ТОМ 4

Открита процедура за сключване на рамково споразумение с предмет: „Доставка на комплектни комутационни устройства" Реф№ PPD 16-049

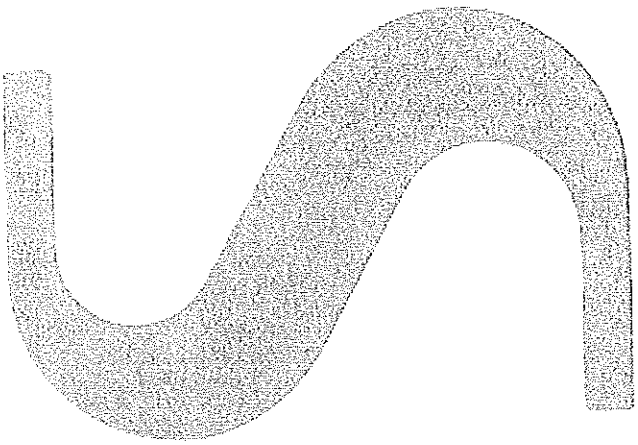
Възложител: „ЧЕЗ Разпределение България" ЕАД

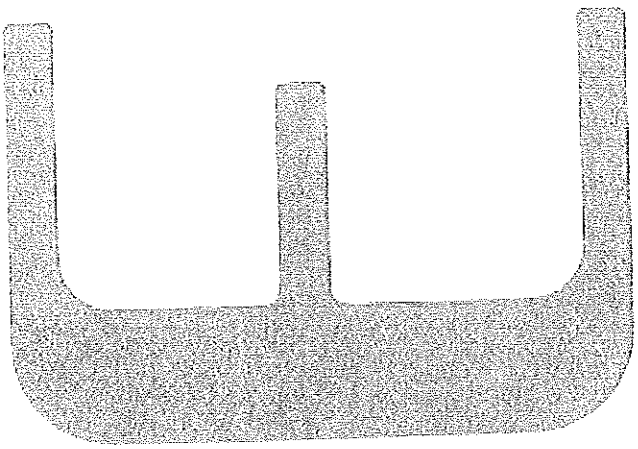
Предложение за изпълнение на поръчката

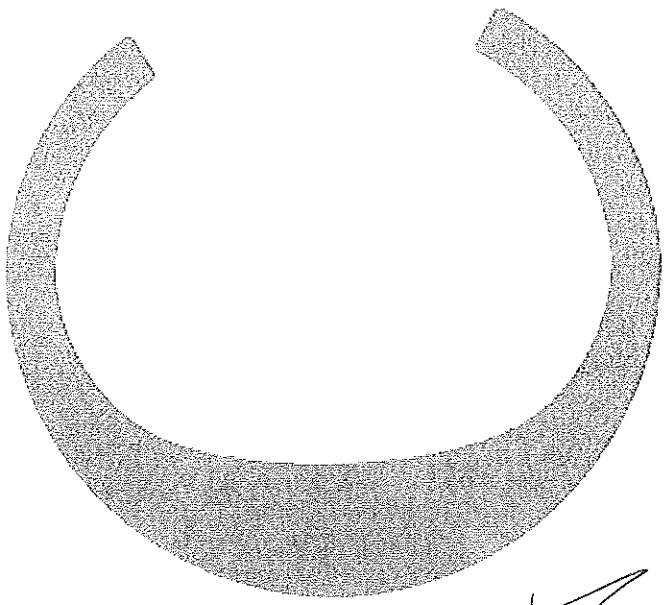
1714

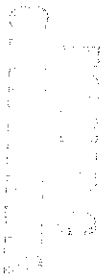
5124902BXA

GPS91/15186









1714A

CESI

test report

GPS-91/015156

client MERLIN GERIN S.A. - Grenoble (France)

object Three-pole metal enclosed air insulated switchgear SM6 system type IM, fitted with an increased operating frequency SF6 gas insulated switch type [illegible] SM6.

characteristics of the tested object assigned by the Client

rated voltage 17.5/24 kV rated current 400 A rated frequency 50 Hz

other characteristics listed on page 2

the tests have been made in accordance with client's instructions based on IEC 265 (1983)

test date June 18th, 1991
June 19th, 1991

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

this document is composed by 12 pages, 120 oscillograms

Milan, August 8th, 1991   test engineer

Ezio Moreno

Keywords : [illegible]

This test report is not a certificate of conformity [illegible]

rated characteristics of the tested object assigned by the client

voltage	12.5/24 kV
frequency	50 Hz
normal current	400 A
short-circuit making current	50 kA
short time withstand current	20 kA
short-circuit duration	1 s
mainly active load breaking current	400 A
cable charging breaking current	25 A
no-load transformer breaking current	16 A
gas pressure for interruption	1.4 bar abs.

identification of the object effected.

The tested object truly conforms to the drawings of its type supplied by the Client. These drawings identified by CESI with embossing stamp and numbered GPS- 91/015161 1 to 12 are assembled in a folder.

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1R16

table of tests performed

date	type of test	[illegible]
	THREE-PHASE MAINLY ACTIVE LOAD CURRENT SWITCHING TESTS	
June 18th,19th 1991	No.100 tests with 400 A at 24 kV	[illegible]
June 18th 1991	No.20 tests with 20 A at 24 kV	[illegible]
	THREE-PHASE NO-LOAD TRANSFORMER CURRENT SWITCHING TESTS	
June 19th 1991	No.10 tests with 15 A at 24.4 kV	[illegible]
	THREE-PHASE CABLE-CHARGING CURRENT SWITCHING TESTS	
June 19th 1991	No.20 tests with 29 A at 24.2 kV	[illegible]

tests witnessed by
Mr. Laurens - MERLIN GERIN S.A.
Mr. Mahroqua - MERLIN GERIN S.A.

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arrangement of the object for the tests

The tested apparatus was associated with two other apparatus of the system (see photo on page 10).
The figure below shows the electric diagram of the complete system (single phase diagram of a three phase circuit) :

1 : switch under test

2-3 : auxiliary switches

A-B-C : cables

During the tests the cables A were connected to the supply. The switch 2 was in closed position and the cables B were connected to the load. The switch 3 was in open position.

The metal enclosure was insulated from earth but connected through by a copper wire 0,1 mm in diameter and 30 mm long to indicate any significant leak or passage to earth.

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1R18

three-phase mainly active load current switching tests

est duty with 400 A at 24.0 kV

test circuit condition:

circuit diagram see page: 10

supply circuit
power factor: > 0.2
frequency: 50 Hz
neutral condition: earthed
TRV : pc 46 kV 67 µs

capacitance 0.9 µF
(20 % of the total capacitance of the circuit)

load circuit
power factor: 0.73
neutral condition: insulated

frequency: - Hz
damping factor:

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation: - bar abs.
breaking: 3.4 bar abs.

conditions of the apparatus before the tests : new

tests performed pc.100 tests with operating sequence CO

test no. 1 to 100

oscillograms no. 4 to 103

test voltage 24 kV

test current 400A

minimum arcing time 3 ms

maximum arcing time 15 ms

The tested switch has always cleared the currents.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests
internal parts not inspected.

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1819

three-phase mainly active load current switching tests

test duty with 20 A at 24.0 kV

test circuit conditions

circuit diagram see page: 30

supply circuit
power factor: < 0.2 impedance: 6.9 Ω
frequency: 50 Hz
neutral condition: earthed
TRV : uc 44 kV t3 84 µs

load circuit
power factor: 0.73 frequency: - Hz
neutral condition: insulated damping factor:

control voltage of operating devices for: closing - V
opening - V
motor - V
gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no. 100

tests performed no.20 tests with operating sequence CO

test no. 101 to 120

oscillograms no. 104 to 123

test voltage 24 kV

test current 20A

minimum arcing time 6 ms

maximum arcing time 11 ms

The tested switch has always cleared the current.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests.
internal parts not inspected.

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1720

three-phase no-load transformer current switching tests

test duty with 15.0 A at 24.4 kV

test circuit conditions

circuit diagram see page: 10

supply circuit
power factor: < 0.2
frequency: 50 Hz
neutral condition: earthed
TRV : uc 44 kV t3 84 µs

impedance 0.9 Ω

load circuit
power factor: 0.12
neutral condition: insulated

frequency: 560 Hz
damping factor: 0.25

control voltage of operating devices for: closing – V
opening – V
motor – V

gas operating pressure for : operation – bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.120

test		no.	121	122	123	124	125	126	127	128	129	130
oscillogram		no.	124	125	126	127	128	129	130	131	132	133
operating duty			O	O	O	O	O	O	O	O	O	O
voltage with open apparatus	phase-to-neutral	kV	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1
	phase-to-phase	kV	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
inrush making current		kA	–	–	–	–	–	–				
maximum closing overvoltage	supply side	kV	–	–	–	–	–	–	–	–	–	–
	load side	kV	–	–	–					–	–	–
breaking current		A	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0
	average	A	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
maximum opening overvoltage	supply side	kV	22.0	22.0	21.0	21.0	23.0	22.0	–	21.0	24.0	23.0
	load side	kV	22.0	24.0	24.0	23.0	25.0	23.0	23.0	23.0	23.0	24.0
restrikes		no.	–	–	–	–	–	–				
		phase	–	–	–	–	–	–				
duration of	closing	ms	–	–	–	–	–	–	–	–	–	–
	opening	ms					–	–	–	–	–	–
	prearc	ms										
	arc	ms	11	11	10	10	12	11	10	12	11	13

conditions of the apparatus after the tests: external parts as before the tests.
internal parts not inspected.

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three-phase cable-charging current switching tests

test duty with 29.0 A at 24.2 kV

test circuit conditions

circuit diagram see page: 11

supply circuit
power factor: < 0.15
frequency: 50 Hz
TRV : uc 44 kV t3 84 μs

short-circuit current: 2 kA

load circuit
capacitance of capacitor banks: CY1 = 6.6 μF (insulated)
voltage decay at 100 ms after final arc extinction < 10 %

voltage with open apparatus: 14.0 kV phase-to-neutral 24.2 kV phase-to-phase

control voltage of operating devices for: closing – V
opening – V
motor – V

gas operating pressure for : operation – bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.130

			131	132	133	134	135	136	137	138	139	140
test		no.	131	132	133	134	135	136	137	138	139	140
oscillogram		no.	134	135	136	137	138	139	140	141	142	143
operating duty			C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O
voltage with closed apparatus	phase-to-neutral	kV	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0
	phase-to-phase	kV	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
inrush making current		kA	–	–	–	–	–	–	–	–	–	–
maximum closing overvoltage	supply side	kV	34.0	37.0	34.0	35.0	37.0	35.0	35.0	35.0	35.0	37.0
	load side	kV	34.0	37.0	34.0	35.0	37.0	35.0	35.0	35.0	35.0	37.0
breaking current		A	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0
	average	A	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
maximum opening overvoltage	supply side	kV	–	–	–	–	–	–	–	–	–	–
	load side	kV	27.0	28.0	27.0	27.0	27.0	28.0	27.0	28.0	28.0	27.0
restrikes		no.	–	–	–	–	–	–	–	–	–	–
		phase	–	–	–	–	–	–	–	–	–	–
duration of	closing	ms	–	–	–	–	–	–	–	–	–	–
	opening	ms	–	–	–	–	–	–	–	–	–	–
	prearc	ms	–	–	–	–	–	–	–	–	–	–
	arc	ms	9	8	8	8	8	8	9	7	9	8

conditions of the apparatus after the tests: –

cont'd.

