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SPECIFICATION FOR
DC AND AC SWITCHBOARDS

M.M. File 304
VOL 5455

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6	05.04.81	ZUN	TDR	JWR	SENT TO ESCOM.	B.P.E.
F	05.04.83	ZUN	TDR	JMC	UP DATED FOLLOWING EJ-6257 KGJ	
5	02.03.81	GAY	JOS	COL	SENT TO ESCOM	B.P.E.
E	20.1.81	GAY	JOS	COL	UP DATED FOLLOWING EJ 5683 KGJ	
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	13/08/80	GAY	JOS	COL	UP DATED FOLLOWING EJ 5022 KGJ	
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C	31/10/79	GAY	JOS	COL	UP DATED FOLLOWING EJ 3507 KGJ & EJ3397TKGJ	
2	31.07.79	GAY	FRA	AUG	SENT TO ESCOM	B.P.E.
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1	21.07.79	AUB	JOS	AUG	SENT TO ESCOM	B.P.E.
A	21.07.79	AUB	JOS	AUG	ORIGINAL ISSUE	

KOEBERG NUCLEAR POWER STATION



ESCOM

ELECTRICITY SUPPLY COMMISSION

**FRAMATOME — ALSTHOM ATLANTIQUE
SPIE BATIGNOLLES — FRAMATEG**

CONTRACT N. OPN 11229

CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE CGEE ALSTHOM		CONTRACTOR MEMBER DOC. No.	P 4 1 0 8 A 4 0 8 6 5													
DOCUMENT NUMBER	K B A 1 2 1 5 G 1 0 0 0 1												A A - - L T D				1/80
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DC AND AC SWITCHBOARDS

This specification is divided into the following sections :

1. Scope
2. Reference documents
3. Composition of equipment
4. Conditions imposed by the environment
5. Overall design
6. Design of sub-assemblies
7. Specifications relating to construction
8. Characteristics and performances
9. Verification and tests applicable to equipment
10. Description of equipments for 220 V AC switchboards
11. Description of equipments for 30 V DC, 48 V DC, 125 V DC and 230 V DC /switchboards
12. Standard diagrams
13. Quality Assurance
14. Miscellaneous
15. Labels

appendix 1 : standard diagram

DR.	GAY	18/8/80	Added § 15	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE CGEE ALSTHOM				
DR.	IX79	GAY	Added § 14 and Appendix 1						
DR.	GAYET	31.7.79	Mod. Title PAR. 10 & 11	CONTRACTOR MEMBER DWG N°	1 2 1 5 G 1 0 0 0 1 A A - - L T D 2/80				
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1. SCOPE

This specification relates to the design, manufacture and testing of 230 V, 125 V, 48 V, 30 V DC cubicles and 220 V single-phase AC cubicles of prefabricated cabinet switchboards with circuit breakers withdrawable on trays, installed in specially prepared premises.

The switchboards are basically destined to feed the 220 V A.C auxiliaries, (data processing systems and analog sensors) and the DC auxiliaries installed in thermal or nuclear power stations (25 V D.C. control of actuators ; 48 V D.C. for control and monitoring automation systems ; 30 V D.C. for regulation of automation systems ; 230 V D.C. for supply to motors and power inverters).

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2. REFERENCE DOCUMENTS

These switchboards will comply with the following documents :

- IEC 529 : classification of degrees of protection provided by enclosures
- IEC 157 : low voltage switchgear and control gear (circuit breakers)
- IEC 158 : low voltage control gear (contactors)
- IEC 439 : factory built assemblies of low voltage switchgear and control gear
- NFC 12 100 : worker's protection
- IEEE 323 (1971) : qualifying class IE electric equipment for nuclear power generating station
- IEEE 344 (1971) : trial use guide for seismic qualification of class 1 electric equipment for nuclear power generating station.
- IEC 269 : LV fuses

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3. COMPOSITION OF EQUIPMENT

The equipment is made up of a set of cubicles.

All the circuit breaking instruments are monobloc circuit breakers withdrawable on bi-pole (two breaking contacts) or tetra-pole (four breaking contacts) trays, manually controlled and fitted with tripping mechanisms.

According to the applied voltage and the required breaking capacity, the breaking contacts are used following fig. 1 or fig. 2.

Certain circuit breakers (incomer type) are fitted with a tripping coil and a mechanical set time mechanism.



fig. 1 : bi-polar

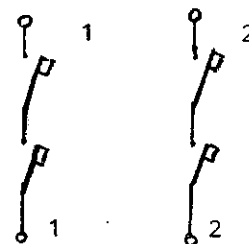


fig. 2 : tetra-polar

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4. CONDITIONS IMPOSED BY THE ENVIRONMENT

4.1. AMBIENT CONDITIONS

Certain conditions of use concerned with the environment and with utilisation are defined on the basis of influencing magnitudes and parameters of which the fields of variation correspond to different conditions.

Influencing magnitudes or factors may vary separately or simultaneously.

4.1.1. Ambient conditions out of service

This is applicable to equipment in transit or during storage or installation.

INFLUENCING FACTORS

FIELD OF VARIATION
OR ESTIMATIONS

a) Climate

- Temperature extreme values - 20 °C to + 40 °C
- Humidity Maximum 100 %
- Water spray in all directions
- Atmospheric pressure 860 to 1060 mbar
- Heat radiation and convection
- . supplementary temperature rise with respect to ambient temperature + 15 °C

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b) Corrosivity of air

- Dust quantities
- Salt saline air
- Gas (SO₂) nil
- Explosive mixtures nil

Packaging also takes account of environmental conditions specific to the mode of transport utilised.

4.1.2. Ambient conditions in service

The switchboards are installed in premises which are normally ventilated and which may be heated.

INFLUENCING FACTORS

FIELD OF VARIATION OR ESTIMATIONS

a) Climate

- Temperature
 . extreme values + 5 °C to + 35 °C
- Humidity
 . maximum 70 %
- Water nil
- Atmospheric pressure 860 to 1060 mbar
- Heat radiation and convection negligible

b) Corrosivity of air

- Dust negligible
- Salt traces
- Gas (SO₂) traces
- Explosive mixtures nil

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c) Mechanical stresses

- Maximum speed of air 0 to 0,5 m/s
- Vibrations of mountings
 - . frequency 10 to 2000 Hz
 - . amplitude of movement
 - at 50 Hz (peak to peak) (1) 0 to 25 μ m
- Impacts 0 to 6 joules
- Seismic level
 - . according to the 7,00 m or 11,50 m floor response spectrum for the switchboards LBA, LBB, LBC, LBD, LBE, LBF, LCA, LCB
 - . according to the 0,00 m floor response spectrum for the switchboards 9 LBK, 9 LCG (Emergency diesel generating switchboards)

4.2. MAINTENANCE

Maintenance inspections of circuit breaking appliances are only carried out after the number of operations specified below, performed at a current equal or less than the set value of short circuit protection devices.

Circuit breakers are able to break current, the value of which is equal to a presumed short circuit current value at least three times without inspection.

Withdrawable equipment is designed to be able to perform 500 operations during 30 years without any damage which might lead to reduction of the electrical and mechanical qualities of the connector of the withdrawable equipment.

4.3. INSTALLATION

The cubicles are designed to compose switchboards installed of floors. The power and control cables enter and leave the switchboard either from above or from below.

Cubicles are such that the total height of the switchboard does not exceed 2.300 m with respect to the floor.

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Only the front of the switchboards are accessible, both for normal movements of operation and for maintenance.

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(1) Amplitudes are specified at constant movement below 50 Hz and at constant acceleration above 50 Hz. Basic values of amplitude and acceleration are the values obtained at 50 Hz for an amplitude of 25 µm.

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5. OVERALL DESIGN

Circuit breakers with their protection devices grouped in cubicles form a switchboard with one set of busbars only. Several types of frames may be used to make up cubicles. The number of different types shall be reduced as much as possible.

Switchboards are of the metal-casing type. They may be mounted back to a wall or back-to-back, and are entirely accessible from the front except switchboards LBC, LBD, LBE, LBF, LMA which are positioned such that access at the rear is adequate for earthing the busbars.

5.1. CUBICLES

Each cubicle is made up of :

- one horizontal busbar compartment
- one vertical busbar compartment
- one cable connection compartment
- one compartment containing instruments (circuit breakers and protection devices)

Each cubicle is separate from the adjoining cubicles.

Circuit breakers are fitted on the basic frame with a maximum of four on each shelf, depending on the calibre of instrument, on 220 V AC switchboard.

A metal cladding is mounted on the base frame to form a cabinet. A compartment at the top front is designed to accomodate voltage relays as well as measurement instruments. Voltmeters are provided with fuses. This front compartment is insulated from the busbars. The compartment is either fitted with a door which carries the measurement instruments or with a dismantable panel with windows.

The circuit breaker lead-out strips are connected to the cable connection compartment by means of perforated bars secured to an insulating support, or by means of cables of suitable cross-section connected to a terminal plate.

The circuit breaker lead-in strips are connected to the vertical busbars by bars or cables of suitable cross-section.

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The door of the cable connection compartment is closed by means of lock and key.

The door of the instrument compartment easily provides a verification of the circuit breaker position.

This door is closed by lock and key.

The earth detection devices may be either fitted in the top compartment with the voltage relays or assembled on a panel in a separate cubicle.

The frame earths of the cubicle are connected to the switchboard main earthing conductors.

5.2. MECHANICAL STRENGTH OF CONTROLS AND LOCKING DEVICES

The mechanical strength of locking devices is greater than that of the mechanical controls and transmission parts so that any distortion or rupture of a part does not lead to reduction of safety of personnel.

5.3. CONDITIONS RELATING TO SAFETY

The use of switchboards in a metal casing ensures protection for personnel against contact with live sections and moving parts and protection of equipment against mechanical damage.

Suitable compartmentation and locking systems automatically ensure safety of personnel. In particular, the protective device may be padlocked when a circuit breaker is withdrawn.

The following is possible during normal daily operation and when working on instruments :

1. Personnel may effect :

- normal operations, in particular, movement of circuit breaking instruments, and withdrawal of circuit breakers,
- operations relating to safety, in particular, short circuiting and earthing,

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- verification during operation of protection, control and monitoring instruments circuits without any resulting reduction of the degree of protection.

2. The methods used to ensure that the above conditions are respected are such that they cannot be rendered ineffective by any manual and unforeseen movement of the operator.

5.4. DEGREE OF PROTECTION (IP 317 of standard IEC 529)

5.4.1. Degree of protection of personnel

Protection when in operating position shall be complete and in particular, all exterior surfaces of switchboards shall be provided with a degree of protection of which the first figure shall be at least equal to 3 in accordance with standard IEC 529.

This degree of protection shall be maintained after a circuit breaker has been withdrawn from a cubicle, for example by closing a door or placing a front panel.

The ventilation or exhaust orifices as well as lateral orifices of doors and panels are installed such that the release of gas or vapour under pressure does not constitute a danger for operators working in the immediate vicinity of the cubicle.

5.4.2. Degree of protection of equipment

The exterior surfaces of switchboards are designed so that it is not possible to insert a wire of thickness greater than 2.5 mm, in order to obviate any penetration of foreign bodies.

Each cubicle of a switchboard is designed to obviate propagation of an arc ; openings necessary for ventilation are, in particular, specially designed for this purpose.

The use of withdrawable circuit breakers on trays in cabinets ensures protection of equipment against mechanical damage.

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5.5. EARTHQUAKES

The equipment will be qualified to withstand a SSE.

This qualification will be performed according to IEEE 344 1971. The following switchboards : 1.LBA, 1 LBB, 1 LBC, 1 LBD, 1 LBE, 1 LBF, 9 LBK, 1 LCA, 1 LCB, 9 LCG, will be qualified.

6. DESIGN OF SUB-ASSEMBLIES

6.1. MANUALLY-OPERATED CIRCUIT BREAKERS

Circuit breakers are designed as follows :

- to feed actuator controls when operating on 230 V DC.
- to feed actuator controls when operating on 125 V DC.
- to feed relay and valve equipment and alarm circuits when operating on 48 V DC.
- to feed regulation automation systems when operating on 30 V DC
- to feed the data processing system and the analog sensors when operating on 220 V AC.

The circuit breakers are of withdrawable type fitted on bases.

An auxiliary contact provides for a remote triggering signal if the circuit breaker operates on electrical defect.

Mechanical locking devices are designed to :

- prevent plugging-in or withdrawal of circuit breakers when in closed position,
- prevent closure of circuit breakers if they are not completely plugged-in.

6.2. CONTROL AND CHECKING INSTRUMENTS

Switches, push-buttons and lamps are of the same type as those used on the reference power plant.

Colours of lamps are as follows :

- green = circuit breaker open
- red = circuit breaker closed
- white = circuit breaker faulty

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A control device enables a permanent measurement of the switchboard insulation.

A voltage control relay, signalling min. and max. U, is fitted to the switchboard.

6.3.. BUSBARS AND AUXILIARY CONDUCTORS

6.3.1. BUSBARS

In each set of cubicles which form a switchboard, the main busbars are horizontal and comprise vertical branches composed of bars which feed circuit breakers superimposed in the cubicles.

The vertical branches are designed to obviate propagation of arcs between the horizontal bars and the casing.

The main busbar is protected by bolted plates.

Cross-sections of conductors are constant over the whole length of any one horizontal busbar and over the whole length of any one vertical branch.

The horizontal busbar is designed to withstand maximum current intensity when operating continuously and short circuit current intensity for one second.

The vertical branches are designed to withstand, when operating continuously, maximum current intensity corresponding to the sum of rated intensities of all the outgoings fed by the branch.

They are also designed to withstand short circuit current intensity for one second.

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6.3.2. Auxiliary conductors

The auxiliary conductors carry the direct current, feeding the auxiliary relays and control equipment.

The auxiliary conductors are of constant cross-section and designed for the amperage which they carry, they are fitted in a separate and undivided compartment located at the top of the switchboard.

6.4. CABLE CONNECTION COMPARTMENT

The cable connection compartment of circuit breakers of one cubicle is common to all the circuit breakers.

On the other hand, partitions are provided between the connection compartments of circuit breaker cables of adjacent cubicles.

Routing of cables inside these cubicles is designed to leave access to cable ends of other lead-outs/and to connection devices for control wiring and any other item of equipment to which access must be easy.

Compartment walls are fitted with devices for securing cables.

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6.5. INSTRUMENT COMPARTMENT

This compartment is located on the front of the switchboard and is accessible.

It is designed for simple access to the instruments fitted inside it. Access to the interior of the compartment is only possible after opening a door by means of a key.

6.6. EARTH CONDUCTOR

One main, non-insulated, copper bar, earth conductor links all the circuits and metal frames which have to be earthed.

It is able to withstand a current of intensity equal to maximum short circuit intensity for one second.

At each end of a switchboard composed of a number of cubicles, this conductor comprises a connection strip which serves to connect with the power station main earth circuit.

Electrical continuity of frame earths is ensured by bolting and welding of compartment casings and of frames.

The frame earths of doors and non-bolted hinged panels are connected to those of the static sections by means of flexible metal braid.

6.7. PROTECTION DEVICES OF CIRCUIT BREAKERS

6.7.1. Incoming circuit breakers

The protection devices of incoming circuit breakers of the switchboard are fitted with a mechanical timing device to ensure selectivity at values of approximately :

- 100 ms for the battery input.
- 25 ms for the rectifier input.

6.7.2. Outgoing circuit breakers

Protection devices of the switchboard outgoing circuit breakers operate instantaneously.

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7. SPECIFICATIONS RELATING TO CONSTRUCTION

7.1. MATERIALS

Materials are exempt from any fault of a progressive nature which might prejudice their performance over a period of time as defined in the purchase order, item: "garanties" between manufacturer and contractor.

7.2. PROTECTION AGAINST CORROSION AND PAINTWORK

Switchboards are carefully protected against corrosion by corrosion-proof materials or by treatment of component parts.

a) Coating composition

- Epoxy powder, colour standard RAL 7023
- Water-soluble lac, blue purple coloured.

b) Powdering

Three stages processing tunnel :

- degreasing, treating with phosphates during 2,5 mn at 70 °C
- cold rinsing
- hot rinsing during 1 mn at 50 °C

Drying-room : 5 mn at 140 °C

Powdering : automatic application by robots and manually by two posts (coat thickness : 50 microns minimum)

Calcining drying-room during 15 mn at 230 °C

7.3. INSTALLATION

Insulation is provided by the surrounding air without a screen.

Waivers may however be granted for the use of insulating screens of small size to provide local supplementary insulation.

Materials used for all insulating parts are non fire propagation materials.

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7.4. MOBILE SECTIONS

Items of equipment are always interchangeable with other items of the same type. The component parts of one type of equipment are interchangeable.

A guide systems is provided in heavy equipment for insertion of a circuit breaker into the static section so that it will take up the operating position without difficulty, even when lighting is defective.

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7.5. IDENTIFICATION MARKING OF COMPONENTS

- Each switchboard and each circuit breaker is marked by a plate screwed or rivetted on the static section.
- Each busbar element is marked
- Each relay box and each control, protection, measurement or metering instrument is fitted with a plate on which is marked the symbol used on the corresponding diagram.

7.6. IDENTIFICATION MARKING ON CONDUCTORS

Each conductor bears a label on which is marked its identification marking.

8. CHARACTERISTICS AND PERFORMANCES

8.1. RATED CHARACTERISTICS

Influencing factors, in relation to ambient conditions and effective power supply, vary within the normal field of variations, and performances of columns are as follows :

Direct current circuits and alternating current phases are insulated from earth.

8.1.1. 230 V DC power supply

Rated operating voltage	230 V
- normal field of voltage variations	237 - 250 V
. ripple factor	1 %
- exceptional field of voltage variations	200 - 283 V
. ripple factor	2 %
Rated insulation voltage	500 V
Max. current on busbars under continuous operation.	800 A

8.1.2. 125 V DC power supply

Rated operating voltage	125 V
- normal field of voltage variations	128 - 135 v
. ripple factor	1 %

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- exceptional field of voltage variations	o - 153 v
. ripple factor	2 %
Rated insulation voltage	500 V
Max. current on busbars under continuous operation	800 A

8.1.3. 48 V DC power supply

Rated operating voltage	48 V
- normal field of voltage variations	50 - 53 V
. ripple factor	1 %
- exceptional field of voltage variations	0 - 60 V
. ripple factor	2 %
Rated insulation voltage	500 V
Max. current on busbars under continuous operation	800 A

8.1.4. 30 V DC power supply

Rated operating voltage	30 V
- normal field of voltage variations	30 - 32 V
. ripple factor	1 %
- exceptional field of voltage variations	0 - 37 V
. ripple factor	2 %
Rated insulation voltage	500 V
Max. current on busbars under continuous operation	200 A

8.1.5. 220 V AC power supply

Rated operating voltage	220 V single phase
- normal field of voltage variations	210 V to 230 V
- exceptional field of voltage variations	200 V to 242 V
Distortion factor	≤ 5 %
Rated frequency	50 Hz
Rated insulation voltage	500 V
Max. current on busbars under continuous operation	200 A
Normal field of frequency variation	49.5 Hz to 50.5 Hz
Exceptional field of frequency variation	47 Hz to 51 Hz

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9 - VERIFICATION AND TESTS APPLICABLE TO EQUIPMENT

9.1 - VERIFICATION AND TESTS APPLICABLE TO NEWLY BUILT EQUIPMENT (TYPE TESTS)

The verifications and tests object of the present chapter have been carried out on the "newly built" switchboards of each type. Corresponding type test certificates will be verified as stated in clause 9.2.1.

All electrical values which are considered as characteristics of the equipment operation (voltage, current...) are measured by calibrated measurement apparatuses and transformers, having an accuracy class less or equal to 1.

Equipment tested includes at least three columns housing :

- the busbars compartment corresponding to the cells, tested with two sections at least assembled by fishing,
- the fix elements of the tested cells, and particularly the protection part,
- a circuit-breaker of each type.

The tests include :

- 1 - test applied to the whole switchboard
- 2 - test applied to the components.

The components are tested as specified in the relevant standards or specifications. Circuit-breakers of the various type are in particular subject to testing. As a rule, these tests are applied to elements that are already mounted in the switchboard concerned. Tests may however be applied to separate elements when the switchboard itself is considered as having no influence on their results.

"Where Type Test Certificates exist, they shall be made available to Escom for examination and consideration shall be given to accept these results in lieu of further Type Testing being required.

9. .1 Tests relating to the whole switchboard

All tests are carried in their listing order, to equipment mounted in the switchboard, except as concerns flame non-propagation test which is carried out separately on insulating elements fitted in the switchboard.

D	8/8/80	GAY	Modified § 9.1	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE	
	31X79	GAY	Modified text § 9...		CGEE ALSTHOM	
		GAYET	17.779 Mod. title par. 9...	CONTRACTOR MEMBER		
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P 4 1 0 8 A 4 0 8 6 5	
DWG N°			KBA 1 2 1 5 G 1 0 0 0 1	AA	L T D	21/80

9.1.1.1. Test of earthquake withstand capability

See document N° KBA 00 22 E 06 950 Rev. 1

9.1.1.2. Verification of degree of protection of personal and protection of equipment against penetration of solid foreign bodies :

These tests are carried out in conformity with IEC 529 standard.

9.1.1.3. Verification of mechanical operation

9.1.1.3.1. Tests on switchboard components

These tests include :

- control of the operations of putting in service and circuit-breakers withdrawal. A control of 500 operations is carried out on one of the switchboard circuit-breakers,
- control of the safety devices (interlocking) and checking of their mechanical withstand.

9.1.1.3.2. Fuse-holders withstand test

The fuse holders are submitted without any damage to 100 fuses withdrawals and 100 successive drawings in.

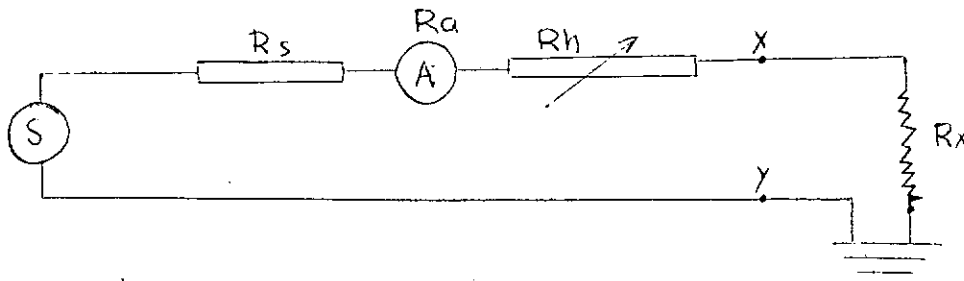
9.1.1.4. Short-circuit withstand test

Tests are carried out in conformity with IEC 439 Standard.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE										
				CONTRACTOR MEMBER	CGEE ALSTHOM										
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P	4	1	0	8	Λ	4	0	8	6	5
DWG N°		KBA		1	2	1	5	G	1	0	0	0	1	AA - - L T D	
														22/80	

9.1.1.5 - Verification of electrical continuity between accessible metal earth frames and earthing circuits

These tests are carried out in conformity with IEC 298 standard as per the following diagram :



The sum of the internal resistance of the source (R_s), of the ammeter resistance (R_a) and of the withdrawable resistance (R_h) is equal to 0.4 Ohm.

The electro-motive force of source "S" (no-load voltage) is 1.6 V and the resistance R_h is adjusted so that current is equal to 4 A when terminals X and T are short-circuited. When this condition is satisfied, terminal Y is connected to the switchboard earthing terminal, and terminal X is connected successively to all accessible metal frames. Continuity between these frames and the earthing circuit is assumed to be satisfactory when the ammeter indicates a current at least equal to 2 A (resistance between frame and earth is less than 0.4 Ohm).

The voltage source may be composed of :

- a transformer rheostat supplied with alternating current and adjusted to deliver a voltage of 1.6 V off-load,
- a cell of a cadmium-nickel battery,
- a cell of a lead battery. In this last case, continuity is assumed to be satisfactory when current is equal to at least 2.25 A.

