

690-1000 V • 1250-6300 A • 40-130 kA (380/415 V)

ITSCB TC/10/AA/10 7-1994

SACE Megamax F

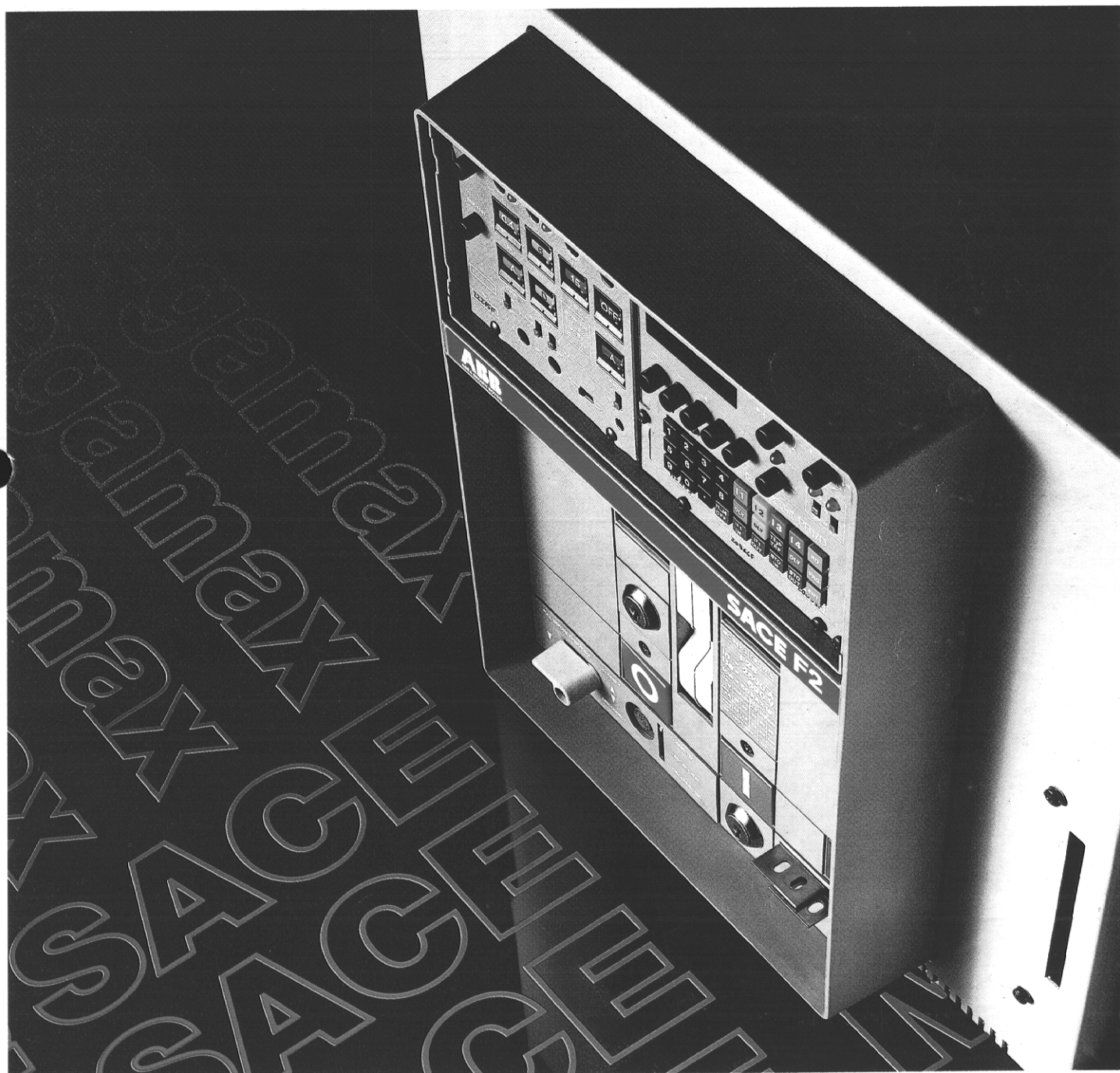


ABB SACE

ABB

Introduction

ABB SACE, a member Company of the ABB Asea Brown Boveri International Group, is present wherever there is the need to produce, transform, distribute and utilize electrical energy under maximum safety conditions.

Technological specialization characterizes ABB SACE as a Company capable of guaranteeing advanced know-how and to emerge as a reliable Italian partner in the most ambitious National and Worldwide achievements.

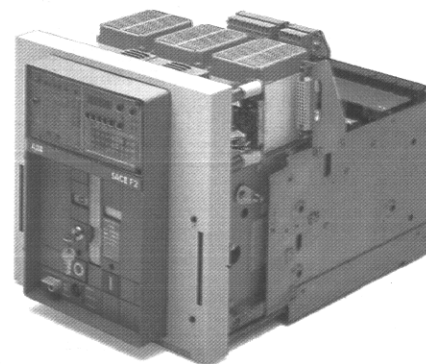
Already established in the forefront for its vast array and qualified programme of production for low voltage, ABB SACE proposes this specialized catalogue dedicated to low voltage air

circuit-breakers.

The SACE Megamax F circuit-breakers have been acclaimed by the prestigious "Golden Compass" award issued by the Association for Industrial Design; recognition motivated by the high degree of reliability for a complex performance product.

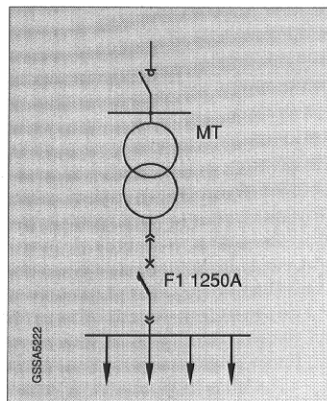
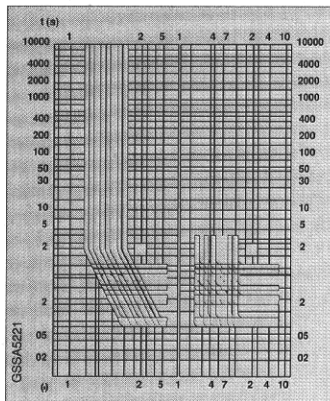
For help in ordering illustrated equipment the following publications are available which must be requested separately:

- integrated catalogue on products for electrical installations
- price list for SACE Megamax circuit-breakers.

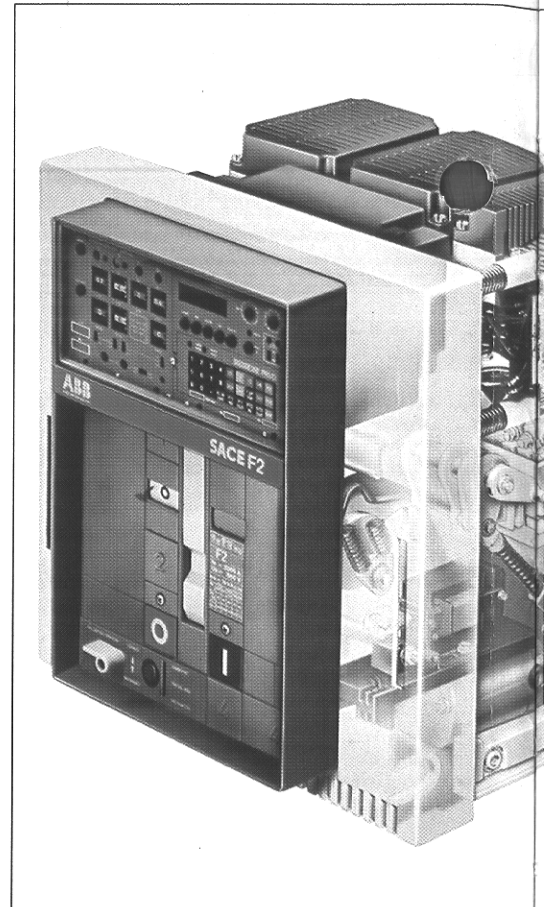


Performances

This circuit-breaker series not only offers excellent performances under normal service conditions, but is also capable of closing, of withstanding without damages and of breaking, with methods of intervention predetermined by the design engineer, overload and short-circuit currents of high duration and intensity.

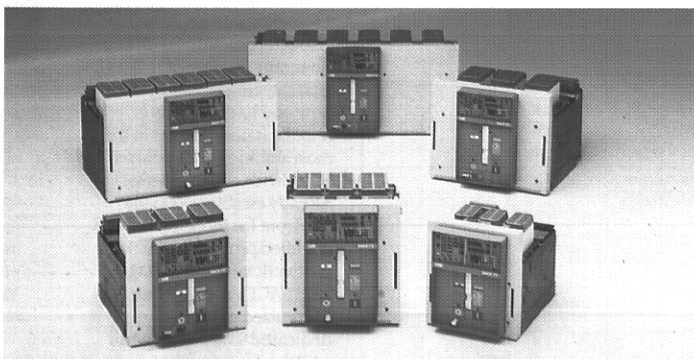


- Rated uninterrupted currents from 1250 to 6300 A
- Rated breaking capacities from 40 to 130 kA (380/415 V a.c.)



Advantages in the switchboard designing and building

The overall dimensions of devices are extremely compact compared with their performances. Moreover, to simplify the switchboard supporting frame in which the circuit-breakers are mounted, some dimensions are

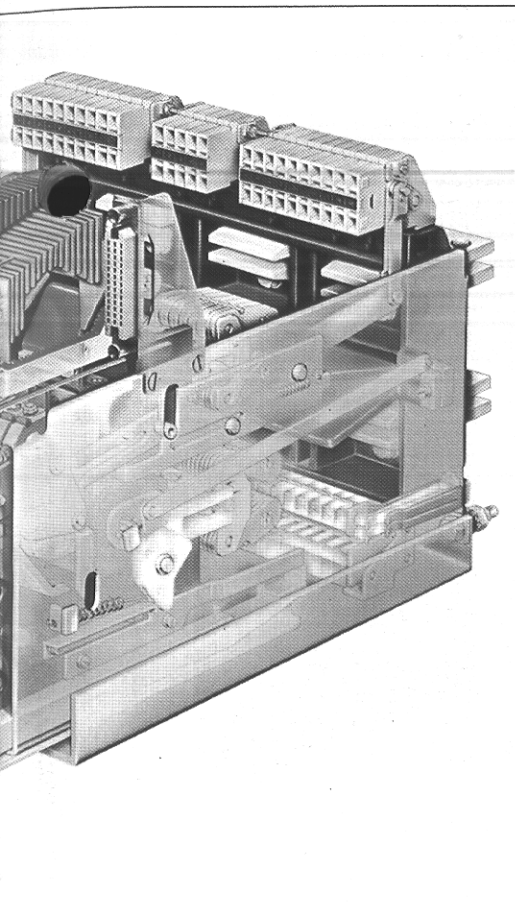


constant: the circuit-breaker range is divided into six sizes designated by the symbols ranging from F1 to F6; circuit-breakers belonging to the same size have equal external dimensions.

- Compact and modular construction
- Wide range of versions, terminals and accessories
- Standardization of fixed parts
- Limitation of thermal and dynamic stresses (especially for current-limiting circuit-breakers) on equipment installed on the load side, which enables a reduction in their dimensions
- Possibility of achieving back-up protection with circuit-breakers installed on the load side and having lower breaking capacities
- Guaranteed coordination of both selective and back-up protections

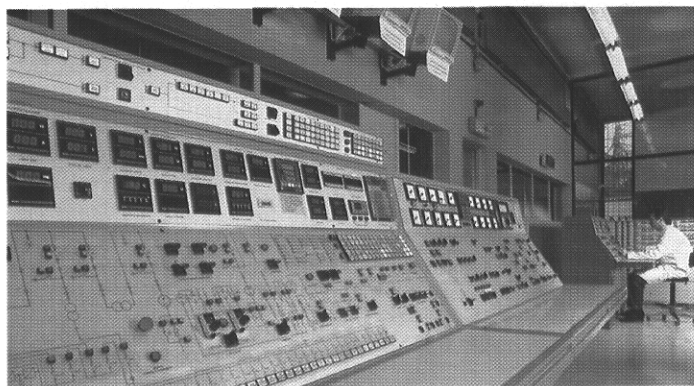


Destination plants



Characteristics connected with the performances and the high reliability as well as with the integration in the equipment of electronic control and interfacing devices make these circuit-breakers particularly suitable for the installation in modern protection systems of important L.V. electrical plants controlled by computer.

- Plants with centralized integrated operating and control systems
- Plants with particular requirements of protection co-ordination and automatic operation
- Plants with high rated and fault currents



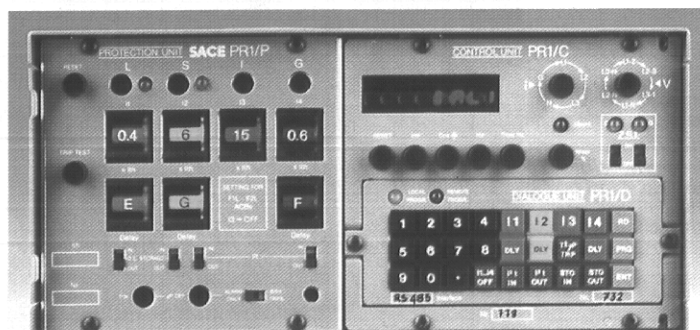
Advantages in the plant operation



The use of the latest production and quality control techniques has permitted the achievement of a high degree of operational reliability. The breaking technique and the mechanics of devices allow a rapid protection.

Through the utilization of the SACE PR1 microprocessor-based release, the SACE Megamax circuit-breakers are in the van worldwide since they are designed for the full insertion in integrated protection, control and supervision systems of electrical installations.

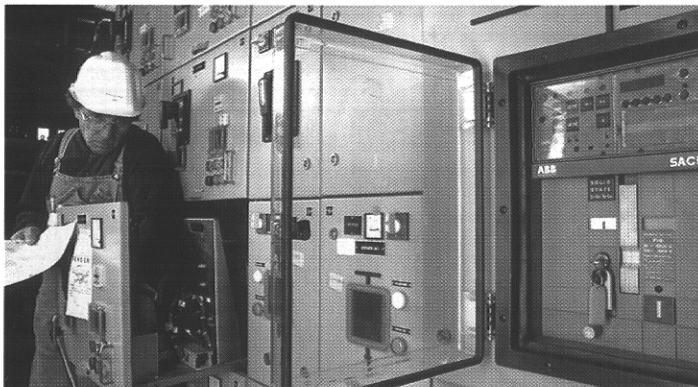
- High degree of reliability
- Possibility for the circuit-breaker to be inserted in a centralized control system
- In case of trip, immediate localization of the fault and maximum rapidity in isolating the area affected by the fault
- Wide adjustment range of currents and trip times
- Possibility of following extensions without modifying either the circuit-breaker or the switchboard



Advantages in servicing

The inspection and maintenance problems, although reduced to a minimum, have already been solved at the equipment designing stage, thus enabling the personnel to carry out their work in complete safety and ease.

