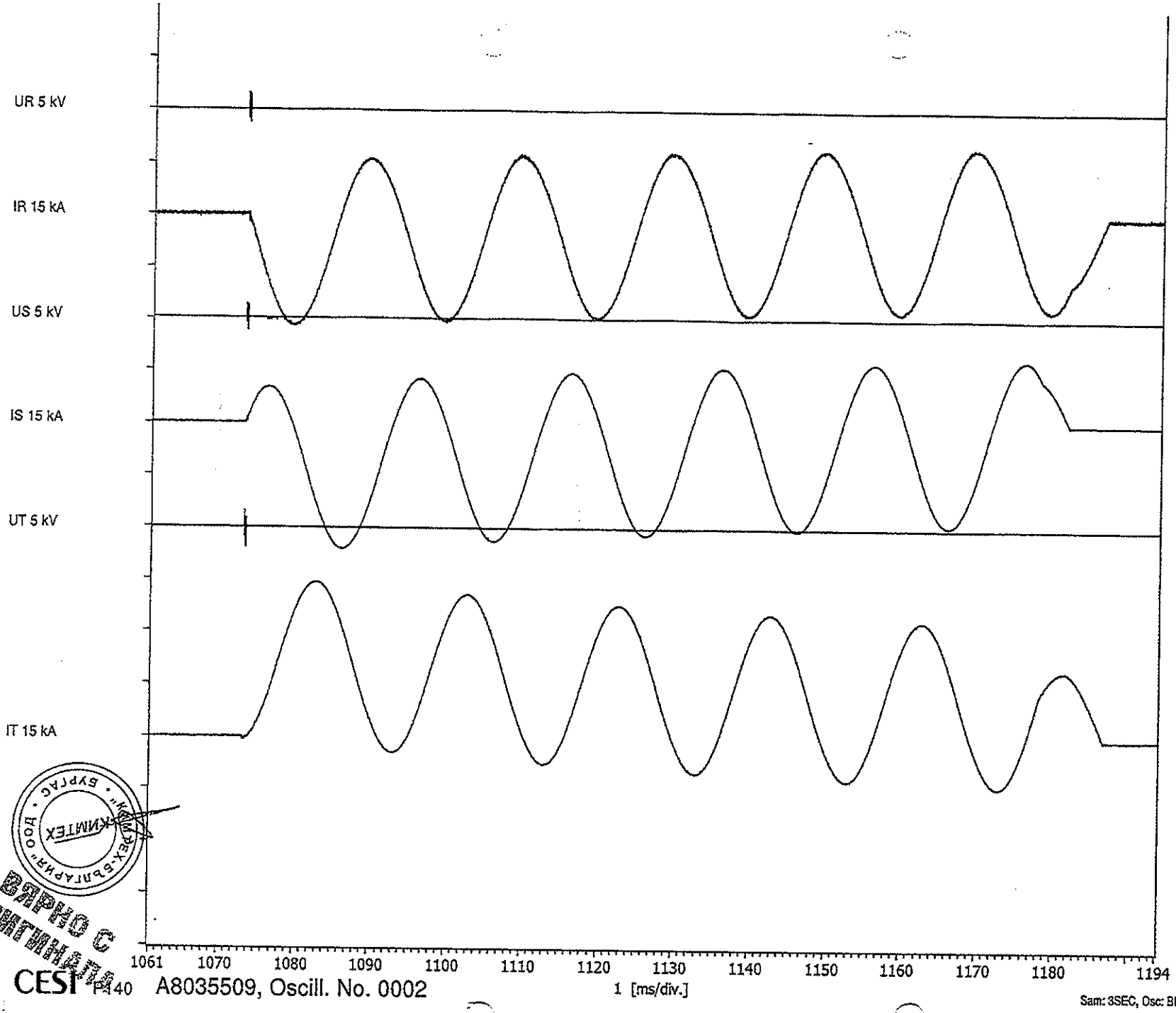


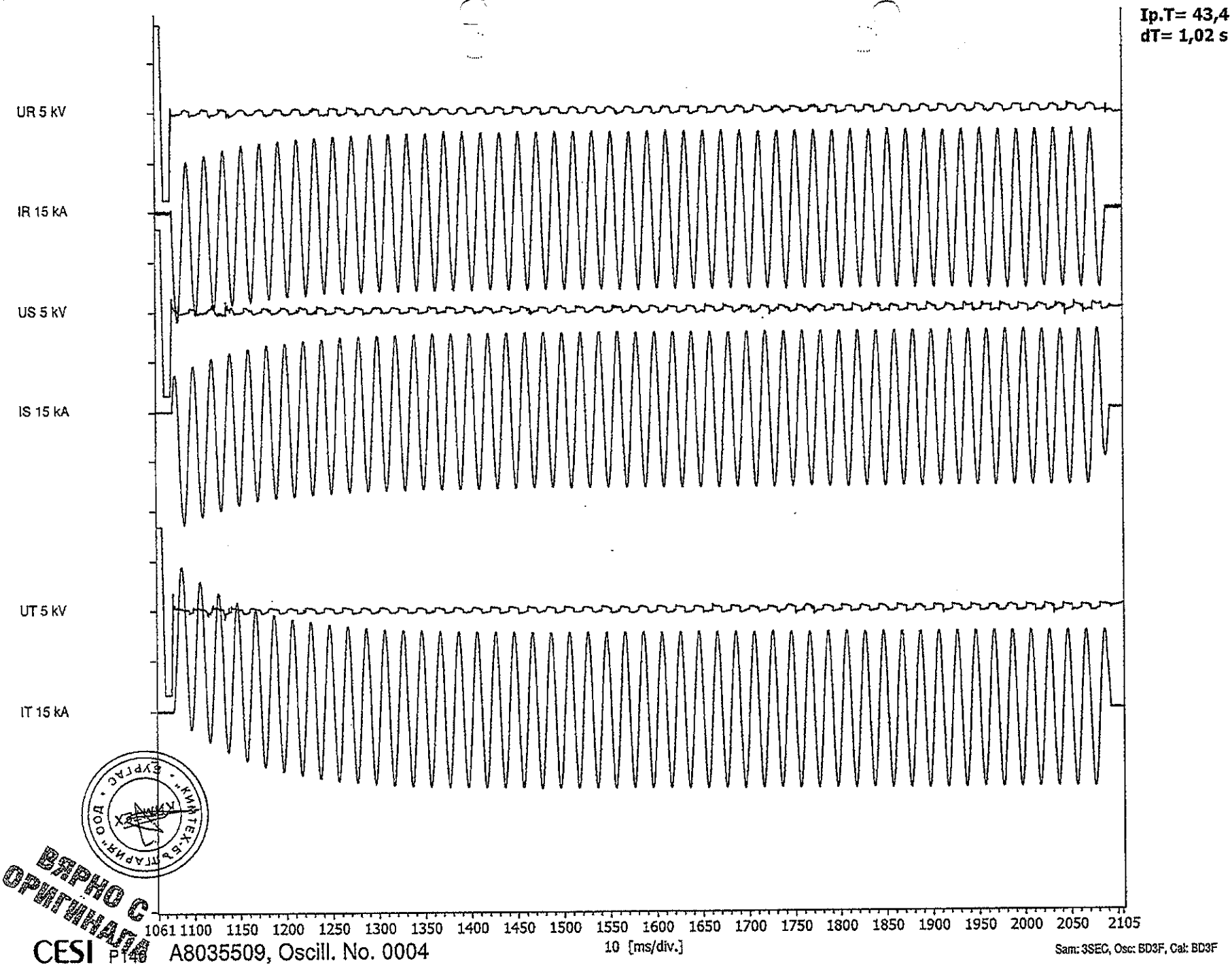
Photo No.3

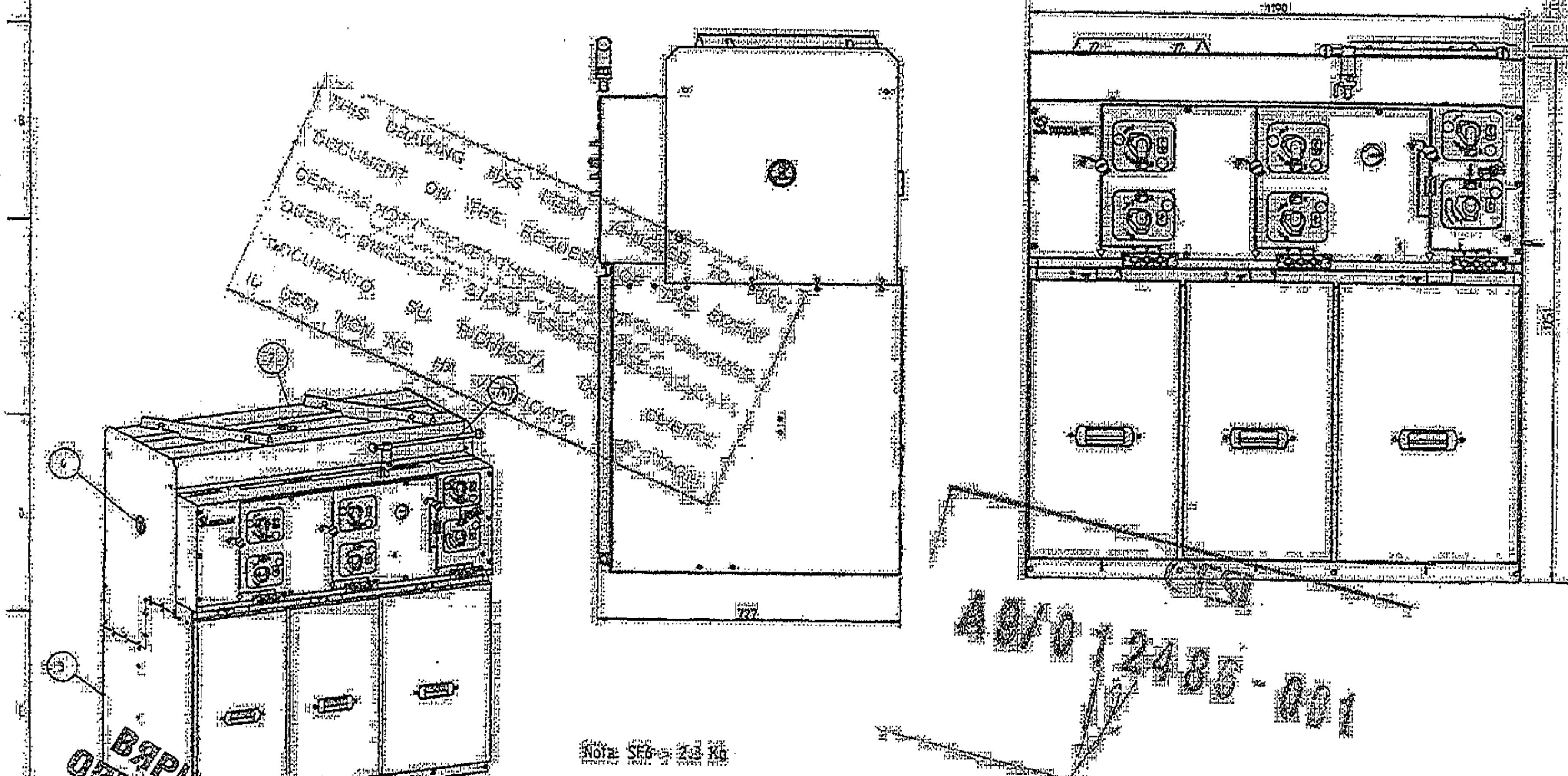


ВЯРНО С ОРИГИНАЛА

CESI P440 A8035509, Oscill. No. 0002

Sam: 3SEC, Osc: BD3F, Cal: BD3F





Nota: SF6 = 23 Kg

[illegible]	X10500705-01	CONECTOR ELASTIMOLD 24 KV 630A	[illegible]	[illegible]
[illegible]	39703067-01	CONECTOR RAYCHEM RSTI	[illegible]	[illegible]
4	33110217-01	DO NOT DRILL LABEL ETIQUETA "NAO PERFURAR"	[illegible]	33110217
3	33108057-01	ASSEMBLED COMPLETE STRUCTURE ESTRUTURA COMPLETA MONTADA	1	[illegible]
2	33107898-01	ASSEMBLED TANK CUBA MONTADA	1	[illegible]
1	33107290-01	ALAVANCA DE MANOBRA	1	[illegible]
ITEM	DRAWING / PLANO	DESCRIPTION DESIGNAÇÃO	QT.	ARTICLE / ARTIGO

FLUOFIX GC 2 IS - 1 CIS

FLUOFIX GC

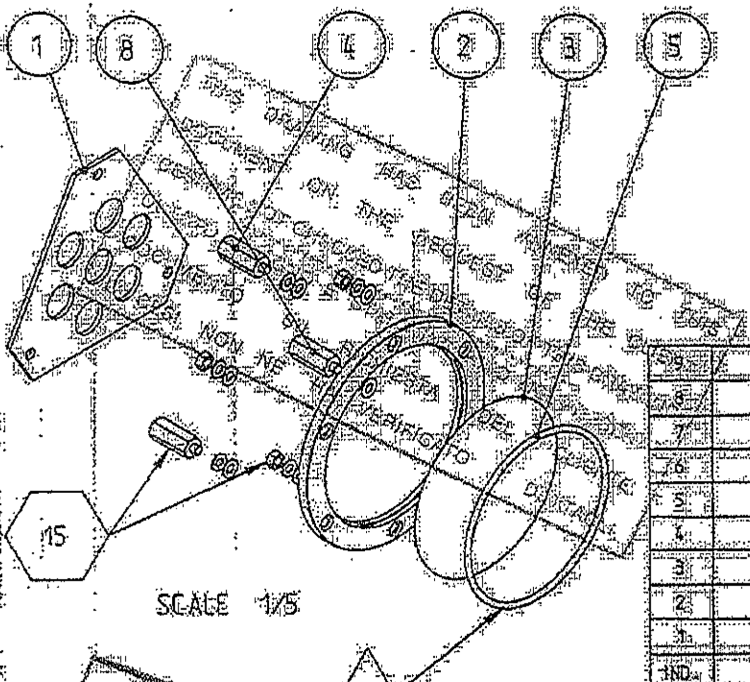
EFACEC

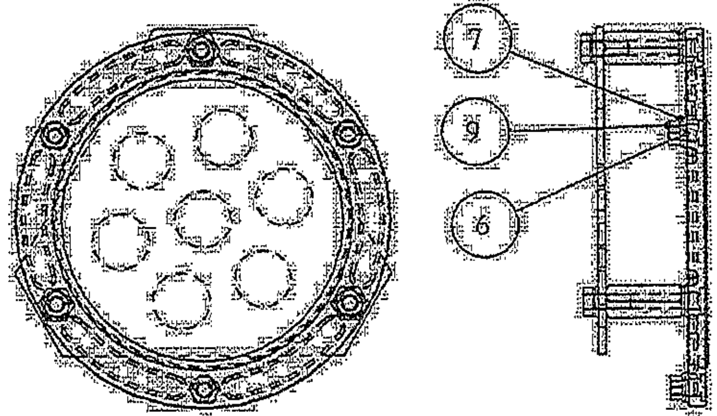
33108059 | A2 | 1/1

Revision / Revisão

ВЯРНО С ОРИГИНАЛА

„КИМТЕХ-БЪЛГАРИЯ" ООД • БУРГАС • КИМТЕХ





IND.	PLANO	DESIGNAÇÃO	QT.	ARTIGO
9	PORCA_H_M8-6-ZN_ISO4032	PORCA H M8-6-ZN ISO 4032	3	9010024
8	PFH_M8X20-8-8-ZN40_ISO4017	PF H M8X20-8-8-ZN40EC ISO4017	3	600018F379
7	ANILHA_CFA-8-DIN128	ANILHA CFA 8 DIN 128	9	9041311
6	ANILHA_8_ZN25_ISO7089	ANILHA 8-140HV ZN25EC ISO 7089	9	9040017
5	9123903-15	JUNTA TÓRICA / O-RING	1	-
4	33116069-01	ESCORA SEXTAVADA	3	33116069
3	33116032-01	MEMBRANA DE SOBREPRESSÃO	1	33116032
2	33116031-01	ARO FUNDIDO	1	33116031
1	33107277-01	TAMPA PROTECÇÃO	1	33116070

Tolerâncias gerais: ISO 2768-m ou I.O. MT 80.2.01 | General Tolerances: ISO 2768-m or I.O. MT 80.2.01

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Escala / Scale: 3/10	Mat.: -	Prof.: -	P.M.G.: EMT598923-01