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three-phase cable-charging current switching tests

cont'd

test			no.	141	142	143	144	145	146	147	148	149	150
oscillogram			no.	144	145	146	147	148	149	150	151	152	153
operating duty				C-O	C-O	C-O	C-O	C-O	C-O	C O	C O	C-O	C-O
voltage with closed apparatus	phase-to-neutral		kV	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0
	phase-to-phase		kV	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
inrush making current			kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side load side		kV kV	35.0 35.0	38.0 38.0	41.0 41.0	35.0 35.0	31.0 31.0	34.0 34.0	35.0 34.0	35.0 35.0	34.0 34.0	34.0 34.0
breaking current			A	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0
	average		A	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
maximum opening overvoltage	supply side load side		kV kV	- 28.0	- 30.0	- 27.0	- 29.0	- 28.0	- 26.0	- 29.0	- 27.0	- 29.0	- 28.0
restrikes			no.	-	-	-	-			-	-	-	
			phase	-	-	-	-	-	-	-			
duration of	closing		ms	-	-	-	-	-	-	-	-		
	opening		ms	-		-	-	-	-	-	-	-	
	prearc		ms	-	-	-	-	-	-	-	-	-	-
	arc		ms	5	9	9	10	9	8	10	8	8	8

conditions of the apparatus after the tests: external parts as before the tests.
internal parts not inspected

note after all the tests : the performance of the apparatus is considered satisfactory for the tests performed.

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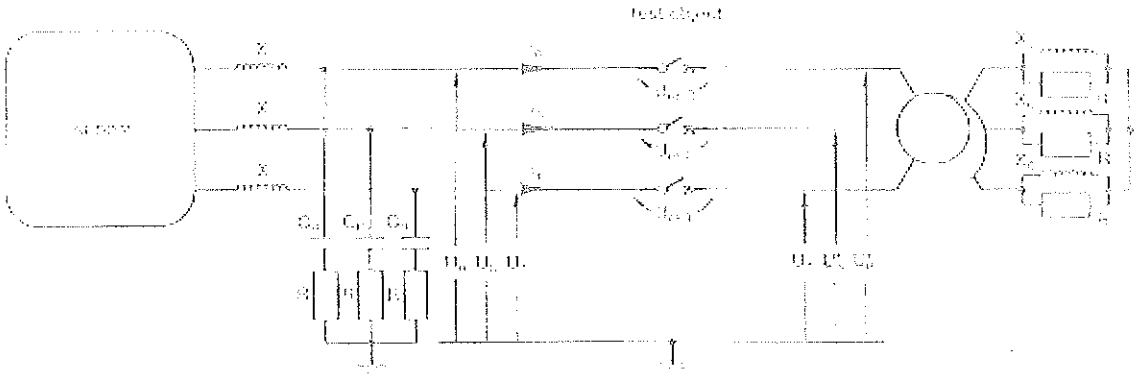
1223

circuit-diagram



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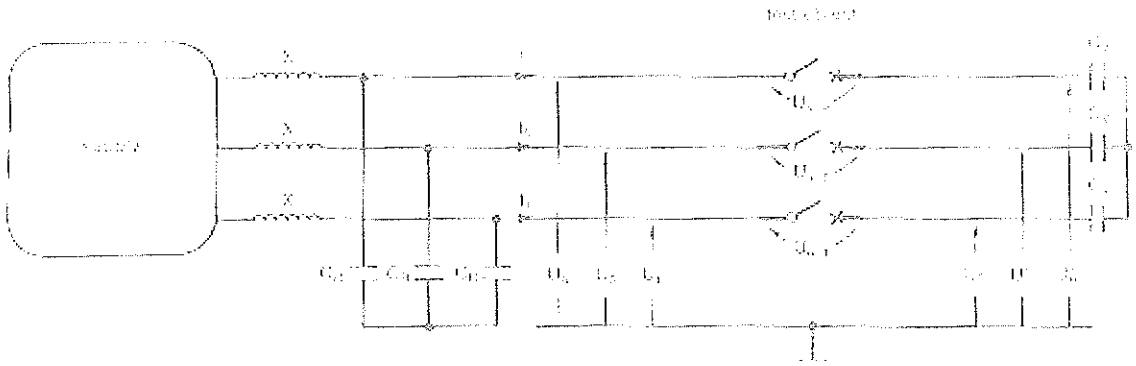
1824

circuit-diagram:



This test report is not a certificate or approval, nor do the results given necessarily permit conclusions on the ratings supplied by the manufacturer.
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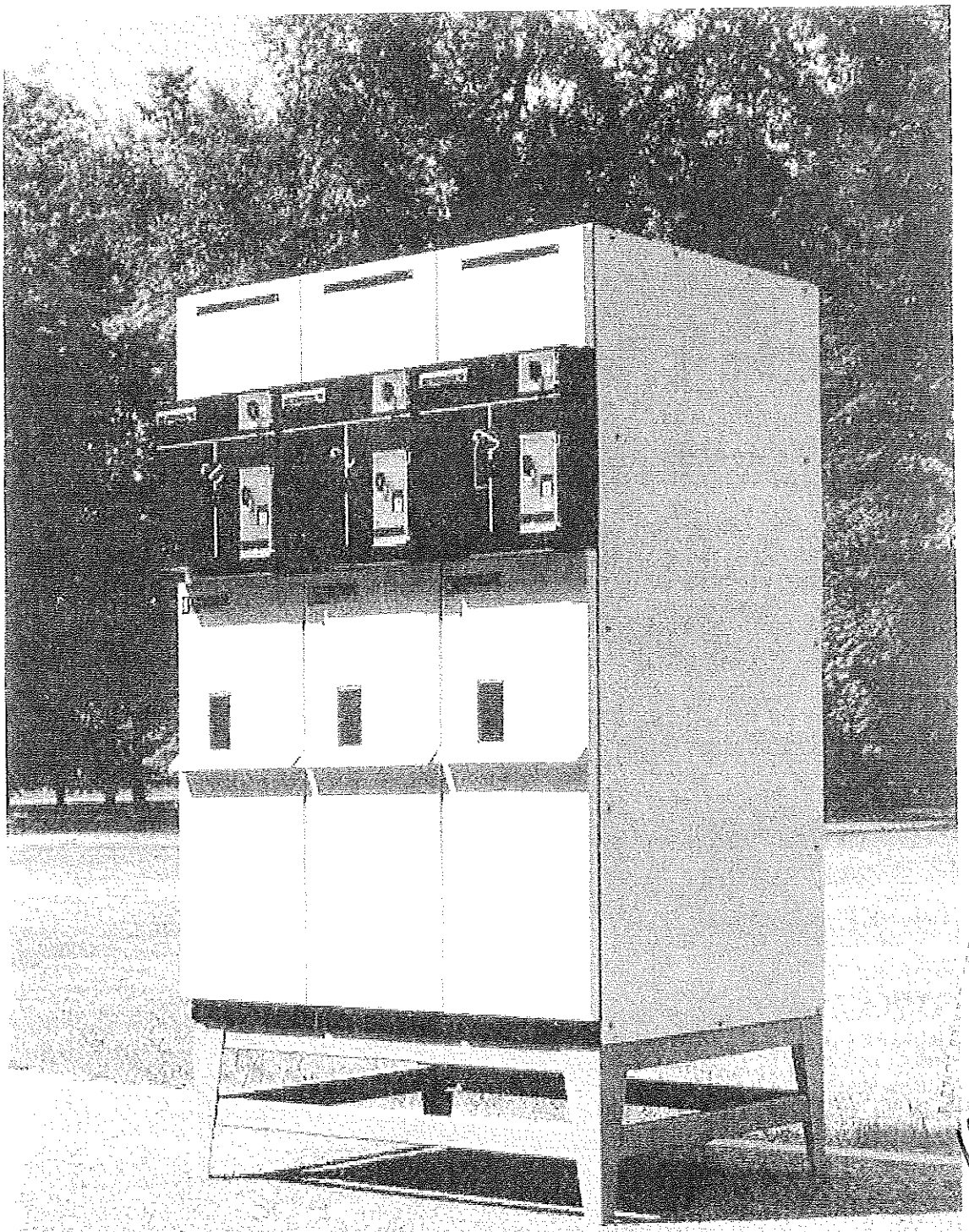