Besides, the control unit of the SACE PR1 release provides the local indication of the contacts wear condition and of the number of switching carried out. This information is available also for the control system, when a dialogue unit is adopted.



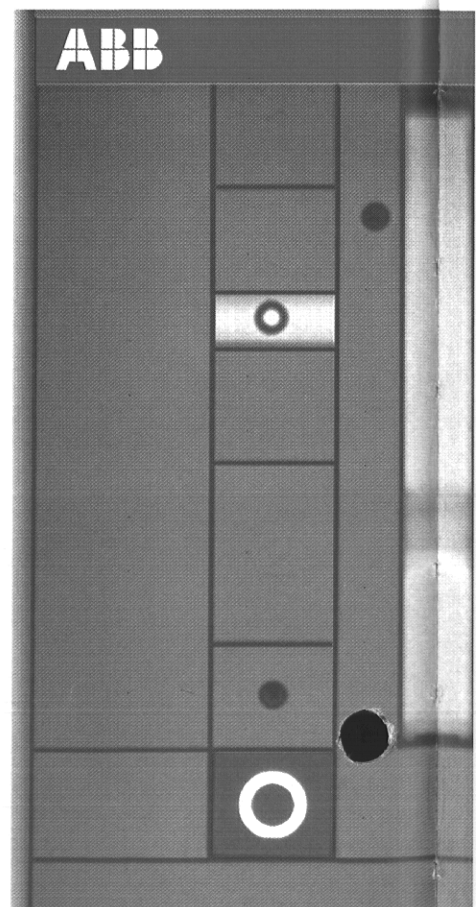
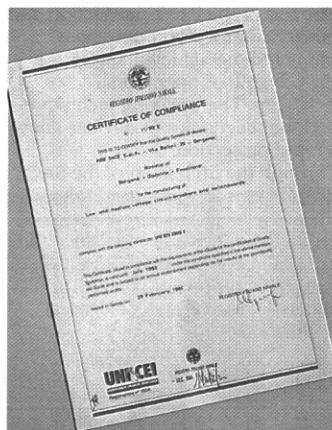
- Maintenance interventions reduced to a minimum and, in any case, easy and safe to execute
- Possibility of electronic control for contacts wear condition and number of operations



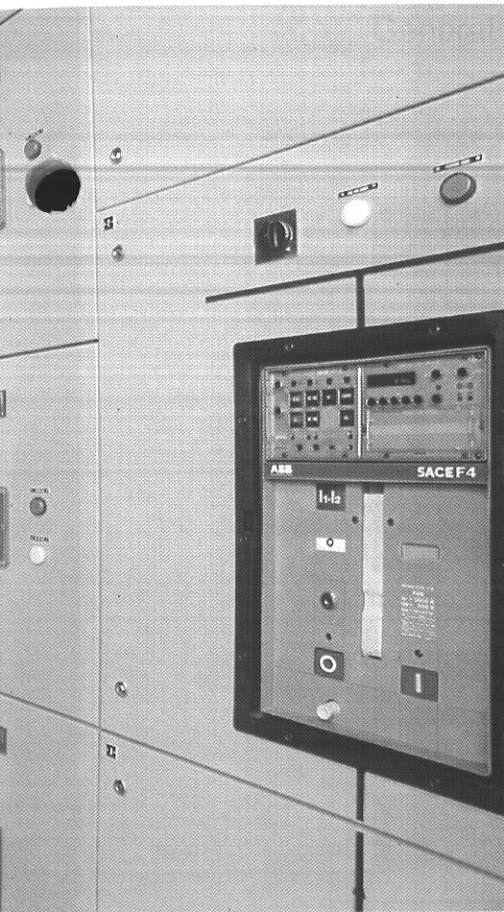
Compliance with Standards. Approvals

In addition to IEC and CEI Standards, the SACE Megamax circuit-breakers are in compliance with those of the main industrialized countries. The SACE Megamax circuit-breakers have been approved by the most important Shipping Registers. For further approvals, please contact ABB SACE.

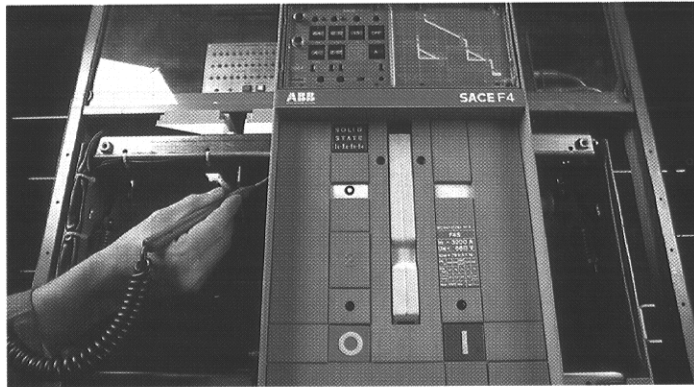
- International Standards IEC 947-2
- Italian Standards CEI 17-5



Advantages in inventory management

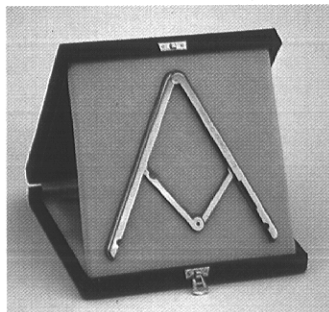


The design of SACE Megamax circuit-breakers, by limiting the number of fixed parts required and by adopting accessories mostly common to all circuit-breakers, makes the switchboard manufacturer's choice easier, permits the wholesaler to maintain an important inventory on hand with a limited commitment of money and also facilitates the spares stock management for the final user.



- Standardization of fixed parts
- Accessories common to the various versions

Other important characteristics



- Modern design of the circuit-breaker featuring clear and easy reading
- Identification of the short-circuit performance levels by means of code letters suitable to indicate the most usual ones (B-N-S), the higher ones (H-V) and the current-limiting ones (L)
- Selectivity degree corresponding to the maximum breaking capacity level
- Possibility of fitting a device allowing isolating with compartment door closed
- Possibility of special versions on request for 1000 V a.c. and d.c., for installation in ambients with highly polluted atmospheres, for equipment on board of ships, for antiseismic installations, for thermonuclear power stations.



General index

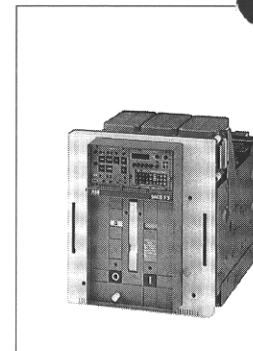
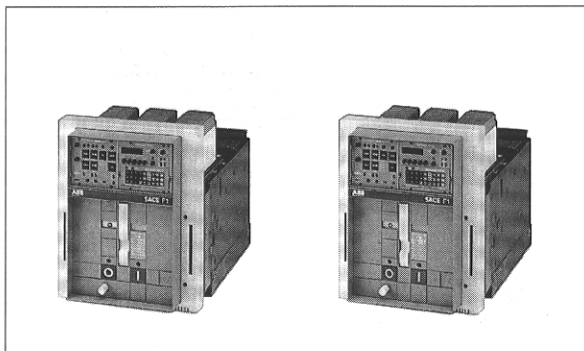
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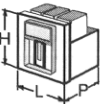


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1.1. Selection table

Rated operational voltage	Ue	50/60 Hz	V~ 690 V~ 250
Rated insulation voltage	Ui	50/60 Hz	V~ 1000
Test voltage	1 min	50 Hz	V~ 3500
Rated impulse withstand voltage	Uimp		kV 12



Circuit-breaker type			F1					F2	
No. of poles			3 - 4			3 - 4		3 - 4	
Rated uninterrupted current (1)	(45 °C) (2)	A	1250 1600 2000			1250 1600		2000 2500	
Identification code			F1B	F1N	F1S	F1H (8)	F1V (8)	F1L(8)	F2H F2V (8)
Rated ultimate short-circuit breaking capacity (3)	220/230(4) V~	kA	40	50	55	120	200	200	120 200
	380/400(4)/415 V~	kA	40	50	55	85	130	130	85 130
	lcu 440 V~	kA	40	50	50	70	100	100	70 100
	500 V~	kA	40	40	50	70	100	100	70 100
	660/690(4) V~	kA	35	35	45	55	85	85	55 85
	250(7) V~	kA	40	50	55	85	130	130	85 130
Rated short-circuit making capacity (peak value)	lcm	kA	85	105	120	265	440	440	265 440
Rated service short-circuit breaking capacity	220/230(4) V~	kA	40	40	55	120	200	200	120 200
	380/400(4)/415 V~	kA	40	40	55	85	130	130	85 130
	lcs 440 V~	kA	40	40	50	70	100	100	70 100
	500 V~	kA	40	40	50	70	100	100	70 100
	660/690(4) V~	kA	35	35	45	55	65	65	55 65
	250(7) V~	kA	40	50	55	85	130	130	85 130
Utilization category (according to Standards)	IEC 947-2		B	B	B	B	B	A	B B
Rated short-time withstand current	1 s	kA	40	40	50	20	20	(9)	25 (5) 30 (6)
	3 s (9)	kA	23	23	50	—	—	—	—
Opening time	max.	ms	30	30	30	—	—	—	—
Make time		ms	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60
Arcing time		ms	10-15	10-15	10-15	—	—	—	—
Break-time	max.	ms	45	45	45	10	10	10	10 10
Dimensions fixed circuit-breaker draw-out circuit-breaker	 HxLxP mm	3/4 POL 3/4 POL	410 x 334/429 x 394 410 x 334/429 x 452			410 x 334/429 x 394 410 x 334/429 x 452		410 x 416/511 x 394 410 x 416/511 x 452	

(1) The rated uninterrupted current identifies also the type of circuit-breaker (e.g. F1B 1250).

(2) Reference temperature (higher than 40 °C as required by Standards).

(3) With power factor (cosφ) according to IEC 947-2 Standards as follows:
cosφ = 0,25 for 20 kA < lcu ≤ 50 kA

cosφ = 0,2 for lcu > 50 kA.

(4) Voltages according to IEC 38 Standards.

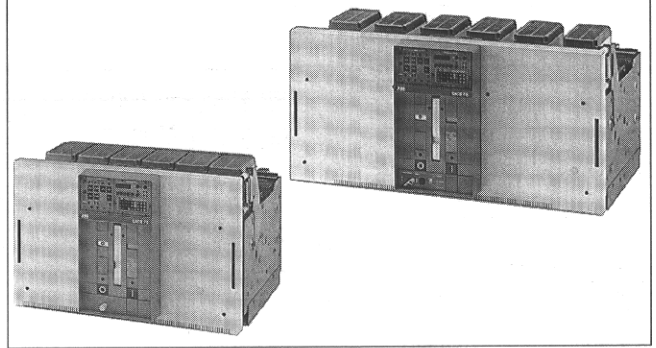
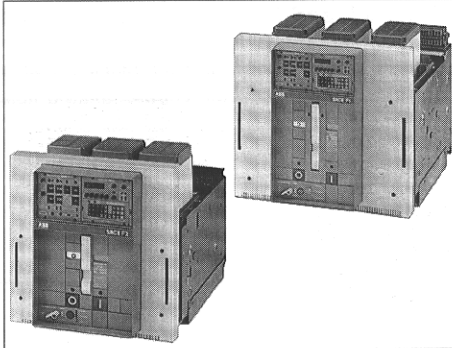
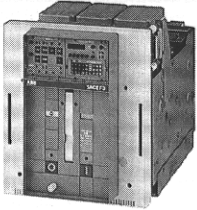
(5) For rated uninterrupted current of 2000 A.

(6) For rated uninterrupted current of 2500 A.

(7) T = 10-15 ms.

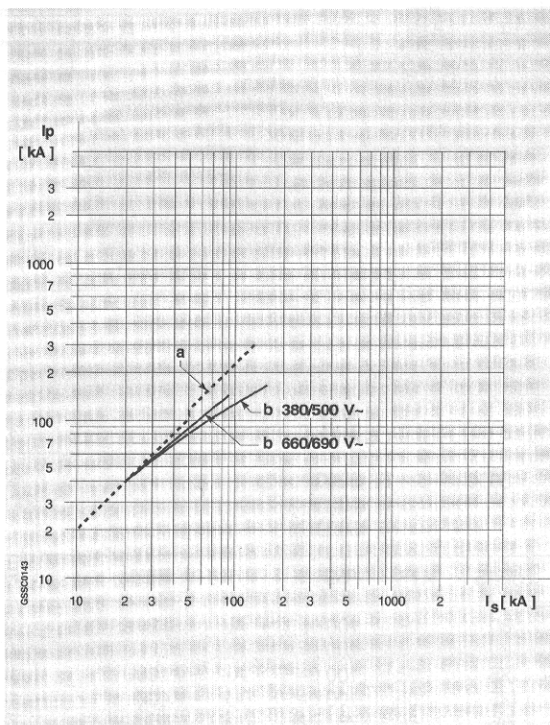
(8) Current-limiting circuit-breakers.

(9) Ask ABB SACE.