Project: C.Lopes	Utilização:	Peça final: 33107583-01	EFACEC AMT, S.A. Aparelhagem de Alta e Média Tensão
Desenh.: C.Lopes		Nív. Opci.: -	
Data Des.: 2007-10-11			
Aprovado: P.Lima	VÁLVULA DE SOBREPRESSÃO	- 33107583	A4 Pág. 1/1
Data Aprov.: 2007-10-12	OVERPRESSURE VALVE / SOUPAPE	Modificação / Revision	
Peso: -		Índice	Número	Data
Área: -			

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ВЯРНО С ОРИГИНАЛА
„КИМТЕХ-БЪЛГАРИЯ" ООД КИМТЕХ

IPH BERLIN

Independent, accredited testing station · Member laboratory of STL and LOVAG

TYPE TEST REPORT

NO. 2197.2090578.0340

EFACEC Energia, Máquinas e Equipamentos Electricos, S.A. Apartado 1018 4466-952 S. Mamede de Infesta PORTUGAL	CLIENT
EFACEC Energia, Máquinas e Equipamentos Electricos, S.A.	MANUFACTURER
Three-phase metal-enclosed SF_6-insulated medium voltage switchgear	TEST OBJECT
Fluofix GC	TYPE
S 18002991	SERIAL NO.

Rated voltage	U_r	24	kV	RATED CHARACTERISTICS GIVEN BY THE CLIENT
Rated normal current	I_r	630	A	
Rated peak withstand current	I_p	50	kA	
Rated short-time withstand current	I_k	20	kA	
Rated duration of short-circuit	t_k	1	s	
Internal arcing classification		IAC AFL 20 kA 1 s		

IEC 62271-200: 2003-11 IEC 62271-1: 2007-10	NORMATIVE DOCUMENT
Test under conditions of arcing due to internal fault	RANGE OF TESTS PERFORMED
4 and 5 June 2009	DATE OF TEST
The ratings of the test object related to the scope of test have been proved. The test has been PASSED	TEST RESULT

H. GLABSCH
Senior engineer

W. MORITZ
Test engineer in charge

Berlin, 05 August 2009

INSTITUT „PRÜFFELD FÜR ELEKTRISCHE HOCHLEISTUNGSTECHNIK" GMBH IPH BERLIN

ВЯРНО С ОРИГИНАЛА

DAT-P-019/92

„БЕЛГАРИЯ" ООД БУРГАС

Contents

This test document consists of 31 sheets.