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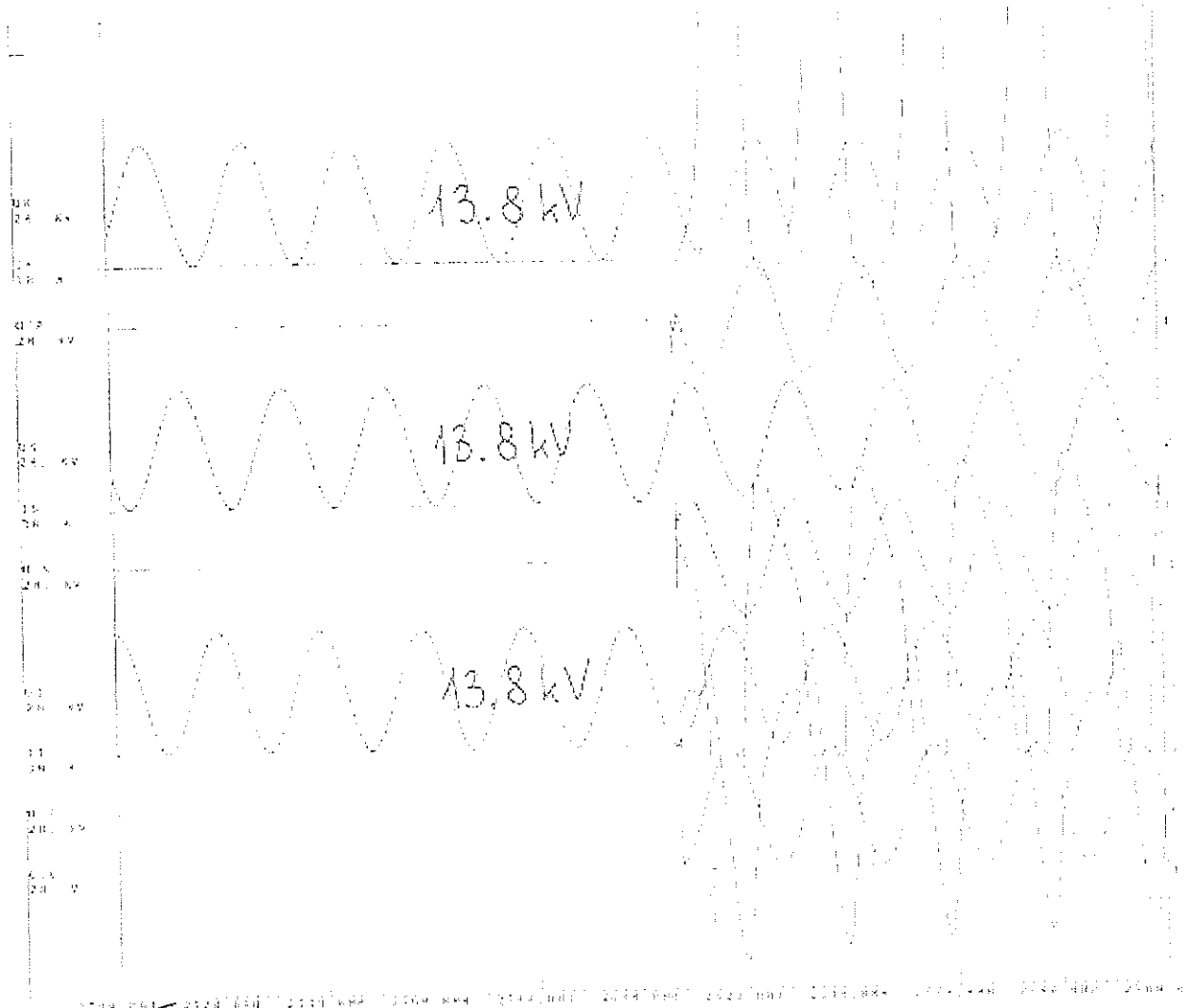
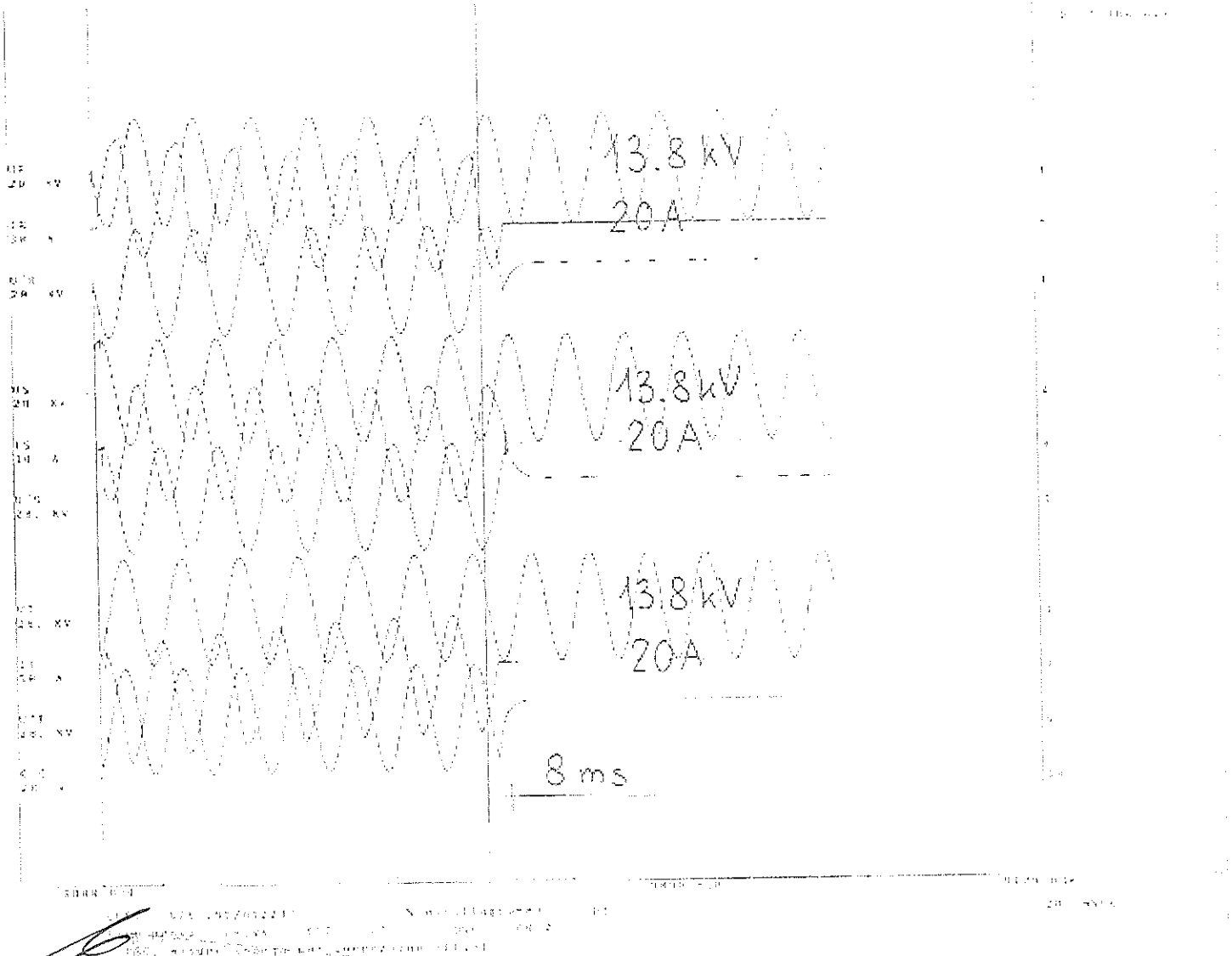
1826


13.8 kV
13.8 kV
13.8 kV



11828

1729

1R30

1731

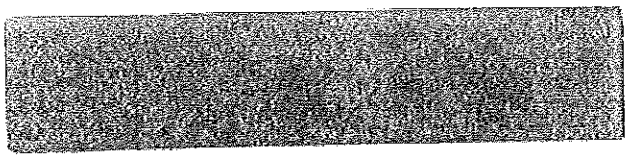
10 ms

1 ms

6 ms

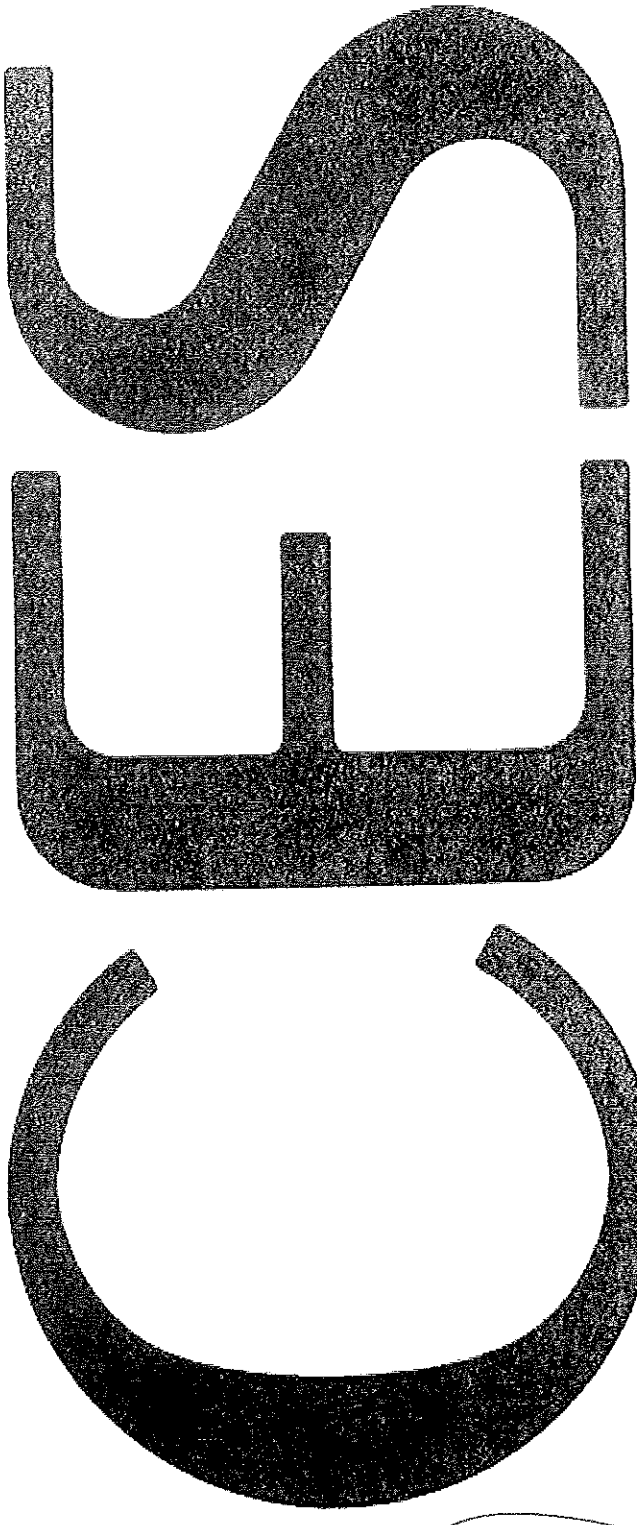
1R35

1R34



51249032XA

GPS91/15191



1232

CESI

test report

CPS-91/015151

client MERLIN GERIN S.A. - Grenoble (France)

object Three pole metal enclosed air insulated switchgear and system type QM. Filled with an increment operating frequency SF6 gas insulated switch type IQ SM6.

characteristics of the tested object assigned by the client

rated voltage 17.5/24 kV rated current 200 A rated frequency 50 Hz

other characteristics listed on page 2

the tests have been made in accordance with client's instructions based on IEC 265 (1982)

test date June 19th, 1991
June 20th, 1991

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

this document is composed by 9 pages, 260 oscillograms

Milan, August 9th, 1991 test engineer

F.Lo Monaco

91/012283
keywords : 120100 234300 350200 450700 530010

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1238

rated characteristics of the tested object assigned by the client

voltage	17.5/24	kV
frequency	50	Hz
normal current	200	A
short-circuit making current	50	kA
short-time withstand current	20	kA
short-circuit duration	1	s
mainly active load breaking current	200	A
no-load transformer breaking current	5	A
gas pressure for interruption	1.4 bar abs.	

identification of the object effected.