		F3		F4		F5		F6	
		3 - 4		3 - 4		3 - 4		3	
		2500 3000		2000 2500 3000		3200 3600		3200 4000 5000	
	F2L(8)	F2S	F3S	F4S	F4S	F5S	F5H	F6S	F6H
	200	65	75	75	80	100	120	100	120
	130	65	75	75	80	100	120	100	120
	100	60	75	75	75	100	100	100	100
	100	60	75	75	75	100	100	100	100
	85	55	65	65	65	75	85	75	85
	130	65	75	75	80	100	120	100	120
	440	143	165	165	176	220	260	220	260
	200	65	75	75	80	100	120	100	120
	130	65	75	75	80	100	120	100	120
	100	60	75	75	75	100	100	100	100
	100	60	75	75	75	100	100	100	100
	65	55	65	65	65	75	85	75	85
	130	65	75	75	80	100	120	100	120
	A	B	B	B	B	B	B	B	B
	(9)	65	75	75	80	100	100	100	100
	—	50	50	50	55	60	60	80	80
	—	30	30	30	30	45	45	45	45
	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60	45 - 60
	—	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15
	10	45	45	45	45	60	60	60	60
410 x 416/511 x 394 410 x 416/511 x 452		480x416/531x467 480x416/531x515		480 x 536/651 x 467 480 x 536/651 x 515		480 x 761/876 x 467 480 x 761/876 x 515		— 480 x 1001 x 515	

1.2. Characteristic curves for F1 H - V - L and F2 H - V - L current-limiting circuit-breakers



I_s = short-circuit symmetrical prospective current
 I_p = peak current
 I^2t = specific let-through energy at the indicated voltages

a = curve of the max. prospective peak current (unrestricted)

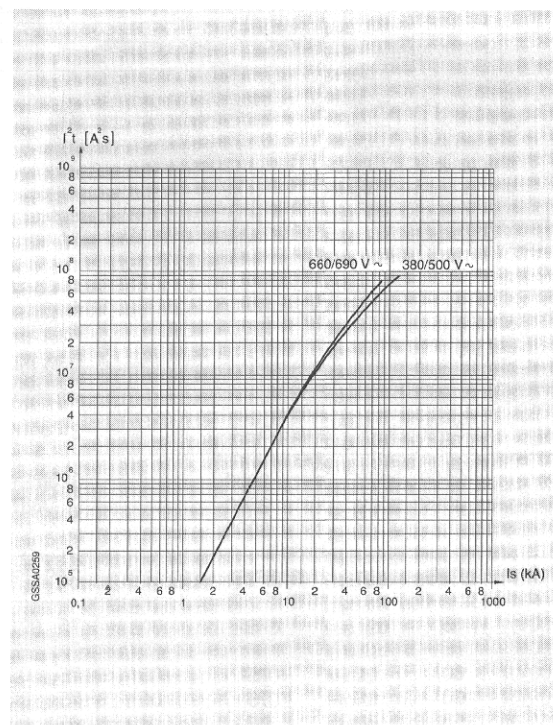
b = curves of the determined max. peak currents (restricted) at the indicated voltages

Note

The knowledge of the specific let-through energy is very important for the study and the solution of many protection and co-ordination problems, such as:

- protection and sizing of conductors
- back-up protection
- selectivity.

Current limitation curves



Curves of the specific let-through energy I^2t

1.3. Table of power losses

Circuit-breaker type	Rated uninterrupted current	Power loss	
		Fixed	Draw-out
	A	3 POL W (*)	3 POL W (*)
F1	1250	115	250
	1600	145	300
	2000	215	360
F2	2000	215	360
	2500	250	450
	3000	350	600
F3	2000	160	290
	2500	230	420
	3000	330	570
F4	3200	300	620
	3600	400	680
F5	3200	250	450
	4000	350	600
	5000	500	800
F6	6300	—	1100

(*) The value indicated refers to the total number of poles.

1.4. Variation of the rated uninterrupted current for circuit-breakers installed in switchboard

The circuit-breaker installation in a switchboard usually requires a reduction of the circuit-breaker steady current carrying capacity because of the limited loss of heat implied by the closed environment of the switchboard. Just as an example, the table below provides valuable information for the installation of SACE Megamax circuit-breakers in low voltage switch-boards. The same table also gives the cross sections recommended for the copper bar connections.

Values are affected by various factors, such as the switchboard degree of protection, ambient temperature, number of circuit-breakers placed in column, etc. Values given below refer to a maximum temperature on terminals of 120°C (rated temperature rise 85°C + external ambient temperature 35°C). For further information, please contact ABB SACE.

Circuit-breaker		F1H - F1V F1B - F1N	F1L F1S	F1B-F1N F1S	F2H - F2V F2B	F2L F2S	F2S	F3S
Steady current-carrying capacity in switchboard	In A	1250	1600	2000	2000	2500	3000	2000
	A	1250	1600	2000	2000	2500	3000	2000
	B	1050	1400	1825	1875	2200	2600	1850
	C	1150	1500	1900	1925	2300	2750	1950
	D	1050	1400	1825	1875	2200	2600	1850
	E	950	1250	1700	1800	2000	2400	1700
Dimensions of copper busbars (mm)	Connections	1 (60x10)	2 (60x8)	2 (80x10)	2 (80x10)	2 (100x10)	6 (80x5)	2 (80x10)
	Main busbars	2 (30x10)	2 (60x10)	2 (60x10)	2 (60x10)	4 (60x10)	4 (60x10)	2 (60x10)

Circuit-breaker		F3S		F4S		F5S - F5H			F6S - F6H
Steady current-carrying capacity in switchboard	In A	2500	3000	3200	3600	3200	4000	5000	6300
	A	2500	3000	3100	3400	3200	3950	4900	6100
	B	2200	2600	2800	3100	3000	3700	4550	5600
	C	2300	2750	2950	3200	3150	3900	4800	6000
	D	2200	2600	2800	3100	3000	3700	4550	5600
	E	2000	2400	2600	2900	2750	3450	4300	5200
Dimensions of copper busbars (mm)	Connections	2 (80x10)	4 (100x5)	2 (120x10)	6 (100x5)	2 (120x10)	4 (100x10)	10 (100x5)	12 (100x5)
	Main busbars	4 (60x10)	4 (60x10)	4 (60x10)	2x4 (60x10)	4 (60x10)	2x4 (60x10)	2x4 (60x10)	2x4 (60x10)

The typical installations provided by the table have been divided, depending on the degree of protection inside and outside the case, into the following classes:

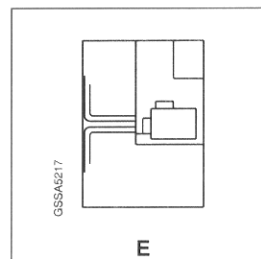
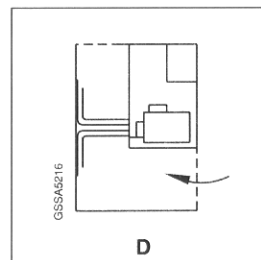
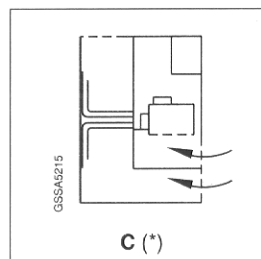
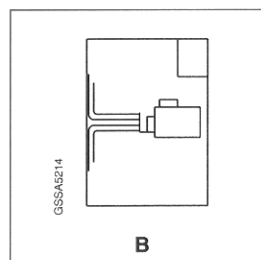
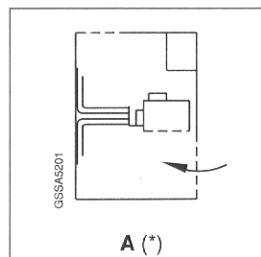
Class	A	B	C	D	E
internal	without internal compartment		IP2X	IP3X	IP3X
external	IP3X	IP5X	IP4X	IP4X	IP5X

1.4.1. Variation of the rated uninterrupted current depending on temperature

All information given in the table of paragraph 1.4. refer to an ambient temperature outside the switchboard of 35 °C. In the event of more complex or anyway different situations, it will be possible to calculate the current carrying capacity of the circuit-breakers inside the switchboard by applying proper correction factors correlated with the temperature that may be determined outside the switchboard.

Ambient temperature	35 °C	40 °C	45 °C	50 °C	55 °C
Correction factor	1	0,97	0,94	0,91	0,88

(*) A and C : **special versions** designed for the use of fixed parts provided with ventilation louvers in the bottom.



Note

In case of one or more superimposed circuit-breakers in the switchboard, please contact ABB SACE as far as the variation of the rated uninterrupted current and their ventilation systems.

1.5. Mechanical and electrical operations

Operations for charging the springs, for closing and opening the circuit-breaker are carried out simply by the local actuation of the operating devices. By mounting the proper accessories, operations may be carried out electrically from a distance. When using the SACE PR1/D dialogue unit, open-

ing and closing may be controlled by a centralized control system.

As an indication, the SACE Megamax circuit-breakers can withstand, without any replacement of parts, the number of operations and frequency shown below.

Circuit-breaker		F1B - F1N 1250 A 1600 A 2000 A			F1S 1250 A 1600 A 2000 A			F1H - F1V - F1L 1250 A 1600 A	
Mechanical endurance	No. of operations	35000	35000	35000	35000	35000	35000	20000	20000
	Frequency (operations/hour)	60	60	60	60	60	60	60	60
Electrical endurance	No. of operations	10000	6500	5000	12000	8000	6000	5000	4000
	Frequency (operations/hour)	30	20	20	30	20	20	30	20

Circuit-breaker		F2S 2500 A 3000 A		F2H - F2V - F2L 2000 A 2500 A		F3S 2000 A 2500 A 3000 A		
Mechanical endurance	No. of operations	30000	30000	20000	20000	25000	25000	25000
	Frequency (operations/hour)	60	60	60	60	60	60	60
Electrical endurance	No. of operations	6000	4500	4000	3000	8000	6000	6000
	Frequency (operations/hour)	20	20	20	20	20	20	20

Circuit-breaker		F4S 3200 A 3600 A		F5S-F5H 3200 A 4000 A 5000 A			F6S-F6H 6300 A	
Mechanical endurance	No. of operations	25000	20000	20000	20000	20000	20000	20000
	Frequency (operations/hour)	60	60	60	60	60	60	60
Electrical endurance	No. of operations	5000	4000	6000	5000	3000	2000	2000
	Frequency (operations/hour)	10	10	10	10	10	10	10

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2.1. View of the main component parts

- 1 Rear terminals
- 2 Auxiliary contacts
- 3 Fixed main contacts
- 4 Moving main contacts
- 5 Fixed arcing contacts
- 6 Moving arcing contacts
- 7 Arcing chamber
- 8 Solid-state microprocessor-based release SACE PR1
- 9 Shunt closing release
- 10 Closing mechanism assembly
- 11 Lever for charging the closing springs by hand
- 12 Geared motor for automatic charging of closing springs
- 13 Shutters for segregating the fixed part terminals. Degree of protection IP20
- 14 Connector for SACE PR1 release (for control, dialog and amperometric unit only)

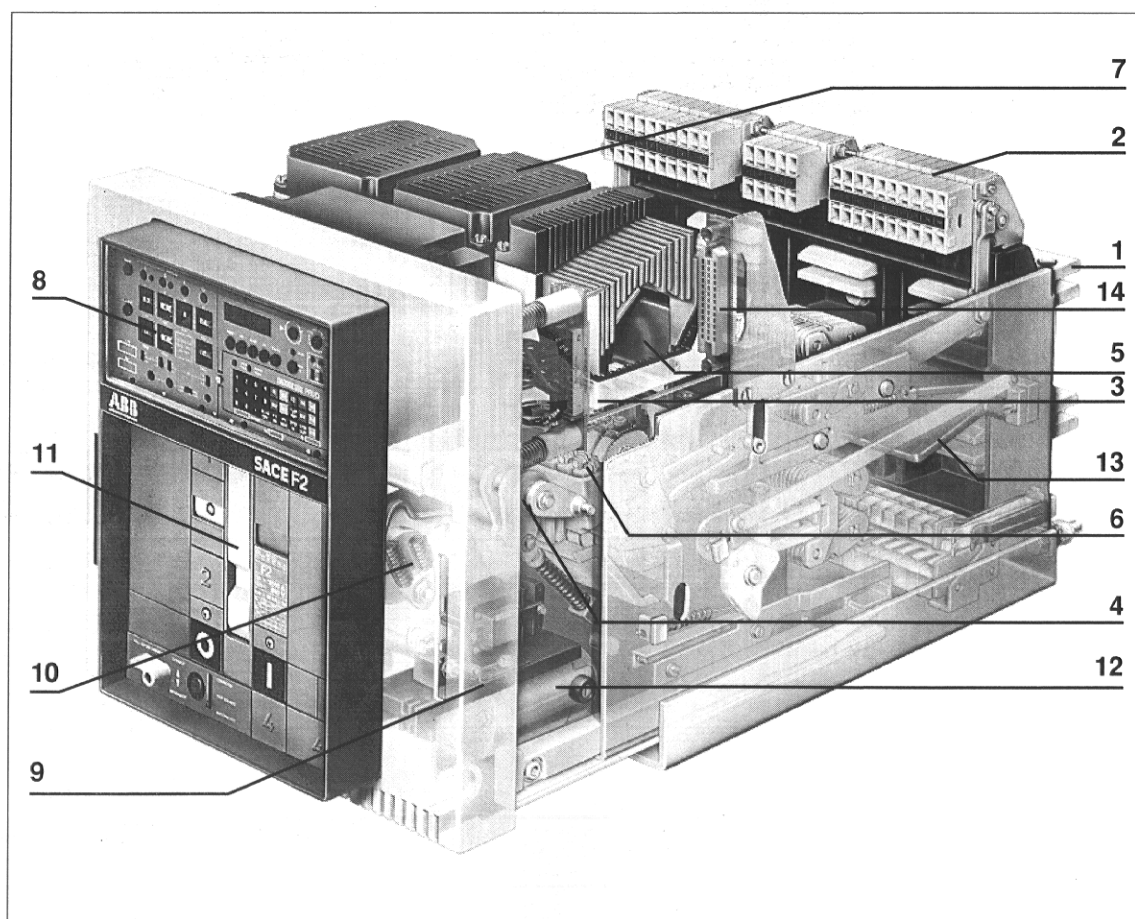
2.2. Operating mechanism

The circuit-breaker is closed and opened by a stored-energy spring-charged operating mechanism. The closing springs can be charged manually by operating the front lever, or the operating mechanism can be fitted with a motor operator which will automatically recharge the closing springs following a closing operation. The excess energy in the closing springs at the end of a closing cycle is utilized to partially recharge the closing springs. In this way the strain on the mechanism is reduced ensuring reliable operation of the mechanism of the circuit-breaker over a long period. The opening springs are automatically charged during the closing operation.

If the operating mechanism is provided with a shunt opening and closing release, the circuit-breaker can be remote controlled.