Distribution

Copy No. 1

Copy No. 1 in English: EFACEC Energia, Máquinas e Equipamentos Electricos, S.A.

1. Present at the test

Mr.	Moritz	IPH test engineer in charge
Mr.	Martins	EFACEC AMT
Mr.	Barbosa	EFACEC AMT

2. Test performed

Test under conditions of arcing due to internal fault

3. Identity of the test object

3.1 Technical data and characteristics

The technical data and characteristics of the test object are defined by the following parameters and specified by the client.

Test object:	Three-phase metal-enclosed SF_6-insulated medium voltage switchgear		
Type:	Fluofix GC		
Manufacturer:	EFACEC Energia, Máquinas e Equipamentos Electricos, S.A.		
Serial No:	S 18002991		
Year of manufacture:	2009		
Data:	Rated voltage	U_r	24 kV
	Rated short-duration power-frequency withstand voltage	U_d	50 kV
	Rated lightning impulse withstand voltage	U_p	125 kV
	Rated frequency	f_r	50 Hz
	Rated normal current	I_r	630 A
	Rated peak withstand current	I_p	50 kA
	Rated short-time withstand current	I_k	20 kA
	Rated duration of short-circuit	t_k	1 s
	Internal arcing classification		IAC AFL 20 kA 1 s
Characteristics:	Number of functional units		3
	Height		1275.3 mm
	Width		1190 mm
	Depth		727 mm
	Insulating medium		SF_6
	Rated Pressure (abs rel. to 20 °C)		0.03 MPa
	Pressure relief disc dimension		See drawing
	Insulating medium during test		Air
	Unit bottom		open
	Busbar dimensions		Ø 16 mm
	Busbar pole centres distance		115 mm
	Unit bottom		open
Built-in components:	Three position switch-diconnector		

ВЯРНО С ОРИГИНАЛА

„КИМТЕХ-БЪЛГАРИЯ" ДООД БУРГАС КИМТЕХ

3.2 Identity documents

The manufacturer confirms that the test object has been manufactured in compliance with the drawings given in this document. IPH did not verify this compliance in detail.
The identity of the test object is fixed by the following drawings and data submitted by the client:

Name of drawing	Drawing No.	Date of drawing	Author	Notes
Fluofix GC 2 IS + 1 CIS	33108059	18.02.08	EFACEC	Sheet 27
Overpressure protection valve	DI1501259	20.03.04	EFACEC	Sheet 28
Extremity panel	33109326	22.05.09	EFACEC	Sheet 29
Riveted door	33108567	22.07.08	EFACEC	Sheet 30
Assembled tank	33107698	30.11.07	EFACEC	Sheet 31

Entry of test object at IPH: 3 June 2009

ВЯРНО С ОРИГИНАЛА

"КИМТЕХ-БЪЛГАРИЯ" ООД КИМТЕХ БУРГАС

4. Test under conditions of arcing due to internal fault

4.1 Test laboratory

High-power test laboratory, test bay 1

4.2 Normative document

IEC 62271-200: 2003-11

4.3 Required test parameters

Required test values as agreed with the client:

Peak current	50 kA
Short-circuit current	20 kA
Duration of short-circuit	1 s
Internal arcing classification	IAC AFL 20 kA 1 s

Distances of the test object to the walls of the room mock-up			Spacing of indicators
Front	F	Freely accessible	300 mm
Left side wall	L	Freely accessible	300 mm
Right side wall	L	100 mm	None
Rear side	R	100 mm	None
Ceiling height above test object		600 mm	-

Assessment of the behaviour under conditions of arcing due to internal fault on the basis of the criteria 1 to 5 of IEC 62271-200: 2003-11.

4.4 Test arrangement

The switchgear consisted of three functional units arranged as an assembly. The test was conducted in a mock-up of a room with a ceiling height of 600 mm above the switchgear. The switchgear was set up with its right side wall having a distance of 100 mm and with its rear side wall having a distance of 100 mm to the corner of the room mock-up. The front and left roof projection was >1000 mm. A mock-up of a cable duct was used.

Fabric indicators representing type A accessibility were placed vertically in front of the operator's side and of the left side wall of the switchgear up to a height of 2 m in a uniform and in a checkerboard pattern thus covering an area of 40-50 %. The spacing between indicators and switchgear was 300 mm.

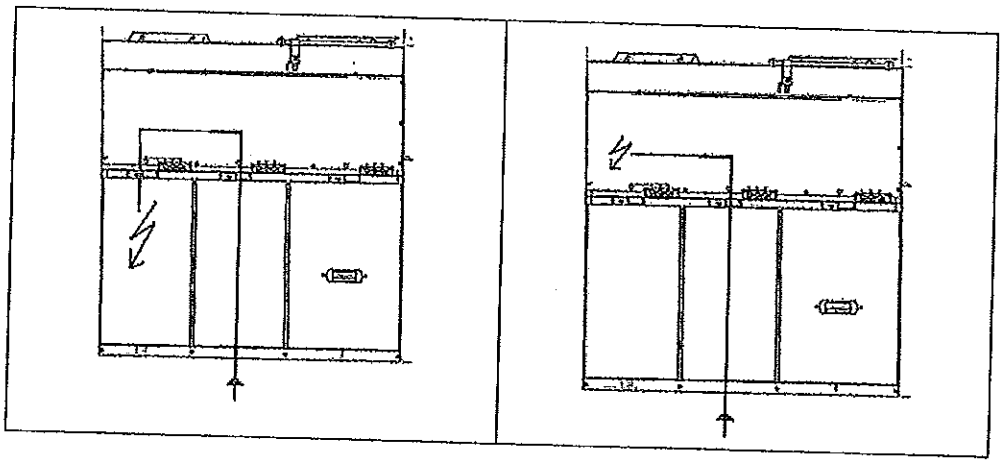
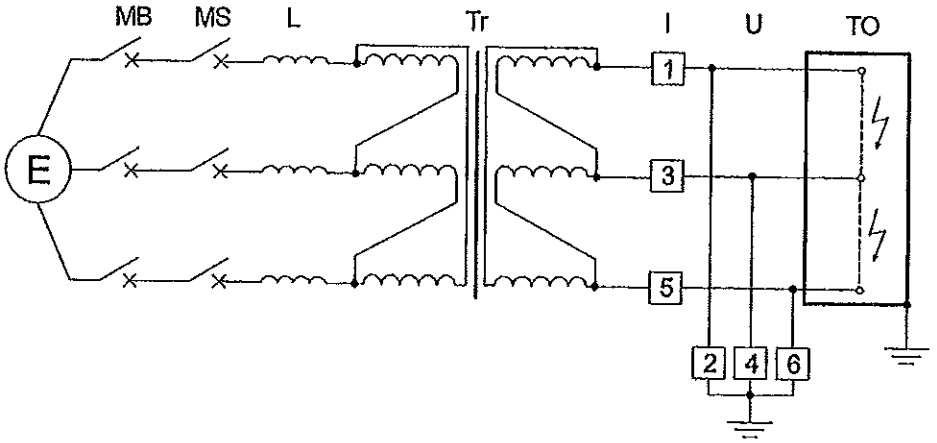


Figure 1: Points of ignition

4.5 Test and measuring circuits

Technical data of test circuits

Test requirement		Tests under conditions of arcing due to internal fault
Test No.		109 2638, 109 2643, 109 2654
Number of phases	(Test circuit)	3
Number of poles/phases	(Test object)	3
Power frequency	Hz	50
Power factor cos φ		‹ 0.15
Earthing conditions	Grid	Not earthed
	Short-circuit transformer	Not earthed
	Short-circuit point	Not earthed
Short-circuit transformer		D/d



E Supply
MB Master breaker
MS Making switch
L Current-limiting reactor
Tr Short-circuit transformer

I Current measurement
U Voltage measurement
TO Test object
1 - 6 Measuring points

Figure 2: Test circuit

Technical data of measuring circuits

Measuring point	Symbol	Measured quantity	Measuring sensor/device
1	I L1	Short-circuit current L1	Rogowski measuring device
2	u L1	Voltage L1	RC divider
3	I L2	Short-circuit current L2	Rogowski measuring device
4	u L2	Voltage L2	RC divider
5	I L3	Short-circuit current L3	Rogowski measuring device
6	u L3	Voltage L3	RC divider
-	P_ges	Arc power	Calculated value
-	W	Arc energy	Calculated value
Recording instrument:			
BE 256 transient recorder system			

ВЕРНО С ОРИГИНАЛА

4.6 Test results

Test requirement: Test under conditions of arcing due to internal fault

Test No.			109	2638
Test voltage	kV			12.2
Prospective peak short-circuit current	kA	L1		43.3
		L2		39.4
		L3		53.2
Prospective symmetrical short-circuit current	kA	L1		20.2
		L2		20.4
		L3		20.3
	Average			20.3
Duration of short-circuit	s			1.01
Notes				1)