The tested object truly conforms to the drawings of its type supplied by the Client. These drawings identified by CESI with embossing press and numbered GPS- 91/015182 1 to 13 are assembled in a folder.

This test report is not a certificate of conformity, nor do the results given necessarily confirm the ratings supplied by the manufacturer.
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1239

table of tests performed

date	type of test	page
	THREE-PHASE MAINLY ACTIVE LOAD CURRENT SWITCHING TESTS	
June 19th 1991	No.100 tests with 200 A at 24 kV	5
June 19th,20th 1991	No.20 tests with 10.5 A at 24 kV	6
	THREE-PHASE NO-LOAD TRANSFORMER CURRENT SWITCHING TESTS	
June 20th 1991	No.10 tests with 3.7 A at 24.4 kV	7

tests witnessed by Mr. Laurens - MERLIN GERIN S.A.
Mr. Dubroqua - MERLIN GERIN S.A.

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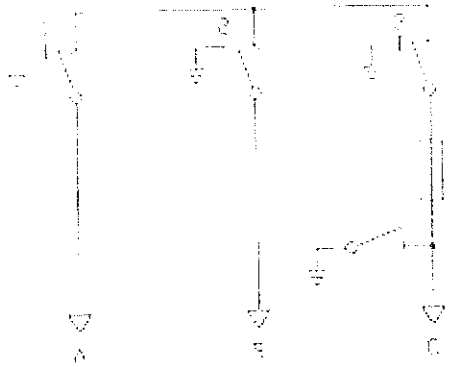
1240

arrangement of the object for the tests

The tested apparatus was assembled with two other apparatus of SM6 system (see photo on page 9).
The figure below shows the electric diagram of the complete setting (single phase diagram of a three phase circuit) :



3 : switch under test

1-2 : auxiliary switches

A-B-C : cables

During the tests the cables A were connected to the supply, the switch 1 was in closed position and the cables C were connected to the load.The switch 2 was in open position.

The metal enclosure was insulated from earth but connected thereto by a copper wire 0.1 mm in diameter and 30 mm long to indicate any significant leakage current to earth.

The fuses were replaced by cylindric copper connections having the same dimensions of fuses.

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1R41

three-phase mainly active load current switching tests

rown duty with 200 A at 24.0 kV

test circuit conditions

circuit diagram see page: 8

supply circuit
power factor: < 0.2
frequency: 50 Hz
neutral condition: earthed
TRV : uc 42 kV t3 93 µs

impedance 13,9 Ω
(20 % of the total impedance of the circuit)

load circuit
power factor: 0.73
neutral condition: insulated

frequency: - Hz
damping factor: -

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : new

tests performed no.100 tests with operating sequence CO

test no. 1 to 100

oscillograms no. 154 to 253

test voltage 24 kV

test current 200 A

minimum arcing time 7 ms

maximum arcing time 14 ms

The tested switch has always cleared the current.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests
internal parts not inspected.

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Three-phase mainly active load current switching tests

test duty with 10.5 A at 24.0 kV

Test circuit conditions

circuit diagram see page: 10

supply circuit
power factor: < 0.2 impedance 13.9 Ω
frequency: 50 Hz
neutral condition: earthed
TRV : uc 42 kV t3 93 µs

load circuit
power factor: 0.73 frequency: - Hz
neutral condition: insulated damping factor: -

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no. 100

tests performed no.20 tests with operating sequence CO

test no. 101 to 120

oscillograms no. 254 to 273

test voltage 24 kV

test current 10.5 A

minimum arcing time 5 ms

maximum arcing time 10 ms

The tested switch has always cleared the current.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests
internal parts not inspected.

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1R43

three-phase no-load transformer current switching tests

with 3.70 A at 24.2 kV

test circuit conditions

circuit diagram see page: 8

supply circuit		impedance	6.3 Ω
power factor:	< 0.2		
frequency:	50 Hz		
neutral condition:	earthed		
TRV : uc 43 kV	t3 89 µs		
load circuit			
power factor:	0.12	frequency:	500 Hz
neutral condition:	insulated	damping factor:	0.15

control voltage of operating devices for: closing - V; opening - V; motor - V

gas operating pressure for : operation - bar abs.; breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.120

test	no.	121	122	123	124	125	126	127	128	129	130
oscillogram	no.	274	275	276	277	278	279	280	281	282	283
operating duty		O	O	O	O	O	O	O	O	O	O
voltage with open apparatus	phase-to-neutral kV	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0
	phase-to-phase kV	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
inrush making current	kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side kV	-	-	-	-	-	-	-	-	-	-
	load side kV	-	-	-	-	-	-	-	-	-	-
breaking current	A	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70	3.70 3.70 3.70
average	A	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
maximum opening overvoltage	supply side kV	24.0	-	-	-	-	-	-	-	-	-
	load side kV	31.0	34.0	33.0	31.0	33.0	27.0	26.0	32.0	30.0	29.0
restriking	no.	-	-	-	-	-	-	-	-	-	-
	phase	-	-	-	-	-	-	-	-	-	-
duration of	closing ms	-	-	-	-	-	-	-	-	-	-
	opening ms	-	-	-	-	-	-	-	-	-	-
	prearc ms	-	-	-	-	-	-	-	-	-	-
	arc ms	5	7	7	6	8	6	6	8	8	6

conditions of the apparatus after the tests: external parts as before the tests, internal parts not inspected

note after all the tests : ~~the performance of the apparatus is considered~~ satisfactory for the tests performed.

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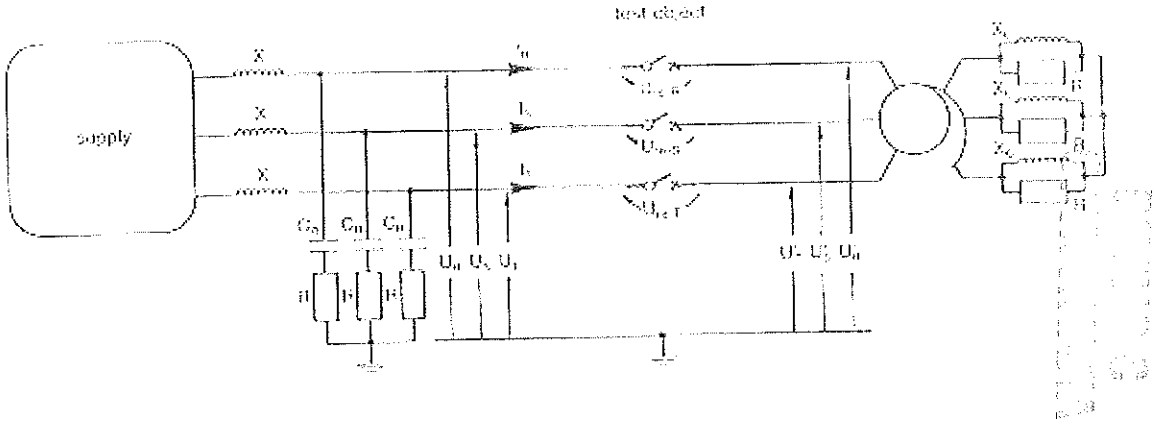
1244

circuit-diagram



symbols used in this diagram are the same as on the oscillograms

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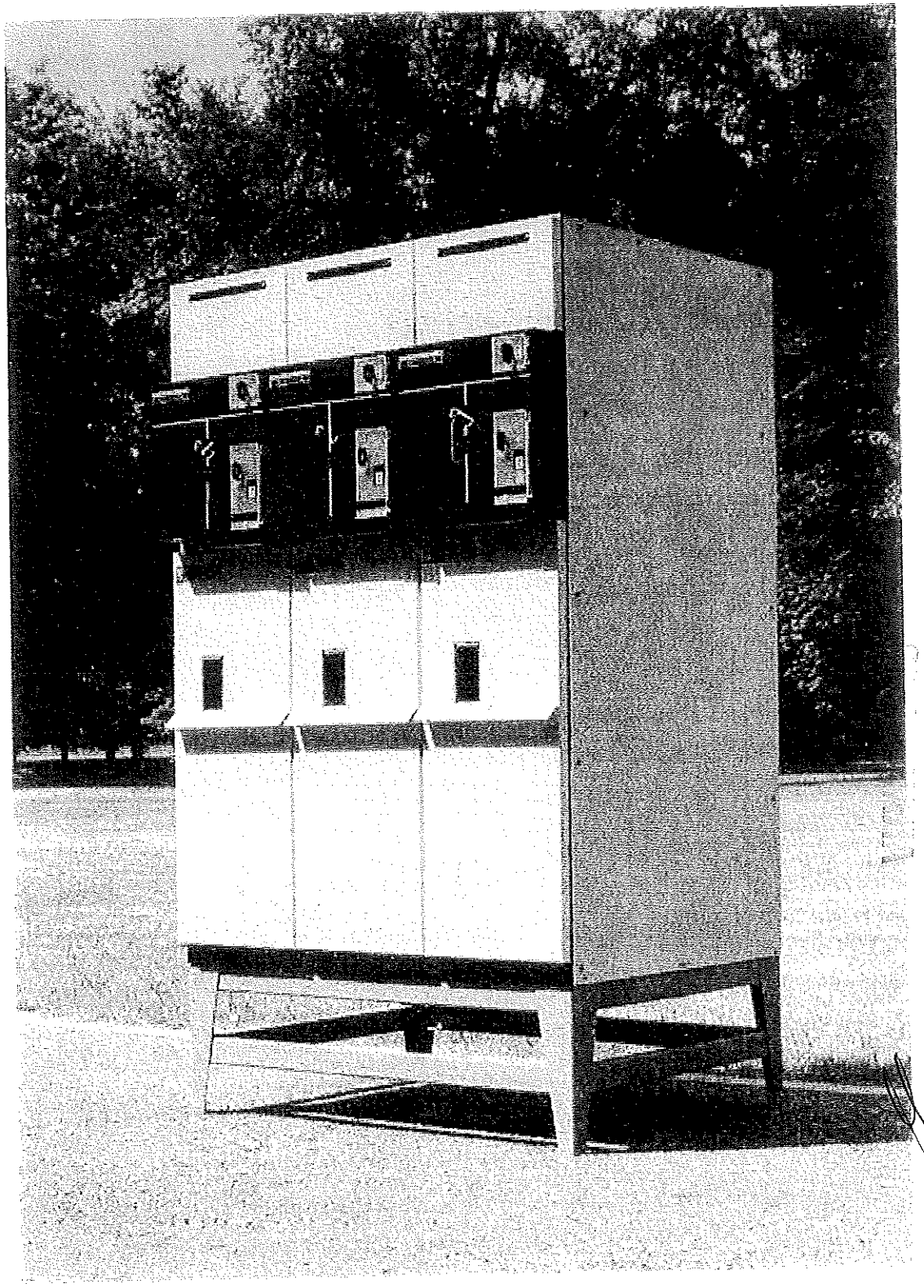
IRU5



This test report is not a certificate of conformity, nor do the results [illegible] confirm the ratings supplied by the manufacturer.
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51249036XA

GPS91/15199

CESI

test report

GPS 91/015199

client MERLIN GERIN S.A. - Grenoble (France)

object Three pole metal enclosed air insulated switchgear SM6 system type IM, fitted with an increased operation frequency SF6 gas insulated switch type I SM6.

characteristics of the tested object assigned by the Client

rated voltage 17.5/24 kV rated current 630 A rated frequency 50 Hz

other characteristics listed on page 3

the tests have been made in accordance with client's instructions based on IEC 265 (1985)

test date June 19th, 1991

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

This document is composed by 10 pages, 80 oscillograms.