9.1.1.6 - Verifications of limits of temperature rise

These tests are carried out on compliance with IEC 439 standard for the switchboards and IEC 157 standard for the circuit-breakers.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE													
				CONTRACTOR MEMBER	CGEE ALSTHOM													
REV	DR. by	DATE	MODIFICATIONS	DWG No.	P	4	1	0	8	A	4	0	8	6	5			
DWG No.		KBA		1	2	1	5	G	1	0	0	0	1	AA	L	T	D	23/80

9.1.1.7 - Verification of dielectric qualities

These tests are carried out in conformity with IEC 439 standard for the switchboards IEC 158, IEC 470 and IEC 157 standards for the components.

9.1.1.8 - Verification of non-propagation of flame

These tests are carried out on the insulating parts contributing to the constitution of the switchboard and are subject to the verifications specified in HN 60 E01 (EDF standard).

9.1.2 - Tests of manually operated circuit-breakers

These tests are carried out in compliance with IEC 157 standard.

9.1.2.1 - Verification of circuit-breakers operation

This verification is carried out as per item 8.2.6 of IEC 157 standard.

9.1.2.2 - Circuit-breakers mechanical withstand test

These tests are carried out in compliance with the recommendations of item 8.2.6 of IEC 157 standard, and circuit-breakers are in conformity with chart VI of item 7.5.

9.1.2.3 - Verification of the circuit-breakers closing power and interrupting capacity

The tests are carried out in accordance with the specifications of item 8.2.4 of IEC 157 standard.

9.2 - VERIFICATION AND TEST APPLICABLE TO EQUIPMENTS "IDENTICAL TO NEWLY BUILT EQUIPMENT" (ROUTINE TESTS)

9.2.1- Verification and tests in works

The type test report will be verified before starting of the acceptance tests and certificate reference will be noted on the acceptance test report.

- Routine tests:
- Dielectric test
 - Checking operation by random test
 - Checking of earth continuity

The acceptance criteria of the auxiliary devices will be given on the subcontractor conformity certificates delivered with the checked panels in the conformity file. The routine test certificates will be included in the O.A. package.

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE					
			CONTRACTOR MEMBER		CGEE ALSTHOM					
REV	DR. by	DATE	MODIFICATIONS		DWG N°		P 4 1 0 8 A 4 0 8 6 5			
	18/8/80	GAY	Modified § 9.2.1							
	GAYET	31.7.79	Mod. title and text par. 9.2							
DWG N°		KBA		1 2	1 5	G 1 0	0 0 1	AA		L T D 24/80

9.2.2 - Verification and tests of switchboards on site

These tests are carried out after assembly and adjustment of all the cubicles which form the switchboard.

9.2.2.1 - Mechanical tests

These tests comprise verification of the positioning, the withdrawal and the handling systems of the circuit breakers, and of their safety (locking devices).

9.2.2.2 - Dielectric tests of main circuits

These tests are carried out in conformity with Standard IEC 439 on all the cubicles which make up the switchboard.

9.2.2.3. Dielectric tests of control and auxiliary circuits

These tests are carried out in conformity with Standard IEC 439 article 8.2.2.4.2 on all the cubicles which make up the switchboard.

9.2.2.4. Verification of electrical continuity between accessible metal frames and earthing circuits.

Tests are carried out on all the switchboards and cover the specifications of paragraph 9.1.15

9.2.2.5. Tests of operation of protection instruments

These tests are limited to verification that the protection instruments operate correctly within the limits specified in corresponding specifications.

9.2.3. VERIFICATIONS AND TESTS OF CIRCUIT BREAKERS ON SITE

Operational tests and dielectric tests are carried out in conformity with standard IEC 157.1.

- operational test : article 8.2.6. of the standard
- dielectric test : article 8.2.3. of the standard

9.2.4. TESTS ON SELECTED SAMPLES

These tests comprise all or part of the tests of first manufacture equipment.

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE							
					CGEE ALSTHOM							
18/8/80	GAY	Modified	9.2.2.3		CONTRACTOR MEMBER							
REV	DR. by	DATE	MODIFICATIONS		DWG N°		08 - 0 0 6 5					
DWG N°		KBA		1 2	1 5	G	1 0	0 0 1	AA	- -	L T D	25/80

10. DESCRIPTION OF EQUIPMENTS FOR 220 V AC SWITCHBOARDS

10.1. GENERAL

The cubicles type N.486 are made of sheet steel plates supporting the incoming load break switches, the circuit breakers for the outgoing protection and the rectifying transformers.

The measuring instruments as well as the protection relays are installed on the front part of these cubicles.

The cubicles can be placed back to wall, the cable connection being realized from the front.

10.2. DEFINITION OF EQUIPMENT

The definition of the different types of equipment takes into account the following data :

- maximum and minimum values of the short circuit currents on different parts of the plant
- through currents of each equipment
- operation safety of the equipments; in particular, for the (KIT) computers, the speed of tripping on short circuit must avoid loss of voltage for more than 10 ms.

The types of equipments so defined are as follows :

- Inverter incoming (equipment type J 0)
JT 200 double pole load break switch without release
- Outgoing 220 V A.C. (equipment type K1 to K7)
ELFA G 2 double pole circuit breaker equipped with its own direct thermal-magnetic release. The instantaneous tripping thresholds are given in the paragraph 10.2.1. : "equipment characteristics".

The operating curves of the thermal element are given in the leaflets 10.4.1. to 10.4.3.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE									
				CONTRACTOR MEMBER	CGEE ALSTHOM									
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P	1	0	A	4	0	8	6	5	
DWG N°				KBA	1	2	1	5	G	1	0	0	0	1
					AA	-	-	L	T	D	26/80			

- Outgoing 48 V or 30 V D.C. (equipment type J1 or J4)

DT 200 double pole circuit breaker equipped with its own direct thermal-magnetic releases. The instantaneous tripping thresholds are given in the leaflet 10.2.1. : "Equipment characteristics".

The operating curves of the thermal element are given in the leaflets 10.4.9. to 10.4.10.

- NOTE - The magnetic releases of the DT 200 C.B's are not adjustable
- All **the** circuit breakers are double pole and hand operated
 - The thermal-magnetic releases of the ELFA circuit breakers are not adjustable

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
				CONTRACTOR MEMBER	CGEE ALSTHOM															
REV	DR. by	DATE	MODIFICATIONS	DWG N.	1	0	8	-	0	8	6	5								
DWG No.			KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	27/80

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10.2.1

EQUIPMENT CHARACTERISTICS

TYPE OF APPARATUS	TYPE OF EQUIP-MENT	RATED USING VOLTAGE V	APPLIED CURRENT AT 60° C <small>(ambient temperature)</small>	THERMAL TRIPPING SETTING CURRENT A <small>AT 60° C (ambient temperature)</small>	MAGNETIC RELEASE		MINIMUM SECTION OF CABLES TO BE CONNECTED
					SETTING CURRENT A	LIMITS ON OPERATING ZONE * <small>mini A maxi A</small>	
INCOMER 220 V AC							
JT 200	JO	250	100	WITHOUT	WITHOUT		1 (2 x 35 ²)
FEEDER 220 V AC							
ELFA G2 - 3A	K1	220	2.5	2.5	27	21	1 (2 x 2.5 ²)
ELFA G2 - 6A	K2	220	5	5	54	42	1 (2 x 2.5 ²)
ELFA G2 - 10A	K3	220	8	8	90	70	1 (2 x 6 ²)
ELFA G2 - 15A	K4	220	12	12	75	60	1 (2 x 6 ²)
ELFA G2 - 20A	K5	220	16	16	100	80	1 (2 x 16 ²)
ELFA G2 - 25A	K6	220	20	20	125	100	1 (2 x 16 ²)
ELFA G2 - 32A	K7	220	25	25	106	80	1 (2 x 16 ²)
30 V and 48 V RECTIFIER OUTLET							
DT 200 RH	J1	125	12.5	12.5	165	130	1 (2 x 16 ²)
DT 200 RH	J4	125	42	42	565	450	1 (2 x 70 ²)

* These values are given at setting current $\pm 22\%$

G	ZUN	28.9.83	CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE			
	GAY	20.181	Modified J1 and J4		CGEE ALSTHOM			
	GAYET	18.8.80	Added K6 mag. release value		P 4 1 0 0 1 A 4 0 8 6 5			
REV	DR. by	DATE	MODIFICATIONS		DWG N°			
DWG N°			KBA 1 2 1 5 G 1 0 0 0 1		AA - - LTD 28/80			

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10.2.2

EQUIPMENT GRID

The incoming and outgoing equipments are placed on a plate in a 486 cubicle which has 85 coefficients (K). A number of coefficients is given to each supporting plate and it is consequently possible to define the maximum possibilities of equipment in a cubicle.

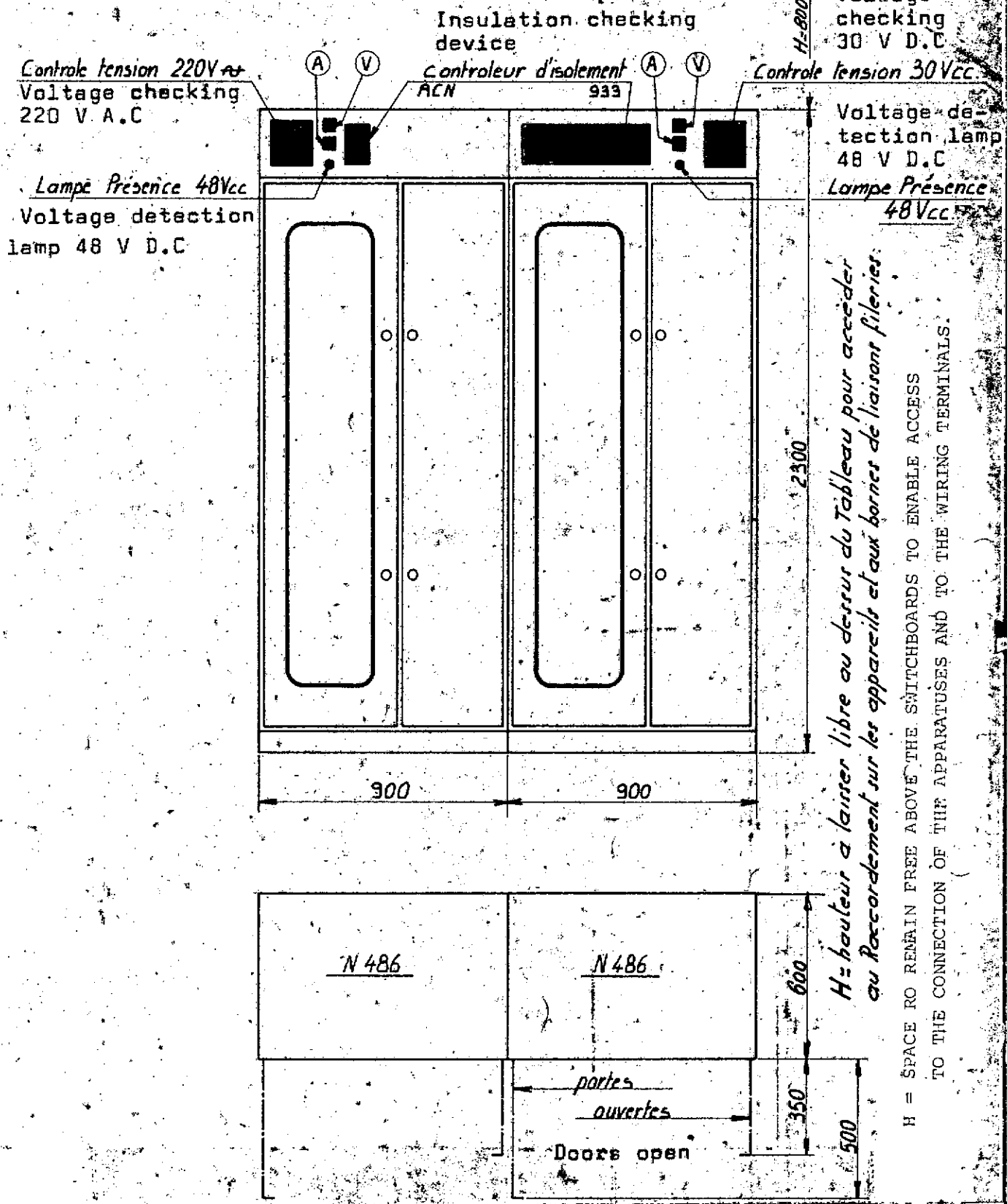
Supporting plates have been designed to realize special assemblies. Please refer to detail hereunder.

Equipment	Switchgear	K number	Installation on plate
Inverter incomers	JT 200 (JO)	17	○ ○ ○
AC feeder	ELFA (K1 to K7)	14	○ ○ ○ ○
DC feeder	DT 200 (J1 or J4)	17	● ● ●
AC incomer + feeder	JT 200 (JO) + ELFA (KI to K7)	17	○ ○ ○
DC feeder + rectifier 500 VA	DT 200 (J1 or J4) + rectifier	23	▽ ●
Rectifier 500 VA	rectifier	14	▽
Rectifier 1000 VA		27	▽
Relaying compartment		13	▭

REV	DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE CGEE ALSTHOM	
	05/4/83	ZUN	Modified	CONTRACTOR MEMBER	P 4 1 0 0 A 4 0 8 6 5	
	18/8/80	GAY	Modified schedule	DWG No.	K B A 1 2 1 5 G 1 0 0 0 1 A A - - L T D 29/80	

OVERALL DIMENSIONS OF THE CUBICLES

10.2.3



H = hauteur à laisser libre au dessus du Tableau pour accéder au Raccordement sur les bornes de liaison filaires.

H = SPACE TO REMAIN FREE ABOVE THE SWITCHBOARDS TO ENABLE ACCESS TO THE CONNECTION OF THE APPARATUS AND TO THE WIRING TERMINALS.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG No.	P	4	1	0	3	A	4	0	3	6	5						
DWG No.				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	30/80

PI 01

LAY-OUT ON "HALFEN" SECTIONS

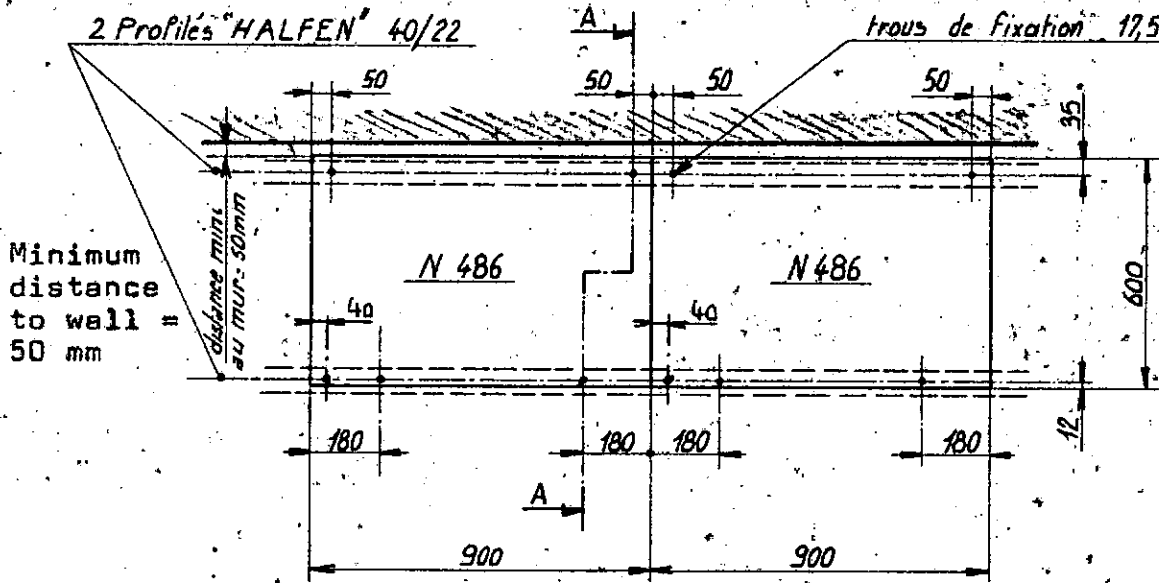
10.2.4

2 "Halfen" sections 40/22

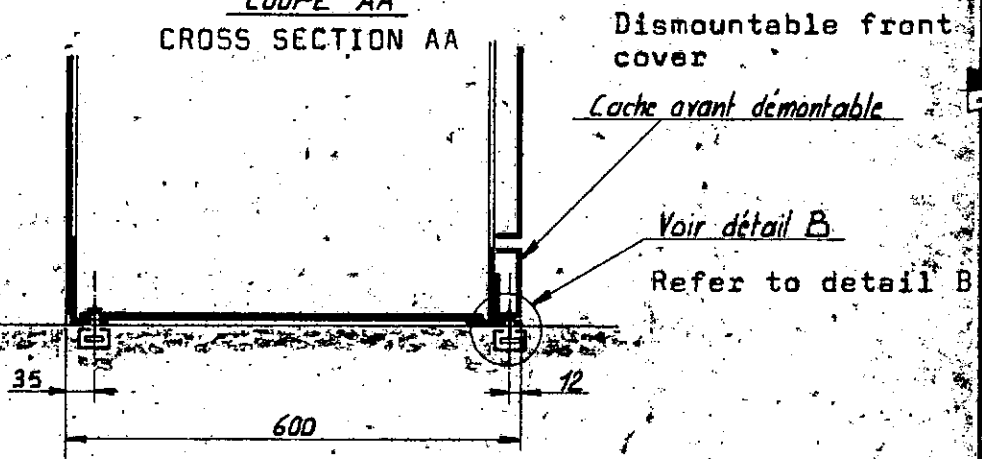
2 Profilés "HALFEN" 40/22

Fixing holes 17.5 X 32

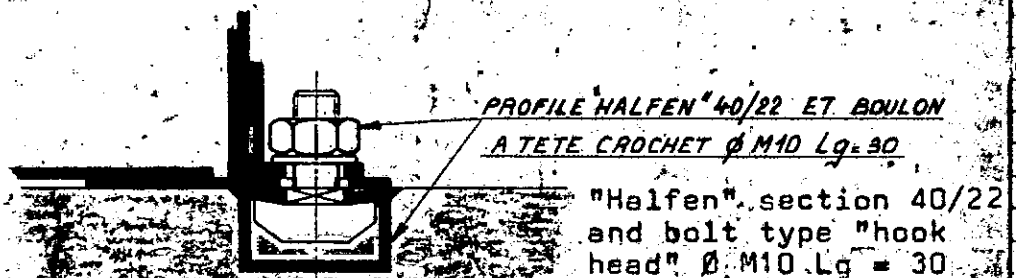
trous de fixation 17,5 x 32



COUPE AA
CROSS SECTION AA



DETAIL B



			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
			CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	P 4 C S A 4 0 8 6 5																
DWG No.			KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	31/80

10.3. GENERAL CHARACTERISTICS

10.3.1 ELECTRICAL CHARACTERISTICS

10.3.1.1 Rated

- rated service voltage : 220 V single phase A.C
- maximum exceptional voltage : 242 V single phase A.C
- insulation rated voltage : 500 V for main circuits
- rated current in continuous duty
 - . main busbar 400 A
 - . tee-off busbar 200 A
- short time permissible current : 2000 A/1 second

10.3.1.2. Compliance with standards

a) Cubicles

- IEC 439 : L.V. metalclad unit
- NFC 12.100 : Decree dated 14.11.62 concerning the workers' protection

b) Switchgear

- IEC 157-1 : general use circuit breaker
- IEC 51 : measuring instruments

c) Protection degree

According to standard IEC 529 : IP 317

10.3.2. Weight and dimensions characteristics

Please refer to leaflets 10.2.3. - 10.3.

10.3.2.1. Main dimensions

- Height : 2300
- Width : 900
- Depth : 600

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE				
			CONTRACTOR MEMBER		CGEE ALSTHOM				
REV	DR. by	DATE	MODIFICATIONS		P 4 1 0 0 1 A 4 0 8 6 5				
DWG No.			KBA 1 2 1 5 G 1 0 0 0 1		AA - - L T D 32/80				

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10.3.2.2. Dimensions of supporting plates

- a) for inverter incomers Height : 400
Width : 500
Depth : 260
- b) for feeder with ELFA H = 315 W = 500 D = 180
- c) for feeder with DT 200 H = 400 W = 500 D = 260
- d) for DT + rectifier 500 VA
H = 520
W = 500
D = 260
- e) for ELFA + rectifier 500 VA
H = 315
W = 500
D = 250
- f) for rectifier 1000 VA
H = 620
W = 500
D = 300
- g) for relaying
H = 300
W = 500
D = 120

10.3.2.3. Approximate weights

- of the columns entirely equipped : 350 kg about
- of the supporting plates : from 15 to 20 kg about

10.3.3. Transport characteristics

The weights and dimensions of the cases will be given in detail for each particular order.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG N.	P	4	1	0	0	4	0	8	6	5							
	ZUN	5/4/83	Modified 10.3.2.2.																		
DWG No				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	33/80

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Indeed, these elements mainly depend upon the importance of the switchboards, and on the handling means provided for unloading and on the dimensions of the doors allowing access to the installation places.