Notes:

1) Verification of the prospective short-circuit current at the test object's input terminals

ВЯРНО С ОРИГИНАЛА

Test results (continued)

Test requirement:	Test under conditions of arcing due to internal fault
Date of test:	4 June 2009
Condition of test object before test:	New
Supply of test object:	Three-phase at the cable terminal of unit 2
Arc initiation:	Three-phase on the busbar in the gas tank using metal wire of 0.5 mm diameter
Direction of the arc:	To left
Arrangement of indicators:	In front of the switchgear and on the left side of unit 1

Test No.			109	2643
Test voltage	kV			12.1
Peak current	kA	L1		39.6
		L2		40.8
		L3		51.4
Short-circuit current	kA	L1		20.1
		L2		20.2
		L3		20.1
	Average			20.1
Duration of short-circuit	s			1.01
Equivalent duration of short-circuit related to a symmetrical short-circuit current of	s			1.02
	kA			20.0
Maximum power	MW			34.0
Energy converted	MWs			15.1

Notes and condition of test object after test:

Criteria of assessment 1 to 5 of IEC 62271-200: 2003-11:		Compliance:
1	Correctly secured doors, covers etc, do not open. Deformations are accepted provided that no part on any side comes as far as the position of the indicators or walls.	Yes
2	No fragmentation of the enclosure occurs within the time specified for the test. Projections of small parts, up to an individual mass of 60 g, are accepted.	Yes
3	Arcing does not cause holes in the accessible sides up to a height of 2.0 m.	Yes
4	Indicators do not ignite due to the effect of hot gases.	Yes
5	The enclosure remains connected to its earthing point.	Yes

Test results (continued)

Test requirement:	Test under conditions of arcing due to internal fault
Date of test:	5 June 2009
Condition of test object before test:	New
Supply of test object:	Three-phase at the cable terminal of unit 2
Arc initiation:	Two-phase between L1-L2 on the cable connections of unit 1 using metal wire of 0.5 mm diameter
Direction of the arc:	Downwards
Arrangement of indicators:	In front of the switchgear and on the left side of unit 1

Test No.			109	2654
Test voltage	kV			12.1
Peak current	kA	L1		44.7
		L2		44.7
		L3		-
Short-circuit current	kA	L1		17.5
		L2		17.5
		L3		-
	Average			-
Duration of short-circuit	s			1.01
Equivalent duration of short-circuit	s			1.02
related to a symmetrical short-circuit current of	kA			0.87 x 20.0
Maximum power	MW			44.5
Energy converted	MWs			9.5

Notes and condition of test object after test:

Criteria of assessment 1 to 5 of IEC 62271-200: 2003-11:		Compliance:
1	Correctly secured doors, covers etc, do not open. Deformations are accepted provided that no part on any side comes as far as the position of the indicators or walls.	Yes
2	No fragmentation of the enclosure occurs within the time specified for the test. Projections of small parts, up to an individual mass of 60 g, are accepted.	Yes
3	Arcing does not cause holes in the accessible sides up to a height of 2.0 m.	Yes
4	Indicators do not ignite due to the effect of hot gases.	Yes
5	The enclosure remains connected to its earthing point.	Yes

4.7 Evaluation of test

The test object was subjected to a test under conditions of arcing due to an internal fault with a prospective peak current of 53.2 kA and a prospective short-circuit current of 20.3 kA for a duration of short-circuit of 1.01 s.

Assessment of the behaviour under conditions of arcing due to an internal fault on the basis of the criteria 1 to 5 of IEC 62271-200: 2003-11. The criteria were met in:

Test No. 109 2644 - three-phase arc initiation in the gas tank
Test No. 109 2654 - two-phase arc initiation at the cable connection.

The internal arcing classification of IAC AFL 20 kA 1 s has been proved.

The test has been PASSED.

Client	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Address of the Client	Apartado 1018 - 4466 - 952 S. Mamede de Infesta - PORTUGAL
Tested samples/items	AC three phase SF6 gas-insulated metal-enclosed switchgear (RMU), for indoor/outdoor application, consisting of three functional units
Tests carried out	Short-time withstand and peak withstand current tests Short-circuit making tests

Standards/Specifications	IEC 62271-200 (2003) IEC 62271-102 (2003) IEC 60265-1 (1998)	
Tests date	from November 13, 2008	to November 13, 2008

No. of pages	12	**No. of pages annexed**	17
Issue date	December 10, 2008		
Prepared	LAP - Beccarini Pierangelo		
Verified	LAP - Arneodo Giorgio, LAP - Ghezzi Giuseppe		
Approved	LAP - Nicolini Roberto		

CESI S.p.A.
Energy Division
Technical Area Components
"Testing Laboratories"
Manager

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Codice fiscale e numero iscrizione CCIAA 00793580150
Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

Tests witnessed by

Mr. M. Martins	EFACEC
Mr. E. Barbosa	EFACEC
Mr. L. Pinto	EFACEC

Identification of the object Not requested.
The drawings ref. No.A8034422 No.1 to 7 have been annexed to this document on the request of the Client.
CESI has not checked the details of these drawings.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: A8033054

The measurement uncertainties of the test results reported in the document are the following:
voltage: ± 5 % ; current: ± 5 % ; time: ± 5 % ; temperature: ± 2 °C
The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

Receipt date of the sample November 12, 2008

ВЯРНО С ОРИГИНАЛА

Rated characteristics of the tested object assigned by the Client

Metal-enclosed	
Manufacturer	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Type	Fluofix GC
Serial number	S 18002990
Voltage	24 kV
Insulation level	
Lightning impulse withstand voltage	
To earth and between phases	125 kV
Across the isolating distance	145 kV
Power frequency withstand voltage	
To earth and between phases	50 kV
Across the isolating distance	60 kV
Frequency	50 Hz
Normal current	630 A
Short-time withstand current	
Main circuit	16 kA
Earthing circuit	16 kA
Peak withstand current	
Main circuit	40 kA
Earthing circuit	40 kA
Short-circuit duration	3 s
Pressure of SF6 gas for insulation (referred to 20 °C)	0,13 MPa abs.

Cont'd

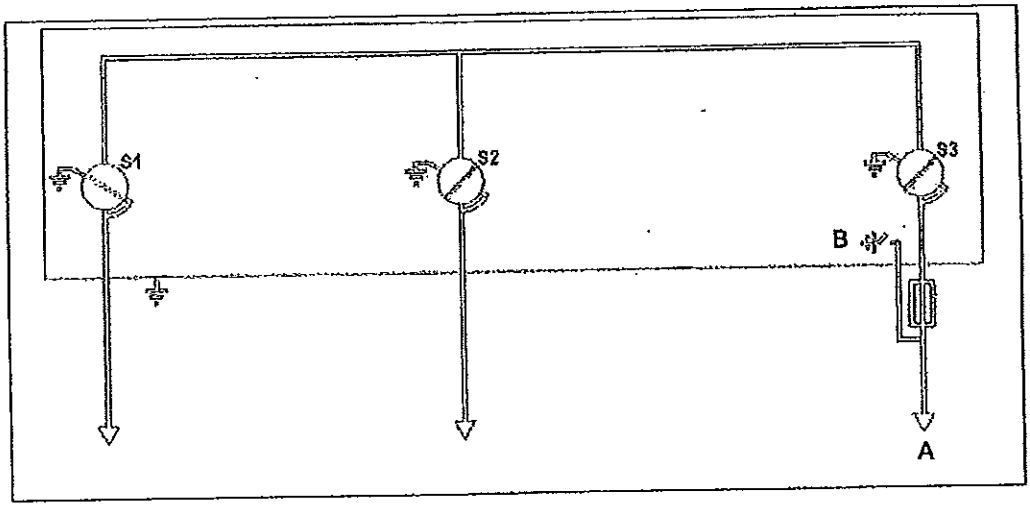
General purpose switch	
Manufacturer	EFACEC Energia, Máquinas e Equipamentos Eléctricos, S.A
Type	ISFG
Serial number	37326730
Switching operations class	B3
Mechanical endurance class	M1
Voltage	24 kV
Insulation level	
Lightning impulse withstand voltage	
To earth and between phases	125 kV
Across the isolating distance	145 kV
Power frequency withstand voltage	
To earth and between phases	50 kV
Across the isolating distance	60 kV
Frequency	50 Hz
Normal current	630 A
Mainly active load breaking current	630 A
Closed-loop breaking current	630 A
No-load transformer breaking current	6,30 A
Cable-charging breaking current	25 A
Line-charging breaking current	25 A
Earth fault breaking current	100 A
Cable and line-charging breaking current under earth fault conditions	75 A
Short-circuit making current	40 kA
Short-time withstand current	16 kA
Short-circuit duration	3 s
Earthing switch	E2
Making capability class	
Supply side	
Short-circuit making current	40 kA
Short-time withstand current	16 kA
Short-circuit duration	3 s
Pressure of SF6 for breaking (referred to 20 °C)	0,13 MPa abs.
Cables earthing switch	
Making capability class	E2
Supply side	
Short-circuit making current	2,50 kA
Short-time withstand current	1,00 kA
Short-circuit duration	3 s
Pressure of SF6 for Making (referred to 20 °C)	0,13 MPa abs.