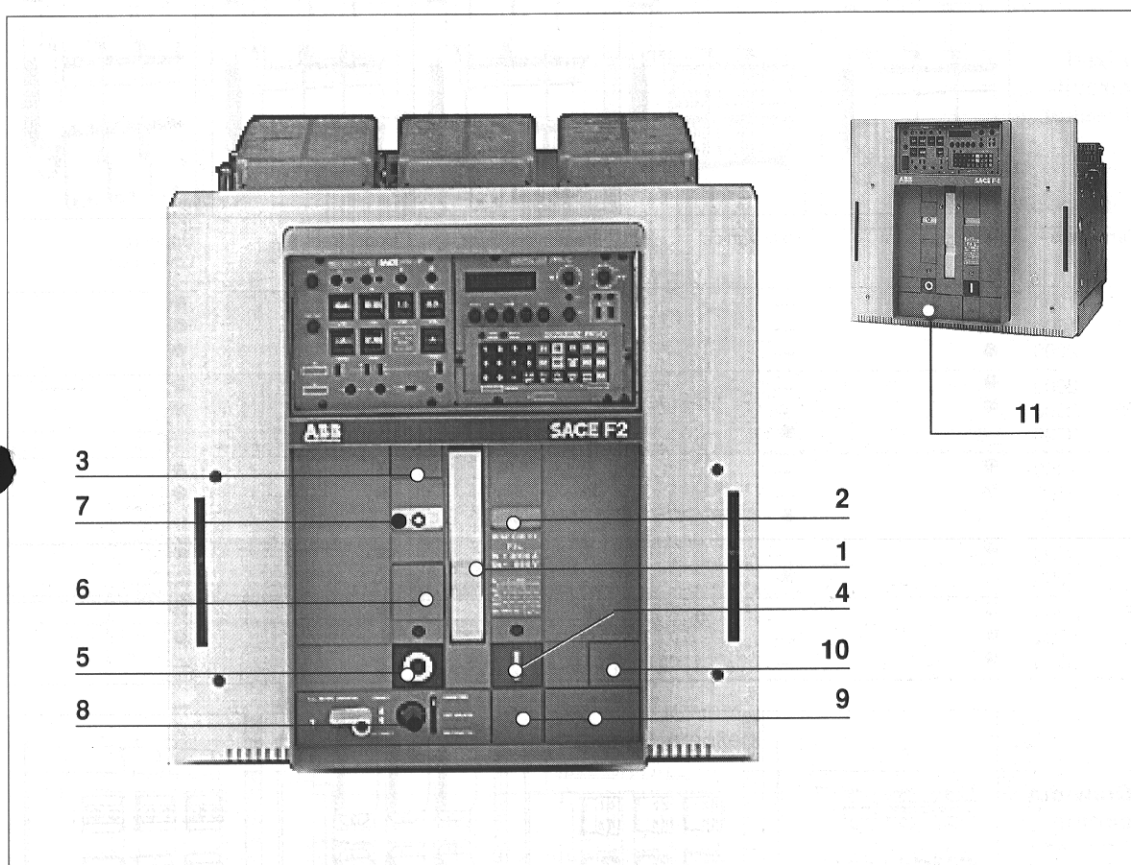
Operating cycles that can be carried out without recharging the springs:

- with the circuit-breaker open and springs charged:
closing-opening
- with the circuit-breaker closed and springs charged:
opening-closing-opening.



2.3. Operating and signalling elements

- 1 Lever for charging the closing springs by hand
- 2 Springs charged (yellow) and springs discharged (white) indications
- 3 Indication of circuit-breaker tripped (projecting pushbutton) by overcurrent releases on overload, short-circuit and earth fault. To reset, press the pushbutton. Supplied on request
- 4 Closing pushbutton
- 5 Opening pushbutton
- 6 Key lock for locking the circuit-breaker in open position (on request)
- 7 Circuit-breaker open "O" and closed "I" indication
- 8 Racking-in and racking-out device with door closed. Supplied on request in alternative to the device under pos. 11
- 9 Mounting position of key lock and padlock device for draw-out circuit-breaker (on request)
- 10 Indication as per pos. 3, but operated by the EF protection (instantaneous fixed protection against short-circuit). It also signals tripping caused by the EG release for d.c., if provided. Supplied on request
- 11 Pushbutton for releasing the draw-out circuit-breaker moving part. Device in alternative to accessory under pos. 8



2.4. Versions

Circuit-breaker	No. of poles	Fixed versions	Draw-out version
F1	3-4	●	●
F2	3-4	●	● (1)
F3	3-4	●	● (1)
F4	3-4	●	●
F5	3-4	●	●
F6	3	—	●

(1) The moving part of the 3000 A draw-out circuit-breaker can be inserted into the fixed part of the 2000/2500 A circuit-breaker and likewise the 2000/2500 A moving part can be inserted into the 3000 A fixed part. For these combinations, the rated uninterrupted currents are of 2000/2500 A.

2.5. Degrees of protection

IP20: circuit-breaker in fixed or draw-out version, terminals excluded

IP30: front parts of circuit-breakers.

For higher degrees of protection (circuit-breakers fitted with accessories such as transparent protections) see sect. 7 "Accessories".

2.6. Combinations of terminals

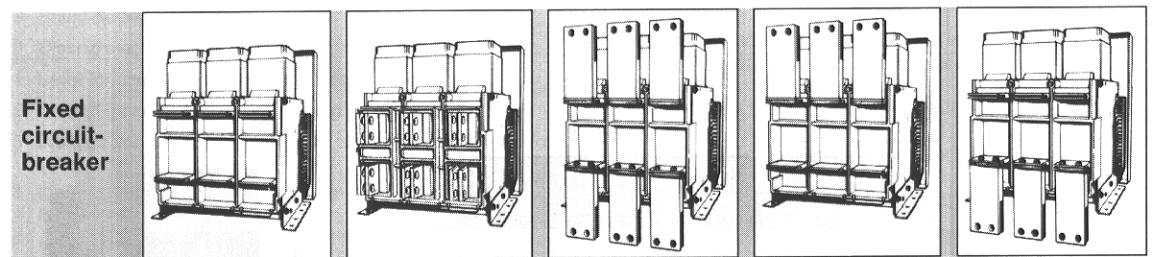
All terminals of low voltage air circuit-breakers are made from silver-plated copper flat bars and, depending on their

position, take up the following denominations:

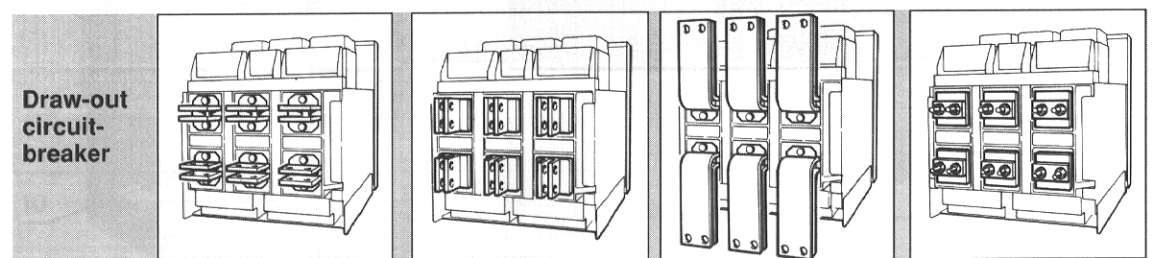
- front terminals
- vertical or horizontal rear terminals made of flat bar
- flat terminals.

The availability of various types of terminals permits the construction of switchboards standing against a wall and having connections accessible from the front as well as of switchboards accessible from the back and having rear connections.

When there are any particular installation requirements, the circuit-breakers can be fitted up with various terminal combinations. Tables below give some examples.

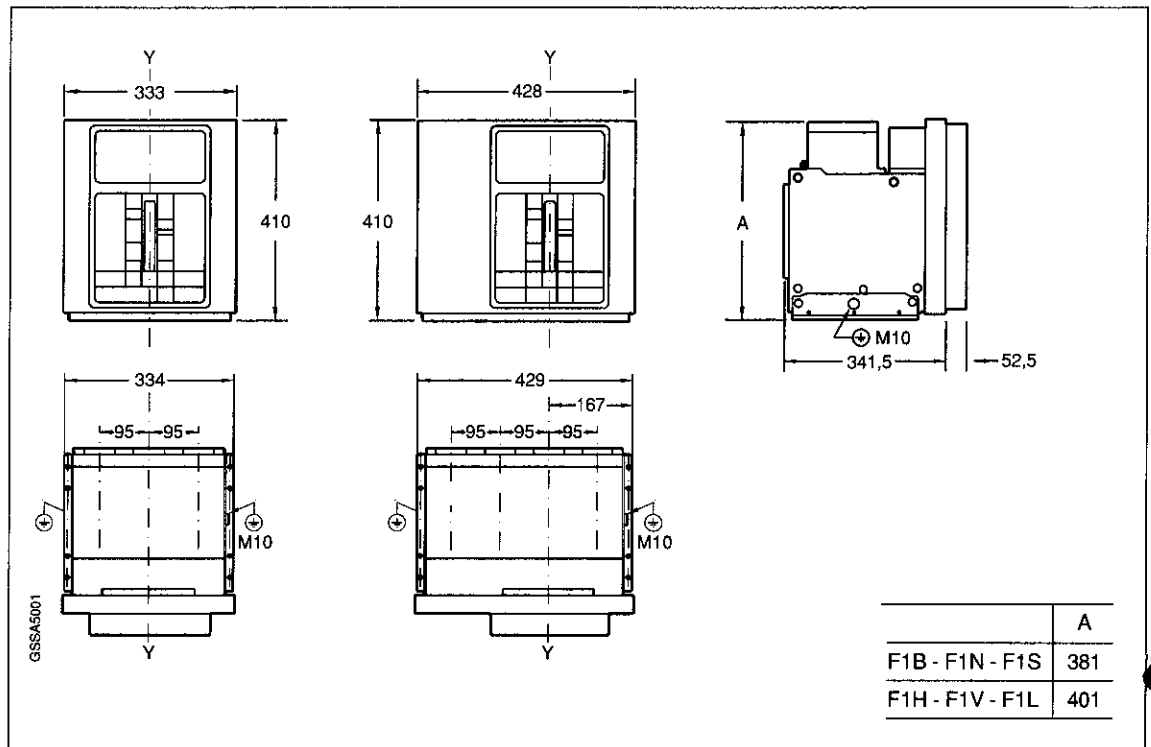
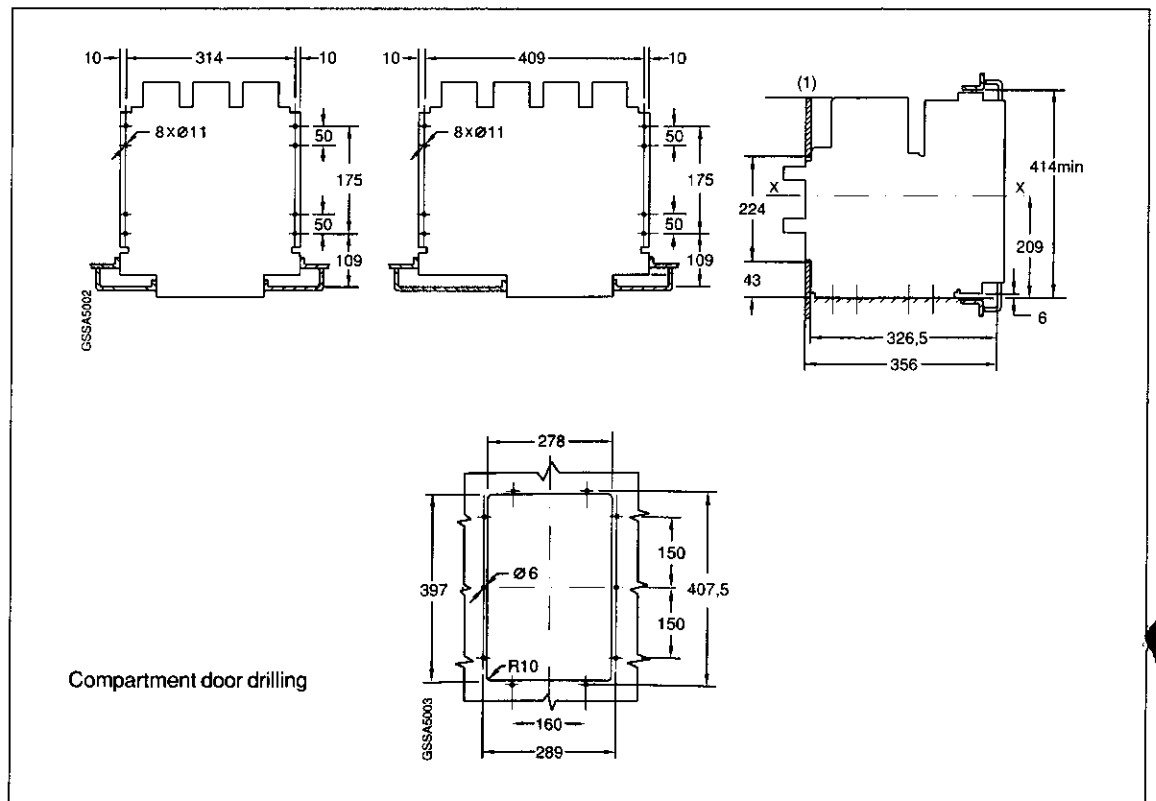


Terminals	Rear horizontal	Rear vertical	Front	Upper front Lower rear	Upper rear Lower front
F1 1250 1600 2000	● ● ●	— — —	● ● ●	● ● ●	● ● ●
F2 2000 2500 3000	● ● —	— — ●	● ● —	● ● —	● ● —
F3 2000 2500 3000	● ● —	— — ●	● ● —	● ● —	● ● —
F4 3200 3600	● —	— ●	● —	● —	● —
F5 3200 4000 5000	● ● ●	— — —	● ● —	● ● —	● ● —



Fixed part with terminals	Rear horizontal	Rear vertical	Front	Flat
F1 1250 1600 2000	● ● ●	● ● ●	● ● ●	● ● ●
F2 2000 2500 3000	● ● —	● ● ●	● ● —	● ● —
F3 2000 2500 3000	● ● —	● ● ●	● ● —	● ● —
F4 3200 3600	● —	● ●	● —	● —
F5 3200 4000 5000	● ● —	● ● ●	● ● —	● ● —
F6 6300	—	●	—	—

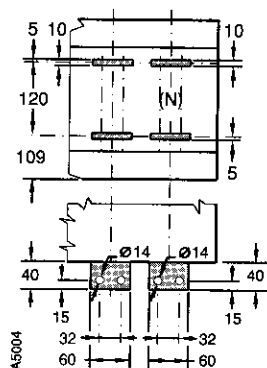
3.1.	F1 fixed circuit-breakers	20
3.2.	F1 draw-out circuit-breakers	22
3.3.	F2 fixed circuit-breakers	24
3.4.	F2 draw-out circuit-breakers	26
3.5.	F3 fixed circuit-breakers	28
3.6.	F3 draw-out circuit-breakers	30
3.7.	F4 fixed circuit-breakers	32
3.8.	F4 draw-out circuit-breakers	34
3.9.	F5 fixed circuit-breakers	36
3.10.	F5 draw-out circuit-breakers	38
3.11.	F6 draw-out circuit-breakers	42
3.12.	Notes for installation	44
3.13.	Table of circuit-breaker weights	46

3.1. F1 fixed circuit-breakers**Dimensions****Fixing drillings****Notes**

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.