10.4. OPERATING CURVES OF THE RELEASES

10.4.1. Table for the checking of the thermal release

- 10.4.2. Operating curve - Equipment K1
- 10.4.3. " " " K2
- 10.4.4. " " " K3
- 10.4.5. " " " K4
- 10.4.6. " " " K5
- 10.4.7. " " " K6
- 10.4.8. " " " K7
- 10.4.9. " " " J1
- 10.4.10. " " " J4

10.5 THERMAL OPERATING CURVES OF THE RELEASES

- 10.5.1. DT 200 RH - Range 10 - 15 A
- 10.5.2. " - " 15 - 25 A
- 10.5.3. " - " 25 - 35 A
- 10.5.4. " - " 35 - 50 A
- 10.5.5. " - " 50 - 70 A
- 10.5.6. " - " 90 - 125 A
- 10.5.7. " - " 120 - 160 A
- 10.5.8. DT 630 RH - " 80 - 125 A
- 10.5.9. " - " 175 - 250 A
- 10.5.10. " - " 280 - 400 A
- 10.5.11. " - " 360 - 500 A

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE						
				CONTRACTOR MEMBER	CGEE ALSTHOM						
REV	DR. by	DATE	MODIFICATIONS	DWG N.	O 8 6 5						
DWG N.		KBA	1 2	1 5	G 1 0	0 0 1	AA	-	-	L T D	34/80

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P10

10.4.1

TABLE FOR THE CHECKING- OF THE THERMAL RELEASE

(EN FONCTION DE LA TEMPERATURE AMBIANTE)
(according TO AMBIENT TEMPERATURE)

Type and marking of circuit breaker	Applied current of the circuit breaker at 60° C	Rectifying coefficient ACCORDING TO THE AMBIENT TEMPERATURE				
		20°	30°	40°	50°	60°
		ELFA G2 K1	2,5	0,73	0,78	0,83
ELFA G2 K2	5	0,73	0,78	0,83	0,89	1
ELFA G2 K3	8	0,73	0,76	0,8	0,88	1
ELFA G2 K4	12	0,71	0,75	0,8	0,88	1
ELFA G2 K5	16	0,73	0,76	0,8	0,88	1
ELFA G2 K6	20	0,71	0,75	0,8	0,88	1
ELFA G2 K7	25	0,7	0,74	0,78	0,86	1
DT200 J1	12,5	0,73	0,78	0,83	0,89	1
DT200 J4	42	0,74	0,78	0,84	0,91	1

HOW TO USE AND READ THIS TABLE

For example checking of C.B type ELFA G2 K3

- . The ambient temperature is e.g 20° C
- . Test current taken at say 50 Amps
- . Multiply 50 Amps by the rectifying coefficient 0.73
50 X 0.73 = 36.5 A .
- . Then take the chart (time/current curves) corresponding to K3 (SEE 10.4.4.) for 36.5 Amps the chart shows that the thermal release should operate between 1 and 5,2 seconds

				CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE							
				CONTRACTOR MEMBER		CGEE ALSTHOM							
REV	DR. by	DATE	MODIFICATIONS			p 4 1 0 5 A 4 0 8 6 5							
DWG No.		KBA		1 2	1 5	G	1 0	0 0 1	AA	-	-	L T D	35/80

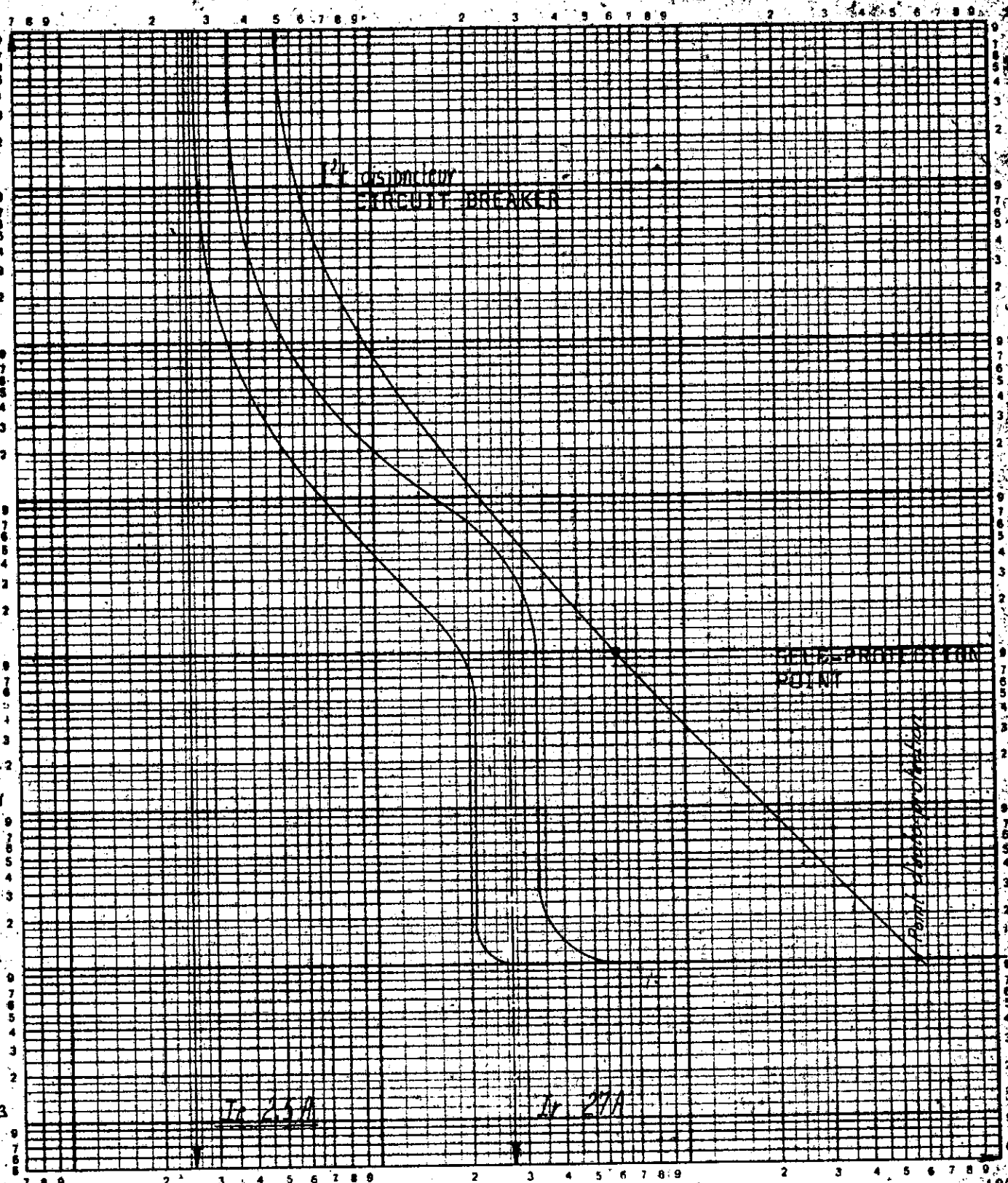
B

A

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Operating time in seconds 10.4.2 OPERATING CURVE EQUIPMENT TYPE K1

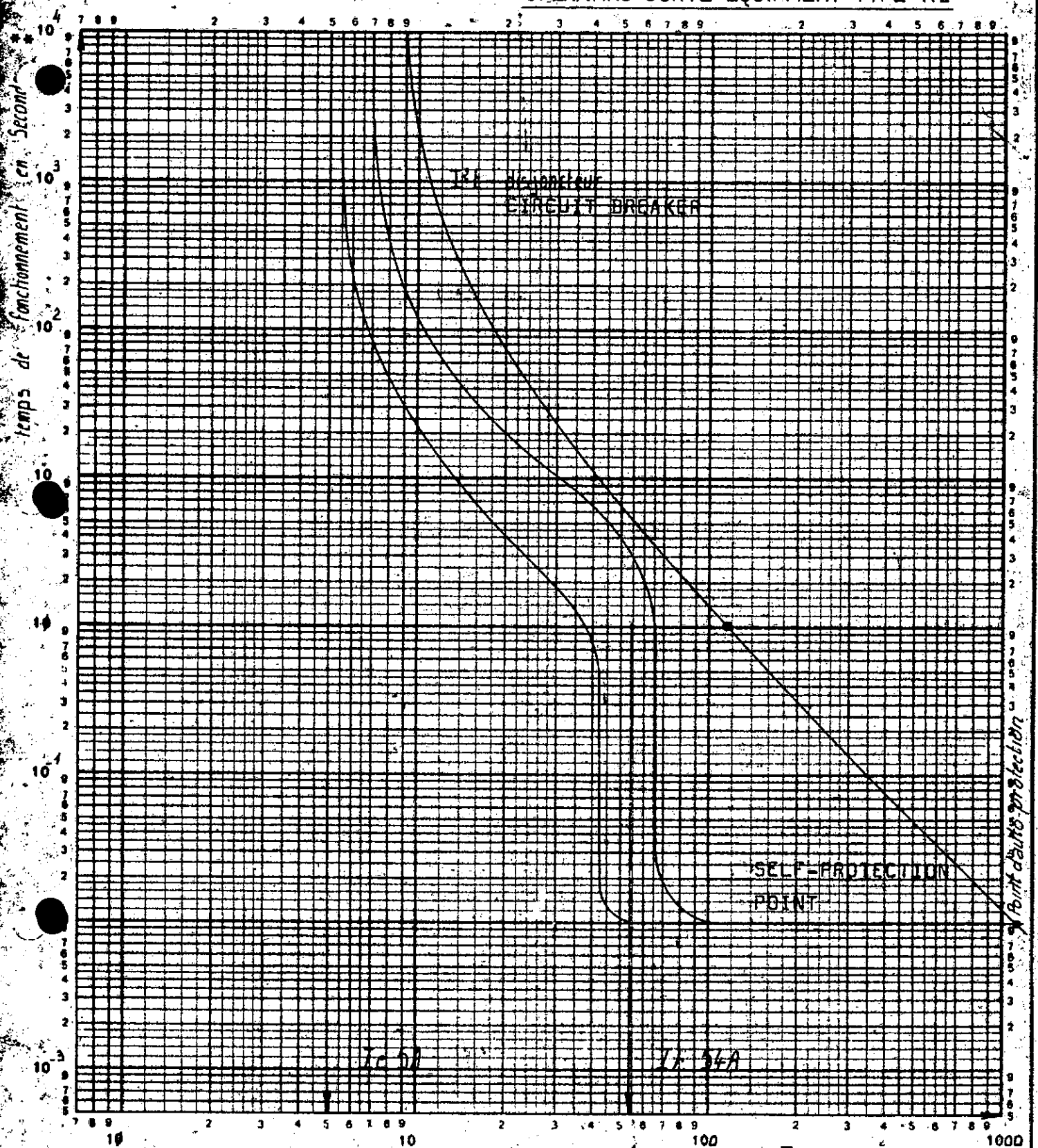
Temps de fonctionnement en secondes



BLFA G2 - OPERATING ZONE OF THE THERMAL MAGNETIC RELEASES AT 60 °C (RATING 25A) Current in Amperes

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE	
			CONTRACTOR MEMBER		CGEE ALSTHOM	
REV	DR. by	DATE	MODIFICATIONS		P 4 1 L A 4 0 8 6 5	
DWG No.			KBA 1 2 1 5 G 1 0 0 0 1		AA - - L T D 36/80	

** Operating time in seconds 10.43 OPERATING CURVE EQUIPMENT TYPE K2

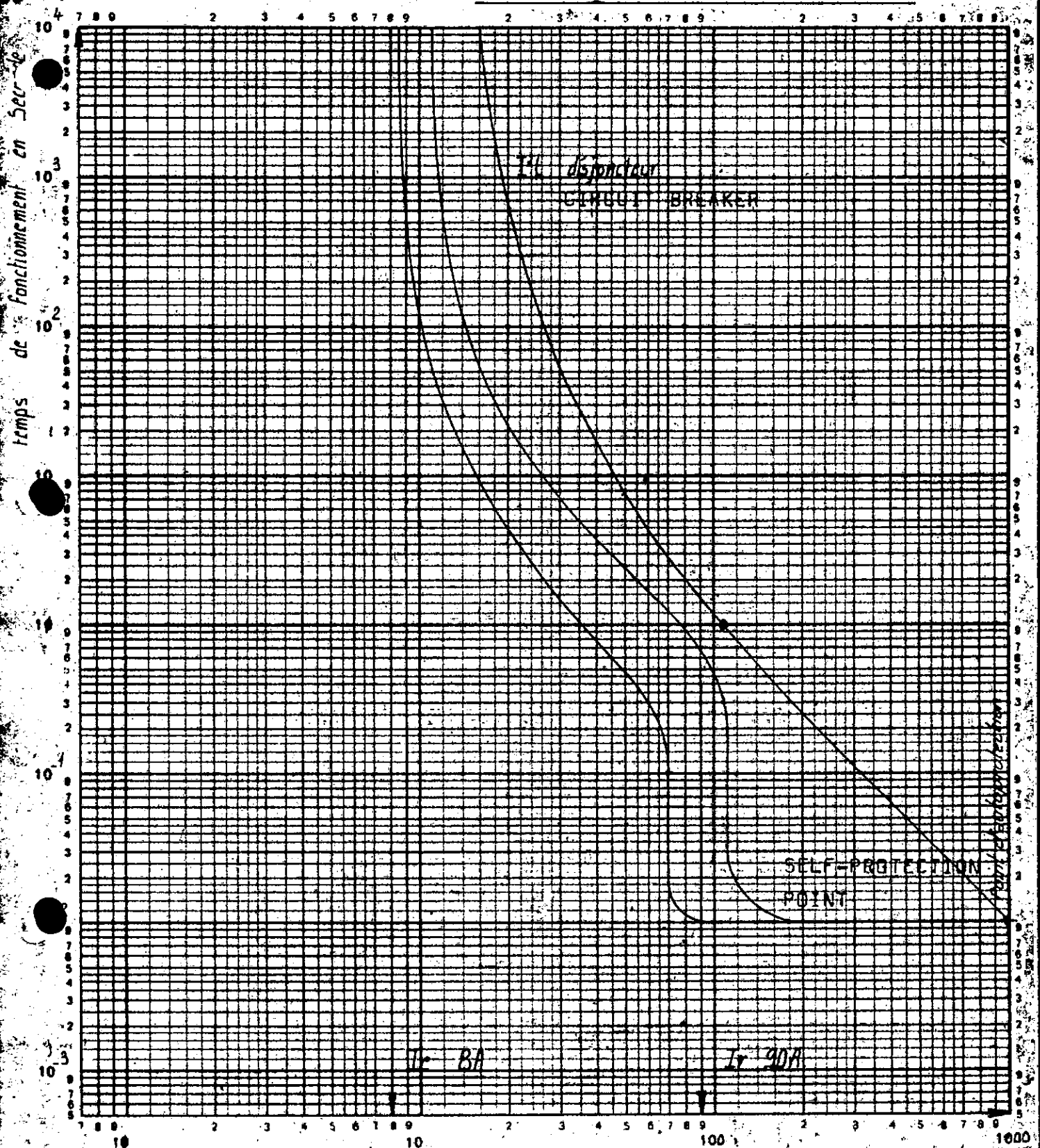


ELFA G2 - OPERATING ZONE OF THE THERMAL - MAGNETIC RELEASES AT 60 °C (RATING 5 A)

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE										
				CONTRACTOR MEMBER	CGEE ALSTHOM										
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P	4	1	0	0	A	4	0	8	6	5
DWG N°		KBA		1	2	1	5	G	1	0	0	0	1	AA - - LTD	
37/80															

** Operating time in seconds

10.4.4 OPERATING CURVE EQUIPMENT TYPE K3



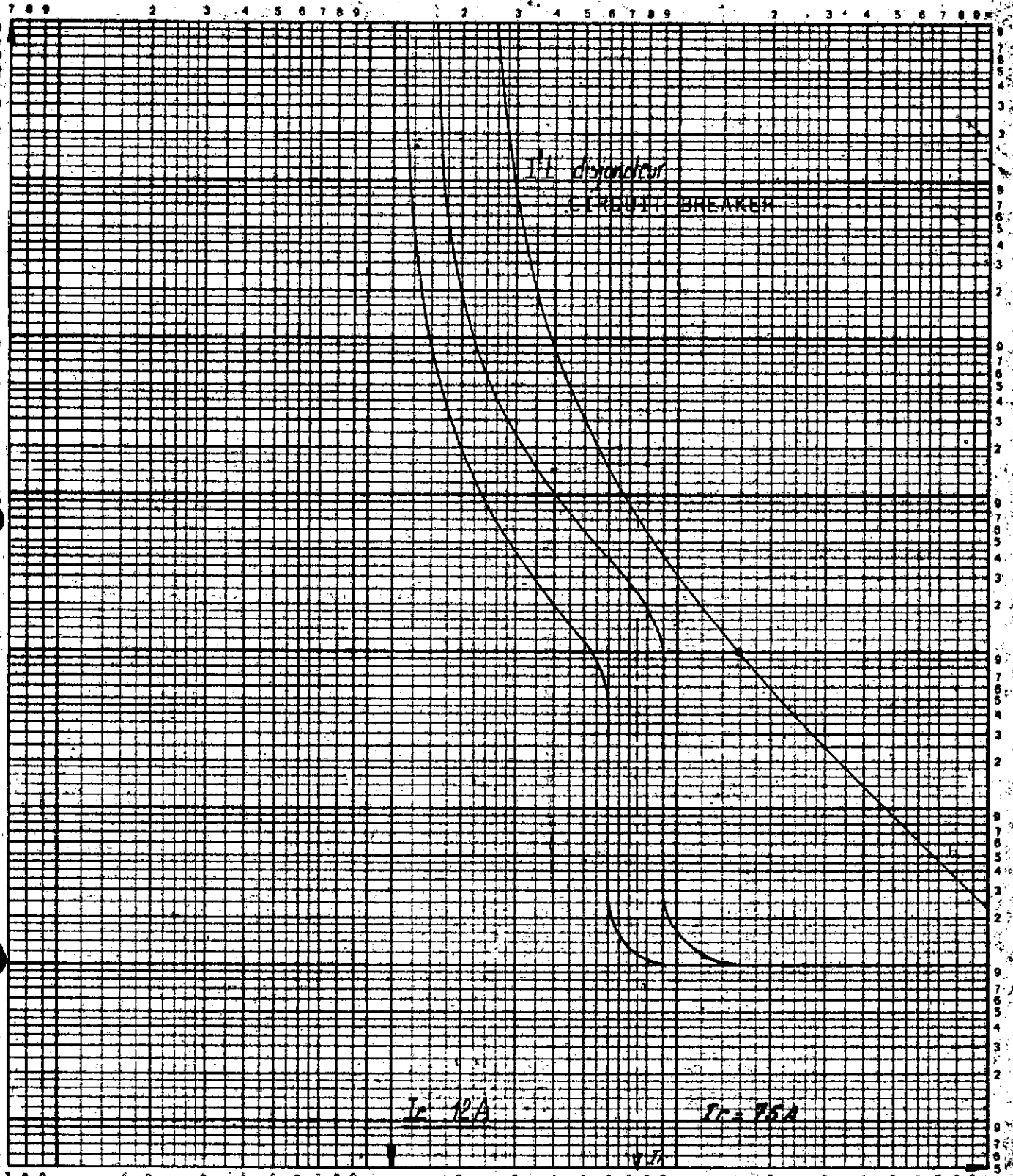
ELFA G2 - OPERATING ZONE OF THE THERMAL - MAGNETIC RELEASES AT 60° C (RATING, 8 A)

I en ampère
Current in Amperes

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P	4	1	0	8	6	5										
DWG N°				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	38/80

Operating time in seconds 10.4.5 OPERATING CURVE EQUIPMENT TYPE K4

Temps de fonctionnement en Secoy



ELFA G2 - OPERATING ZONE OF THE THERMAL - MAGNETIC RELEASES AT 60° C (RATING: 12 A)

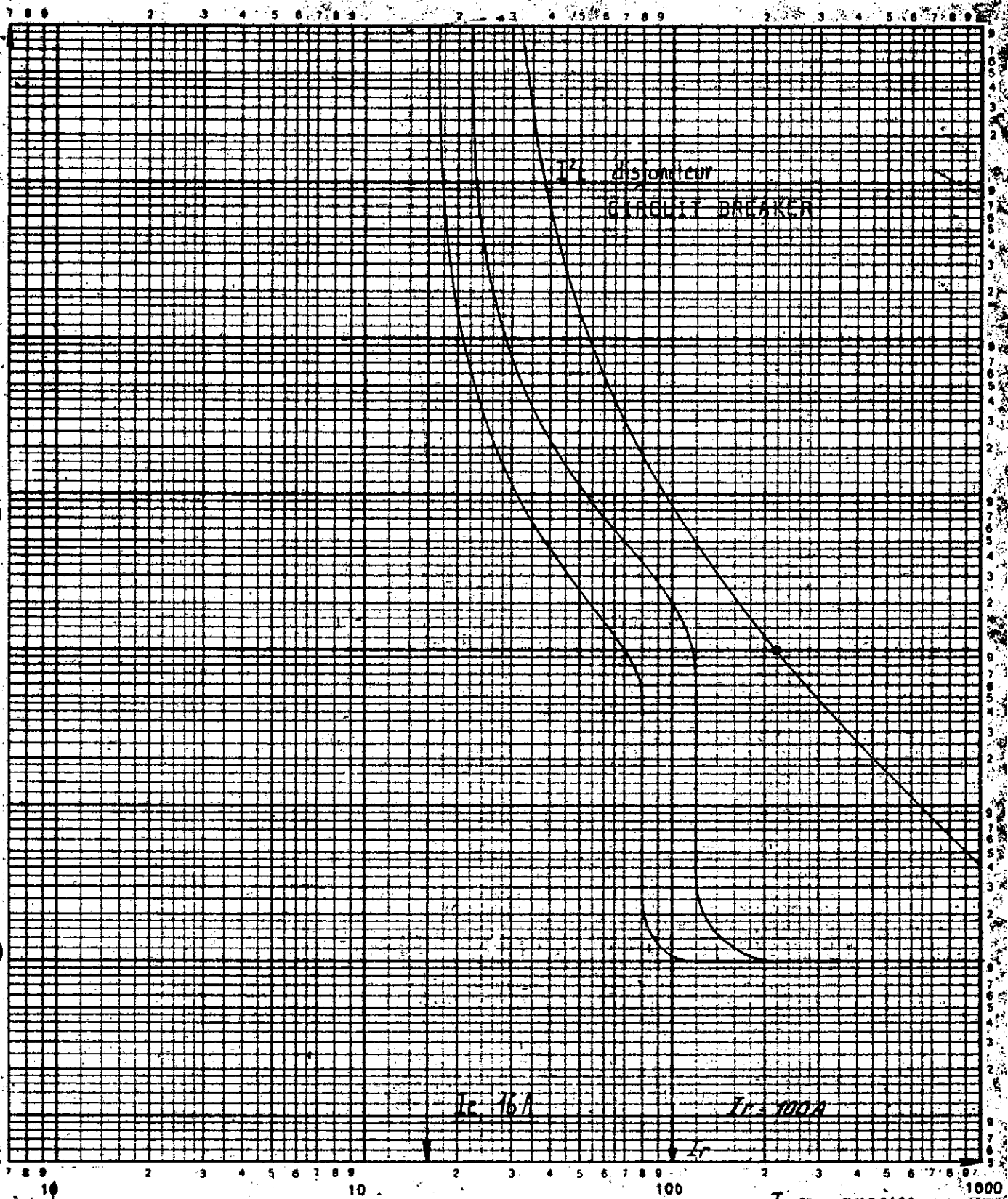
Icn amperes
Current in
Amperes

			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
			CONTRACTOR MEMBER	CGEE ALSTHOM															
REV	DR. by	DATE	MODIFICATIONS	P 4 1 0 0 A 4 0 8 6 5															
DWG No.			KBA	1	2	1	5	G	1	0	0	1	AA	-	-	L	T	D	39/80

Operating time in seconds 10.4.6

OPERATING CURVE EQUIPMENT TYPE K5

Temps de fonctionnement en Secondes



ELFA G2 - OPERATING ZONE OF THE THERMAL-MAGNETIC RELEASES AT 60° C (RATING 16 A)

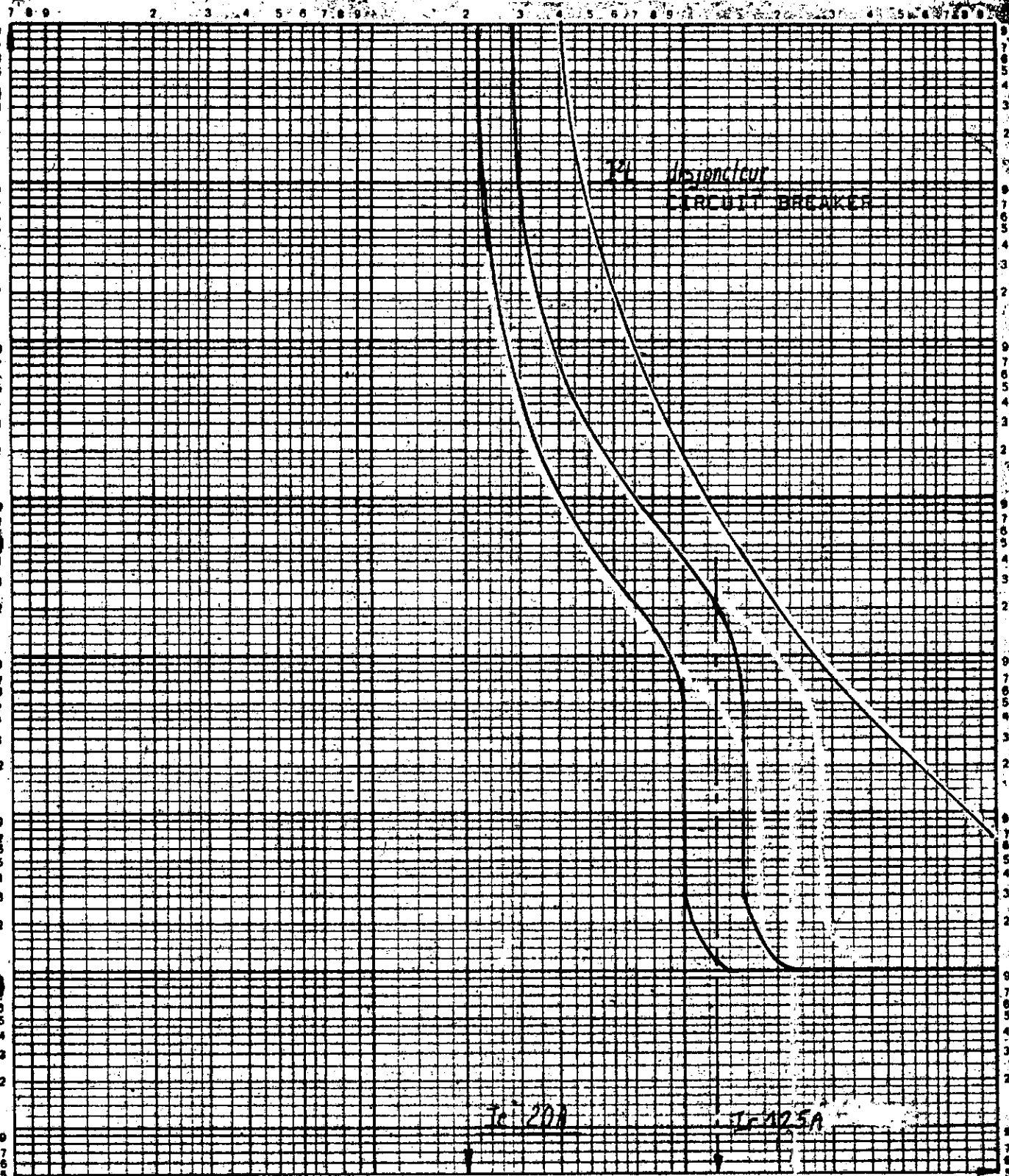
I en ampères
Current in Amperes

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE				
				CONTRACTOR MEMBER	CGEE ALSTHOM				
REV	DR. BY	DATE	MODIFICATIONS	CONTRACTOR MEMBER DWG N°	0865				
DWG N°				KBA 12 15 G 10001				AA - - LTD 40/80	