Table of the no-load operations

Vn: Rated voltage of the auxiliary device

Oscillogram		Operating sequence	Supply voltage Opening device		Supply voltage Closing device		Supply voltage Motor		Gas operating pressure for Operation	Gas operating pressure for Interruption	Opening time	Closing time	Opening time	Made before the test	Made after the test
No.	Sheets	-	V	% Vn	V	% Vn	V	% Vn	MPa abs.	MPa abs.	ms	ms	ms	No.	No.
8	2	C			110	-	-	-	-	-	-	1577	-	2	-

D8006 - Test arrangement



Test performed No.	Apparatus under test	Supply on point	Load or short-circuit on point
1 to 6	Cables earthing switch	A	B

Power frequency voltage withstand dry test on the main circuit

Tests effected	Applied voltage (kV for 60 s) across the pole		
	R	S	T
After the test No.6	40	40	40

Note: No discharge occurred during the test.

Three-phase short-time withstand and peak withstand current test with 1,02 kA for 3,00 s

Test circuit : See D0026 Power factor : <0,15 Frequency : 50 Hz

Test arrangement : See page 7
Pressure of SF6 gas during the test : 0,12 MPa abs

Under test: Cables earthing-switch

Condition of the apparatus before the tests: new, see photos No.1 and 2 Supply side of the test circuit connected to : see page 7

Date: November 13, 2008

Test	Oscillogram		Duration	Test current				Notes
				Maximum peak		rms value	Average	
No.	No.	Sheets	s	kA	Phase	kA	kA	-
1	7	2	3,00	2,58	T	1,02 1,02 1,02	1,02	-

Condition of the apparatus after the tests: after the test the cables earthing switch operated properly.

ВЕРНО С ОРИГИНАЛА

КИМТЕХ БЪЛГАРИЯ ООД

Three-phase short-circuit making tests; test duty No.5 with a prospective peak current of 2,58 kA at 24,1 kV

Test circuit : See D0026 Power factor : <0,15 Frequency : 50 Hz

Prospective test current		
Oscillogram		Peak value
No.	Sheets	kA
10	1	2,58

Supply voltage for operating device				
Closing V d.c.	Opening V d.c.	Motor V d.c.		
110	-	-	-	-

Test arrangement : See page 7
Pressure of SF6 gas during the test : 0,12 MPa abs

Under test: Cables earthing-switch
Condition of the apparatus before the tests: as after the test No.1 Supply side of the test circuit connected to : see page 7

Date: November 13,2008

Test	Oscillogram		Operating sequence	Applied voltage Phase to earth	Making current Peak value		Current rms value	Current Average	Duration	Closing time	Pre-arcing time
No.	No.	Sheets	-	kV	kA	Phase	kA	kA	s	ms	ms
2	12	1	C	13,9 13,9 13,9	2,47	T	0,98 0,98 0,98	0,98	0,20	-	-
3	13	1	C	13,9 13,9 13,9	2,57	S	0,98 0,98 0,98	0,98	0,20	-	-
4	14	1	C	13,9 13,9 13,9	2,56	T	0,98 0,98 0,98	0,98	0,20	-	-
5	15	1	C	13,9 13,9 13,9	2,55	S	0,98 0,98 0,98	0,98	0,20	-	-
6	17	1	C	13,9 13,9 13,9	2,34	R	0,98 0,98 0,98	0,98	0,20	-	-

Condition of the apparatus after the tests: after the tests the cables earthing switch operated properly, see verifications on page 8.

EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIRECTION

TEST REPORT
No. MT.99.3.C.072.I

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

Trip linkages mechanical reliability test

Test regulations applied:

IEC 420 (1990).
IEC 282-1 (1985).
IEC 298 (1990).

Tests results:

The Ring Main Unit Fluofix passed the tests

Date of tests: February 2nd, 1999.

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

1 - TECHNICAL DATA OF SWITCHGEAR

Ring Main Unit
Type: Fluofix GC
Serial no.: Prototype
Rated voltage: 24 kV
Rated current: 630 A
Rated power-frequency withstand voltage: 50 kV
Rated lightning impulse withstand voltage: 125 kVp
Rated peak withstand current: 40 kAp
Rated short-time withstand current: 16 kA / 3 s
Rated frequency: 50 Hz
SF6 pressure (20°C): 0.3 bar rel.
See drawing on page 4.

With SF6 rotary three position disconnector
Type: ISFG - Fuse Switch function
Serial no.: Prototype
Rated voltage: 24 kV
Rated current: 200 A
Rated power-frequency withstand voltage: 50 / 60 kV
Rated lightning impulse withstand voltage: 125 / 145 kVp
Breaking capacity:
- Active charge: 200 A
- No-load transformer: 1250 kVA
- No-load cables: 16 A

Rated short-time withstand current: 16 kA / 3 s
Rated peak withstand current: 40 kAp
Rated frequency: 50 Hz
See drawing of fuse casing on page 5 and trip mechanism on page 6.

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Direction.

3 - TESTS PERFORMED

Current limiting fuses with built-in striker pin linkages mechanical reliability test, in accordance with IEC420 (point 6.106.2) with 100 operating cycles according to the following scheme:

No. of operations	Pole tested	Striker energy	Total no. of operations
30	L1	Minimum	30
30	L2	Minimum	60
30	L3	Minimum	90
10	L1 L2 L3	Maximum	100

Recorded characteristics at the start and the end of the test
- ISFG switch tripping time for the striker pin
- Minimum striker energy needed in order to trip the ISFG switch;
- Minimum striker travel needed in order to trip the ISFG switch.

4 - TEST CONDITIONS

It was used fuse striker simulators delivering the strike energy of a medium type fuse striker.

For the minimum striker energy operations, the fuse striker simulator delivered the strike energy of 0.5J ± 0.05J with a total strike travel of 9 mm.

For the maximum striker energy operations, it was used three fuse striker simulators working simultaneously, each delivering the strike energy of 1.5J ± 0.05J with a total strike travel of 9 mm.

5 - TESTS RESULTS

Test start			
Parameters		Value	Units
ISF switch tripping time	Pole L1	61	ms
	Pole L2	60	ms
	Pole L3	59	ms
Minimum striker energy	Pole L1	0.24	J
	Pole L2	0.29	J
	Pole L3	0.29	J
Minimum striker travel	Pole L1	8	mm
	Pole L2	8	mm
	Pole L3	8	mm

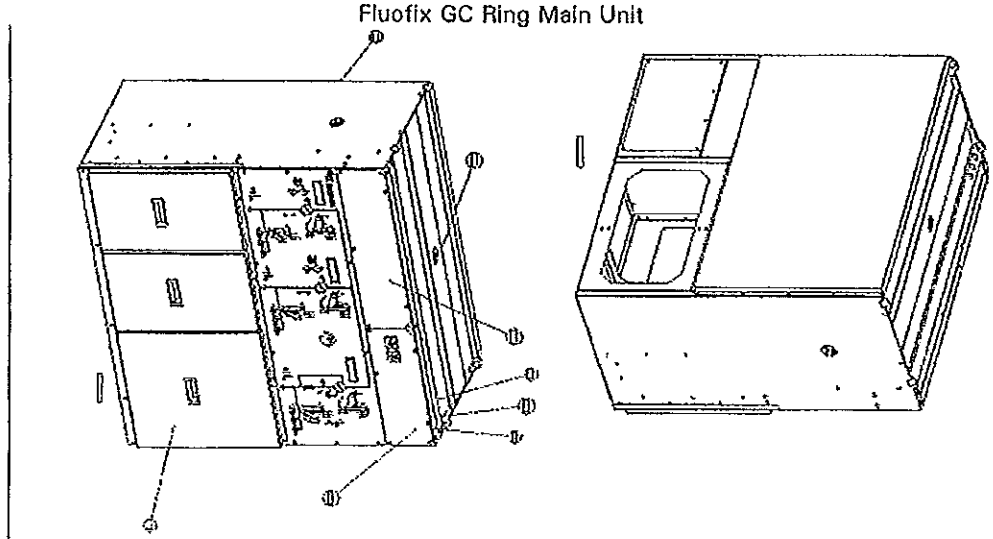
Test start - F.N.S.A.			
Parameters		Value	Units
ISF switch tripping time	Pole L1	58	ms
	Pole L2	59	ms
	Pole L3	56	ms
Minimum striker energy	Pole L1	0.24	J
	Pole L2	0.26	J
	Pole L3	0.29	J
Minimum striker travel	Pole L1	8	mm
	Pole L2	8	mm
	Pole L3	8	mm

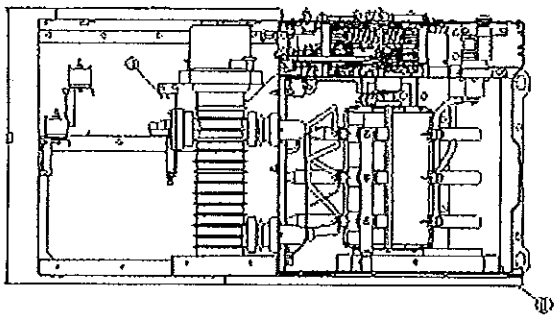
During the 100 operating cycles no malfunction has been detected.