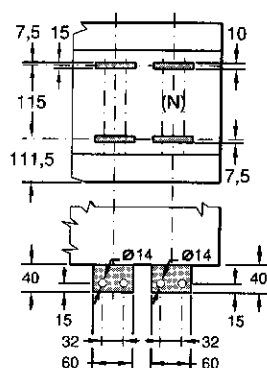
Terminals

Horizontal rear terminals

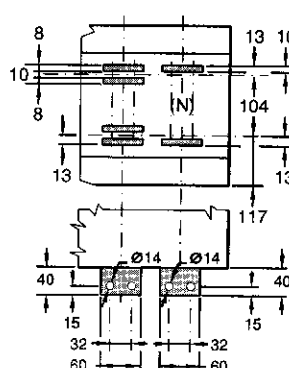


GSSA5004

1250 A

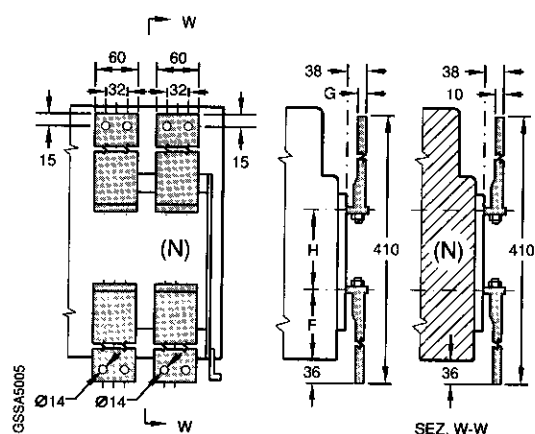


1600 A



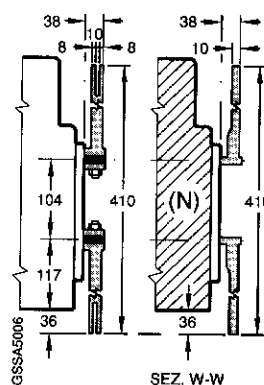
2000 A

Front terminals



GSSA5005

1250 - 1600 A



GSSA5006

SEZ. W-W

2000 A

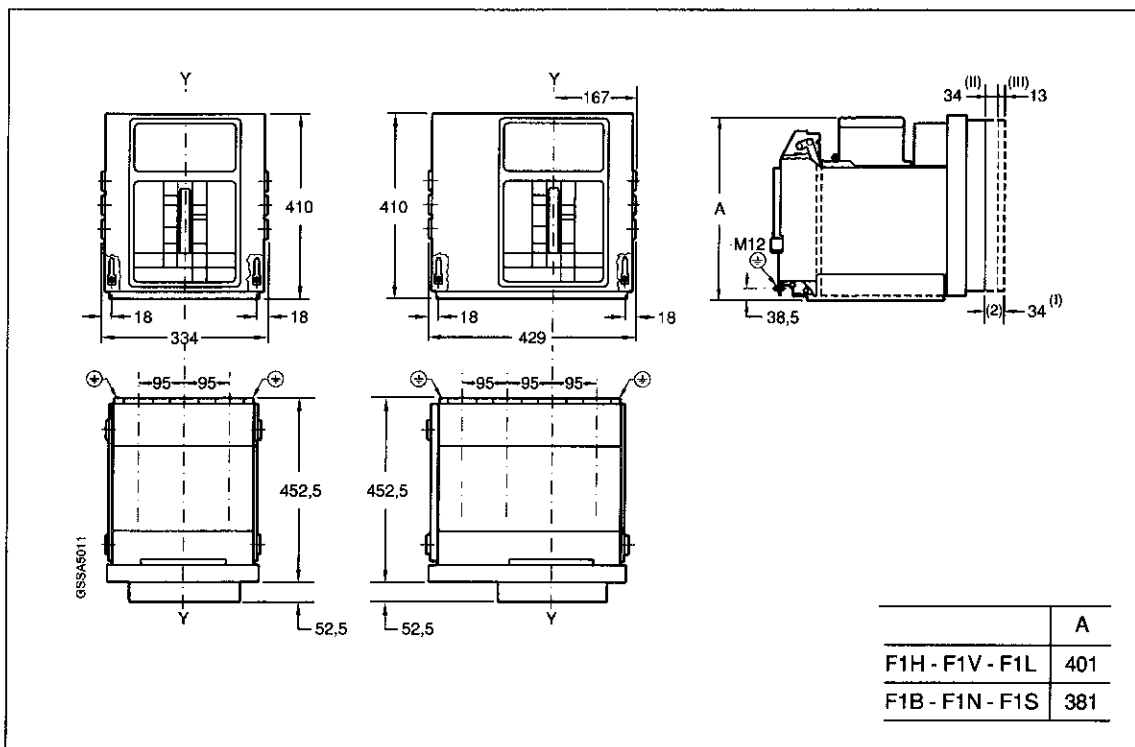
	F	G	H
F1 1250	109	10	120
F1 1600	111,5	15	115

Note

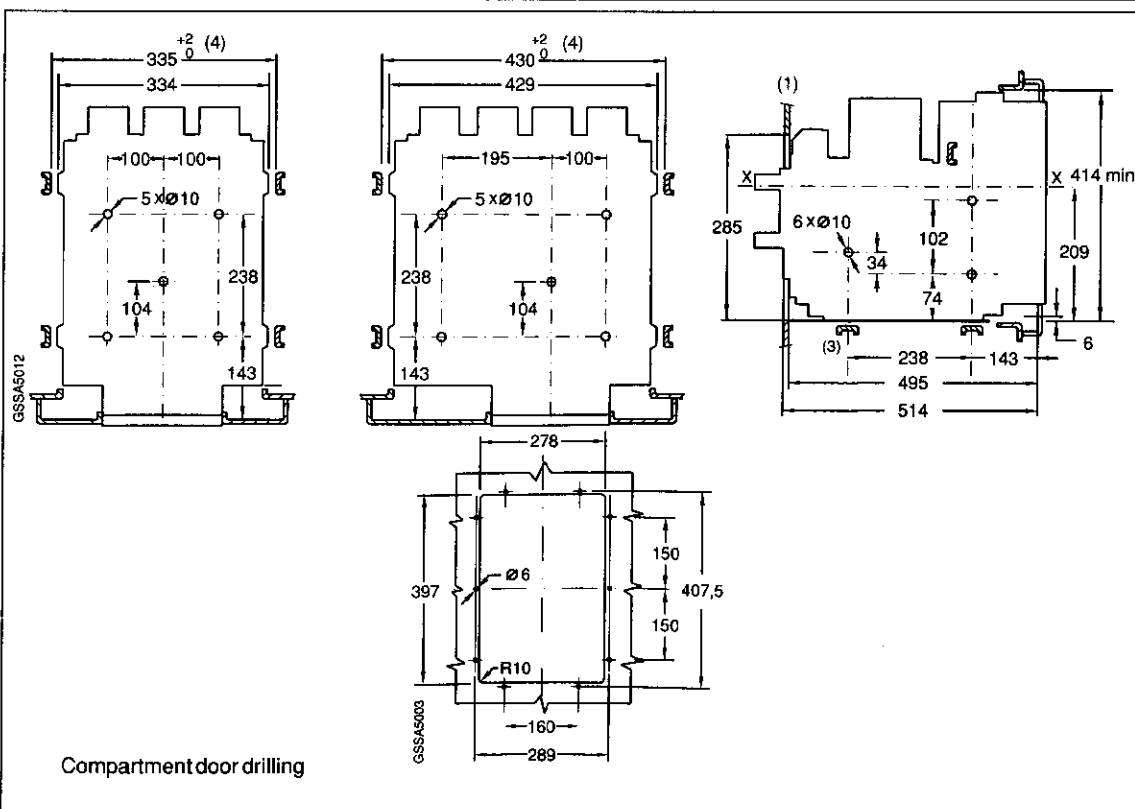
Neutral pole may have, upon request, the same section as other poles (special version).

3.2. F1 draw-out circuit-breakers

Dimensions

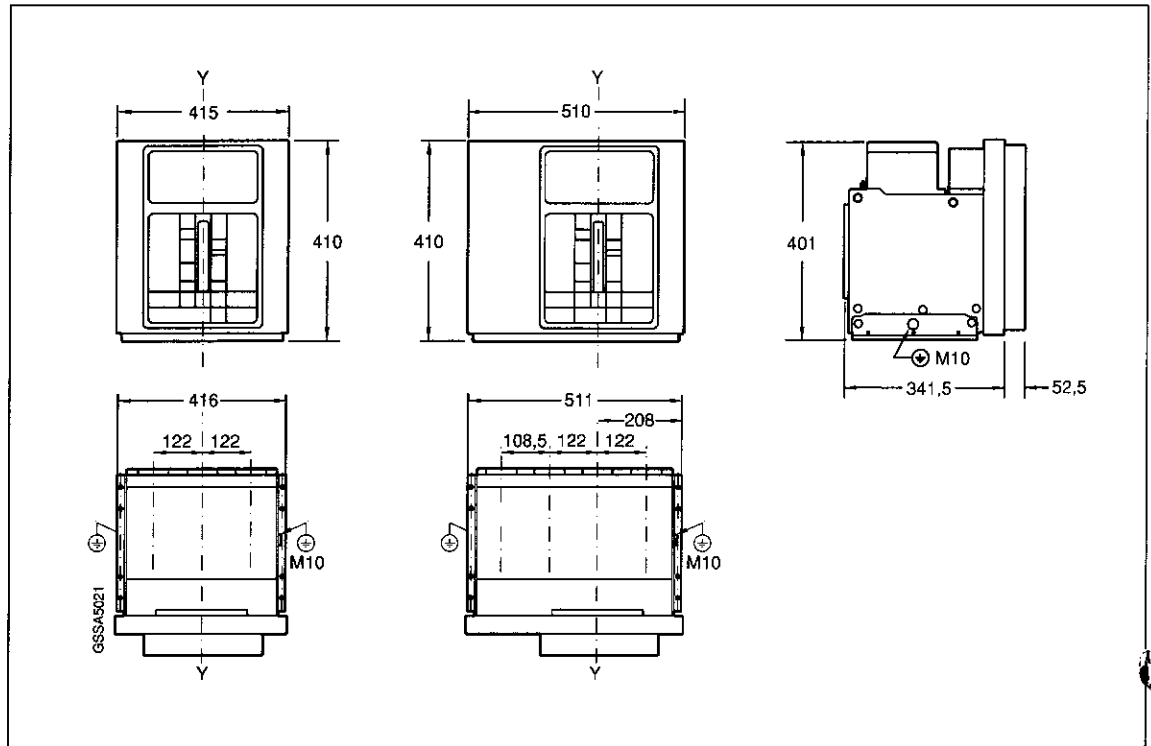
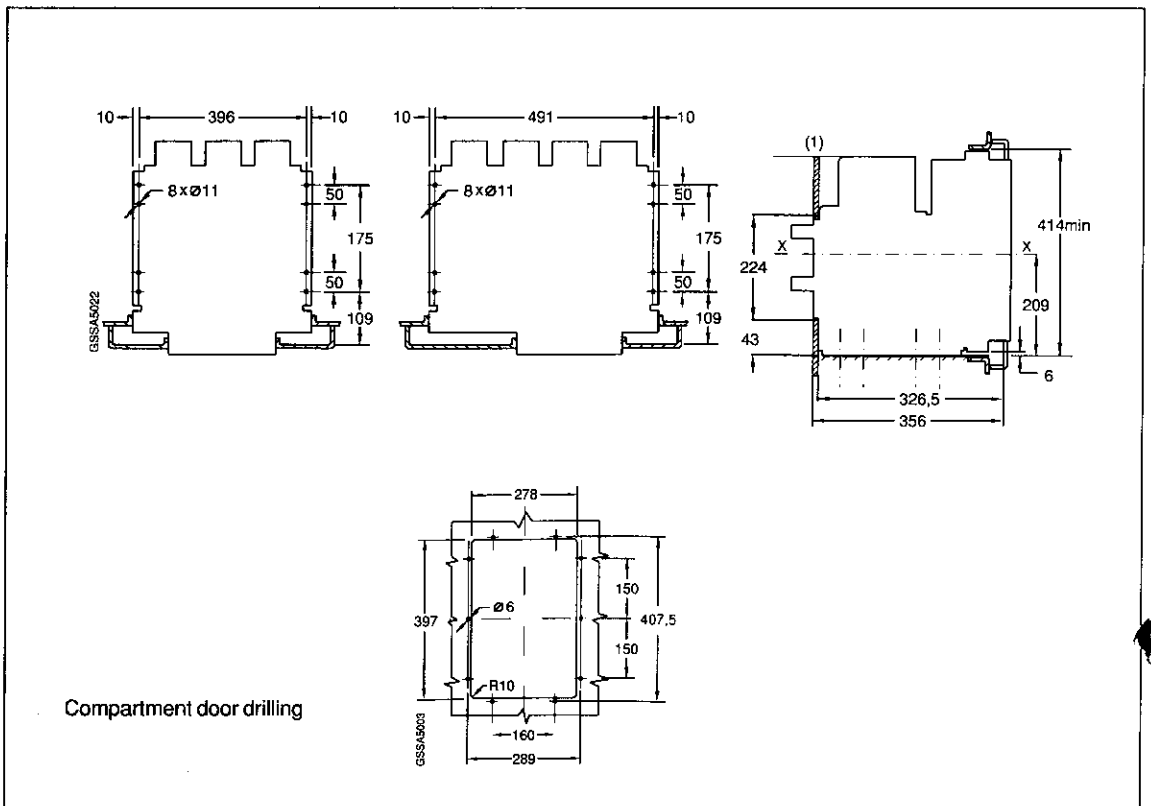


Fixing drillings



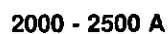
Notes

- (1) Any segregation of rear part containing the connections, at customer's care.
Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated for test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

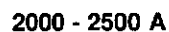
3.3. F2 fixed circuit-breakers**Dimensions****Fixing drillings****Notes**

- (1) Any segregation of rear part containing the connections, at customer's care.
Width of empty part equal to that of circuit-breaker.