Milan, August 19th, 1991

test engineer

P.I.P. Morosco

91/012283

Keywords : 120100 234308 350201 450707 530010

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1248

rated characteristics of the tested object assigned by the client

voltage	17.5/24 kV
frequency	50 Hz
normal current	630 A
short-circuit making current	50 kA
short-time withstand current	20 kA
short-circuit duration	1 s
cable charging breaking current	25 A
no-load transformer breaking current	16 A
gas pressure for interruption	1.4 bar abs.

identification of the object effected.

The tested object truly conforms to the drawings of its type supplied by the client. These drawings identified by CESI with embossing press and numbered CPS- 91/015191 1 to 12 are assembled in a folder.

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1243

table of tests performed

date	type of test	see page
June 19th 1991	THREE-PHASE NO-LOAD TRANSFORMER CURRENT SWITCHING TESTS No.10 tests with 15 A at 24.4 kV	5
June 19th 1991	THREE-PHASE CABLE-CHARGING CURRENT SWITCHING TESTS No.20 tests with 29 A at 34.2 kV	6-7

tests witnessed by Mr. Jauvens - MERLIN GERIN S.A.
Mr. Dubreuil - MERLIN GERIN S.A.

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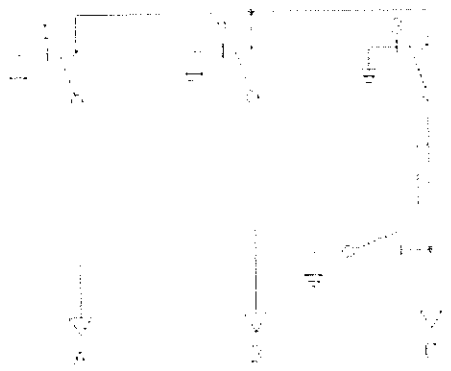
1750

arrangement of the object for the tests

The tested apparatus was assembled with two other apparatus of SM6 system (see photo on page 5).
The figure below shows the electric diagram of the complete setting (single phase diagram of a three phase circuit) :



1 : switch under test

2-3 : auxiliary switches

A-B-C : cables

During the tests the cables A were connected to the supply, the switch 2 was in closed position and the cables B were connected to the load.The switch 3 was in open position.

The metal enclosure was insulated from earth but connected thereto by a copper wire 0.1 mm in diameter and 30 mm long to indicate any significant leakage current to earth.

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three-phase no-load transformer current switching tests

test duty with 15.0 A at 24.4 kV

test circuit conditions

circuit diagram see page: 6

supply circuit
power factor: < 0.2 impedance 6.0 Ω
frequency: 50 Hz
neutral condition: earthed
CBV : no 44 kV -3 84 µs

load circuit
power factor: 0.12 frequency: 560 Hz
neutral condition: insulated damping factor: 0.25

control voltage of operating devices for: closing V
opening - V
motor V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : new

test		no.	1	2	3	4	5	6	7	8	9	10
oscillogram		no.	124	125	126	127	128	129	130	131	132	133
operating duty			O	O	O	O	O	O	O	O	O	O
voltage with open apparatus	phase to-neutral	kV	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 14.1	14.1 14.1 24.1	24.4 24.4 24.4	14.1 14.1 24.1	14.1 14.1 14.1	14.1 24.1 14.1	14.1 24.1 24.1	14.1 24.1 24.1
	phase-to-phase	kV	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
inrush making current		kA	-	-	-	-	-		-	-	-	-
maximum closing overvoltage	supply side	kV	-	-	-	-	-	-	-	-	-	-
	load side	kV	-	-	-	-	-	-	-	-	-	-
breaking current		A	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0
	average	A	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
maximum opening overvoltage	supply side	kV	22.0	22.0	21.0	21.0	23.0	22.0	-	21.0	24.0	23.0
	load side	kV	23.0	24.0	24.0	23.0	25.0	23.0	23.0	25.0	25.0	24.0
restrikes		no.	-	-	-	-	-	-	-	-	-	-
		phase	-	-	-	-	-	-	-	-	-	-
duration of	closing	ms	-	-	-	-	-		-	-	-	-
	opening	ms		-	-	-	-		-	-	-	-
	prearc	ms	-	-	-	-	-	-	-	-	-	-
	arc	ms	11	12	13	10	12	11	10	12	11	13

conditions of the apparatus after the tests: external parts as before the tests,
internal parts not inspected.

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1852

three-phase cable-charging current switching tests

test duty with 29.0 A at 24.2 kV

test circuit conditions

circuit diagram see page 9

supply circuit
power factor: < 0.15 short-circuit current: 2 kA
frequency: 50 Hz
TRV : uc 44 kV t3 86 µs

load circuit
capacitance of capacitor banks: CV1 = 6.6 µF (insulated)
voltage decay at 100 ms after final arc extinction < 10 %

voltage with open apparatus: 14.0 kV phase-to-neutral 24.2 kV phase-to-phase

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.10

test no.	11	12	13	14	15	16	17	18	19	20
oscillogram no.	134	135	136	137	138	139	140	141	142	143
operating duty	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O
voltage with closed apparatus phase-to-neutral kV	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0
phase-to-phase kV	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
inrush making current kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage supply side kV	34.0	37.0	34.0	35.0	37.0	35.0	35.0	35.0	35.0	37.0
load side kV	34.0	37.0	34.0	35.0	37.0	35.0	35.0	35.0	35.0	37.0
breaking current A	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0
average A	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
maximum opening overvoltage supply side kV	-	-	-	-	-	-	-	-	-	-
load side kV	27.0	28.0	27.0	27.0	27.0	28.0	27.0	26.0	28.0	27.0
restrikes no.	-	-	-	-		-	-	-	-	-
phase	-	-	-		-	-	-		-	-
duration of closing ms	-	-		-	-	-		-	-	
opening ms	-	-	-	-	-		-	-	-	
phase ms	-	-	-	-	-	-	-	-	-	
arc ms	9	8	8	8	8	8	9	9	9	

conditions of the apparatus after the tests -

cont'd.

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1753

three phase cable-charging current switching tests

cont'd

test		no.	21	22	23	24	25	26	27	28	29	30
oscillogram		no.	144	145	146	147	148	149	150	151	152	153
operating duty			C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O
voltage with closed apparatus	phase-to-neutral	kV	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0	14.0 14.0 14.0
	phase-to-phase	kV	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
inrush making current		kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side load side	kV kV	35.0 35.0	38.0 38.0	41.0 41.0	35.0 35.0	31.0 31.0	34.0 34.0	35.0 35.0	35.0 35.0	34.0 34.0	34.0 34.0
breaking current		A	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0	29.0 29.0 29.0
	average	A	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
maximum opening overvoltage	supply side load side	kV kV	- 28.0	- 30.0	- 27.0	- 29.0	- 28.0	- 26.0	- 29.0	- 27.0	- 28.0	- 28.0
restrikes		no.	-	-	-	-	-	-	-	-	-	-
		phase	-	-	-	-	-	-	-	-	-	-
duration of	closing	ms	-	-	-	-	-	-	-	-	-	-
	opening	ms	-	-	-	-	-	-	-	-	-	-
	prearc	ms	-	-	-	-	-	-	-	-	-	-
	arc	ms	9	9	9	10	9	8	10	8	8	8

conditions of the apparatus after the tests: external parts as before the tests, internal parts not inspected

note after all the tests : the performance of the apparatus is considered satisfactory for the tests performed.

This test report is not a certificate of conformity for the tests given necessarily based on the ratings supplied by the manufacturer.
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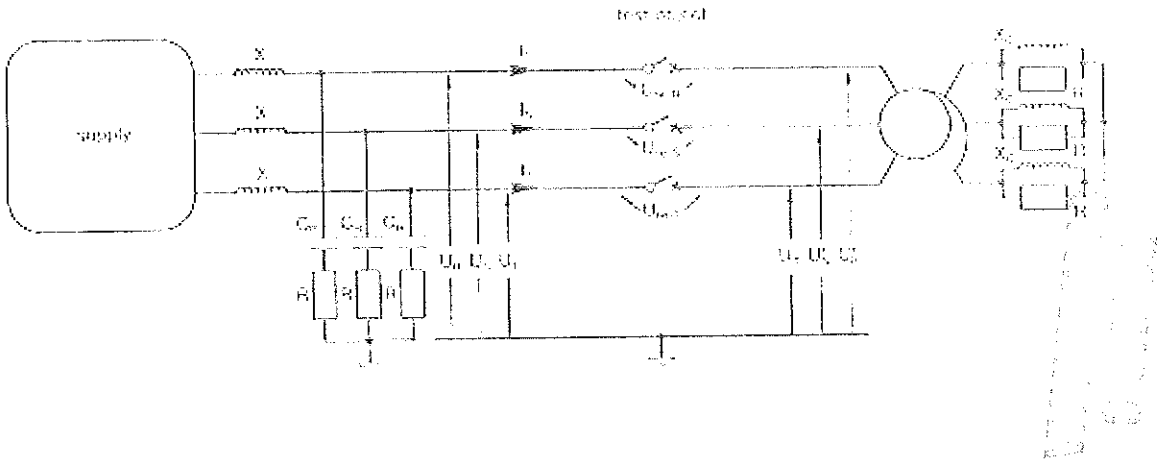
1R54