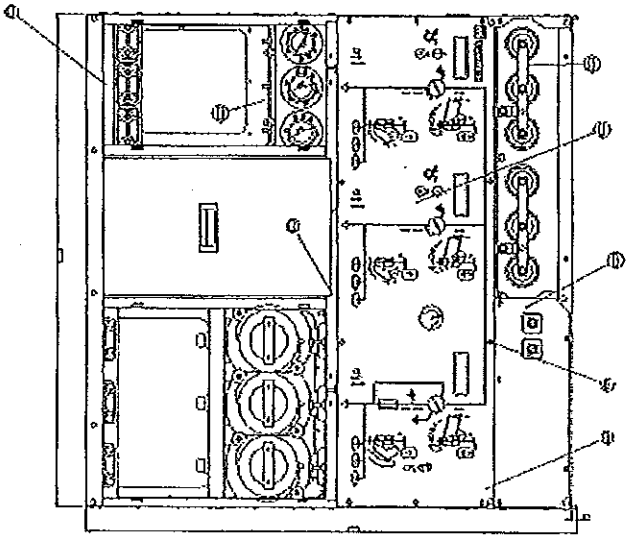
There is no remarkable change of characteristics after the test.

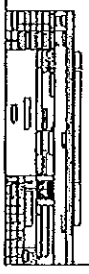
After the 100 operating cycles and using a fuse striker dummy 9mm long inserted in each phase at a time, it was observed that the ISFG switch cannot remain closed after the spring recharge operation.

Fluofix GC Ring Main Unit

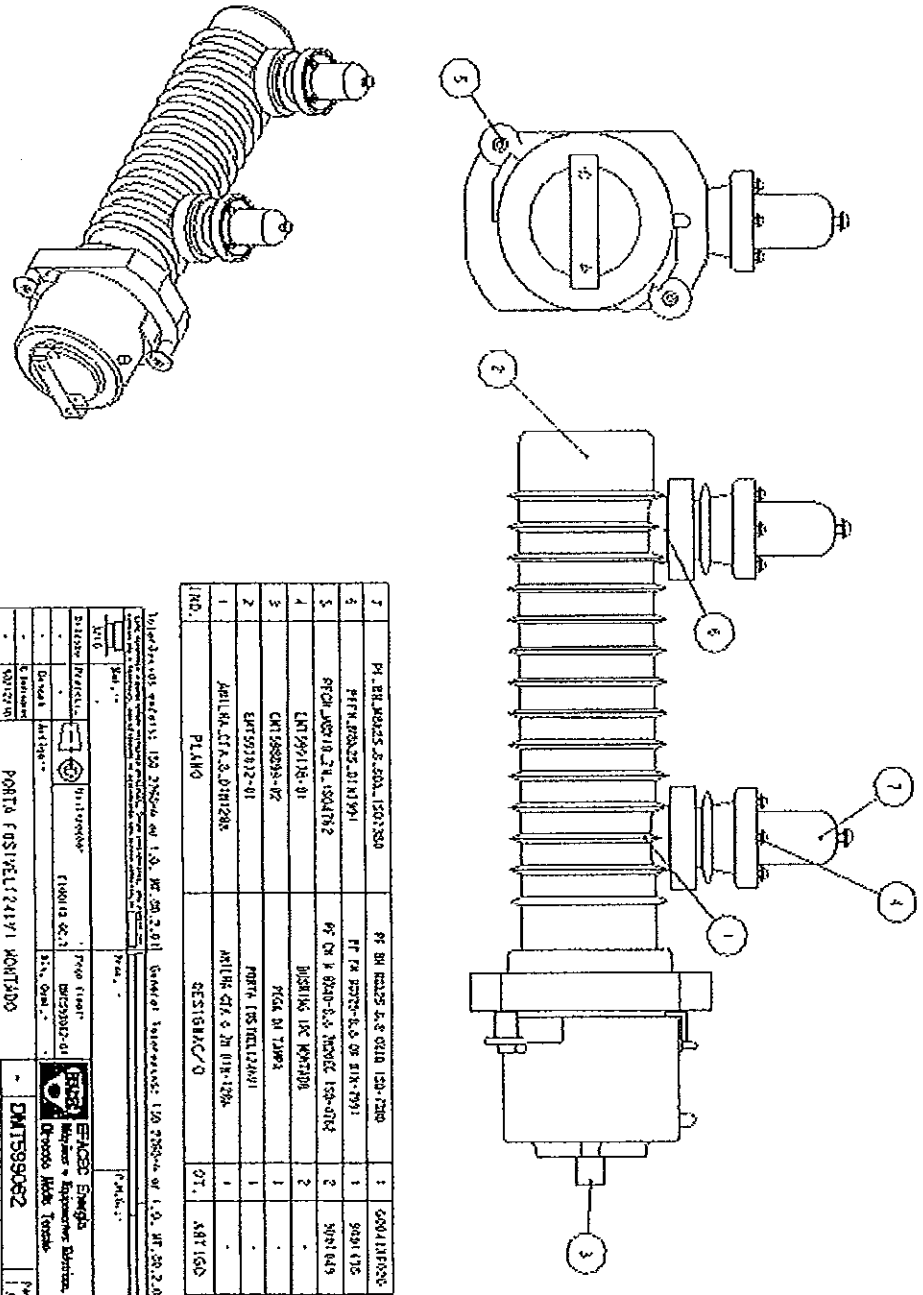




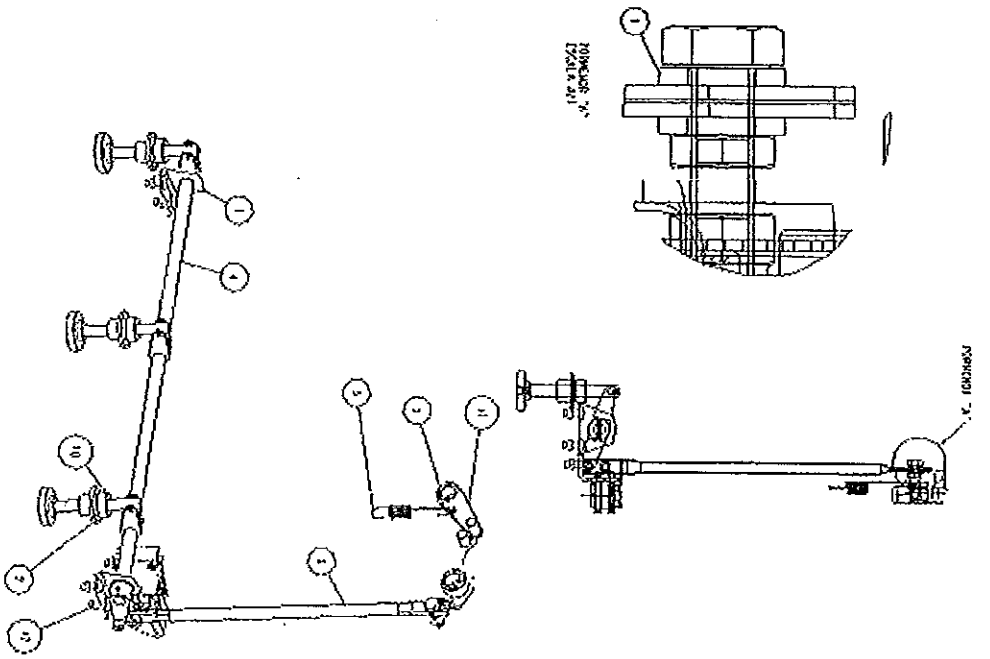


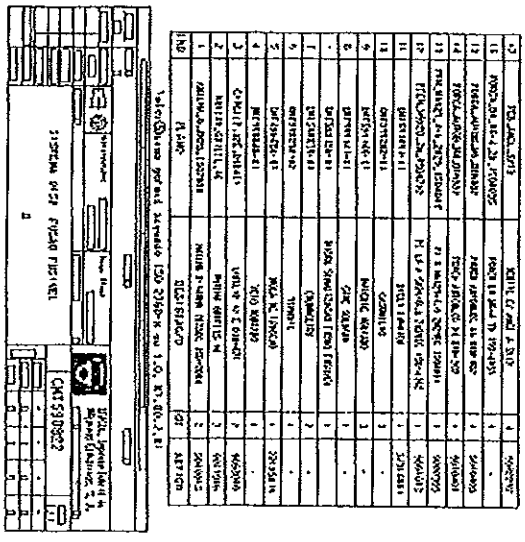


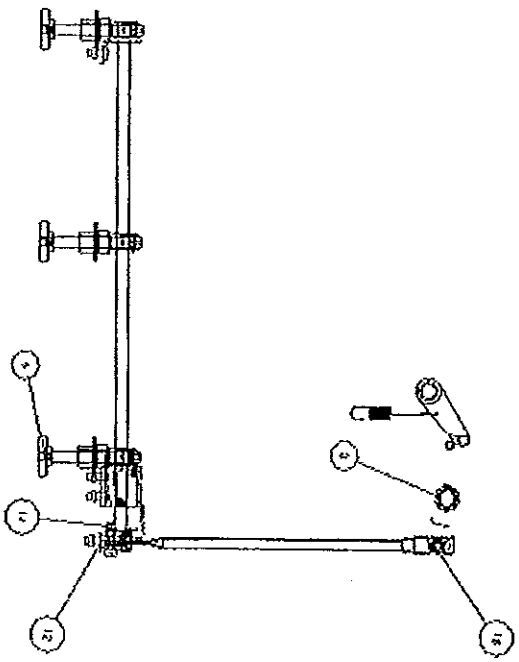
Fuse casing



Fuse striker trip linkages







EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIVISION

TEST REPORT
No. DI.02.3.15.036.I

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

Temperature rise tests at 37.5 A with 43 A SIBA fuses

Test regulations applied:

IEC 298 (1990).
IEC 694 (1980).
IEC 282-1 (1985).