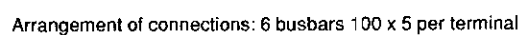
Horizontal rear terminals



Front terminals

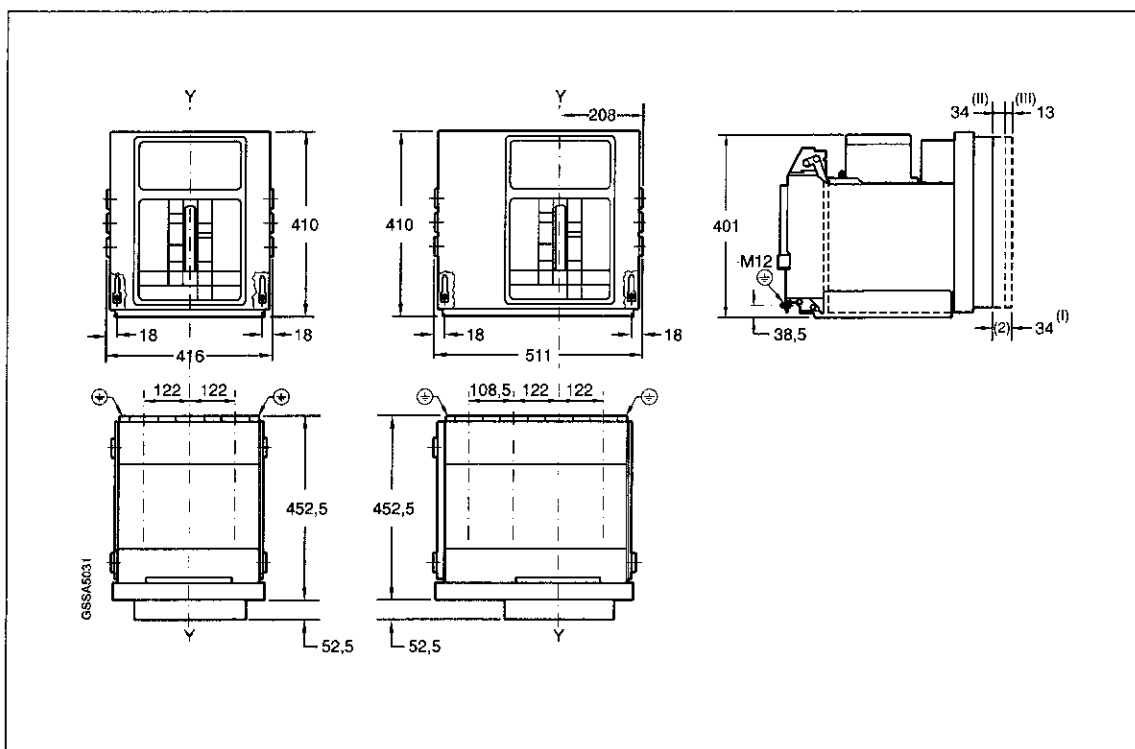


Vertical rear terminals

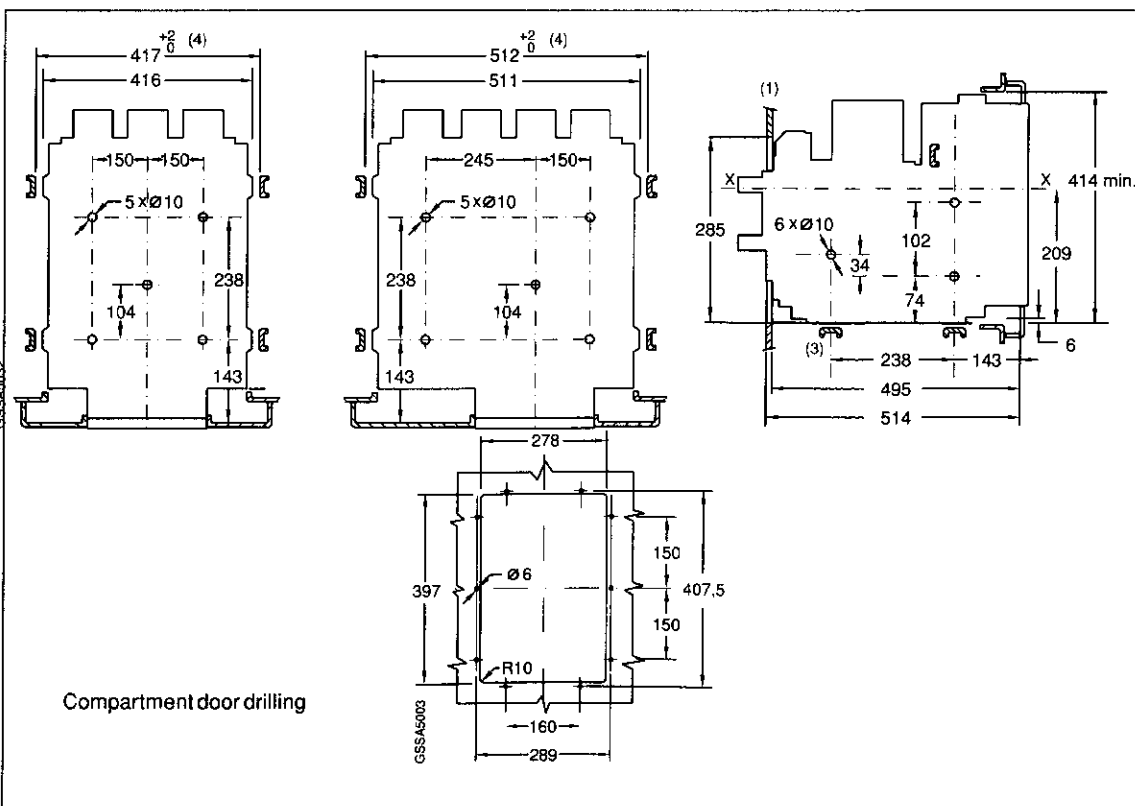


3.4. F2 draw-out circuit-breakers

Dimensions



Fixing drillings

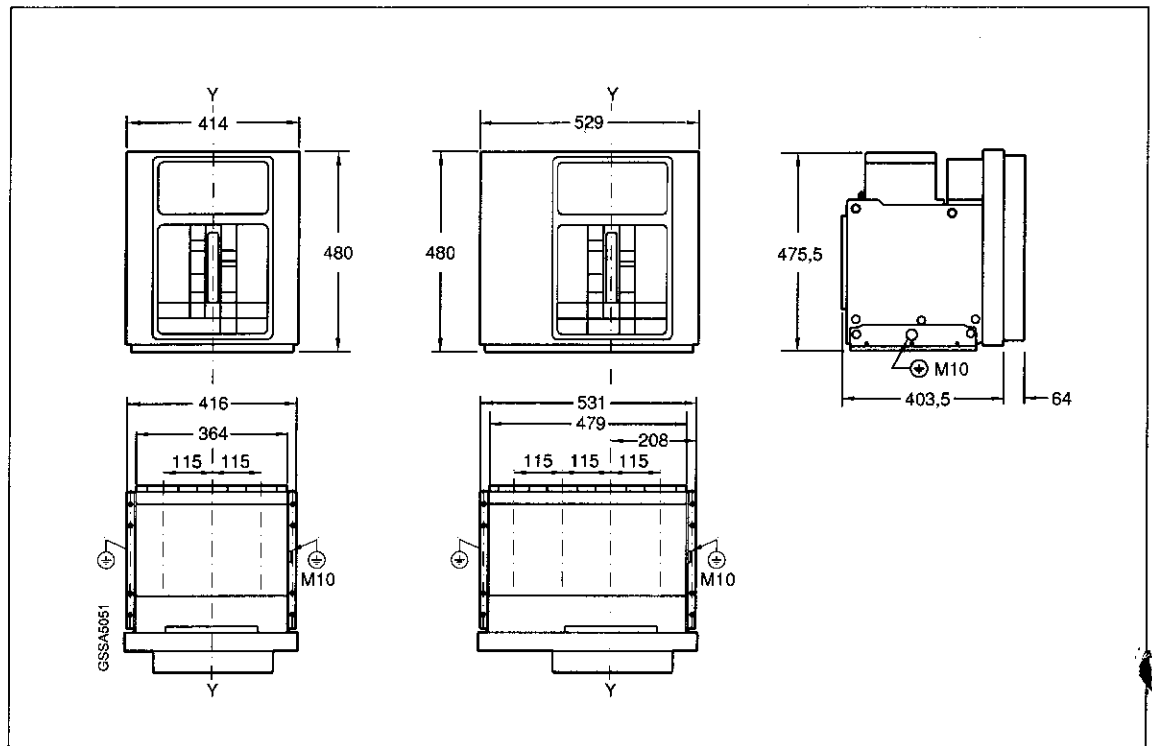


Notes

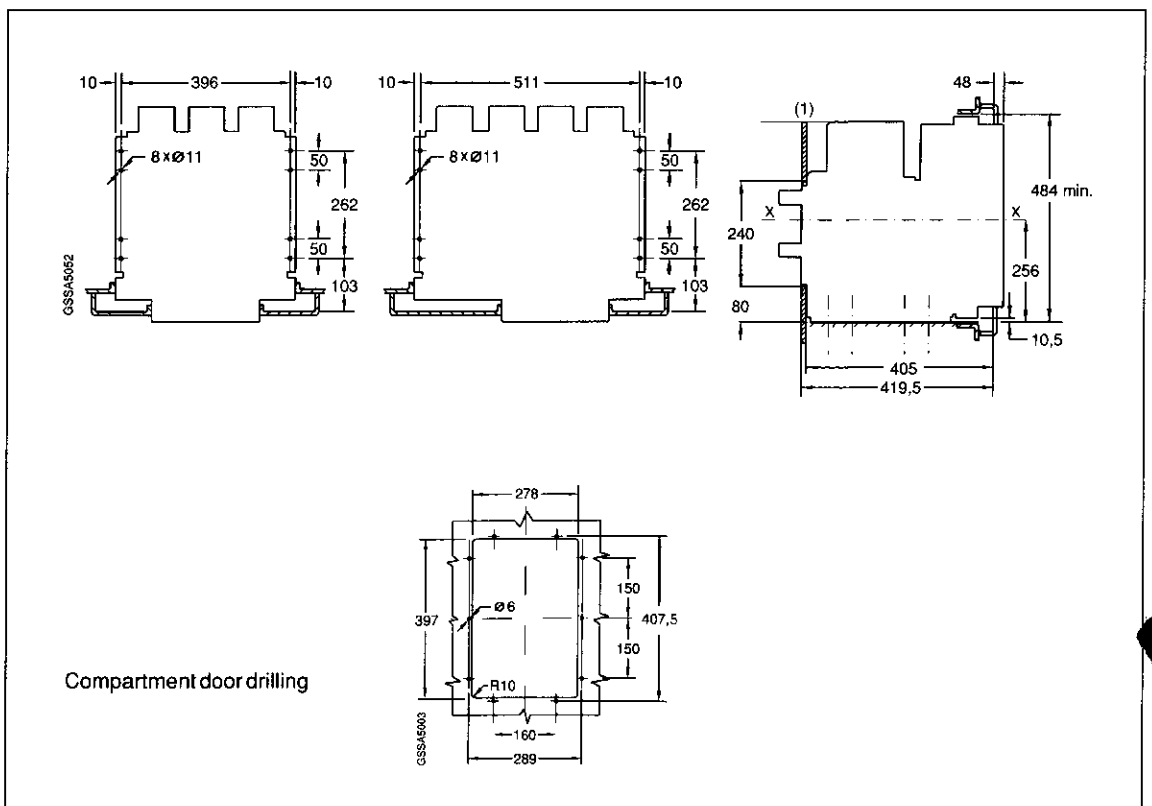
- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated for test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

3.5. F3 fixed circuit-breakers

Dimensions



Fixing drillings

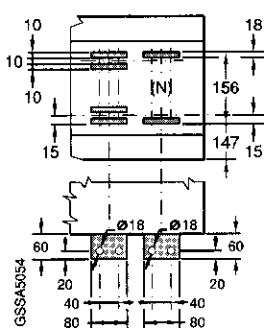


Notes

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.