Operating time in seconds

OPERATING CURVE EQUIPMENT TYPE K6

temps de fonctionnement en sec



ELFA G2 - OPERATING ZONE OF THE THERMAL-MAGNETIC RELEASES AT 60° C (RATING 20 A)

I en ampères
Current in Amperes

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE			
					CGEE ALSTHOM			
REV	DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER		0 8 6 5	
					DWG N°			
DWG N°		KBA		1 2	1 5	G	1 0 0 0 1	AA - - L T D 41/80

B

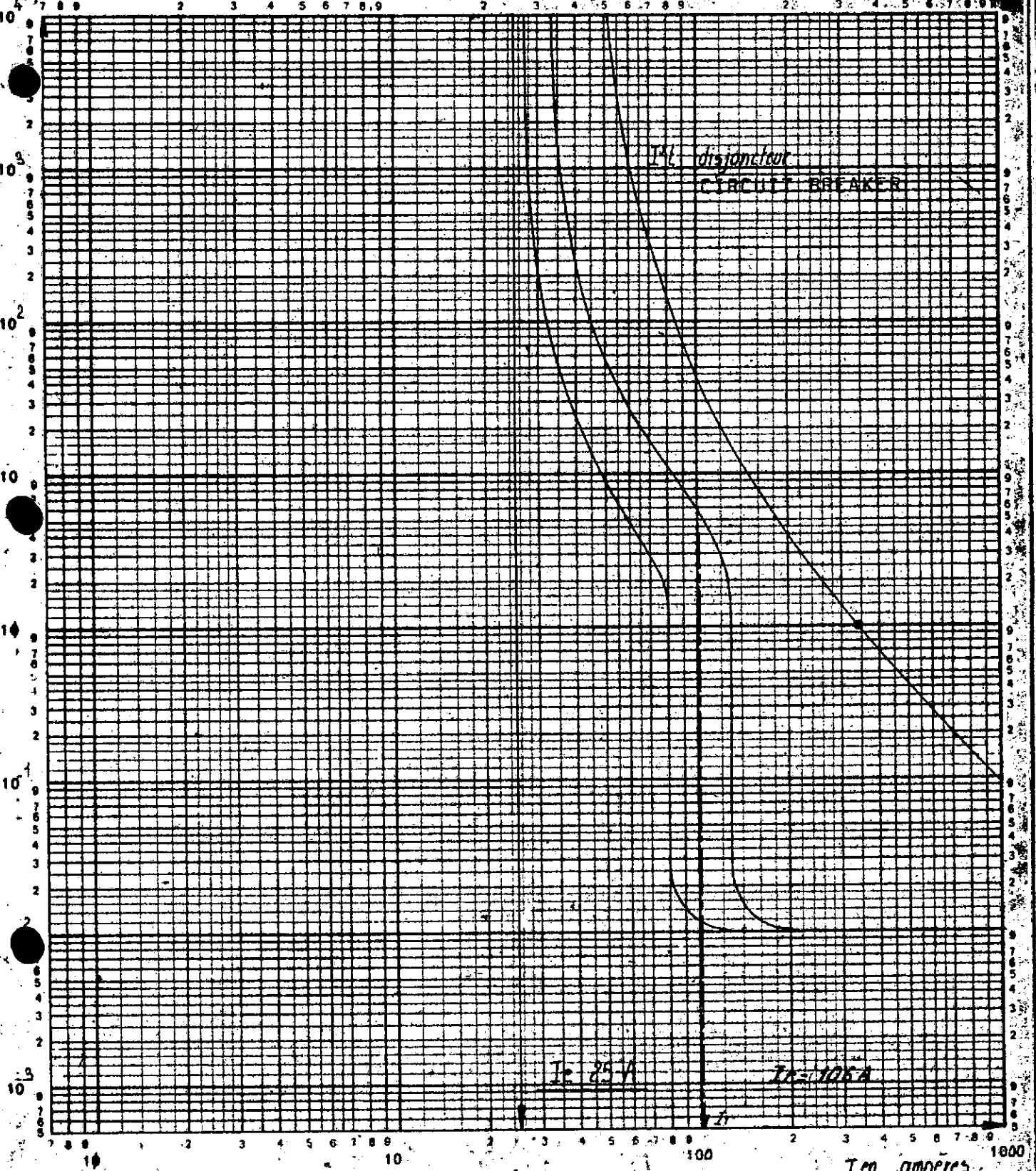
A4

NORME AFNOR S

P101

** Operating time in seconds 10.4.8 OPERATING CURVE EQUIPMENT TYPE K7

temps de fonctionnement en secondes



ELFA G2 - OPERATING ZONE OF THE THERMAL-MAGNETIC RELEASES AT 60°C (RATING 25 A)

I en ampères
Current in Amperes

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE				
				CONTRACTOR MEMBER	CGEE ALSTHOM				
REV	DR. by	DATE	MODIFICATIONS	DWG N°	0865				
DWG N°		KBA	1 2	1 5 G	1 0 0 0 1	AA	- -	L T D	42/80

B

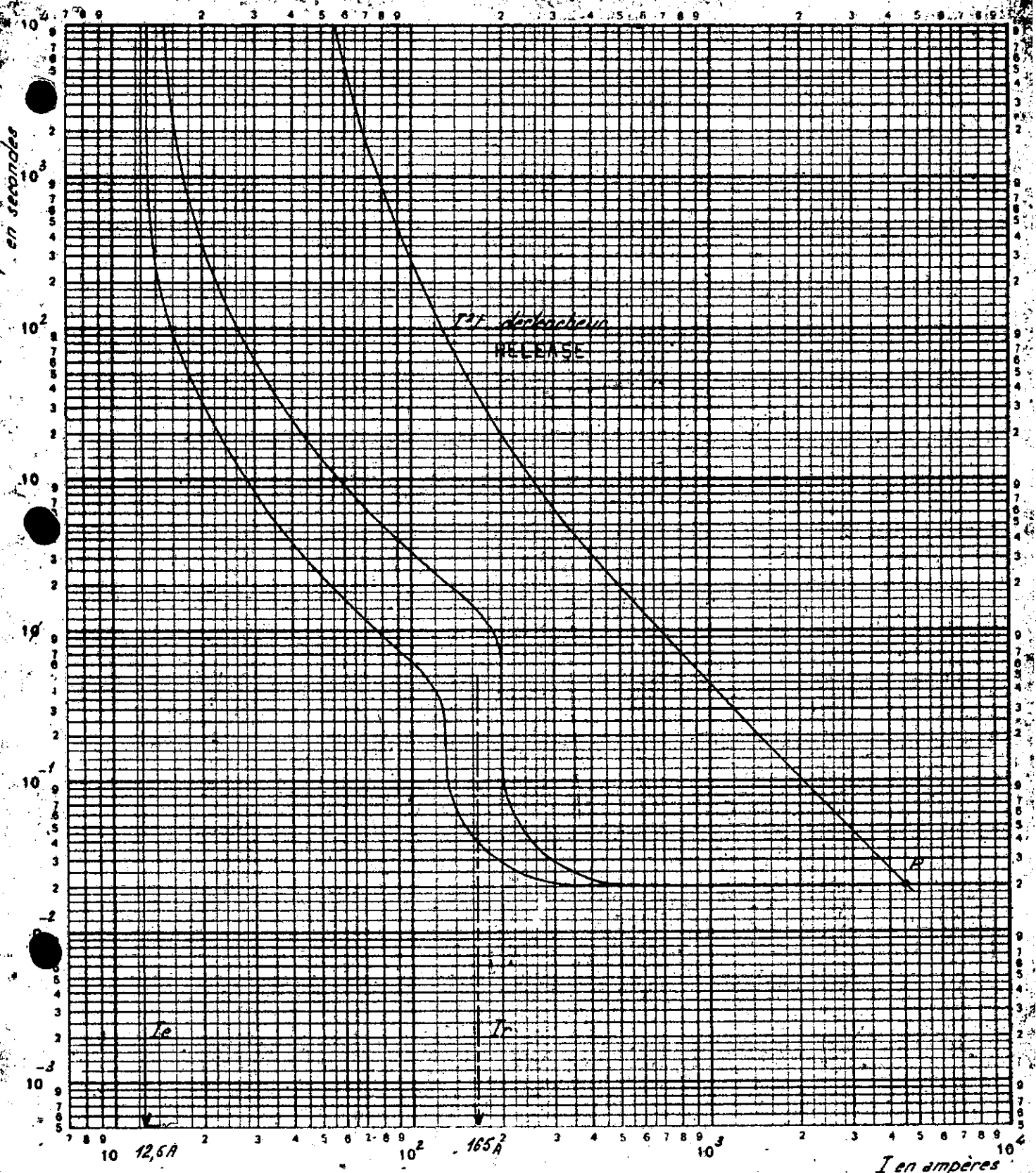
A4

NORME AFNOR

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Operating time in seconds 10.4.9

OPERATING CURVE EQUIPMENT TYPE J1



OPERATING ZONE OF THE THERMAL-MAGNETIC RELEASES AT 60° C

Current in Amperes

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE			
				CONTRACTOR MEMBER	CGEE ALSTHOM			
REV	DR. by	DATE	MODIFICATIONS	DWG N.	0865			
DWG No.		KBA	1 2 1 5 G 1 0 0 0 1	AA	-	-	L T D	43/80

B

A4

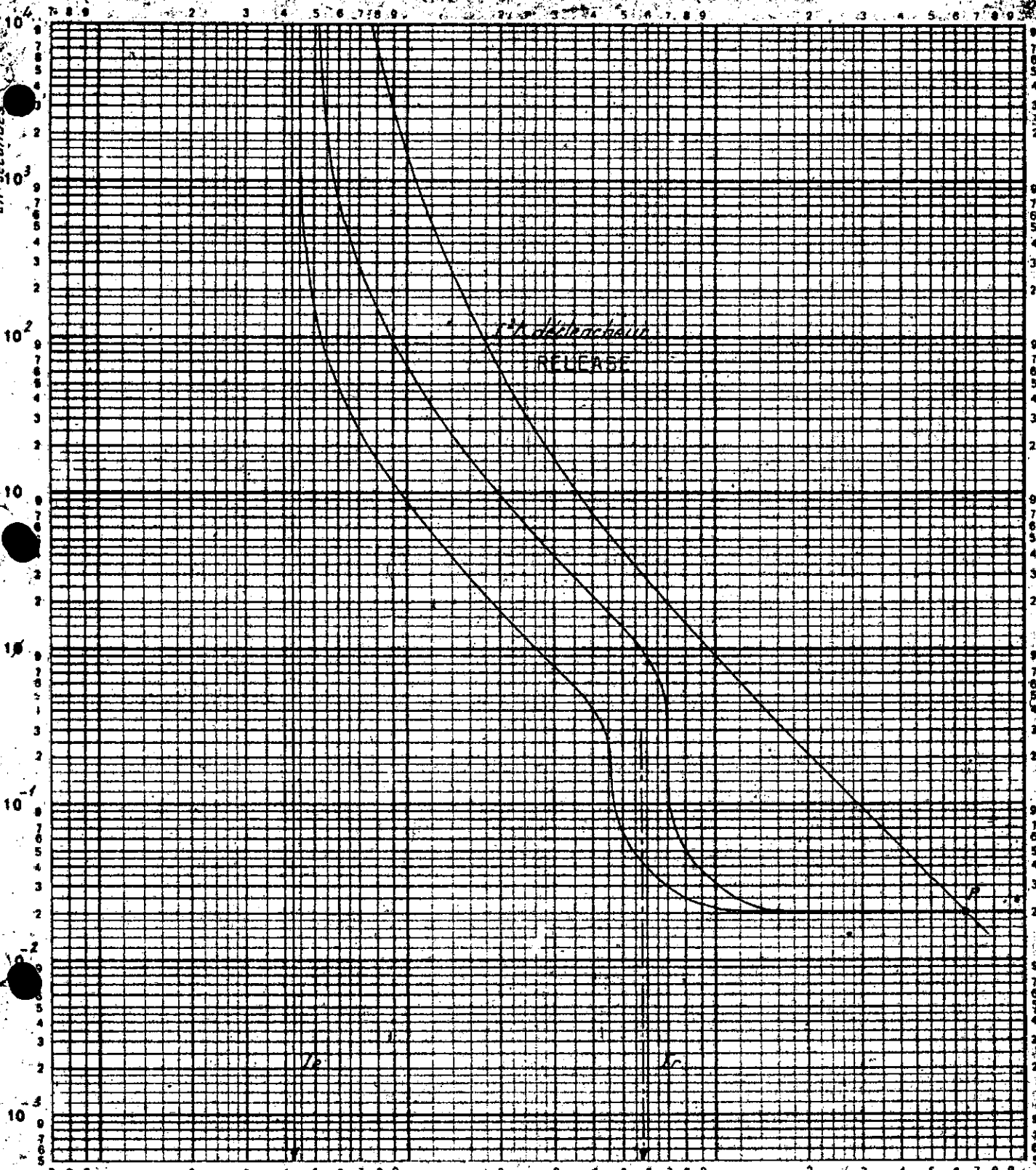
NORVE 4FNDR

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Operating time in seconds 10.410

OPERATING CURVE EQUIPMENT TYPE J4

Temps de fonctionnement en secondes



OPERATING ZONE OF THE THERMAL-MAGNETIC
RELEASES AT 60° C

Current in Amperes

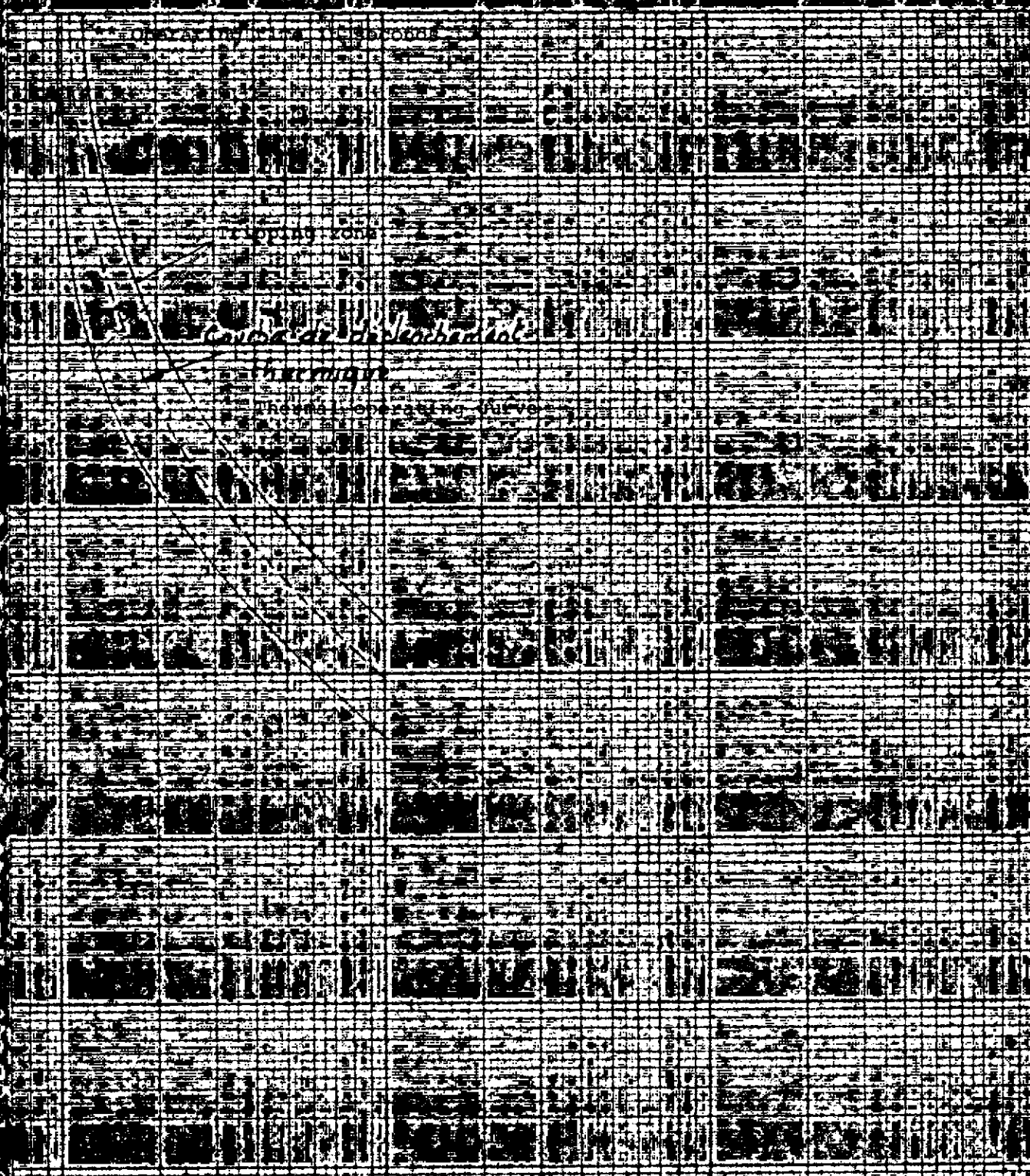
				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE						
				CONTRACTOR MEMBER	CGEE ALSTHOM						
REV	DR. by	DATE	MODIFICATIONS	DWG N.	0865						
DWG No.		KBA 1 2			1 5 G		1 0 0 0 1		AA - - L T D		44/80

B

A4

NORVE ARNOF

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Multiples de l'intensité de réglage

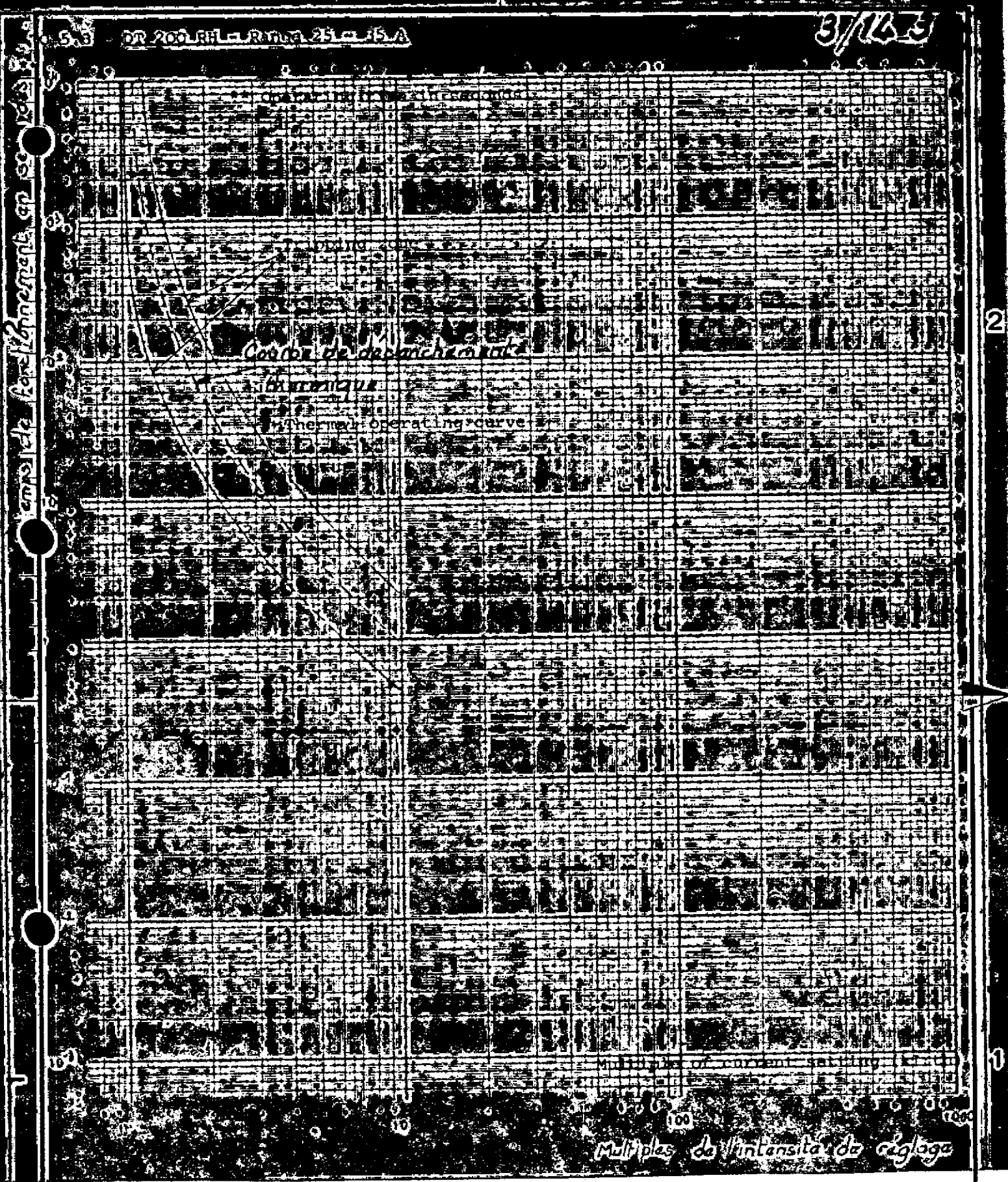
			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE			
				CGEE ALSTHOM			
			CONTRACTOR MEMBER	P 4 1 0 3 A 4 0 8 6 5			
DR. by	DATE	MODIFICATIONS	DWG N°				
DWG N°	KBA	1 2	1 5	G	1 0	0 0 1	AA - L T D 46/80

B

A4

NORME AFNOR

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				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE												
				CONTRACTOR MEMBER	CGEE ALSTHOM												
DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER DWG N°	P	4	1	U	8	A	4	0	8	6	5		
DWG N°	KBA	1	2	1	5	G	1	0	0	0	1	AA	-	L	T	D	47/80