Tests results:

The temperature rises did not exceed the permissible values in accordance with the above mentioned standards at an ambient air temperature not exceeding 40 °C.

Date of tests: 3rd of August, 2001.

Tests performed by:

Manuel Martins

The laboratory manager

Miguel Carvalho

ВЯРНО С ОРИГИНАЛА

"КИМТЕХ БЪЛГАРИЯ" ООД КИМТЕХ БУРГАС

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: 63 kAp
Rated short-time withstand current: 25 kA / 1 s
Rated frequency: 50 Hz

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: 25 kA / 1 s
Rated peak withstand current: 63 kAp
Rated frequency: 50 Hz
SF6 pressure (20°C): 0.3 bar rel.

Medium voltage fuses

Type: SIBA
Rated voltage: 24 kV
Rated current: 43 A

Resistance measurement

L1 fuse: 33.8 mΩ
L2 fuse: 34.0 mΩ
L3 fuse: 33.6 mΩ

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Division

3 - TESTS PERFORMED

Temperature rise test with 37.5 Aac - 50 Hz.

4 - TEST CONDITIONS

A compact switchgear provided with a SF6 switch disconnectors type ISFG.
The tests were performed under 37.5 A three - phase. Supply was ensured through the three phases of the cable compartment (Ring - left side), the short-circuit point was done in the three phases cables (Fuse protection) .

Supply connections from current transformer to the switchgear: 1 x 95 mm² copper.
The supply connections has been connected to the cables compartment.

5 - TESTS RESULTS

The maximum permissible temperature rises are:
- At a silver coated connection: 75 °C
- At a silver coated contact: 65 °C

The temperature rises with a current of 37.5 Aac did not exceed the permissible values in accordance with above mentioned standards at an ambient air temperature not exceeding 40 °C.

6 - MEASURING VALUES

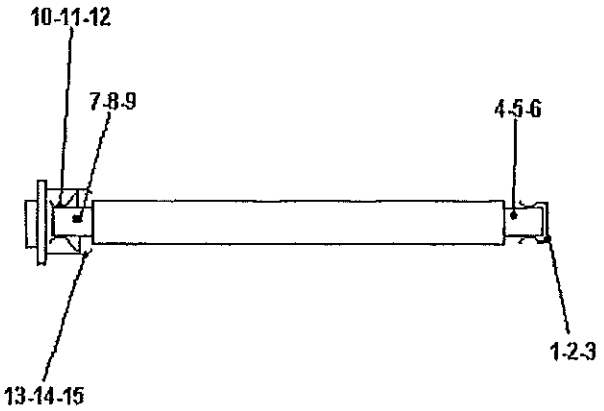
According drawing on page 4:

Measuring points	Designation	Temperature rise in °C
1	Fuse holder contact	50.0
2		52.3
3		52.6
4	Terminal fuse (back)	59.6
5		61.6
6		60.2
7	Terminal fuse (front)	57.0
8		59.1
9		59.0
10	Fuse holder cover contact (fuse side)	56.9
11		61.2
12		59.2
13	Fuse holder cover contact (holder side)	52.2
14		56.9
15		55.9

ВЯРНО С ОРИГИНАЛА

КИМТЕХ-БЪЛГАРИЯ-ООД КИМТЕХ БУРГАС

Ambient air temperature: 26.9 °C



EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIRECTION

TEST REPORT
No. MT.00.3.C.075.I

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

Measurement of the insulation resistance

Test regulations applied:

IEC 298 (1990).
IEC 694 (1996).

Tests results:

The prefabricated panel Fluofix GC passed the tests.

Date of tests: 28th Mars 2000

Tests performed by:

Manuel Martins

The laboratory chief

Rui Cardoso

ВЕРНО С ОРИГИНАЛА

КИМТЕХ

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 5

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 Direction

3 - TEST PERFORMED

Measurement of the insulation resistance

4 - TEST CONDITIONS

Tests performed according circuit diagram on page 4.

Tests performed under 5000 Vdc.

5 - TESTS RESULTS

According drawing on page 4:

5.1 - ISFG's switch disconnectors closed in service position

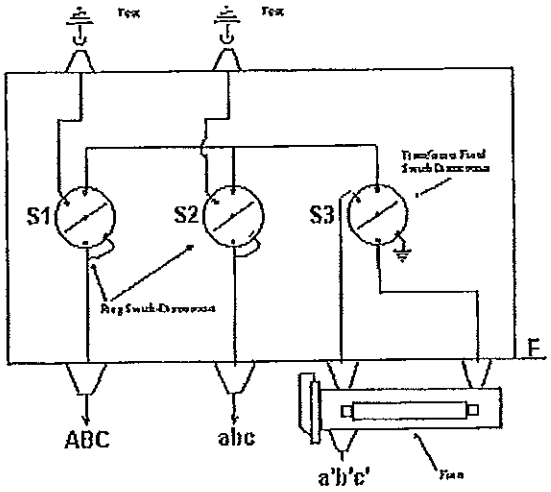
(Test between phases)

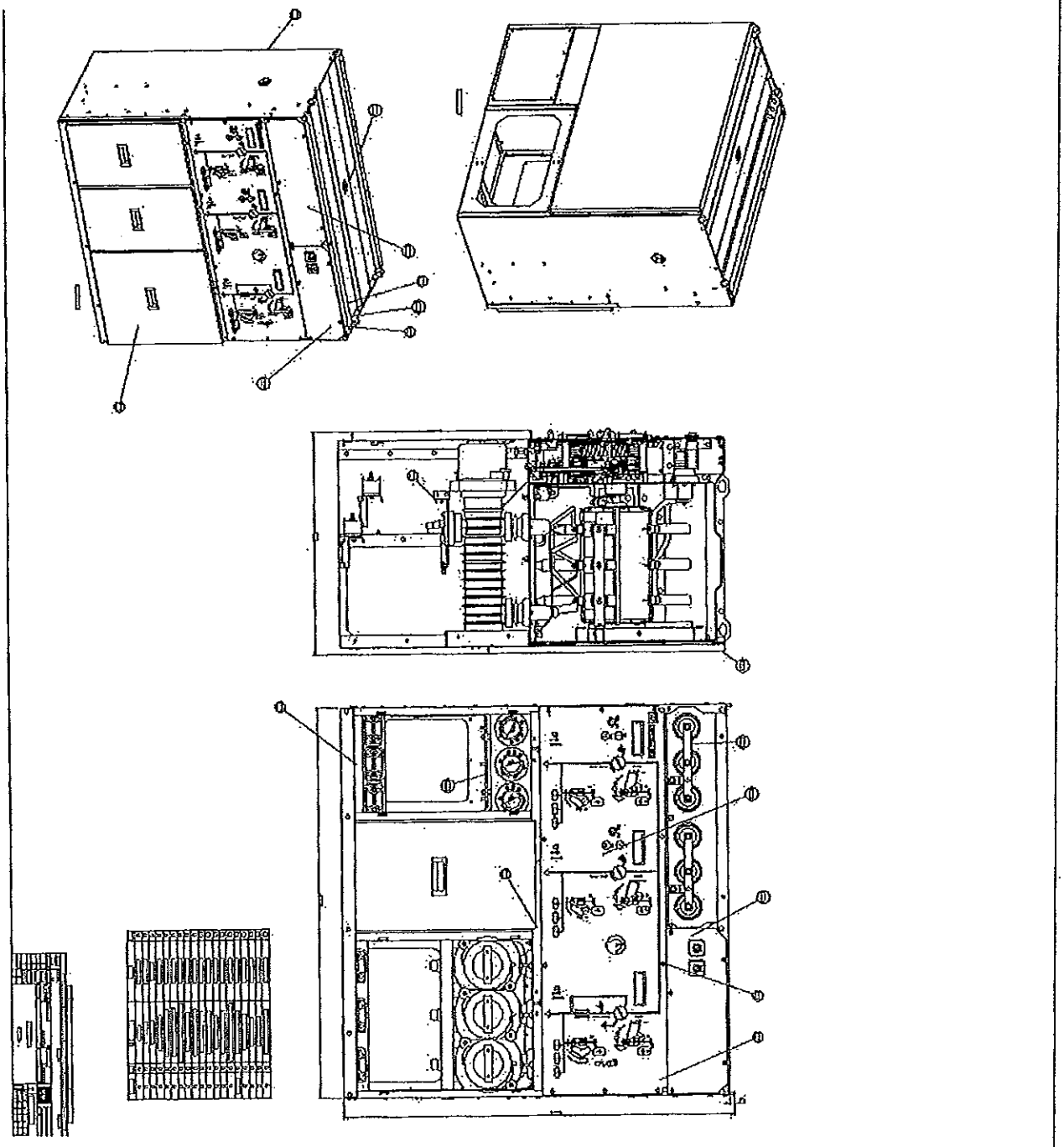
Resistance (MΩ)		
L1 – L2 A - B	L1 – L3 A - C	L2 – L3 B - C
> 50 000	> 50 000	> 50 000

5.2 - ISFG's switch disconnectors closed in service position

(Test between phases and earth)

Resistance (MΩ)		
L1 – earth A - F	L2 – earth B - F	L3 – earth C - F
> 50 000	> 50 000	> 50 000





EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIRECTION

TEST REPORT
No. MT.00.3.C.078.I

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

Partial discharge measurements

Test regulations applied:

IEC 270 (1981).
IEC 298 (1990).