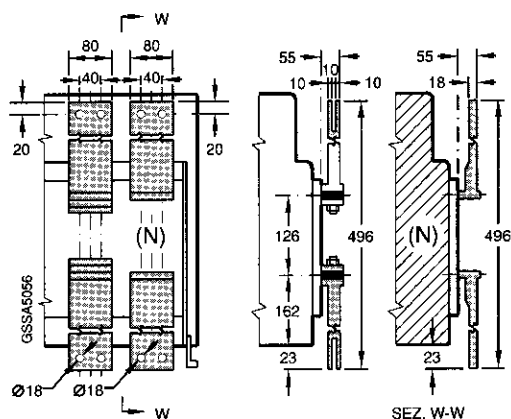
Terminals

Horizontal rear terminals



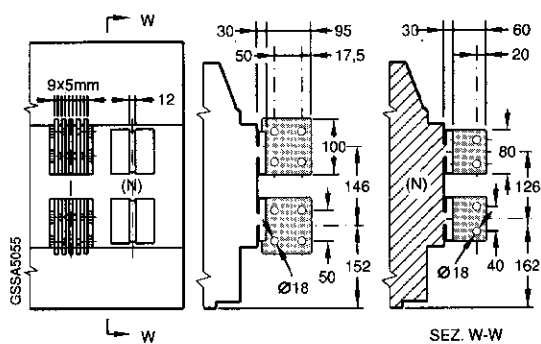
2000 - 2500 A

Front terminals

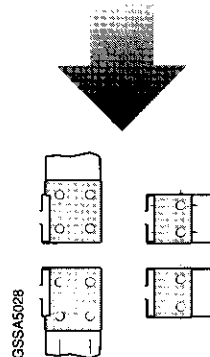


2000 - 2500 A

Vertical rear terminals



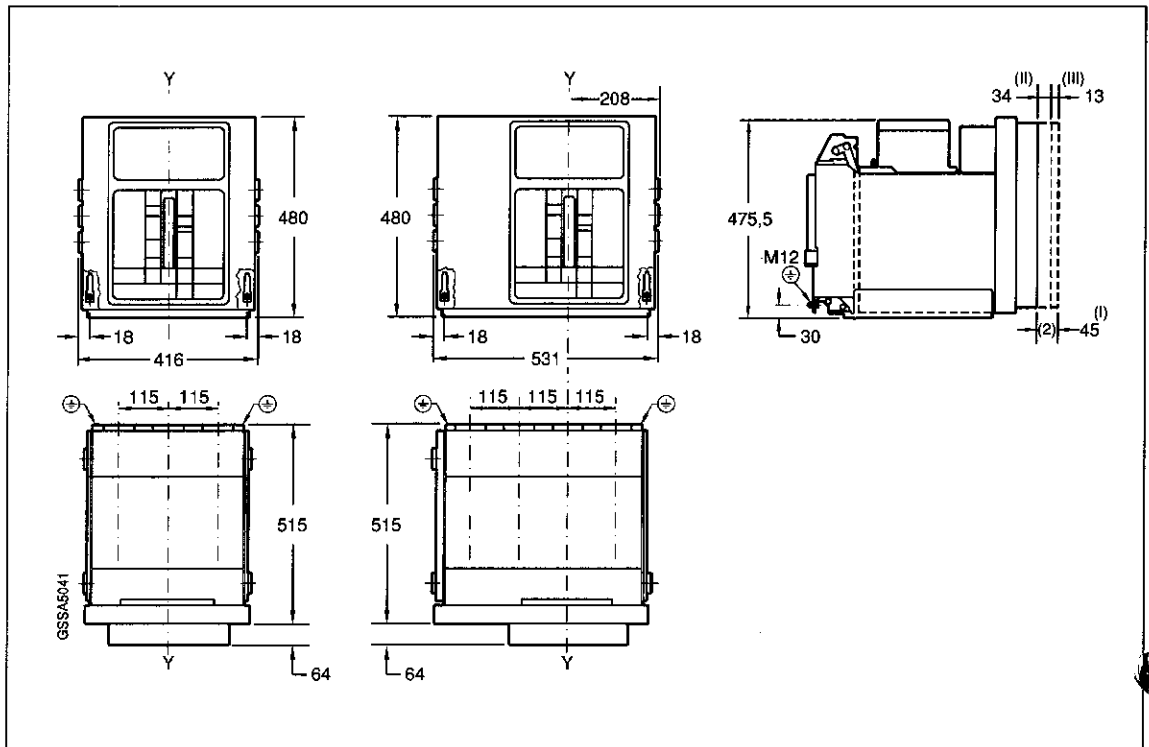
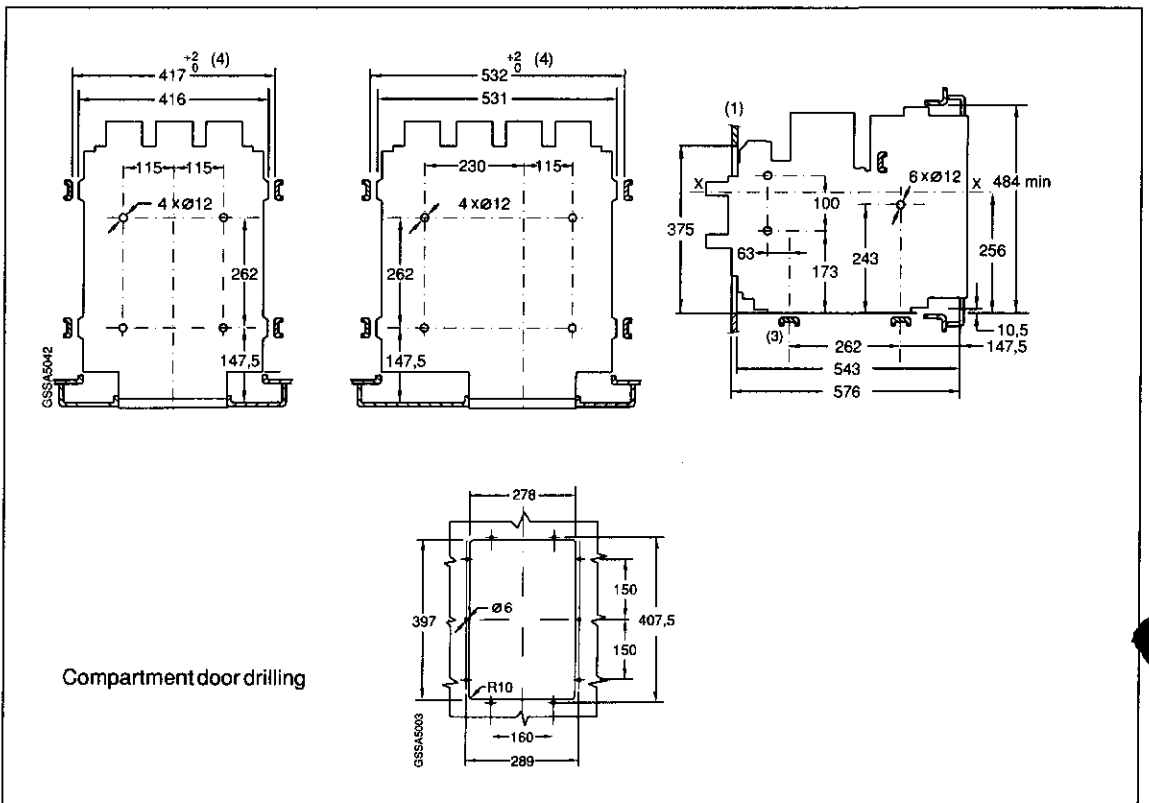
3000 A



Arrangement of connections: 6 busbars 100 x 5 per terminal

Note

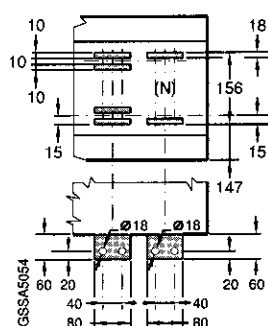
Neutral pole may have, upon request, the same section as other poles (special version).

3.6. F3 draw-out circuit-breakers**Dimensions****Fixing drillings****Notes**

- (1) Any segregation of rear part containing the connections, at customer's care.
Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated for test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

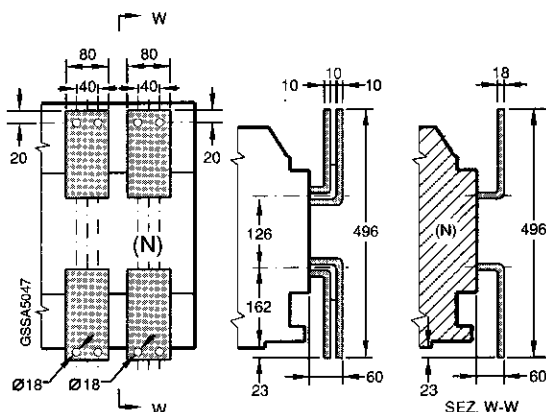
Terminals

Horizontal rear terminals



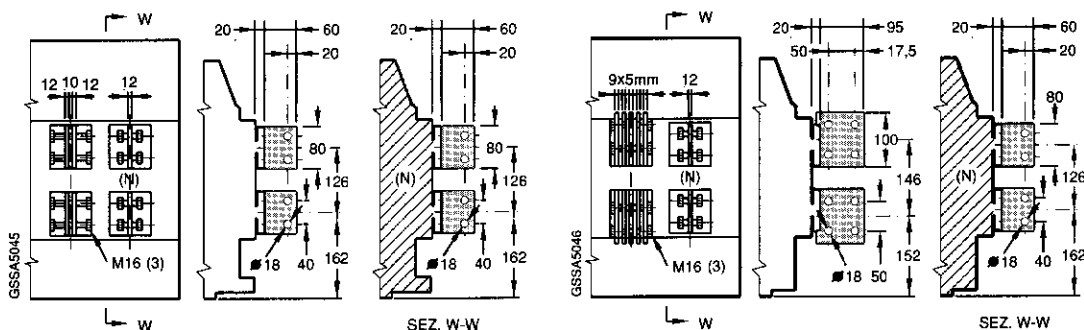
2000 - 2500 A

Front terminals



2000 - 2500 A

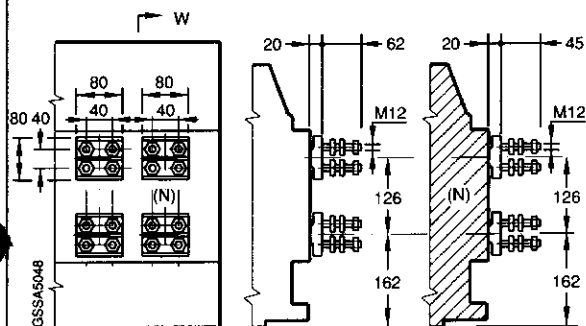
Vertical rear terminals



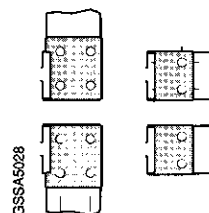
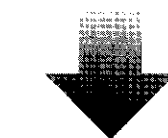
2000 - 2500 A

3000 A

Flat terminals



2000 - 2500 A



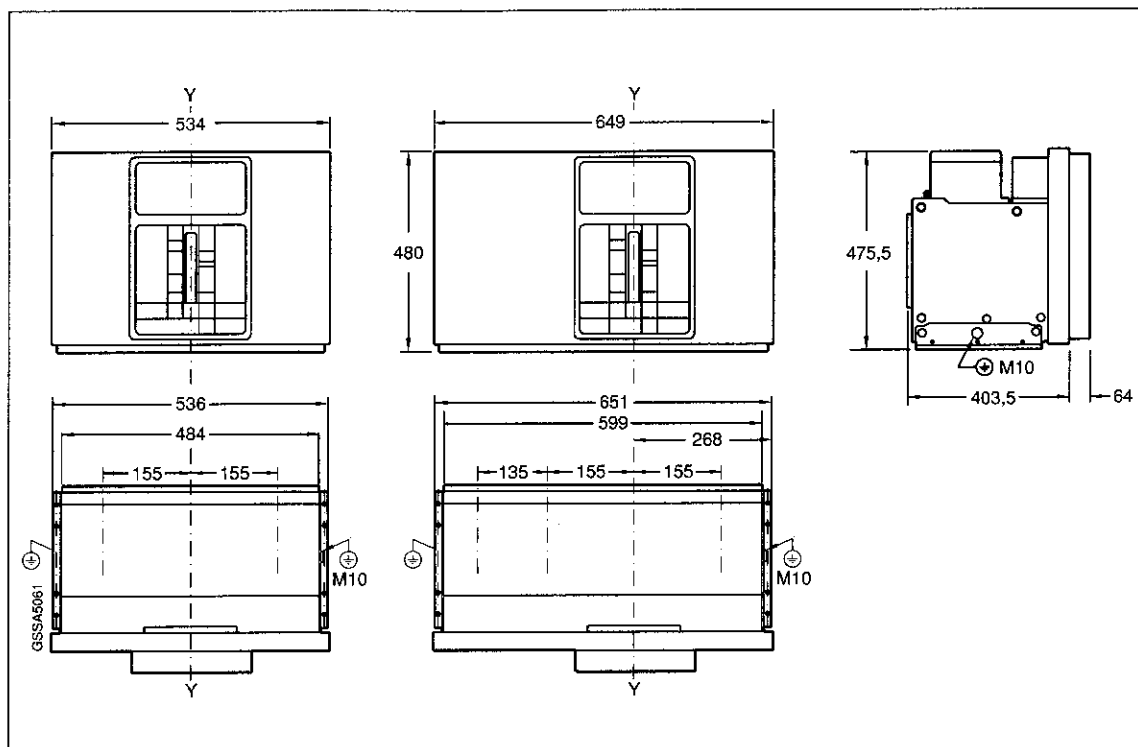
Arrangement of connections: 6 busbars 100 x 5 per terminal

Note

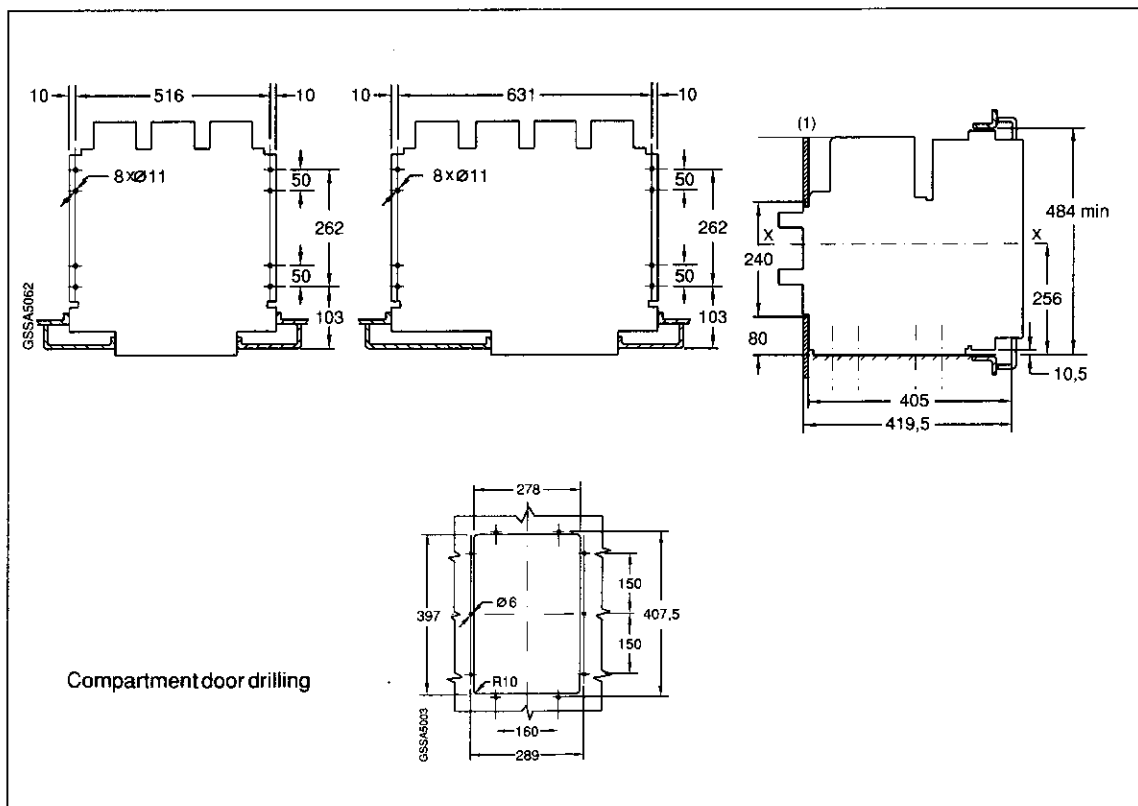
Neutral pole may have, upon request, the same section as other poles (special version).