circuit diagram



Arrows used in this diagram are the same as on the oscillograms

This test report is not a certificate of conformity, nor do the results given necessarily confirm the ratings supplied by the manufacturer.
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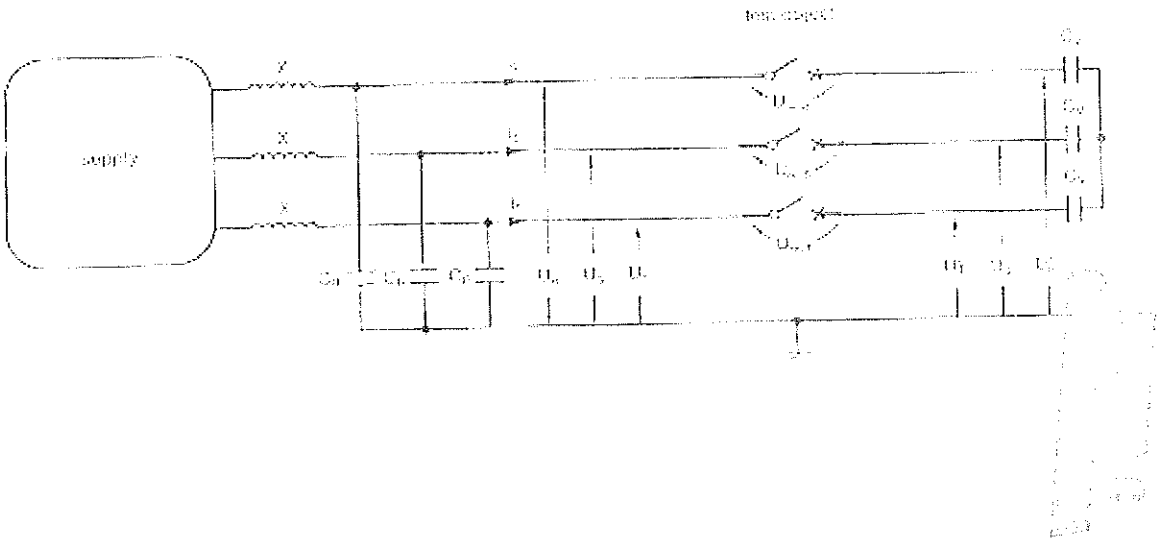
1205

circuit diagram



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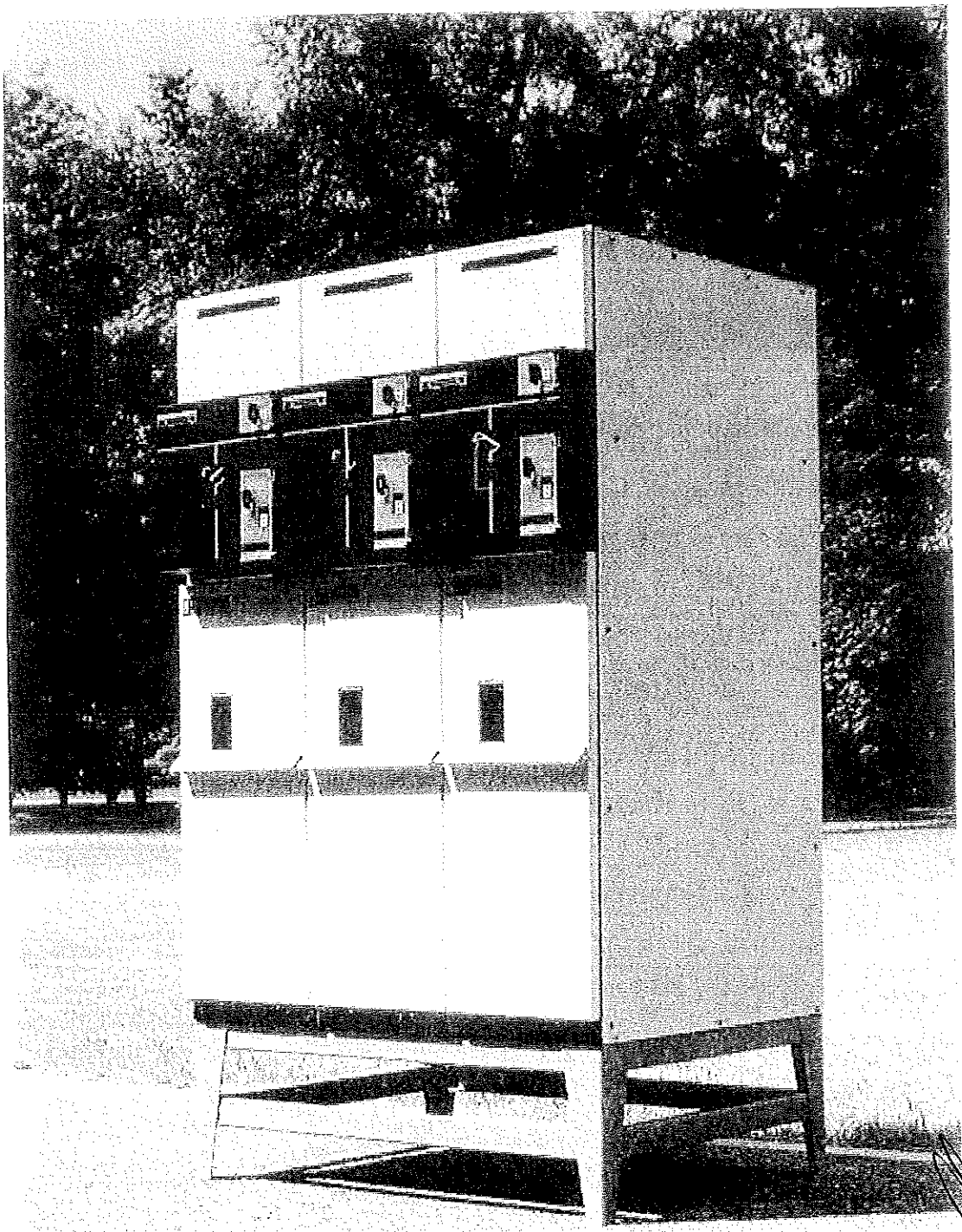
1256



This test report is not a certificate of conformity, nor do the tests carried out by the manufacturer
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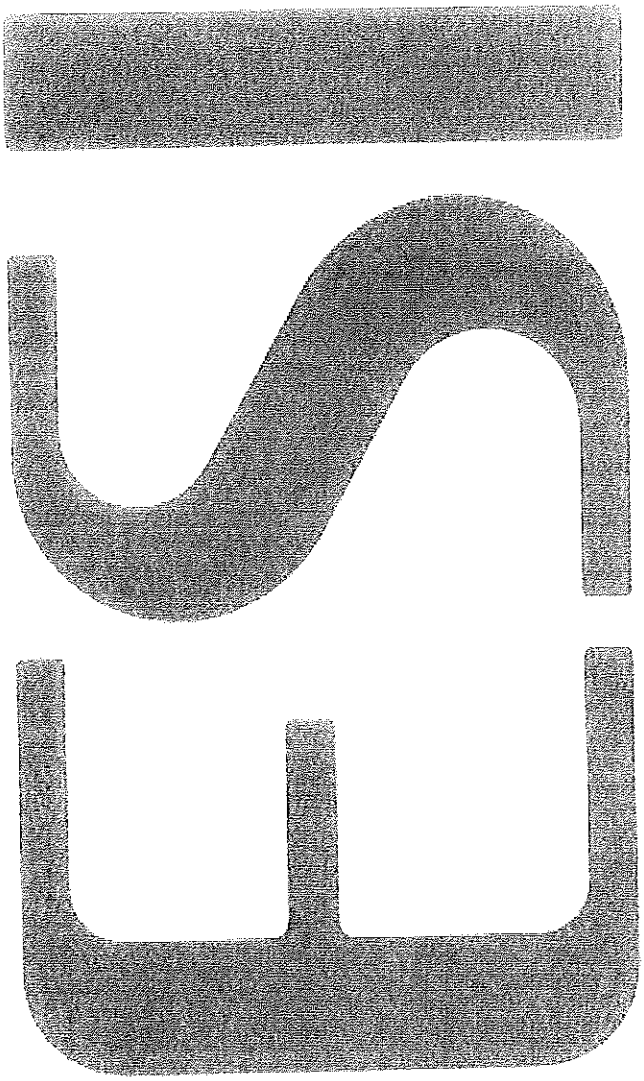
1252

+30°
+15°
-15°
-30°
24 MS

1R59



51249040XA

GPS91/15213

1260

CESI

test report

qvs-91/[illegible]213

client MERLIN GERIN S.A. - Grenoble (France)

object three pole modul enclosed air insulated switchgear GHG system type IV. fitted with an increased operating frequency SF6 gas insulated switch type T SF6.

characteristics of the tested object assigned by the Client

rated voltage 12 kV rated current 630 A rated frequency 50 Hz

other characteristics listed on page 2

The tests have been made in accordance with client's instructions based on IEC 265 (1963)

test date June 26th, 1991

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

this document is composed by 13 pages. 119 oscillograms

milan, August 22nd, 1991 test engineer

P.Lo Monaco

91/012285

keywords : 120100 234303 [illegible] 456442 530011

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1761

rated characteristics of the tested object assigned by the client

voltage	12	kV
frequency	50	Hz
normal current	630	A
short-circuit making current	50	kA
short time withstand current	20	kA
short-circuit duration	1	s
mainly active load breaking current	630	A
cable charging breaking current	25	A
no-load transformer breaking current	16	A
gas pressure for interruption	1,4	bar abs.

identification of the object effected.

The tested object truly conforms to the drawings of its type supplied by the Client. These drawings identified by CESI with embossing press and numbered GPS- 91/013161 1 to 12 are assembled in a folder.

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1262

table of tests performed

date	type of test	test page
	THREE-PHASE MAINLY ACTIVE LOAD CURRENT SWITCHING TESTS	
June 26th 1991	No.100 tests with 630 A at 12 kV	5
June 26th 1991	No.20 tests with 35 A at 12 kV	6
	THREE-PHASE NO-LOAD TRANSFORMER CURRENT SWITCHING TESTS	
June 26th 1991	No.10 tests with 15 A at 12 kV	7
	THREE-PHASE CABLE-CHARGING CURRENT SWITCHING TESTS	
June 26th 1991	No.20 tests with 28 A at 12 kV	8-9

tests witnessed by
Mr. Lauzens - MERLIN GERIN S.A.
Mr. Dubroqua - MERLIN GERIN S.A.

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1263

Arrangement of the object for the tests

The tested apparatus was assembled with two other apparatus of SF6 system (see photo on page 12).
The figure below shows the electric diagram of the complete switching (single phase diagram of a three phase circuit) :

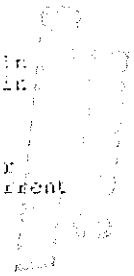
1 : switch and earthing switch under test

2-3 : auxiliary switches

A-B-C : cables

During the tests the cables B were connected to the supply, the switch 2 was in closed position and the cables A were connected to the load. The switch 3 was in open position.

The metal enclosure was insulated from earth but connected thereto by a copper wire 0.1 mm in diameter and 30 mm long to indicate any significant leakage current to earth.