Tests results:

The prefabricated panel Fluofix GC passed the tests.

Date of tests: January 14th 1999

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 5

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 Direction

3 - TEST PERFORMED

Partial discharge measurement for 10 pC discharge level.

4 - TEST CONDITIONS

Tests carried out according to IEC 298, annex FF, procedure B.
The voltage set-up transformer was connected to each phase successively and earth was applied to all the parts earthed in service.
The prestress voltage applied was 1.3 × Un = 1.3 × 24 = 31.2 kV.

ВИЗА СТЕНА

КИМТЕХ БУРГАС

The test voltage for partial discharge measurement was 1.1 x Un = 1.1 x 24 = 26.4 kV.
Tests performed before and after the dielectric tests.

See test circuits diagram on page 4.

5 - TESTS RESULTS

Voltage applied according to test circuits diagram on page 4.

5.1 - Before dielectric tests

ISFG's switch disconnectors closed in service position.

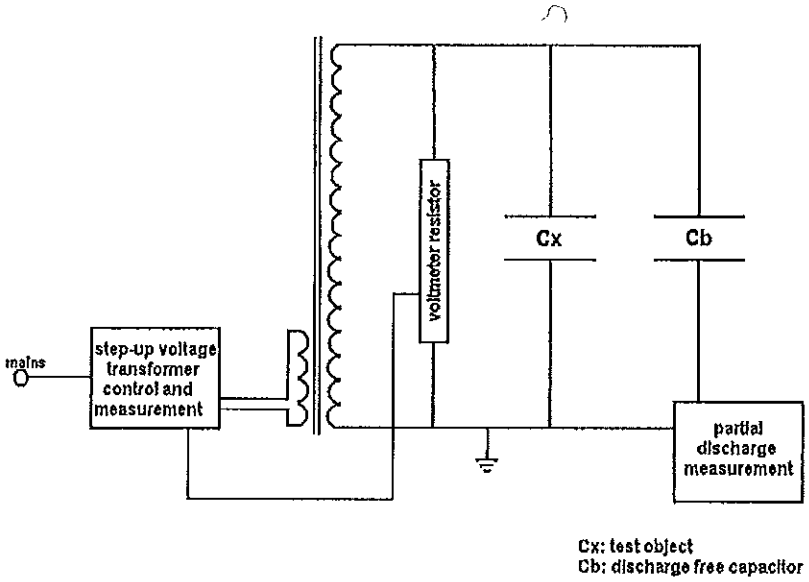
Phase measured	Partial discharge inception voltage (kV)	Partial discharge extinction voltage (kV)	Partial discharge quantity at 26.4 kV (pC)	Results
Aaa'	29	28	≤10 pC	Passed
Bbb'	28	27	≤10 pC	Passed
Ccc'	29	27	≤10 pC	Passed

5.2 - After dielectric tests

ISFG's switch disconnectors closed in service position.

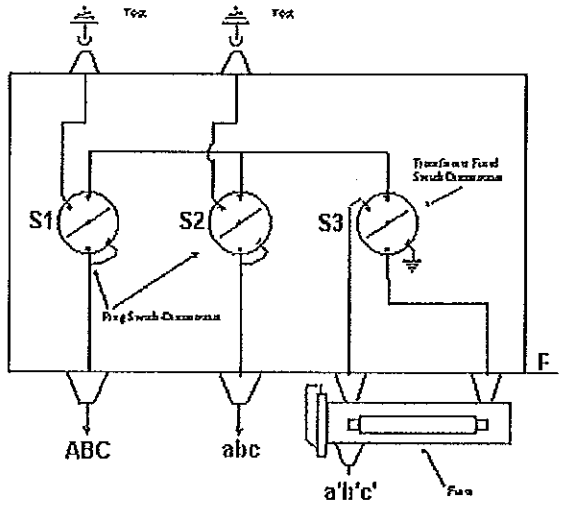
Phase measured	Partial discharge inception voltage (kV)	Partial discharge extinction voltage (kV)	Partial discharge quantity at 26.4 kV (pC)	Results
Aaa'	28	27	≤10 pC	Passed
Bbb'	28	27	≤10 pC	Passed
Ccc'	29	28	≤10 pC	Passed

Partial discharge measurement circuits

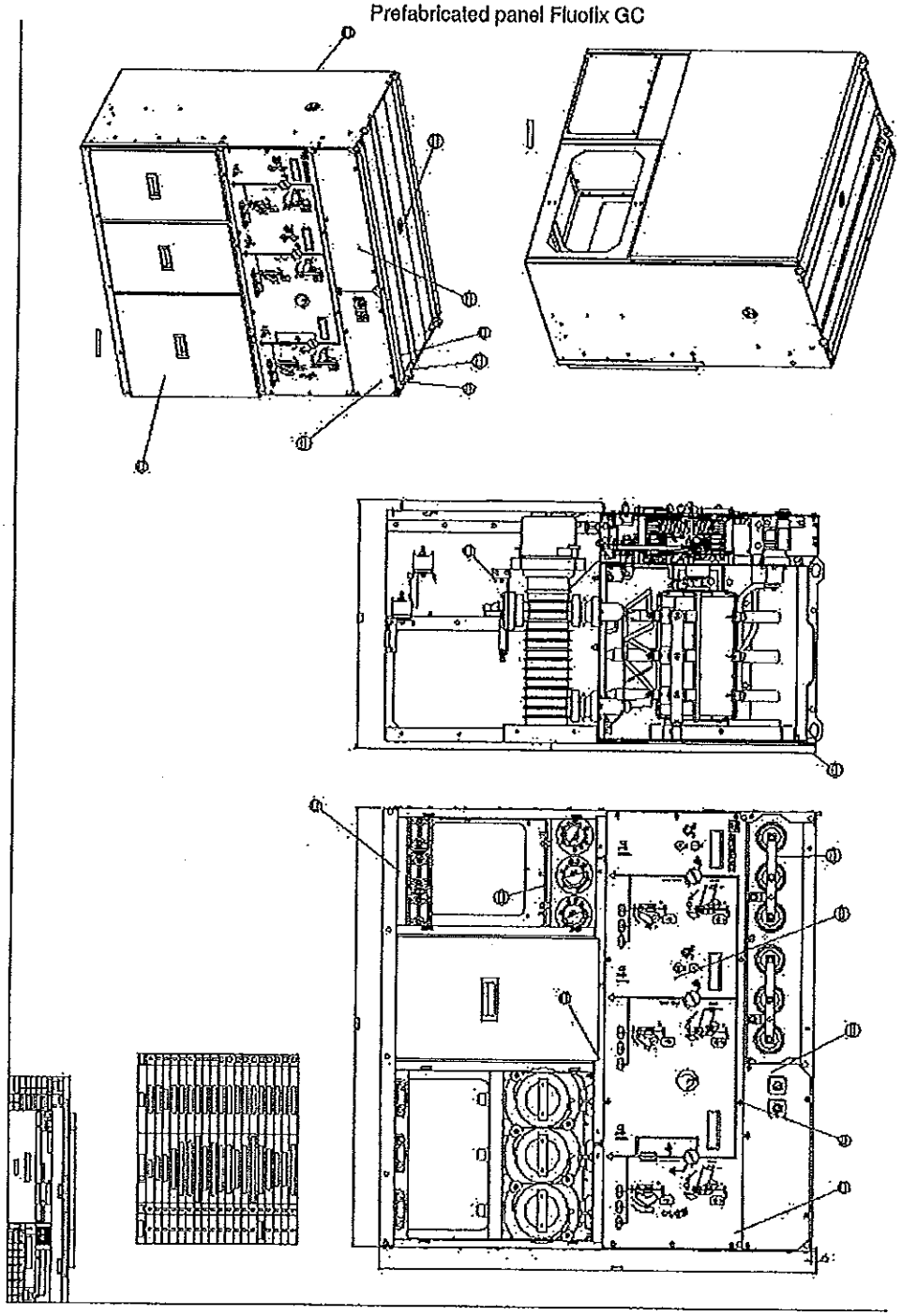


Cx: test object
Cb: discharge free capacitor

Fluofix GC single line diagram



Prefabricated panel Fluofix GC



EFACEC ENERGY

MEDIUM VOLTAGE SWITCHGEAR DIRECTION

TEST REPORT
No. MT.00.3.C.153.I

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

Mechanical Tests

Test regulations applied:

IEC 60129
IEC 60265-1
IEC 60694

Tests results:

The prefabricated panel Fluofix GC passed the Tests.

Date of tests: 16 to 22 May, 2000.

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: CI1M
Command with a motor kit, 110 Vdc.

2 - MANUFACTURER

EFACEC, Medium Voltage Switchgear Direction.

3 - TEST PERFORMED

3.1 - Service position

Mechanical operation test with 2000 close / open operations.

No of operating sequences	Control Voltage	Operating sequence
1800	Rated	C - 15s – O - 15s
100	minimum (85 % Un)	
100	maximum (110 % Un)	

Total:	2000

3.2 - Earth position

1000 close / open manual operations.