B

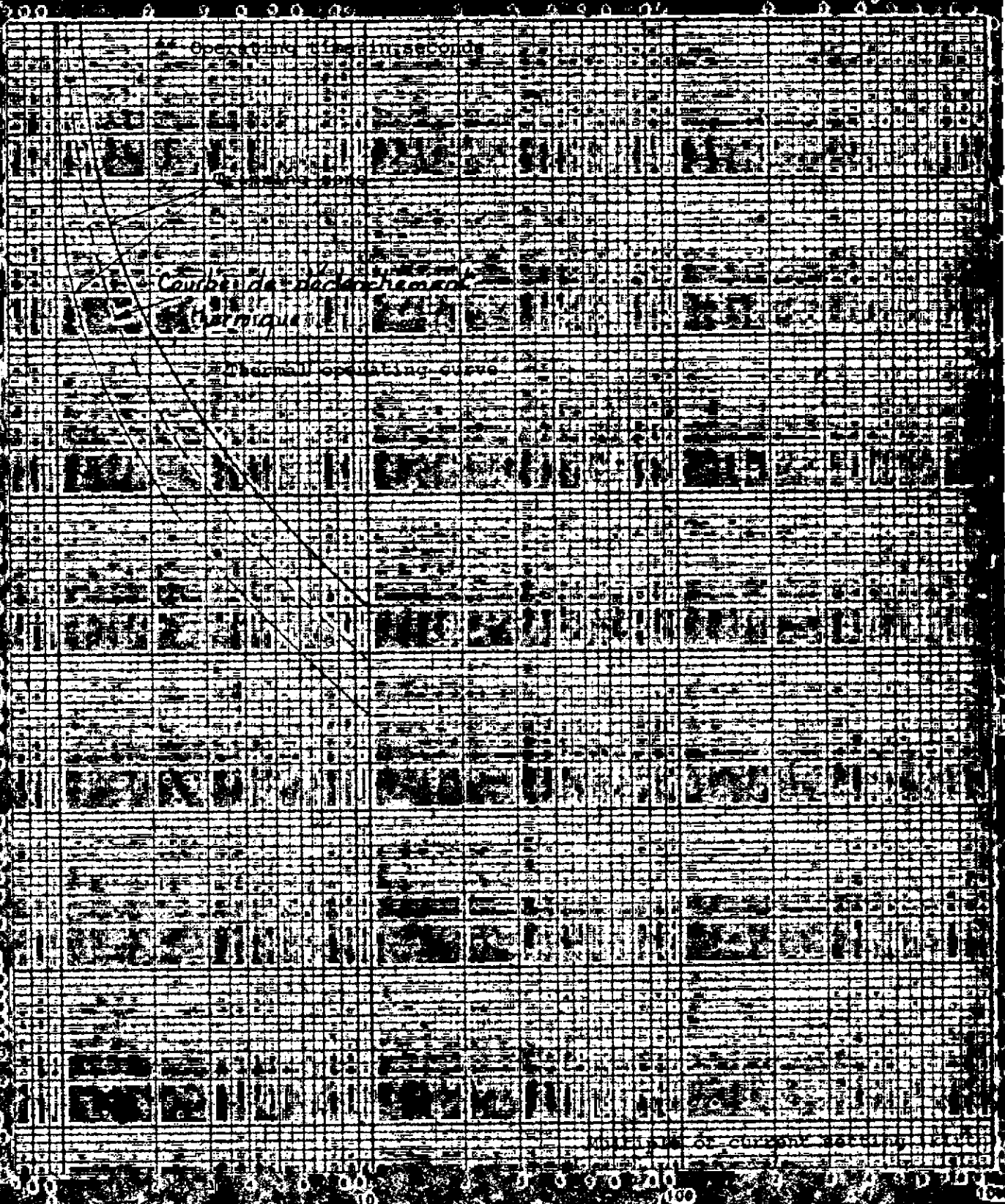
A4

NORME AFNOR

P101

3/12/6

Camp de fortification An 9



camp de fortification An 9

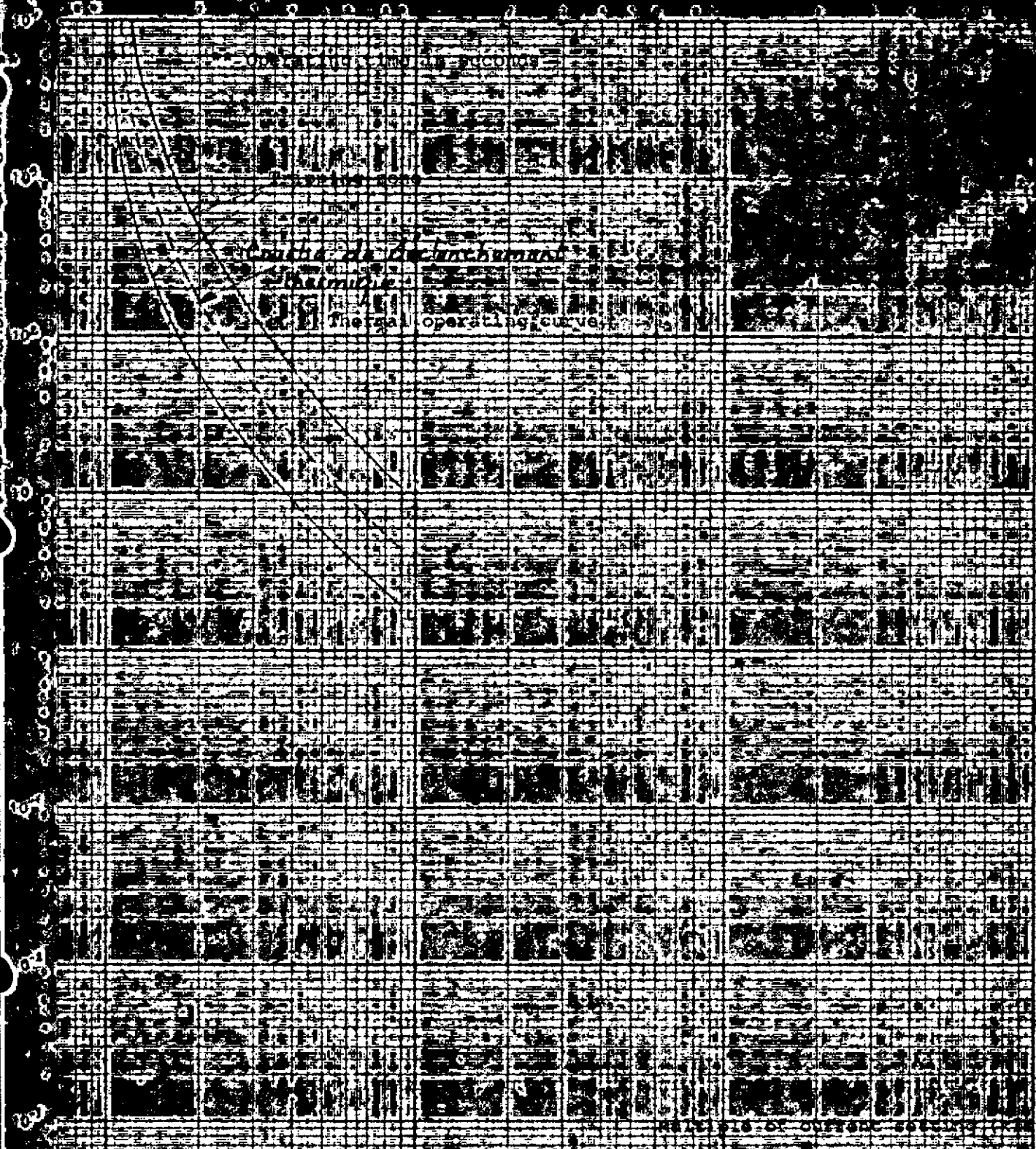
		CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE			
		CONTRACTOR MEMBER		CGEE ALSTHOM			
DR. by	DATE	MODIFICATIONS		P 4 1 0 8 A 4 0 8 6 5			
DWG N°	KBA	1 2	5	G 1 0	0 0 1	AA	L T D 48/80

B

A4

NORME AFNOR

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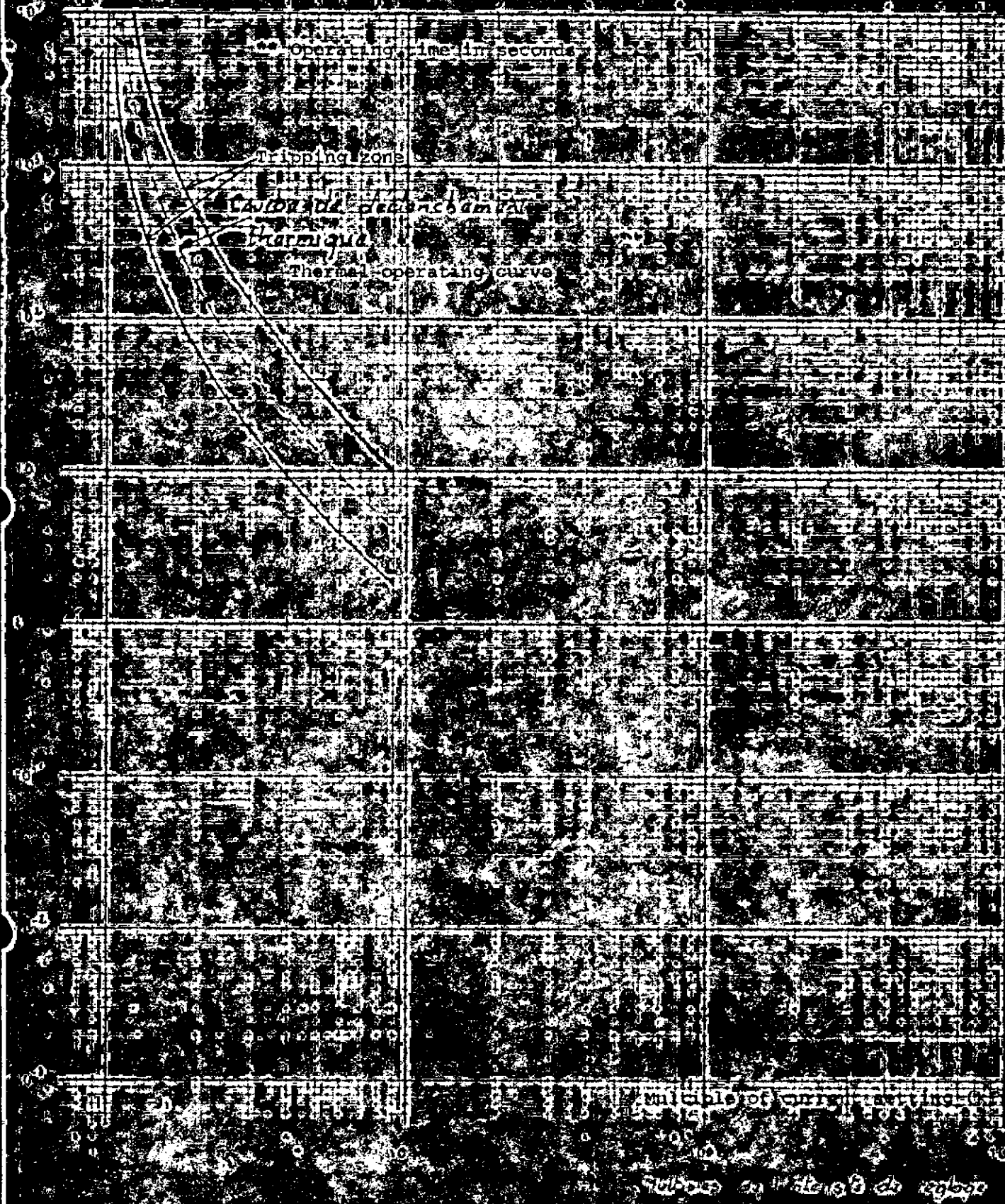
Multiples de l'intensité de réglage

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE											
				CONTRACTOR MEMBER	CGEE ALSTHOM											
DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER DWG N ^o	P	4	1	U	8	A	4	0	8	6	5	
DWG N ^o	KBA	1	2	1	5	G	1	0	0	0	1	AA	L	T	D	49/80

B

A4

NORME AFNOR 70



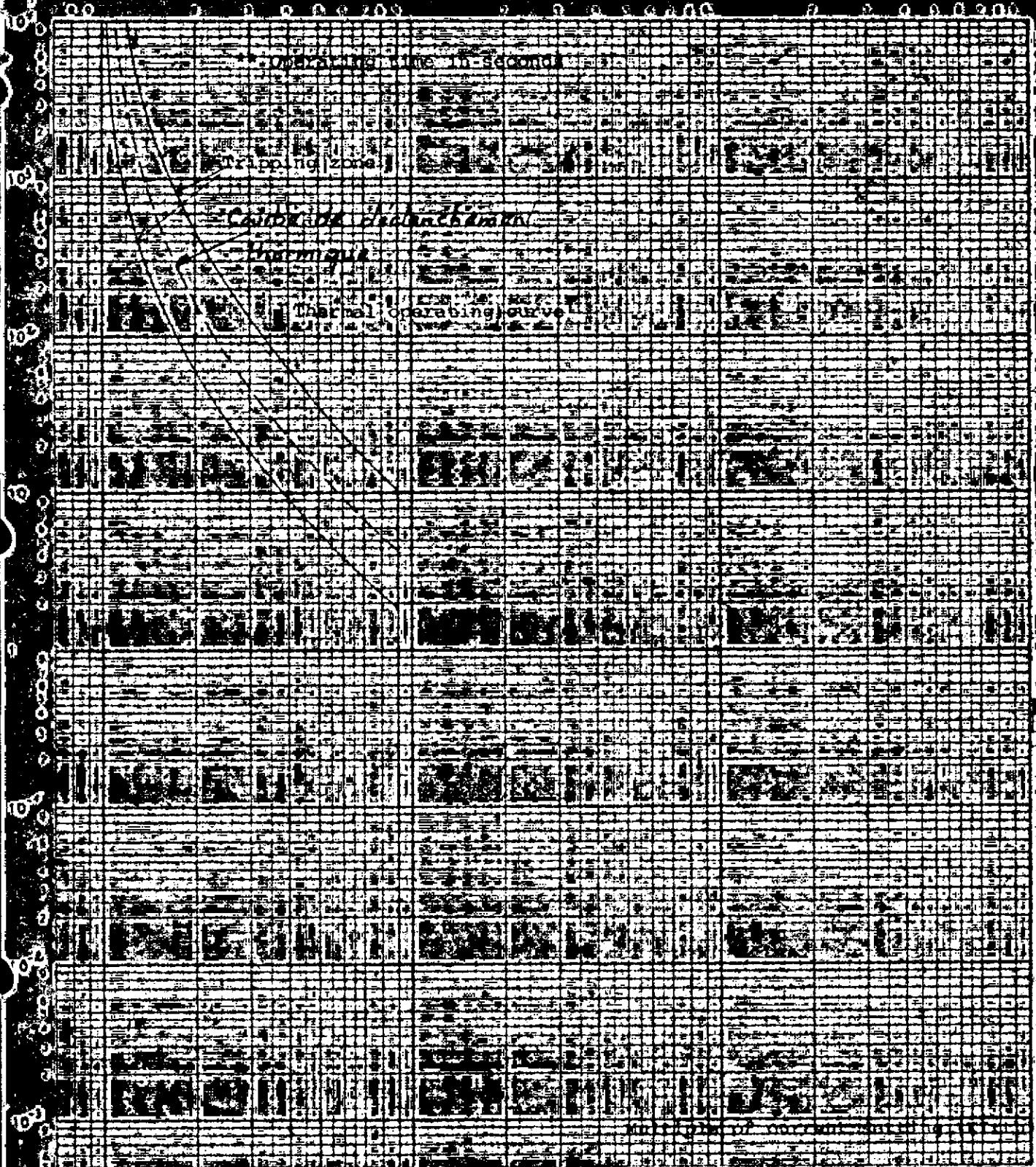
				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE										
					CGEE ALSTHOM										
REV	DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER DWG N.	P	4	1	0	3	A	4	0	8	6	5
DWG N.		KBA	2	1	5	G	1	0	0	0	AA	L	T	D	50/80

B

A4

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Multiples de l'intensité de réglage

			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE								
			CONTRACTOR MEMBER	CGEE ALSTHOM								
DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER DWG N°	P	4	10	GA	4	0	8	6	5
DWG N°	KBA	1 2 1 5	G 1 0	0 0 1	AA	L	T	D	51/80			

B

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no de fabrication machine 1200

2

1

Caractéristiques de la section

Carba de declenchament

Chemique

Thermal separating curve

subduct zone

Multiple for current setting (KALSH)

Multiple de l'intensité de réglage

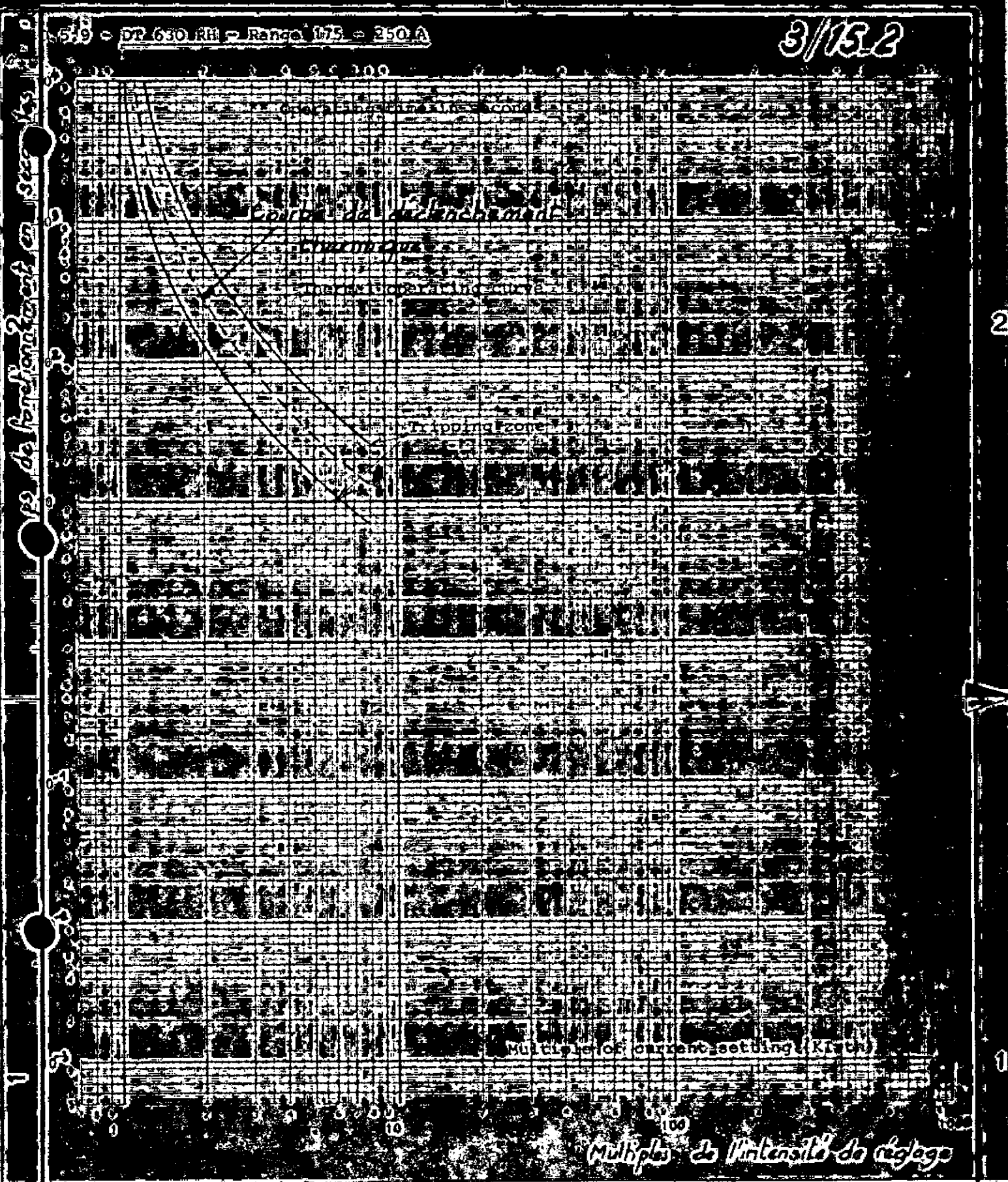
				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE												
				CONTRACTOR MEMBER	CGEE ALSTHOM												
EV	DR. by	DATE	MODIFICATIONS	DWG N ^o	P	4	1	0	3	A	4	0	8	6	5		
DWG N ^o		KBA	2	1	5	G	1	0	Q	0	1	AA	-	L	T	D	52/80

B

A4

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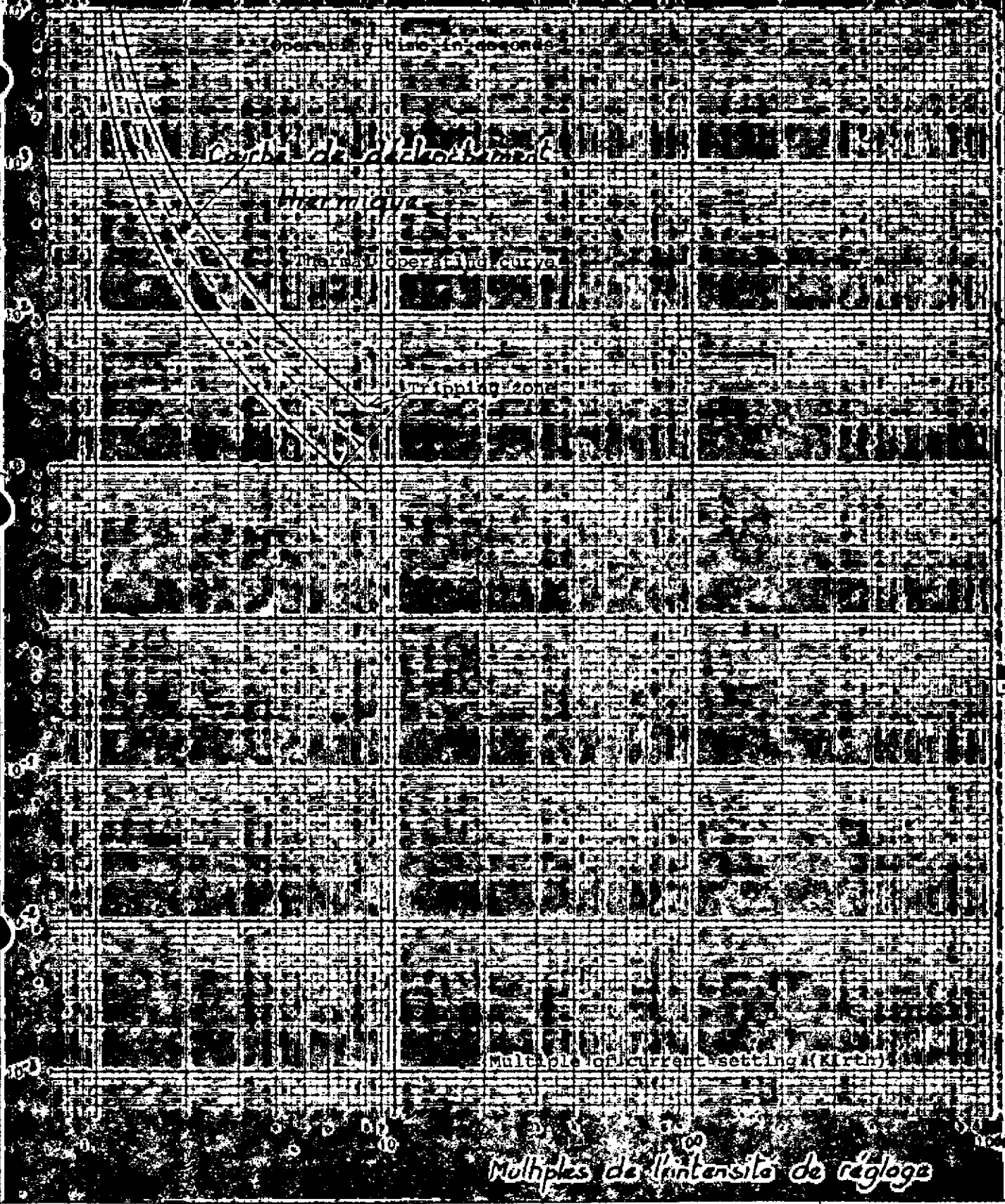
				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE														
				CONTRACTOR MEMBER	CGEE ALSTHOM														
DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER DWG No.	P	4	1	0	8	A	4	0	8	6	5				
DWG No.	KBA		1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	53/80

B

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			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE											
					CGEE ALSTHOM											
EV	DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER		DWG N°			P 4 1 U 8 A 4 0 8 6 5						
DWG N°			KBA		2	1	5	G	0	0	1	AA	L	T	D	54/80