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1264

three-phase mainly active load current switching tests

Test duty — with 630 A at 12.0 kV

Test circuit conditions

circuit diagram see page: 10

supply circuit
power factor: < 0.2
frequency: 50 Hz
neutral condition: earthed
TRV : up 21 kV ±3 62 µs
impedance 2.2 Ω
(20 % of the total impedance of the circuit)

load circuit
power factor: 0.73
neutral condition: insulated
frequency: - Hz
damping factor: -

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : new

Tests performed no.100 tests with operating sequence CO

Test no. 1 to 100

oscillograms no. 4 to 103

test voltage 12 kV

test current 630 A

minimum arcing time 7 ms

maximum arcing time 13 ms

The tested switch has always cleared the current.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests
internal parts not inspected.

This test report is not a certificate of conformity, nor do the results given necessarily confirm the ratings supplied by the manufacturer.
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1765

three-phase mainly active load current switching tests

test duty — with 35 A at 12.0 kV

test circuit conditions

circuit diagram see page: 10

supply circuit
power factor: < 0.2 — impedance: 2.2 Ω
frequency: 50 Hz
neutral condition: earthed
TRV : as 21 kV τ3 52 μs

load circuit
power factor: 0.73 — frequency: Hz
neutral condition: insulated — damping factor:

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no. 100

tests performed: no.20 tests with operating sequence CO

test no.: 101 to 120

oscillograms no.: 104 to 123

test voltage: 12 kV

test current: 35 A

minimum arcing time: 7 ms

maximum arcing time: 10 ms

The tested switch has always cleared the current.
No overvoltage was observed on supply and load side of the circuit.

conditions of the apparatus after the tests: external parts as before the tests
internal parts not inspected.

This test report is not a certificate of conformity, nor do the results given necessarily confirm the ratings supplied by the manufacturer.
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1R69

three-phase no-load transformer current switching tests

test duty with 15.0 A at 12.0 kV

test circuit conditions

circuit diagram see page: 10

supply circuit
power factor: < 0.2 impedance 3.2 Ω
frequency: 50 Hz
neutral condition: earthed
TRV : uc 21 kV t3 62 μs

load circuit
power factor: 0.07 frequency: 500 Hz
neutral condition: insulated damping factor: 0.15

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.120

test no.			121	122	123	124	125	126	127	128	129	130
oscillogram no.			127	128	129	130	131	132	133	134	135	136
operating duty			O	O	O	O	O	O	O	O	O	O
voltage with open apparatus	phase-to-neutral	kV	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90
	phase-to-phase	kV	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
inrush making current		kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side	kV	-	-	-	-	-	-	-	-	-	-
	load side	kV	-	-	-	-	-	-	-	-	-	-
breaking current		A	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0	15.0 15.0 15.0
	average	A	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
maximum opening overvoltage	supply side	kV	-	-	-	-	-	-	-	-	-	-
	load side	kV	16.0	12.0	15.0	13.0	13.0	14.0	11.0	12.0	13.0	14.0
restrikes		no.	-	-	-	-	-	-	-	-	-	-
		phase	-	-	-	-	-	-	-	-	-	-
duration of	closing	ms	-	-	-	-	-	-	-	-	-	-
	opening	ms	-	-	-	-	-	-	-	-	-	-
	prearc	ms	-	-	-	-	-	-	-	-	-	-
	arc	ms	10	9	7	9	9	9	8	10	10	9

conditions of the apparatus after the tests: external parts as before the tests, internal parts not inspected.

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three-phase cable-charging current switching tests

rom duty with 28.0 A at 12.0 kV

test circuit conditions

circuit diagram see page: 11

supply circuit
power factor < 0.15 short-circuit current: 2 kA
frequency: 50 Hz
TRV : ac 21 kV t3 62 µs

load circuit
capacitance of capacitor banks: CV1 = 13 µF (insulated)
voltage decay at 100 ms after final arc extinction < 10 %

voltage with open apparatus: 6.90 kV phase-to-neutral 12.0 kV phase-to-phase

control voltage of operating devices for: closing - V
opening - V
motor - V

gas operating pressure for : operation - bar abs.
breaking 1.4 bar abs.

conditions of the apparatus before the tests : as after the test no.130

test	no.	131	132	133	134	135	136	137	138	139	140
oscillogram	no.	137	138	139	140	141	142	143	144	145	146
operating duty		C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O
voltage with closed apparatus	phase-to-neutral kV	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90
	phase-to-phase kV	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
inrush making current	kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side kV load side kV	19.0 19.0	17.0 17.0	17.0 17.0	16.0 16.0	18.0 18.0	16.8 16.8	17.7 17.7	16.7 16.7	16.0 16.0	16.4 16.4
breaking current	A	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0
	average A	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
maximum opening overvoltage	supply side kV load side kV	- 14.0	- 13.0	- 13.0	- 14.0	- 13.0	- 13.0	- 13.0	- 14.0	- 13.0	- 13.0
restrikes	no.	-	-	-	-	-	-	-	-	-	-
	phase	-	-	-	-	-	-	-	-	-	-
duration of	closing ms	-	-	-	-	-	-	-	-	-	-
	opening ms	-	-	-	-	-	-	-	-	-	-
	preare ms	-	-	-	-	-	-	-	-	-	-
	arc ms	8	7	6	9	7	9	9	7	7	8

conditions of the apparatus after the test:

cont'd.

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three-phase cable-charging current switching tests

cont'd

test	no.	141	142	143	144	145	146	147	148	149	150
oscillogram	no.	147	148	149	150	151	152	153	154	155	156
operating duty		C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O	C-O
voltage with closed apparatus	phase-to-neutral kV	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90	6.90 6.90 6.90
	phase-to-phase kV	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
inrush making current	kA	-	-	-	-	-	-	-	-	-	-
maximum closing overvoltage	supply side kV load side kV	17.9 17.9	17.0 17.0	16.4 16.4	19.0 19.0	19.0 19.0	16.0 16.0	16.0 16.0	18.5 18.5	16.0 16.0	16.0 16.0
breaking current	A	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0	28.0 28.0 28.0
average	A	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
maximum opening overvoltage	supply side kV load side kV	- 13.0	- 13.0	- 14.0	- 14.0	- 13.5	- 13.6	- 13.5	- 13.5	- 14.0	- 13.5
restrikes	no.	-	-	-	-	-	-	-	-	-	-
	phase	-	-	-	-	-	-	-	-	-	-
duration of	closing ms	-	-	-	-	-	-	-	-	-	-
	opening ms	-	-	-	-	-	-	-	-	-	-
	prearc ms	-	-	-	-	-	-	-	-	-	-
	arc ms	9	8	9	7	9	8	8	9	9	9

conditions of the apparatus after the tests: external parts as before the tests, internal parts not inspected

note after all the tests : the performance of the apparatus is considered satisfactory for the tests performed.

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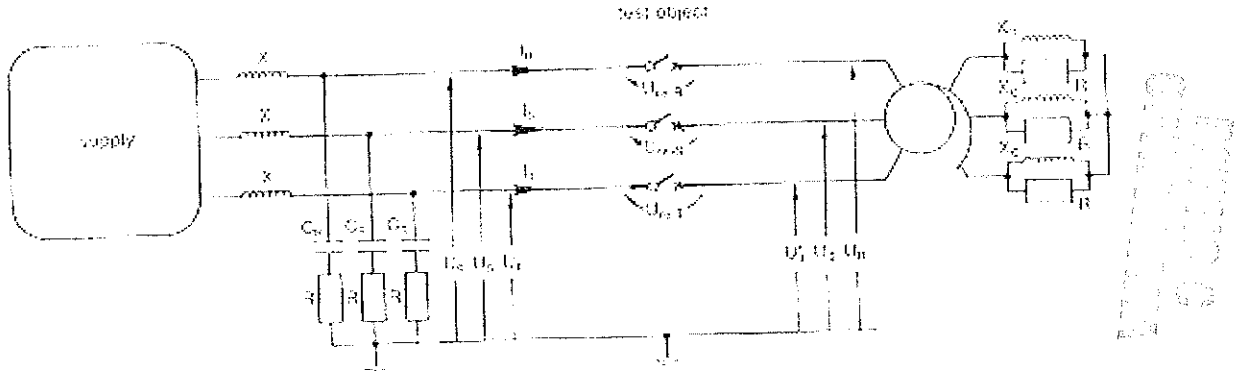
circuit-diagram



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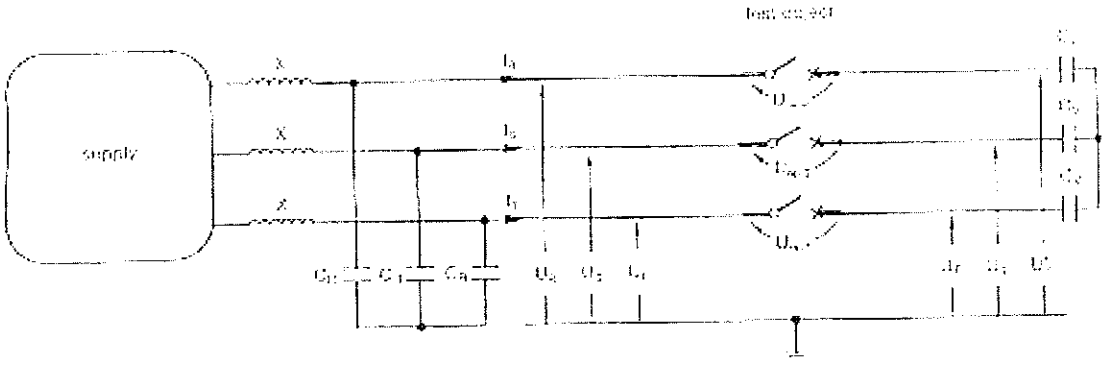
circuit-diagram



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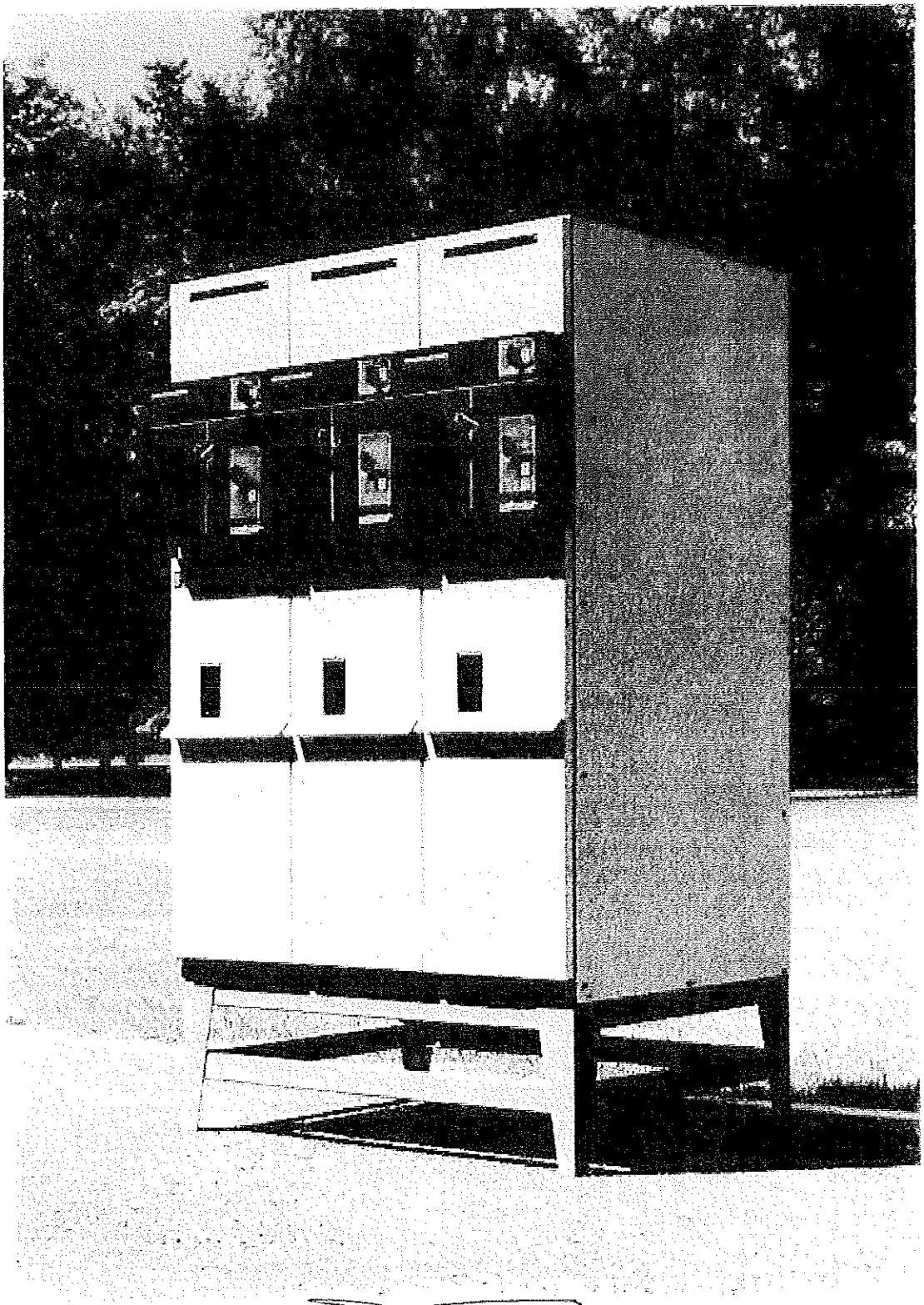

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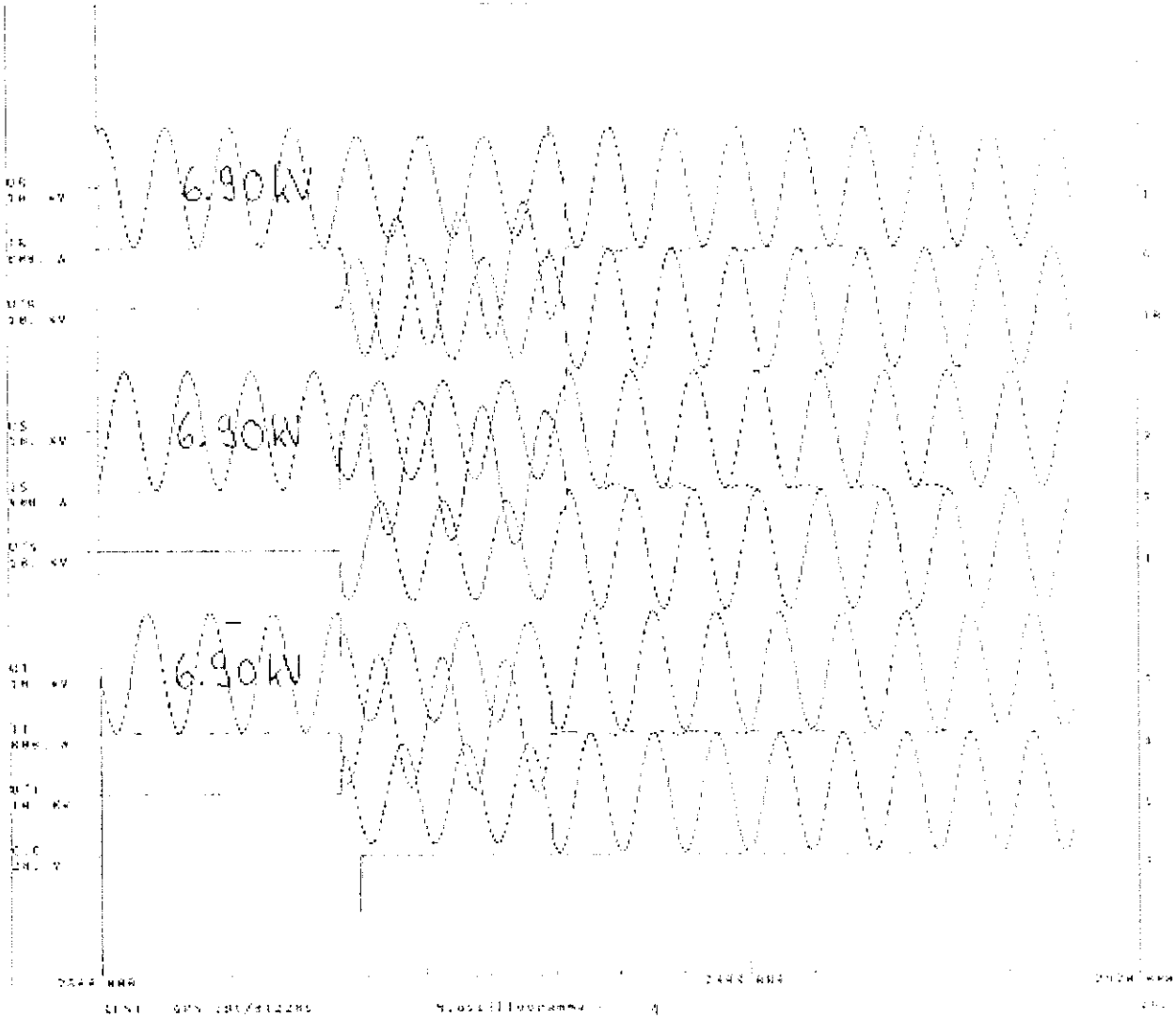
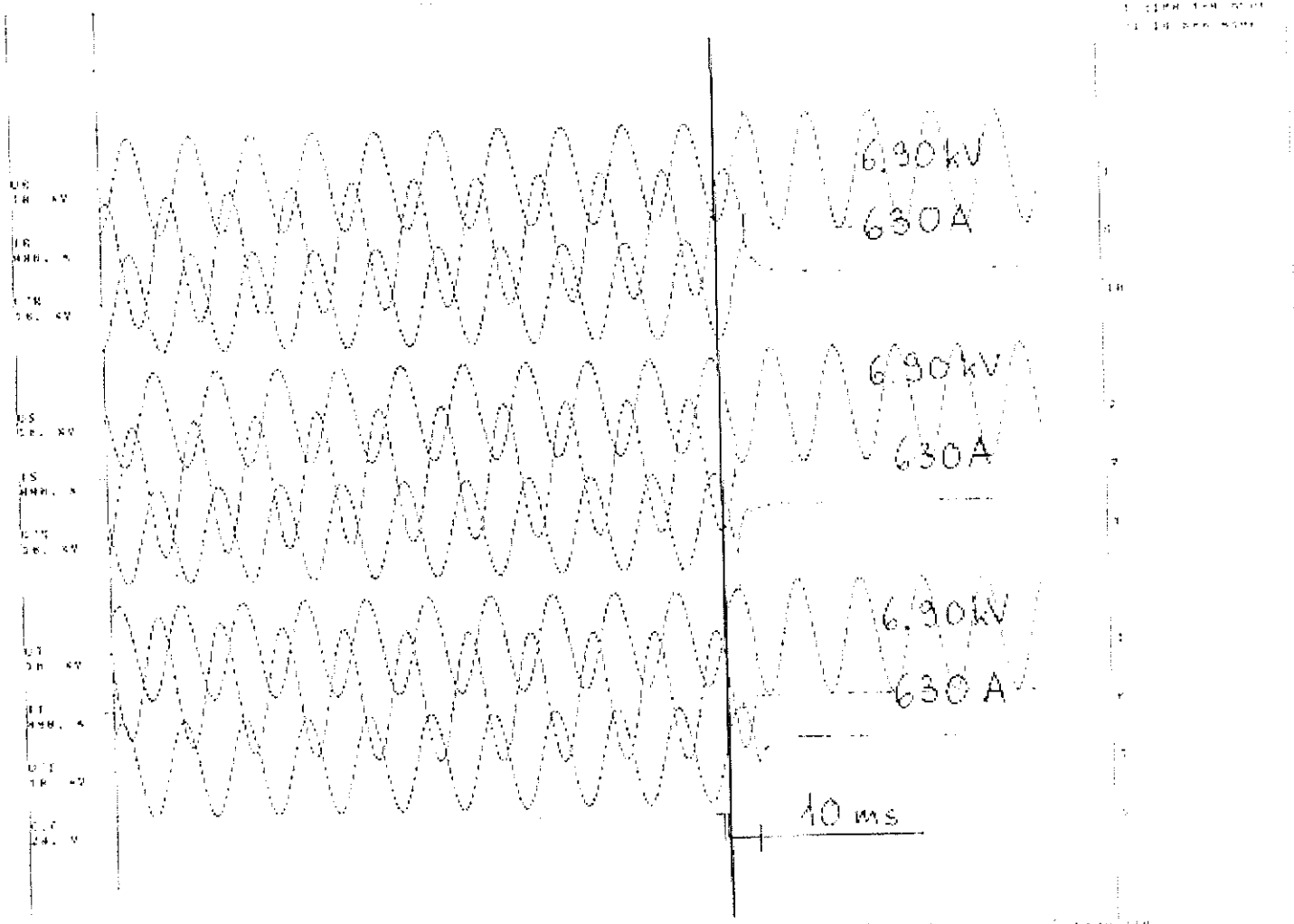

6.90kV
6.90kV
6.90kV


6.90kV
630A
6.90kV
630A
6.90kV
630A
10 ms