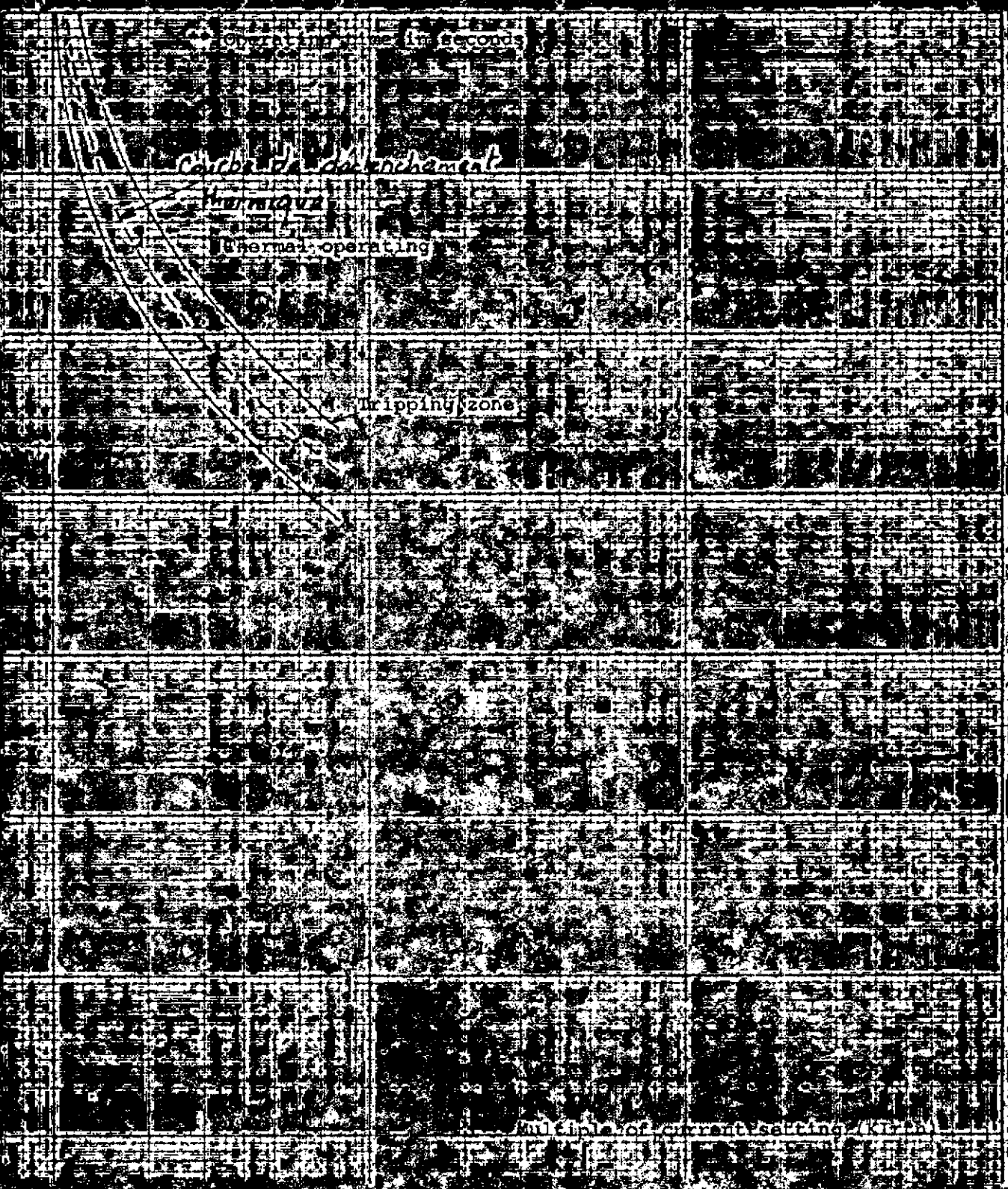
B

A4

NORME AFNOR 7C

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Echelle de l'emplacement en mètres



Multiples de l'intensité de réglage

		CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE												
				CGEE ALSTHOM												
D 18/8/80	GAY	Modified	10.5.													
DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER DWG No.												
				P 4 1 0 8 A 4 0 8 6 5												
DWG No.	KBA	1	2	1	5	G	1	0	0	0	1	AA	L	T	D	55/80

B

A4

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11. DESCRIPTION OF EQUIPMENTS FOR 30 V DC, 48 V DC, 125 V DC and 230 V DC SWITCHBOARDS

11.1. GENERAL

The cubicles type N. 686 are made of withdrawable units containing the following circuit breakers :

- battery incoming
- rectifier incoming
- battery discharge

The cubicles type N.486 are made of sheet steel plates supporting the circuit breakers for the outgoing protection.

The protection relays and measuring instruments are installed on the front parts of these two types of cubicles.

These cubicles can be placed back to wall, the cable connection being realized from the front part.

11.2. DEFINITION OF EQUIPMENT

The definition of the different types of equipments takes into account the following data :

- maximum and minimum values of the short circuit currents on different parts of the plant
- through currents on a level with each equipment
- selectivity of the tripping, on one hand, between outgoing and incoming, on the other hand, between battery incoming and rectifier incoming

The four types of equipments so defined are as follows :

- Battery incoming (equipment type 'T')
 - circuit breaker type CNP 1000 or DT 630 associated with a double pole magnetic relay type DN 2 (time delay adjusted to 100 ms) supplied by two shunts (one per polarity) ...

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE							
			CONTRACTOR MEMBER		CGEE ALSTHOM							
REV	DR. by	DATE	MODIFICATIONS		P 4 1 0 0 A 4 0 8 6 5							
DWG No.			KBA	1 2	1 5	G	1 0	0 0 1	AA	- -	L T D.	56/80

2

1

P10

The operation of the protection takes place at about 4 times the rating of the corresponding shunt.

- Rectifier incoming (equipment type T)
 - circuit breaker type CNP 1000 or DT 630 associated with a double pole magnetic relay type DN 1 (pulse delay adjusted to 25 ms) supplied by 2 shunts (one per polarity)

NOTE

The circuit breakers DT 630 used for the battery incoming and rectifier incoming are equipped with an indoor thermal release ensuring the protection of the DT 630 against overloading.

The thermal release is adjustable. The rated values given in the table of leaflet 11.2.1.1. correspond to the maximum setting.

- The setting ranges are :
- 80 to 125 A
 - 175 to 250 A
 - 280 to 400 A

Operating time of the circuit breakers on short circuit :

	Minimum pulse delay of magnetic relay DN	Maximum short circuit duration
- CPN 1000 with DN2 (battery incoming)	100 ms	165 ms
- CPN 1000 with DN1 (rectifier incoming)	25 ms	90 ms
- DT 630 with DN2 (battery incoming)	100 ms	160 ms
- DT 630 with DN1 (rectifier incoming)	25 ms	90 ms

- Battery discharge (equipment type U)

Circuit breaker type DT 630 (or DT 200) equipped with its own direct thermal-magnetic releases. The instantaneous tripping thresholds are given in the table "Equipment characteristics".

- Outgoing (equipment type J)

Double pole DT 200 circuit breaker equipped with its own thermal-magnetic releases.

The instantaneous tripping thresholds are given in the table "Equipment characteristics" (leaflets 11.2.1.1. and 11.2.1.2.)

The standard curves of the thermal elements are given by the leaflet 11.5.1.

			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE														
					CGEE ALSTHOM														
REV	DR. by	DATE	MODIFICATIONS		CONTRACTOR MEMBER		0 8 6 5												
			DWG N°																
DWG N°		KBA		1	2	1	5	G	1	0	0	1	AA	-	-	L	T	D	57/80

2

1

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NOTE

All the circuit breakers are hand operated and :

- double pole for all CNP 1000
- double pole for all DT 630 and 200 up to 125 V DC .
- double pole (tetrápole with two poles in series) for all DT 630 and DT 200, for 230 V DC.

The rating of these thermal releases is defined according to the rating of the shunt supplying the release type DN associated to the circuit breaker (please refer to leaflet 11.2.1.1.).

2

2

1

1

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE				
				CONTRACTOR MEMBER	CGEE ALSTHOM				
REV.	DR. by	DATE	MODIFICATIONS	DWG N.	J			08	65
DWG N.	KBA	1 2	1 5 G	1 0 0 0 1	AA	-	-	L	T D 58/80

B

A

11.2.1 — EQUIPMENT CHARACTERISTICS

11.2.1.1 — BATTERY INCOMER AND RECTIFIER

Power drawn by release at 48 V DC		30 watts		600 watts		
Total resistance per pole at 20 °C (10 ⁻³ Ω)		0,360	0,290	2,300	2,100	
MAGNETIC TRIPPING TYPE DN1 OR DN2	Limits on operating zone	MIN	1 700	2 200	3 200	
		MAX	2 500	3 200	2 290	
	Setting current (A)	2 100	2 700	335	520	
	SHUNT	Resistance at 20 °C (10 ⁻³ Ω)	0,293	0,2258	2,07	1,2617
		Withstand (KA.s.)	30KA 0,15 s	30KA 0,15 s	3,2 0,15	5,5 0,15
		Applied current at 60 °C	500 A	600 A	60 A	100 A
		Thermal rated current	500 A	640 A	80 A	125 A
	THERMAL TRIPPING (INCORPORATED)	Current setting at 60 °C	WITHOUT	WITHOUT	70	112
		Current setting at 40 °C	WITHOUT	WITHOUT	80 A	125
	Applied current at 60 °C (Ie)	500 A	600 A	60 A	100 A	150 A
Applied voltage (V)	230	230	Bipolar circuit-breaker: 125 V. Tetrapolar circuit-breaker: 230 V.			
Type of equipment	T1	T2	T3	T4	T5	
Type of apparatus	CNP 1 000	CNP 1 000	DT 630 RH	DT 630 RH	DT 630 RH	
			T6	T7	T8	
			DT 630 RH	DT 630 RH	DT 200 RH	
			T9			
			DT 630 RH			

Insulation voltage : 500 V
 All equipment are double pole
 Breaking capacity 10 kA (except T3 and T4) (T8-T9-13kA)
 All equipment except T8-T9 with releases 25ms or 100ms

DR.	20.1.81	GAY	Added RH after DT
REV.	18/8/80	GAY	Modified § 11.2.1.1
DR. by	DATE	MODIFICATIONS	

CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE				
CONTRACTOR MEMBER	CGEE ALSTHOM				
DWG N°	P	4	A	4	0 8 6 5

DWG N° **KBA** 1 2 1 5 G 1 0 0 0 1 **AA** - - L T D 59/80

B

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CHARACTERISTICS OF THE EQUIPMENT
"OUTGOING" AND "BATTERY" DISCHARGE

11.2.1.2

APPLIED CURRENT AT 60° C (A)	APPLIED VOLTAGE (V)	TYPE OF EQUIPMENT	TYPE OF APPARATUS	THERMAL TRIPPING		MAGNETIC TRIPPING		TOTAL RESISTANCE PER POLE AT 20° C (10 ⁻³ Ω)	POWER DRAWN BY RELEASE AT 48 V D.C.	
				CURRENT SETTING AT 40° C	CURRENT SETTING AT 60° C	CURRENT SETTING (Ir)	LIMITS ON OPERATING ZONE Min. Max.			
OUTGOING										
12,5	Bipolar circuit-breaker : 125 V. Tetrapolar circuit-breaker : 230 V.	J1	DT 200 RH	15 A	12,5 A	165 A	130 A	200 A	600 WATTS	
20,5		J2	DT 200 RH	25 A	20,5 A	275 A	220 A	330 A	600 WATTS	
28,5		J3	DT 200 RH	35 A	28,5 A	400 A	320 A	480 A	600 WATTS	
42		J4	DT 200 RH	50 A	42 A	565 A	450 A	680 A	600 WATTS	
60		J5	DT 200 RH	70 A	60 A	725 A	580 A	870 A	600 WATTS	
103		J7	DT 200 RH	125 AS	103 A	920 A	735 A	1100 A	600 WATTS	
135		J8	DT 200 RH	160 AS	135 A	920 A	735 A	1100 A	600 WATTS	
28,5		BATTERY DISCHARGE								
60	U1	DT 200 RH	35 A	28,5 A	400 A	320 A	480 A	2,250	600 WATTS	
103	U2	DT 200 RH	70 A	60 A	725 A	580 A	870 A	2,050	600 W	
220	U3	DT 200 RH	125 A	103 A	920 A	735 A	1100 A	0,875		
440	U4	DT 630 RH	250 A	220 A	1500 A	1200 A	1800 A	0,470		
	U5	DT 630 RH	500 A	440 A	3000 A	2400 A	3600 A	0,315		

INSULATION VOLTAGE : 500 V
 ALL EQUIPMENTS ARE DOUBLE POLE
 BREAKING CAPACITY 10 KA

20.1.81	GAY	Added RH after DT---	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE							
REV	DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER	CGEE ALSTHOM						
				DWG No.	40 865						
DWG No.			KBA	1 2	1 5	G	1 0 0 0 1	AA	- -	L T D	60/80

B

A4

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11.2.2

EQUIPMENT GRID

1. EQUIPMENTS

- battery incoming and rectifier incoming by CNP 1000 and DT 630
- battery discharge, by DT 630 and DT 200

are of the withdrawable type and installed in a column type N.686 with 12 modules.

2. The "outgoing" equipments by DT 200 are placed on supporting plates in columns N.486 with 15 modules.

Each supporting plate can receive three DT 200. $U \leq 125$ V DC
or two DT 200 $U = 230$ V DC

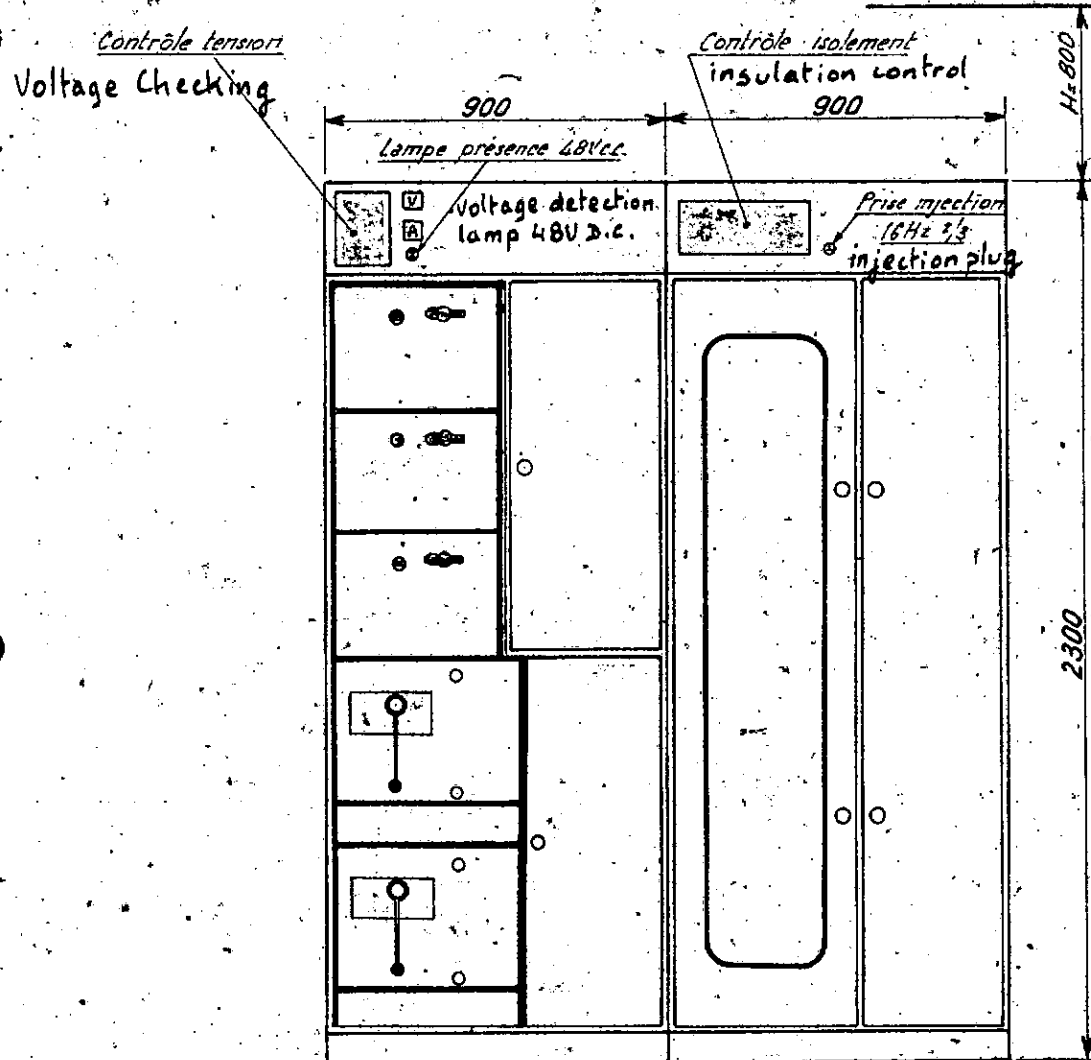
EQUIPMENT	TYPE	CIRCUIT BREAKER	Number of modules	Assembly in cubicles	
				N 686	N 486
Battery or rectifier incoming	T1 T2	CNP 1000	3	●	≡
Battery or rectifier incoming	T3 to T7	DT 630	2	●	≡
Battery discharge	U1 to U5	DT 630 DT 200	2	●	≡
Outgoing $U \leq 125$ V DC	J1 to J8	DT 200	3	○ ○	● ● ●
Outgoing $U = 230$ V DC	J1 to J8	DT 200	3	≡	● ●

Note : Taking into account the operating conditions, the equipments type "T" have to be placed in the lower part of the column.

- Standard assembly
- Special assembly
- ≡ Impossible assembly

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE				
				CONTRACTOR MEMBER	CGEE ALSTHOM				
REV	DR. by	DATE	MODIFICATIONS	DWG N°	1				0 8 6 5
DWG N°		KBA	1 2	1 5	G	1 0	0 0 1	AA	- - L T D 61/80

DIMENSIONS OF THE CUBICLES

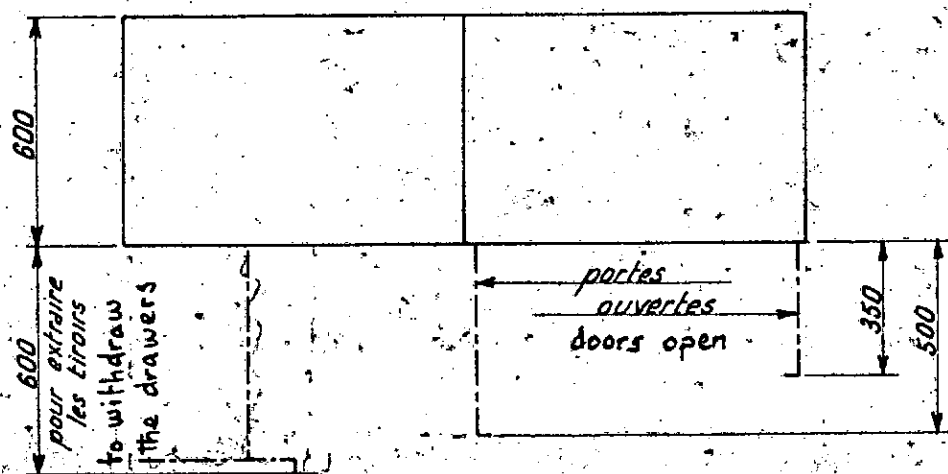


H = height to be left free above the switchboard to have access to the connecting lugs and terminals.

H = hauteur à laisser libre au dessus du tableau pour accéder au raccordement sur les appareils et aux bornes de liaisons des fileries (Démontage des tôles rep. 10 ou 16 - voir feuilles 2/16.1 et 2/17.1)

N 686

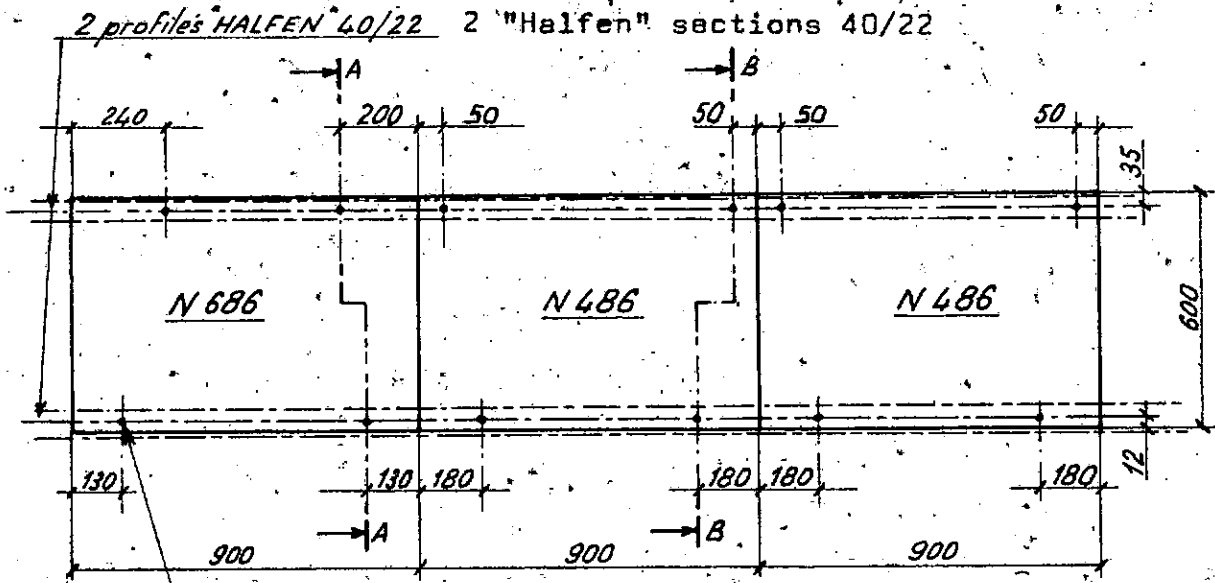
N 486



			CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE	
			CONTRACTOR MEMBER		CGEE ALSTHOM	
REV	DR. by	DATE	MODIFICATIONS		1 0 8 6 5	
DWG No.			KBA 1 2 1 5 G 1 0 0 0 1		AA - - L T D 62/80	

11.2.5

LAY-OUT ON "HALFEN" SECTIONS

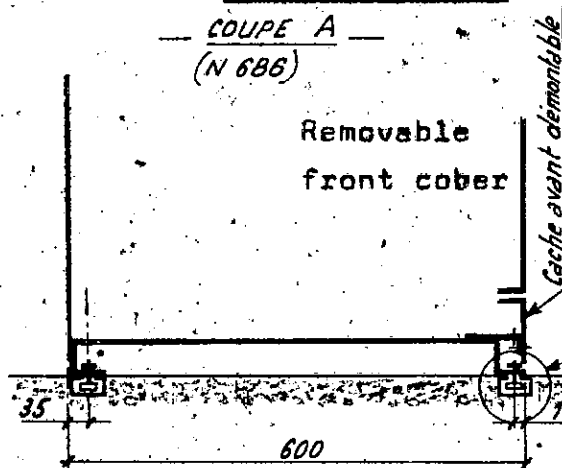


Trous de fixation 17,5x32

Fixing holes 17.5 X 32

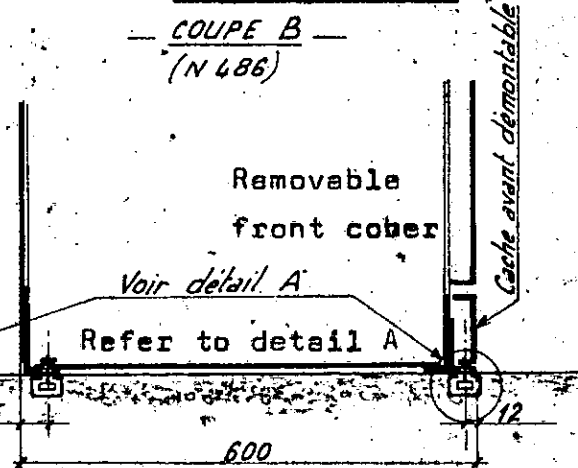
CROSS SECTION A

COUPE A
(N 686)

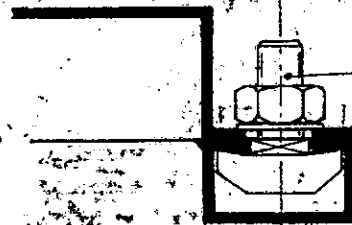


CROSS SECTION B

COUPE B
(N 486)



DETAIL A



PROFILE HALFEN 40/22 ET BOULON
A TETE CROCHET Ø M10 - Lg = 30

"Halfen" section 40/22 and
bolt type "hook-head" Ø
M 10 - Lg = 30 -

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE					
				CONTRACTOR MEMBER	CGEE ALSTHOM					
REV	DR. by	DATE	MODIFICATIONS	DWG N.					0 8 6 5	
DWG N.				KBA	1	2	1	5	G	1 0 0 0 1
				B	AA				-	L T D 63/80

B

A4

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11.3

GENERAL CHARACTERISTICS

11.3.1. ELECTRICAL CHARACTERISTICS

11.3.1.1. Rated characteristics

- rated service voltage : 125 V DC (230 V DC for LAA and LAC)
- maximum service voltage : 135 V DC (250 V DC for LAA and LAC)
- exceptional voltage on busbars and incomings : 153 V DC (283 V for LAA and LAC)
- insulation rated voltage : 500 V for main circuits
- maximum current in continuous duty : 800 A in the main busbar
- assumed short circuit current : 10 000 A maximum

Compliance with standards

a) column

IEC 439 : M. V. metalclad unit

NFC 12 100 : decree dated 14.11.62 concerning the workers' protection

b) switchgear

IEC 157-1 : main use circuit breaker

IEC 51 : measuring instruments

c) protection degree

According to standard IEC 529 : IP 317

11.3.2. WEIGHT AND OVERALL DIMENSIONS CHARACTERISTICS

Refer to sketches of leaflets 10.2.3. - 10.3.

11.3.2.1. Main dimensions

- height : 2 300
- width : 900
- depth : 600

11.3.2.2. Dimensions of the equipments

For T types

- with CNP 1000 : H = 360
W = 500
D = 420

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
				CONTRACTOR MEMBER	CGEE ALSTHOM															
18/8/80	GAY	Modified ; 11.3.1.1		DWG N°	1	0	8	0	8	6	5									
REV	DR. by	DATE	MODIFICATIONS	DWG N°																
DWG N°		KBA		1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	64/80

- with DT 630 : H = 320
 W = 460
 D = 670

For U types

- with DT 630 H = 320
 or DT 200 W = 460
 D = 670

For J type

- plates with 3 DT 200 H = 400
 W = 500
 D = 260

11.3.2.3. Approximate weights

- of the columns (entirely equipped)
 - . N.686 with incoming by CNP = 470 kg
 - . N.686 with incoming by DT = 380 kg
 - . N.486 with 15 outgoing = 280 kg

- of the equipments
 - Type T with CNP 1000 = 40 kg
 - Type T with DT 630 = 25 kg
 - Type U with DT 630 or DT 200 = 20 kg or 15 kg
 - Type J (plate with 3 DT 200) = 15 kg

11.3.3. TRANSPORT CHARACTERISTICS

The weights and overall dimensions of the cases will be given in detail for each particular order.
 Indeed, these values depend upon the importance of the switchboards, the handling means provided for unloading and the dimensions of the doors providing access to the installation places.

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE														
				CONTRACTOR MEMBER	CGEE ALSTHOM														
REV	DR. by	DATE	MODIFICATIONS	DWG No.	1	0	8	4	0	8	6	5							
DWG No.			KBA	1	2	1	5	G	1	0	0	1	AA	-	-	L	T	D	65/80

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11.4. EQUIPMENT PHOTOS

- 11.4.1. Type T1 and T2 - Front view
- 11.4.2. Type T1 and T2 - Rear view
- 11.4.3. Type T3 to T7
- 11.4.4. Type U1 - U2 - U3
- 11.4.5. Type U4 - U5
- 11.4.6. Type J1 to J8

2

2

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
				CONTRACTOR MEMBER	CGEE ALSTHOM															
REV	DR. by	DATE	MODIFICATIONS		1 4 1 0 8 A 4 0 8 6 5															
DWG N.		KBA		1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	66/80

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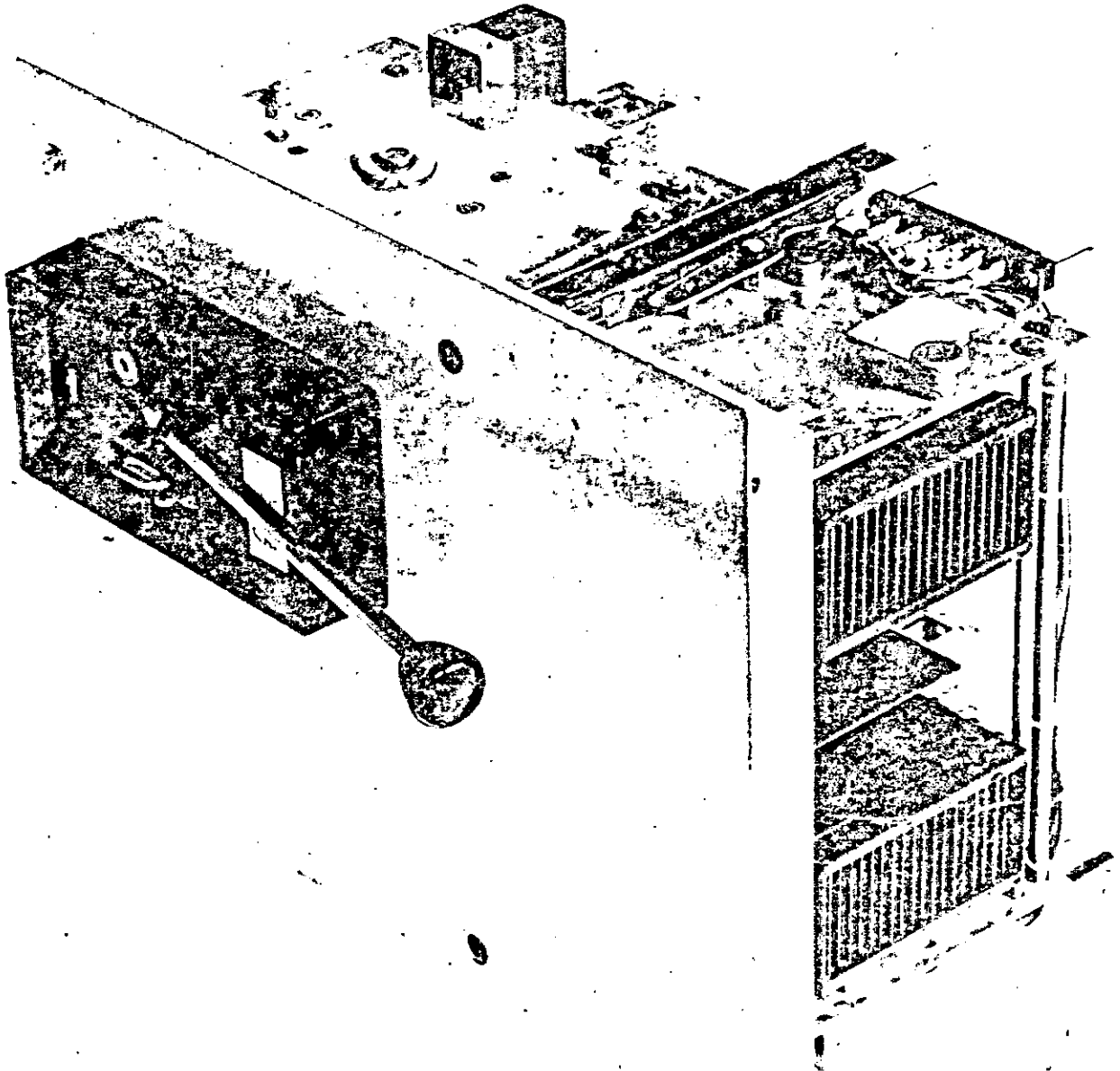
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11.4.1

EQUIPMENTS TYPE T1 AND T2 CNP AIR BREAK CIRCUIT BREAKERS

FRONT VIEW



2

1

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG N°	1	4	1	0	8	A	0	8	6	5							
DWG N°				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	67/80

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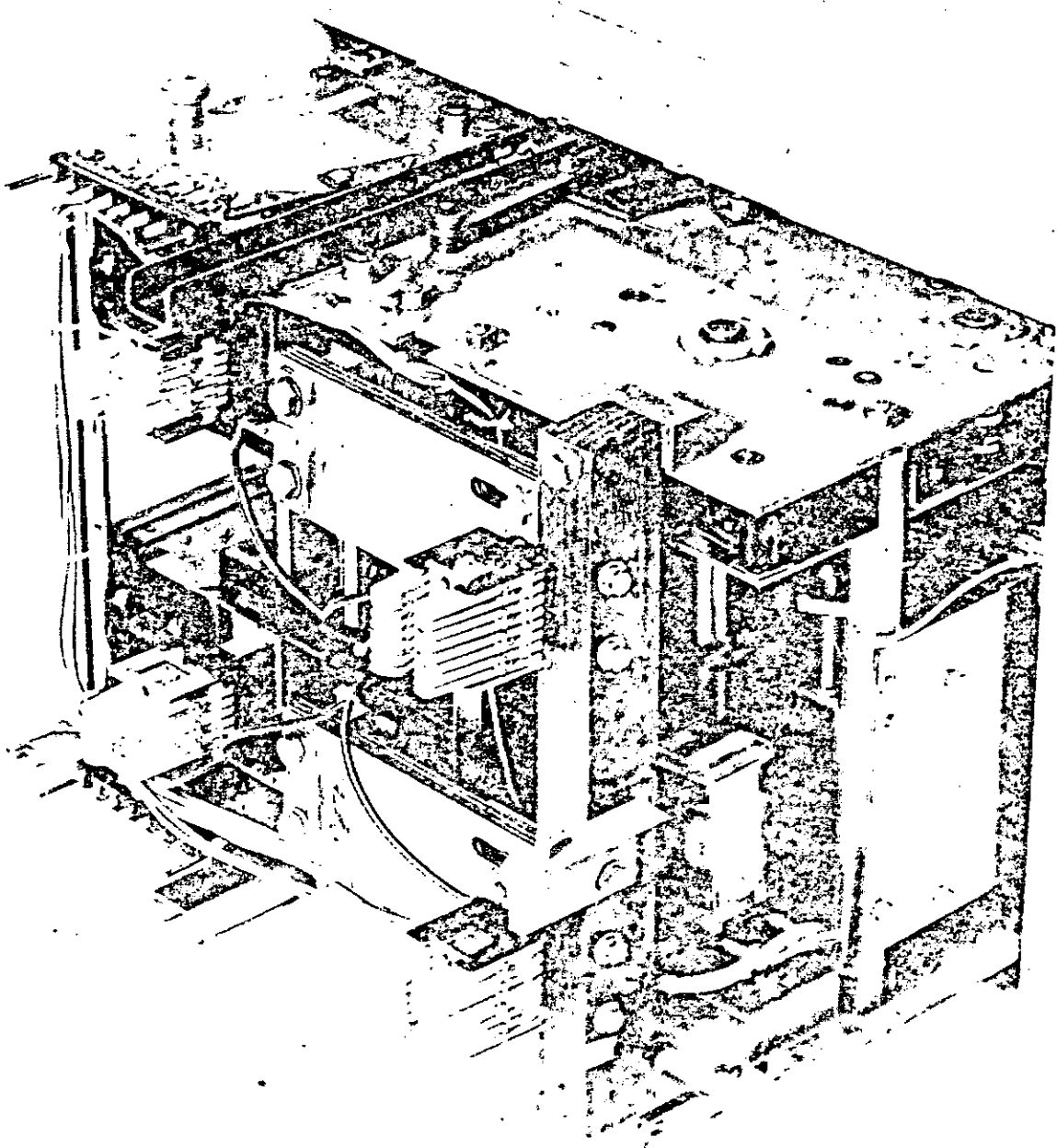
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EQUIPMENT TYPE T1 AND T2
CNP AIR BREAK CIRCUIT BREAKERS

REAR VIEW



				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE										
				CONTRACTOR MEMBER	CGEE ALSTHOM										
REV	DR. by	DATE	MODIFICATIONS	DWG N°	4	1	0	8	A	4	0	.	8	6	5
DWG N°				KBA 1 2 1 5 G 1 0 0 0 1				AA - - L T D 68/80							

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NORVEGE ALSTHOM

1

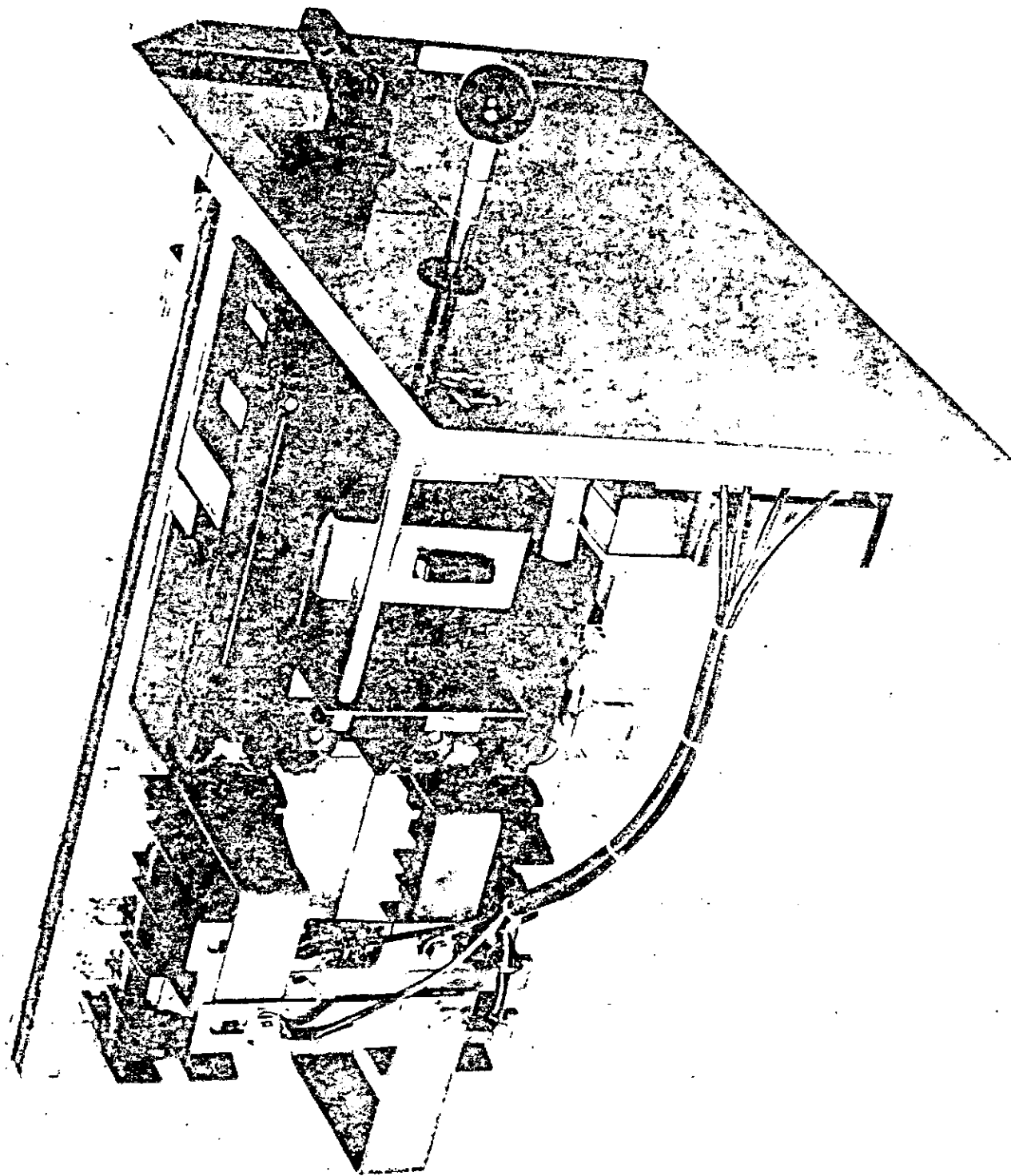
P101

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11.4.3

EQUIPMENT TYPE T3 TO T7
MOULDED CASE CIRCUIT BREAKER



2

1

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																	
				CONTRACTOR MEMBER	CGEE ALSTHOM																	
REV	DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER DWG N°	4	1	0	8	A	4	0	8	6	5								
DWG N°				KBA				1	2	1	5	G	1	0	0	0	1	AA		- - L T D		69/80

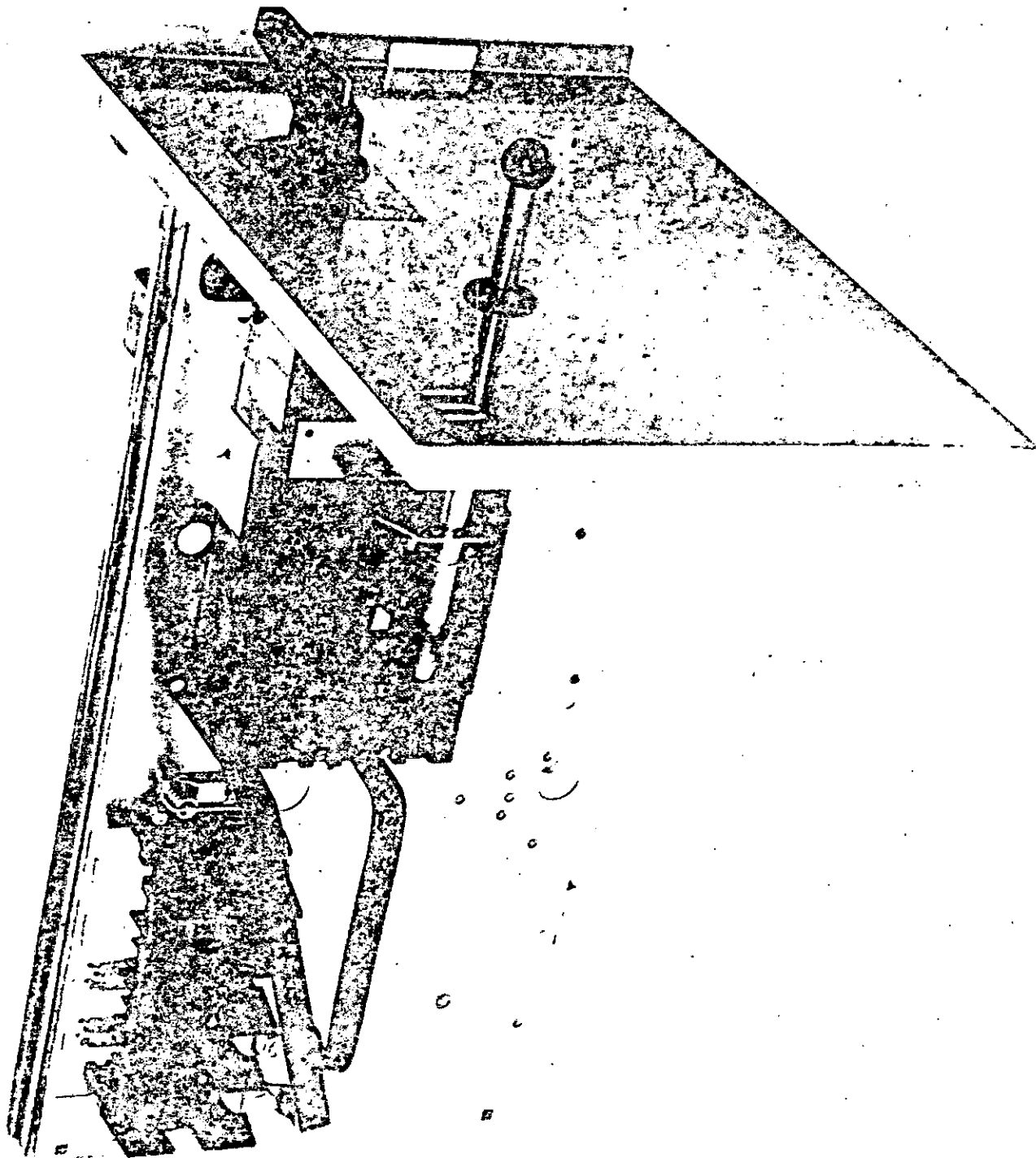
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11.4.4

EQUIPMENT TYPE U1_U2_U3
MOULDED CASE CIRCUIT BREAKER



2

1

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG N.	4	1	0	8	A	4	0	8	6	5							
DWG No.				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	70/80

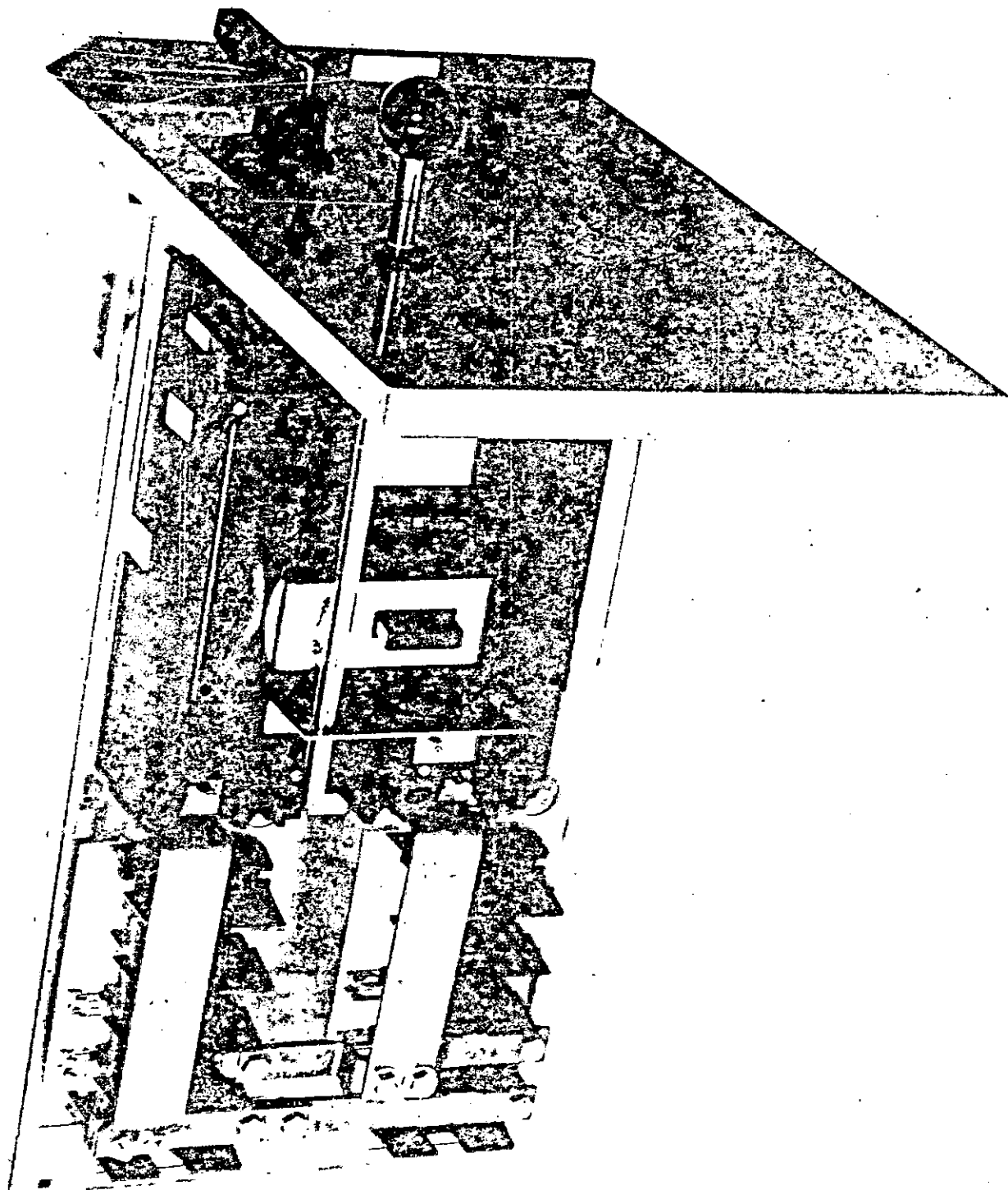
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11.4.5

EQUIPMENT TYPE U4 U5
MOULDED CASE CIRCUIT BREAKER



2

1

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE																
				CONTRACTOR MEMBER	CGEE ALSTHOM																
REV	DR. by	DATE	MODIFICATIONS	DWG N°	4	10	8A	40865													
DWG N°				KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	71/80

B

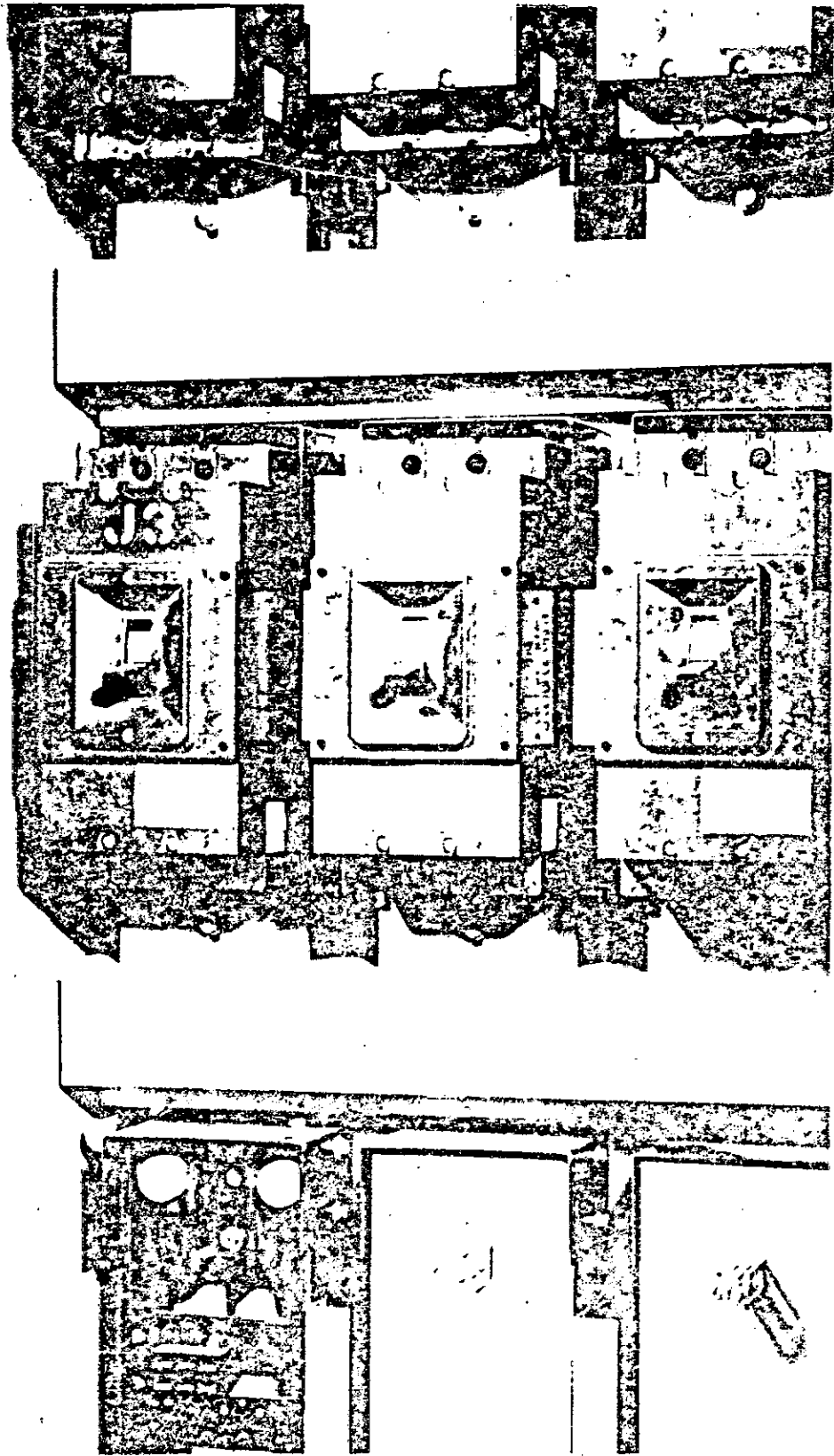
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EQUIPMENT J1 TO J8

11.4.6

FIXED SUPPORT WITH 3 EQUIPMENTS
MOULDED CASE CIRCUIT BREAKERS



				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
				CONTRACTOR MEMBER	CGEE ALSTHOM															
REV	DR. by	DATE	MODIFICATIONS	DWG N°	P	4	1	0	8	A	4	0	8	6	5					
DWG N°			KBA	1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	72/80

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11.5. OPERATING CURVES OF THE RELEASES

11.5.1. Standard curves of DT 630 - DT 200 and CNP 1000

11.5.2. Operating chart function of °C.

2

2

				CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE								
				CONTRACTOR MEMBER	CGEE ALSTHOM								
REV	DR. by	DATE	MODIFICATIONS	DWG N°	4	1	0	8	A	0	8	6	5
DWG N°				KBA 1 2 1 5 G 1 0 0 0 1				AA - - L T D 73/80					

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CORVE 3500

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P101

- Courbe de déclenchement à 60°C des DT 630 avec ou sans shunt -
DT 200 et CNP (Magnétiques seuls pour CNP)

Courbes - N° 4843 p. 34 to 42
à 4857

Définition des symboles

- Ie : courant d'emploi
- Ir : courant de réglage du déclencheur magnétique
- Ic1 - Ic2 : Pouvoir de coupure de l'appareil limité par le DN1 ou DN2.

Point d'autoprotection

- DN1 déclencheur magnétique retardé 25 ms
- DN2 déclencheur magnétique retardé à 100 ms.

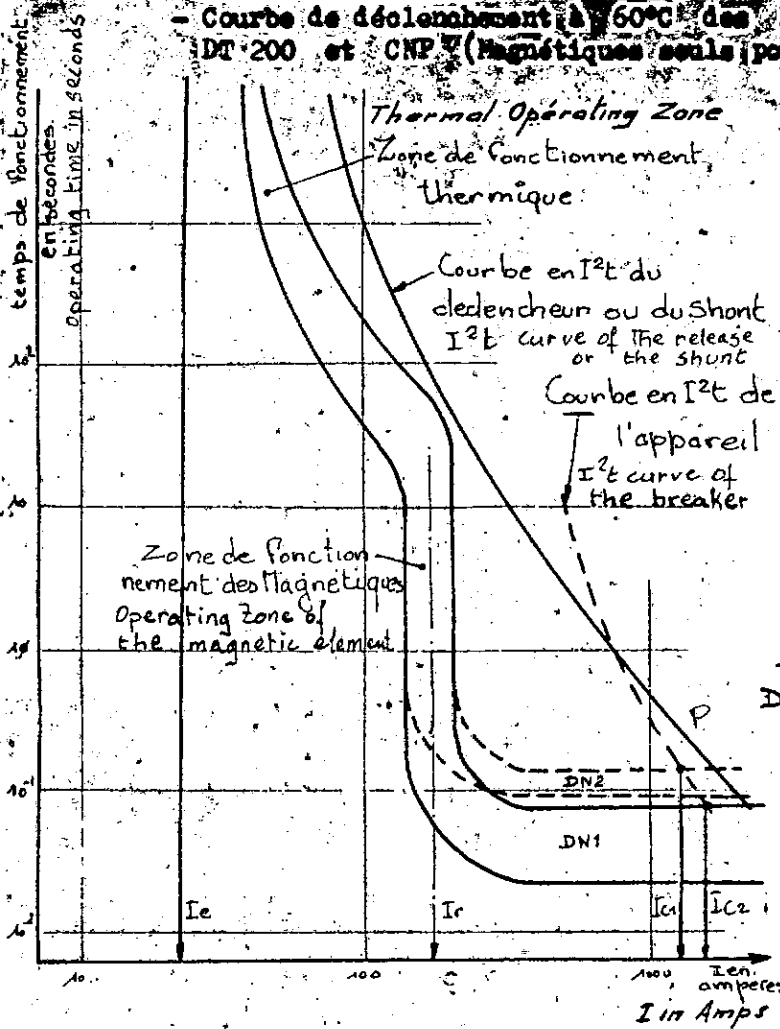
- Tripping Curves at 60°C of DT 630 - DT 200 - CNP (magnetic for CNP)

Symbols:

- Ie = applied current
- Ir = setting of magnetic release
- Ic1 - Ic2: Breaking capacity limited by the DN1 or DN2

DN1 magnetic release is time delayed for 25 ms

DN2 magnetic release time delayed 100ms



- Courbe des temps de fonctionnement thermiques en fonction du kIrth

quelque soit la température ambiante

Thermal Release Operating Time At Any Ambient Temperature

At Any Ambient Temperature

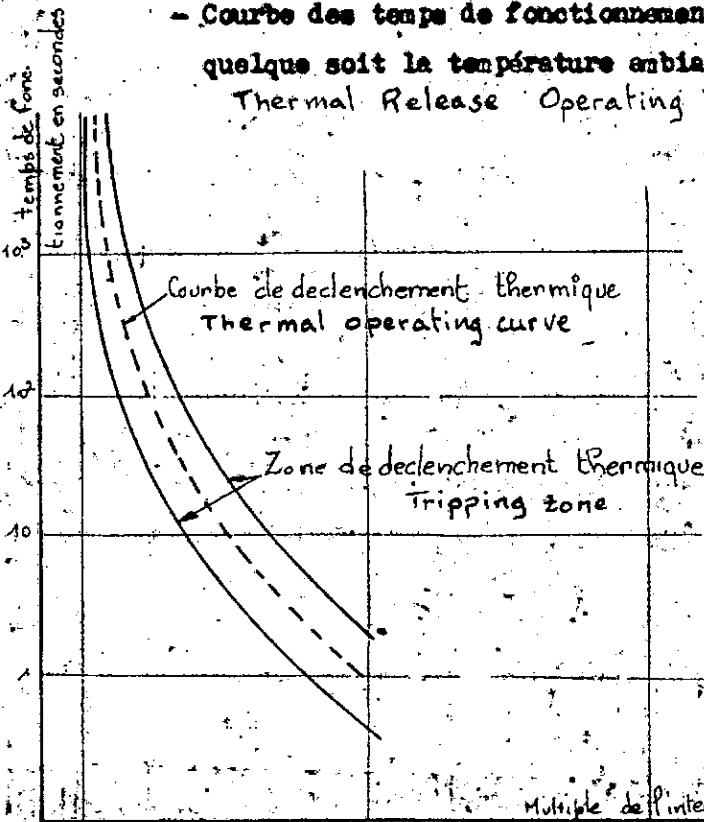
Courbes N° 4488 à 4492

N° 4494 N° 4499

N° 4540 N° 4542

N° 4841

Curves p 43 to 52



k I_r th = multiple of the setting in Amps

Please refer to leaflet 11/5.2

Multiple de l'intensité de réglage (kIrth) multiple of current setting

CONTRACTOR MEMBER		ALSTHOM ATLANTIQUE	
CONTRACTOR MEMBER		CGEE ALSTHOM	
REV	DR. by	DATE	MODIFICATIONS
DWG N°		KBA 1 2 1 5 G 1 0 0 0 1	
		AA - - L T D 74/80	

Circuit Breaker	Max. Thermal Setting At 40 °C	Max. Thermal setting at :				Min. Thermal Setting At 40 °C	Min. Thermal Setting At 60 °C	Test current * 1 Magnetic Setting x 0,5	K1r Thermal For Test At 20 °C Max Setting	Example Tripping Time (s) At 20 °C * 2
		20°C	30°C	50°C	60°C					
DT200 J1	15	17	16	14	12,5	10	165X0,5 = 82,5	82,5/17 = 4,85	1,5" & 9"	
DT200 J2	25	29	27	23	20,5	15	275X0,5 = 137,5	137,5/29 = 4,74	1,6" & 9"	
DT200 J3U1	35	40,5	38	32	28,5	25	400X0,5 = 200	200/40,5 = 4,94	1,5" & 8"5	
DT200 J4	50	57	53,5	46	42	35	565X0,5 = 282,5	282,5/57 = 4,95	1,5" & 8"5	
DT200 J5U2	70	80	75	65	60	50	725X0,5 = 362,5	362,5/80 = 4,53	7" & 45"	
DT200 J7U3	125	144	135	115	105	90	920X0,5 = 460	460/144 = 3,19	16" & 110"	
DT630 J3	80	90	85	74	70	80	335X0,5 = 167,5	167,5/90 = 1,86	160" & 750"	
DT630 J4	125	137	131	119	112	80	520X0,5 = 260	260/137 = 1,90	160" & 750"	
DT630 J5	250	275	263	236	220	175	840X0,5 = 420	420/275 = 1,53	400" & 2000"	
DT630 J6	250	275	263	236	220	175	1050X0,5 = 525	525/275 = 1,91	150" & 750"	
DT630 J7	400	440	422	378	352	280	1670X0,5 = 835	835/440 = 1,9	150" & 750"	
DT630 J4	250	275	263	236	220	175	1500X0,5 = 750	750/275 = 2,72	55" & 250"	
DT630 J5	500	552	526	472	440	360	3000X0,5 = 1500	1500/552 = 2,72	55" & 240"	

* 1 The test current can be from 0.3 to 0.5 times the magnetic setting

* 2 The operating times are read on with curves on page 11/5.1

REV	DR. by	DATE	MODIFICATIONS	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE
				CGEE ALSTHOM	
				CONTRACTOR MEMBER	
				DWG N°	1 4 1 0 8 A 4 0 8 6 5
DWG N°	KBA	1 2	1 5 G	1 0 0 0 1	AA - - L T D 75/80

12. LIST OF DRAWINGS

12.1. STANDARD DIAGRAMS

12.1.1. D.C. SWITCHBOARDS

See KBA 12-17 000 073 AA LSP

12.1.2. 220 V A. C. SWITCHBOARDS

See KBA 12-17 000 094 AA LSP

12.2. "EQUIPMENTS DEFINITION" DOCUMENTS

These documents show the composition of each switchboard

Switchboard	Reference of document
1 & 2 LAA	KBA 12 15 G 10 015.
1 & 2 LAB	KBA 12 15 G 10 020
1 & 2 LAC	" 002
" LBA	" 003
" LBB	" 004
" LBC	" 005
" LBD	" 006
" LBE	" 007
" LBF	" 008
9 LBG	KBA 09 15 G 10 001
9 LBH	" 002
1 & 2 LBJ	KBA 12 15 G 10 009
9 LBK	KBA 09 15 G 10 003
1 & 2 LCA	KBA 12 15 G 10 010
" LCB	" 011
" LCC	" 012
9 LCD	KBA 09 15 G 10 004
9 LCE	" 005
9 LCG	" 006
1 & 2 LDA	KBA 12 15 G 10 013
" LMA	" 016
" LNE	" 014
9 LNF	KBA 09 15 G 10 007
9 LNG	" 008
9 LBL	" 009
9 LCH	" 010
9 LNH	" 011

F	5/4/83	ZUN	Modified 12.2	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
D	18/8/80	GAY	Modified 2.2		CGEE ALSTHOM															
	GAYET	31.79	mod. title and text par. 12	CONTRACTOR MEMBER	P 4 1 0 8 A 4 0 8 6 5															
REV	DR. by	DATE	MODIFICATIONS		DWG No.															
DWG No.		KBA		1	2	1	5	G	1	0	0	0	1	AA	-	-	L	T	D	76/80

13. QUALITY ASSURANCE

The following switchboards :

1 and 2 LBA, 1 and 2 LBB, 1 and 2 LBC, 1 and 2 LBD, 1 and 2 LBE, 1 and 2 LE, 9 LBK, 1 and 2 LCA, 1 and 2 LCP, 9 LCG,

will comply with the Quality Assurance Program for quality level Q1 equipment and services.

This specification referenced KBA.00.22.D.02.202 is based on the following documents :

- 10 CFR 50 appendix B
- ANSI N 45.2 (1971)

The following switchboards :

1 and 2 LAA, 1 and 2 LAC, 9 LBG, 1 and 2 LBJ, 9LBL, 1 and 2 LCC, 9 LCD, 9 LCH 1 and 2 LNE, 9 INF, 9 ING, 9 LNH, 9 LCE, 1 and 2 LDA, 9 LBH, 1 and 2 LMA

will comply with Quality Assurance directive for quality level C2 in our "Specification of Quality Organization Program, equipment and service".

This specification is referenced KBA.00.22.D.02.201.

These two specifications will be complemented by guide specifications.

14. MISCELLANEOUS

14.1. Instruction manuals

Complete erection, maintenance and operating instructions will be supplied before delivery.

One copy of the instruction manuals shall be submitted to ESCOM for approval, prior to the required quantity being finally submitted.

14.2. Drawings to be handed over

The following drawings will be supplied

- a) outline of each panel
- b) floor holing plan of each switchboard giving also magnetude and disposition of all loads imposed on foundation
- c) internal wiring diagram for each type of panel
- d) schematic diagram of each panel with clear indication of wiring terminals

CGEF AT		ESCOM
A	I	
	x	x
	x	
	x	x
x		x

15. LABELS

All labels mounted externally and all labels pertaining to operating instructions shall be in both in english and afrikaans, with english taking precedence over afrikaans.

ESCOM will advise the afrikaan translations

D	GAYET	18.8.80	Added § 15	CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE	
C	GAY	31X79	Added C2 boards and §14		CGEE ALSTHOM	
	GAY	317 B	Modified text § 13	CONTRACTOR MEMBER DWG No.	P 4 1 0 8 A 4 0 8 6 5	
REV	DR. by	DATE	MODIFICATIONS			
DWG No.		KBA 1 2 1 5 G 1 0 0 0 1		AA - -		T D 77/80

APPENDIX 1

STANDARD DIAGRAMS

48-125 230 V DC SWITCHBOARD VOLTAGE AND INSULATION MONITORING CIRCUIT	KBA.12.17.000.061 Rev. 3
30 V DC SWITCHBOARD VOLTAGE AND INSULATION MONITORING CIRCUIT	KBA.12.17.000.062 Rev. 3
125-230 V DC SWITCHBOARD VOLTAGE AND INSULATION MONITORING CIRCUIT	KBA.12.17.000.063 Rev. 3
30-48-125 V. DC SWITCHBOARD BATTERY INCOMER CIRCUIT DT 630 RH	KBA.12.17.000.064 Rev. 3
48-230 V DC SWITCHBOARD BATTERY INCOMER CIRCUIT CNP 1000	KBA.12.17.000.065 Rev. 3
30-48-125 V DC SWITCHBOARD CHARGER INCOMER CIRCUIT DT 630 RH	KBA.12.17.000.066 Rev. 3
48-230 V DC SWITCHBOARD CHARGER INCOMER CIRCUIT CNP 1000	KBA.12.17.000.067 Rev. 3
125 V DC SWITCHBOARD INVERTER OUTGOING CIRCUIT DT 200 RH	KBA.12.17.000.068 Rev. 3
30-48 125 V DC SWITCHBOARD BATTERY DISCHARGE OUTGOING CIRCUIT DT 200 RH DT 630 RH	KBA.12.17.000.069 Rev. 3
30-48-125 V DC SWITCHBOARD NORMAL OUTGOING CIRCUIT DT 200 RH	KBA.12.17.000.070 Rev. 3
48-125-230 V DC SWITCHBOARD BATTERY INCOMER + 1 CHARGER INCOMER RELAYING CIRCUIT	KBA.12.17.000.071 Rev. 3
30-48-125-230 V DC SWITCHBOARD BATTERY INCOMER + 2 CHARGER INCOMER RELAYING CIRCUIT	KBA.12.17.000.072 Rev. 3
230 V DC SWITCHBOARD BATTERY DISCHARGE OUTGOING CIRCUIT DT 630 RH	KBA.12.17.000.096 Rev. 2
230 V DC SWITCHBOARD NORMAL OUTGOING CIRCUIT DT 200 RH	KBA.12.17.000.097 Rev. 2
230 V DC SWITCHBOARD MOTOR OUTGOING CIRCUIT DT 200 RH DT 630 RH	KBA.12.17.000.098 Rev. 2

			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE															
			CONTRACTOR MEMBER	CGEE ALSTHOM															
31X79	GAY	Added sheet	CONTRACTOR MEMBER	P	4	1	0	8	A	4	0	8	6	5					
REV	DR. by	DATE	MODIFICATIONS	DWG N°															
DWG N°		KBA		1	2	1	5	G	1	0	0	C	AA	-	-	I	7	D	78/80

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230 V DC SWITCHBOARD
NORMAL OUTGOING CIRCUIT E 200 RH

KBA.12.17.000.102 Rev.2

230 V DC SWITCHBOARD
INVERTER OUTGOING CIRCUIT DT 200 RH

KBA.12.17.000.104 Rev.2

FOR 1 INVERTER

220 V AC SWITCHBOARD
VOLTAGE AND INSULATION MONITORING CIRCUIT

KBA.12.17.000.077 Rev.2

220 V AC SWITCHBOARD
AC OUTGOING AND INCOMER PLATE

KBA.12.17.000.078 Rev.2

220 V AC SWITCHBOARD
RELAYING PLATE FOR 1 INVERTER INCOMER

KBA.12.17.000.079 Rev.2

FOR 3 INVERTERS

220 V AC SWITCHBOARD
VOLTAGE AND INSULATION MONITORING CIRCUIT

KBA.12.17.000.080 Rev.2

220 V AC SWITCHBOARD
INVERTER INCOMER PLATE

KBA.12.17.000.081 Rev.2

220 V AC SWITCHBOARD
RELAYING PLATE FOR 3 INVERTER INCOMERS

KBA.12.17.000.082 Rev.2

FOR 30 V DC

220 V AC SWITCHBOARD
VOLTAGE AND INSULATION MONITORING CIRCUIT
(30 V DC)

KBA.12.17.000.083 Rev.2

220 V AC SWITCHBOARD
1 000 W rectifier (30 V DC)

KBA.12.17.000.084 Rev.2

OUTGOING

220 V AC SWITCHBOARD
AC OUTGOING PLATE

KBA.12.17.000.085 Rev.2

220 V AC SWITCHBOARD
500 W RECTIFIER PLATE (48 V DC)

KBA.12.17.000.086 Rev.2

220 V AC SWITCHBOARD
500 W RECTIFIER AND DC OUTGOING PLATE

KBA.12.17.000.087 Rev.2

			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE										
			CONTRACTOR MEMBER	CGEE ALSTHOM										
31X79	GAY	Added sheet	CONTRACTOR MEMBER	P	4	1	0	8	A	4	0	8	6	5
DR. by	DATE	MODIFICATIONS	DWG No.											
DWG No.	KBA	1 2	1 5	G	1	0	0	0	1	AA	L	T	D	79/80

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220 V AC SWITCHBOARD
DC OUTGOING PLATE

KBA.12.17.000.088 Rev.2

220 V AC SWITCHBOARD
AC OUTGOING AND BUSBAR EARTH CONNECTION
PLATE

KBA.12.17.000.133 Rev.1

FOR SWITCHBOARD SUPPLIED BY TRANSFORMER

220 V AC SWITCHBOARD
TRANSFORMER CELL

KBA.12.17.000.106 Rev.1

220 V AC SWITCHBOARD
VOLTAGE AND INSULATION MONITORING CIRCUIT

KBA.12.17.000.105 Rev.1

220 V AC SWITCHBOARD
RELAYING PLATE

KBA.12.17.000.107 Rev.1

220 V AC SWITCHBOARD
AC OUTGOING AND INCOMER PLATE

KBA.12.17.000.108 Rev.1

			CONTRACTOR MEMBER	ALSTHOM ATLANTIQUE														
			CONTRACTOR MEMBER	CGEE ALSTHOM														
31X79	GAY	Added sheet		P	4	1	0	8	A	4	0	8	6	5				
DR. by	DATE	MODIFICATIONS	DWG No.															
DWG No.	KBA			1	2	1	5	G	1	0	0	0	1	AA	L	T	D	80/80

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