3.7. F4 fixed circuit-breakers

Dimensions



Fixing drillings

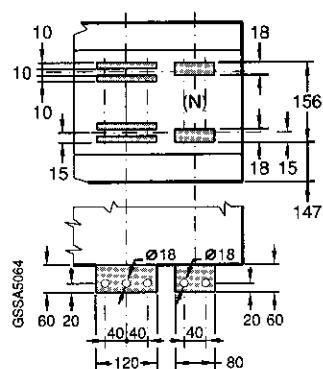


Notes

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.

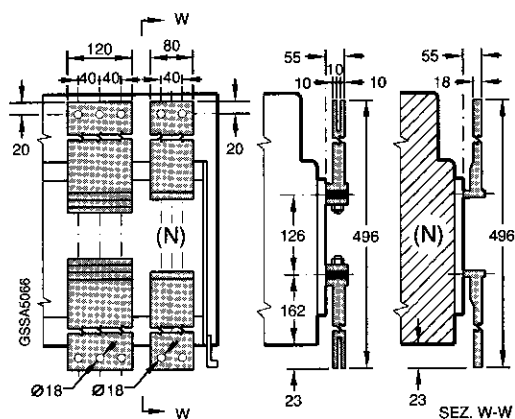
Terminals

Horizontal rear terminals



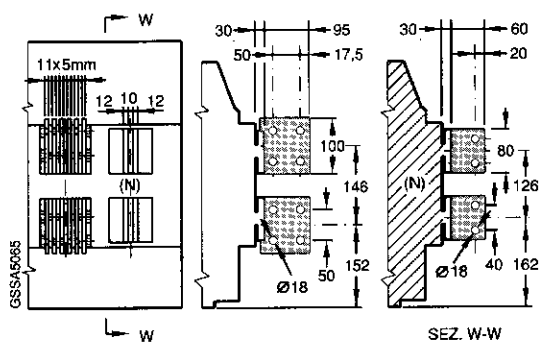
3200 A

Front terminals

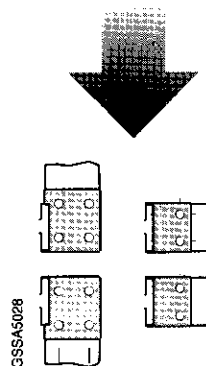


3200 A

Vertical rear terminals



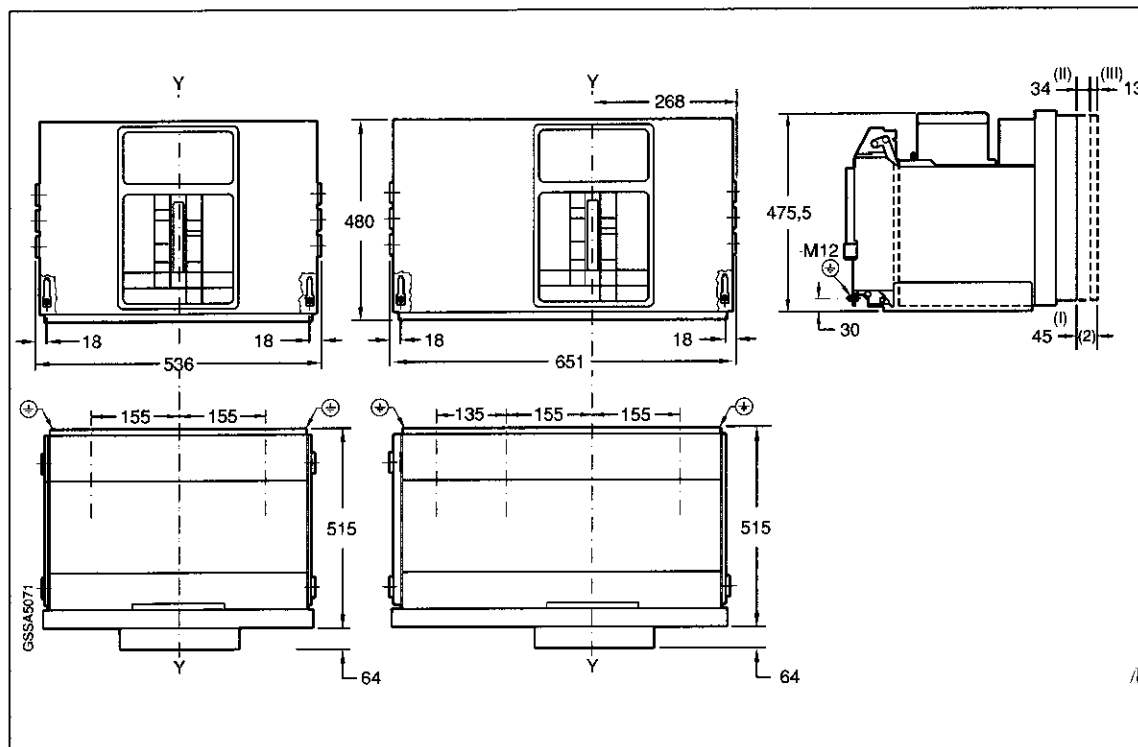
3600 A



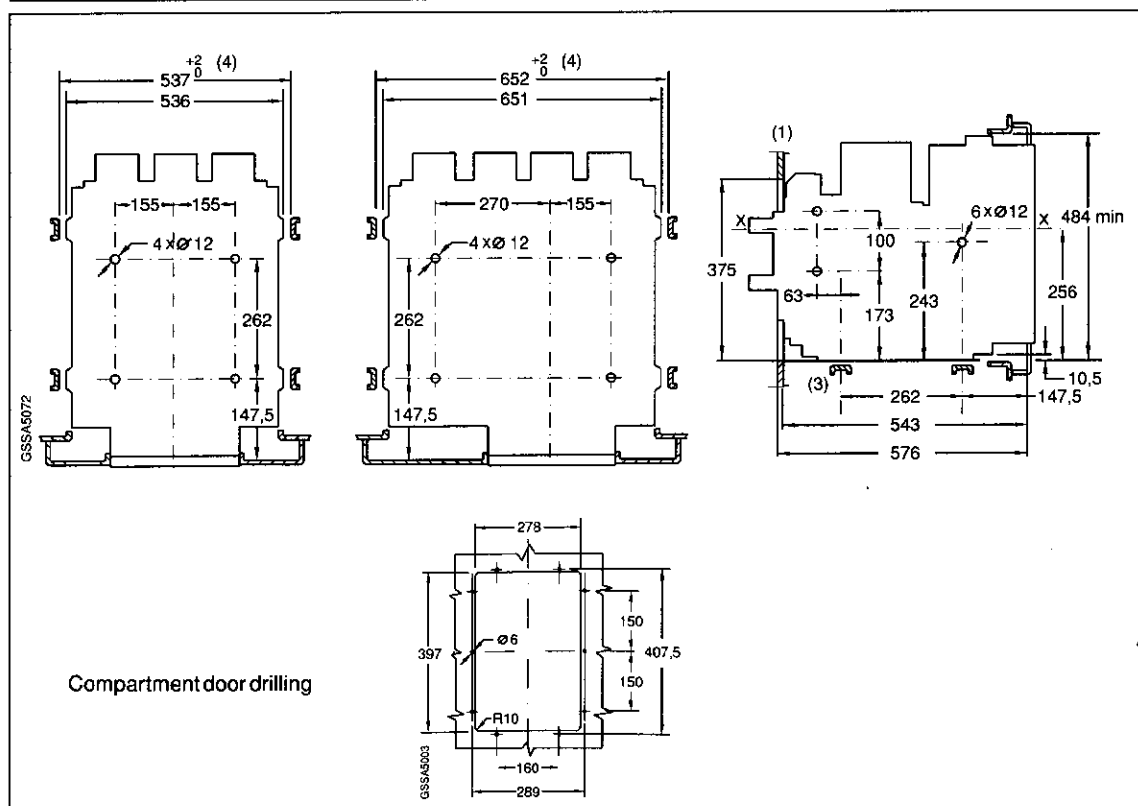
Arrangement of connections: 7 busbars 100 x 5 per terminal

3.8. F4 draw-out circuit-breakers

Dimensions



Fixing drillings

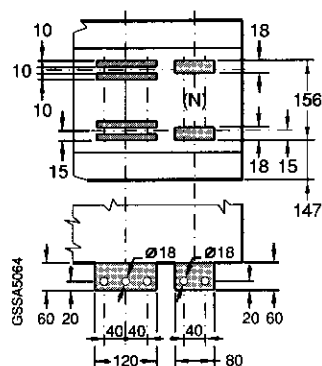


Notes

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated to test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

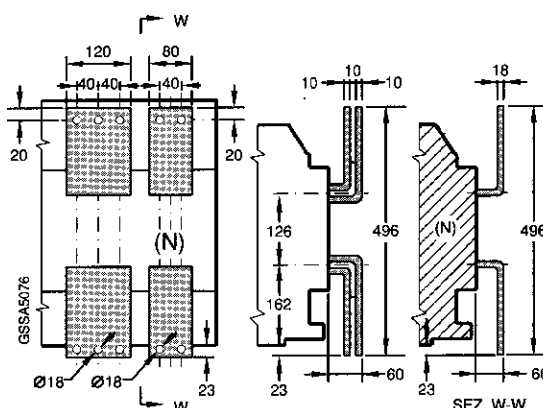
Terminals

Horizontal rear terminals



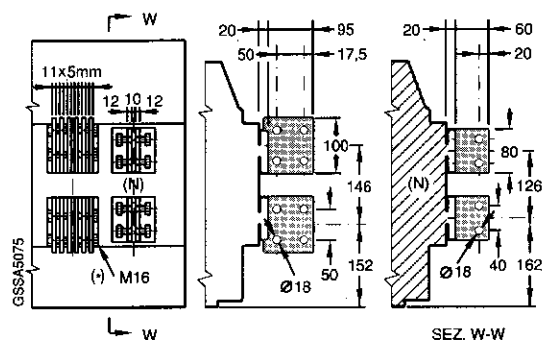
3200 A

Front terminals



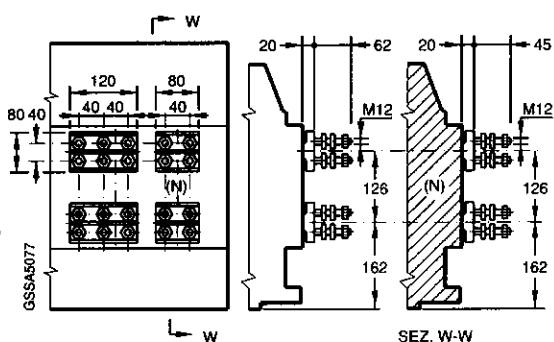
3200 A

Vertical rear terminals

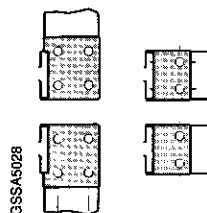


3600 A

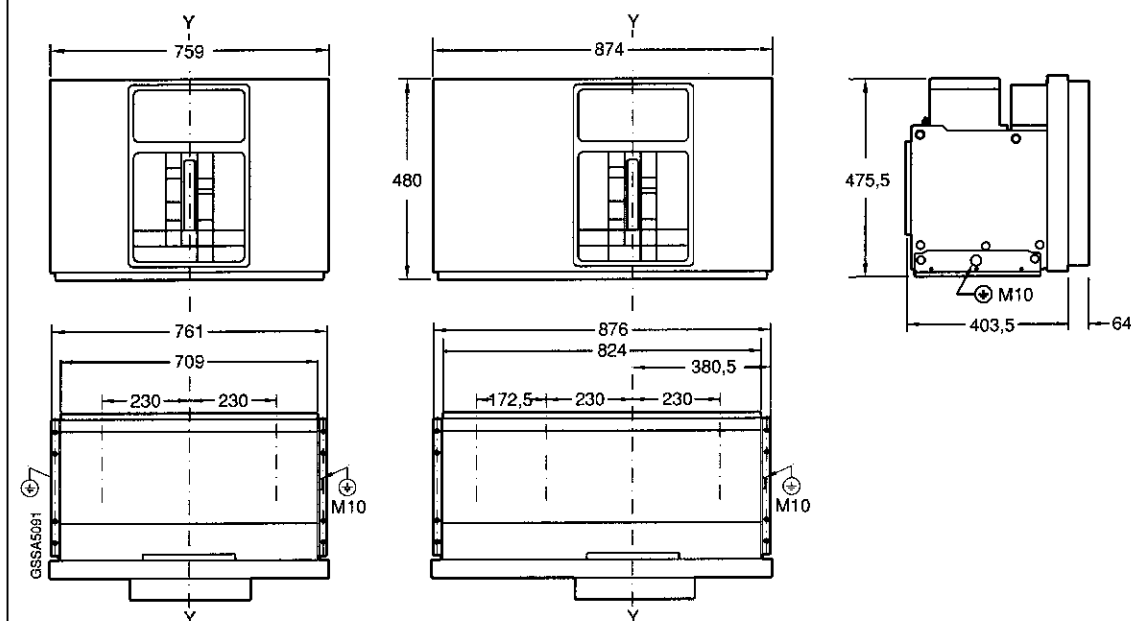
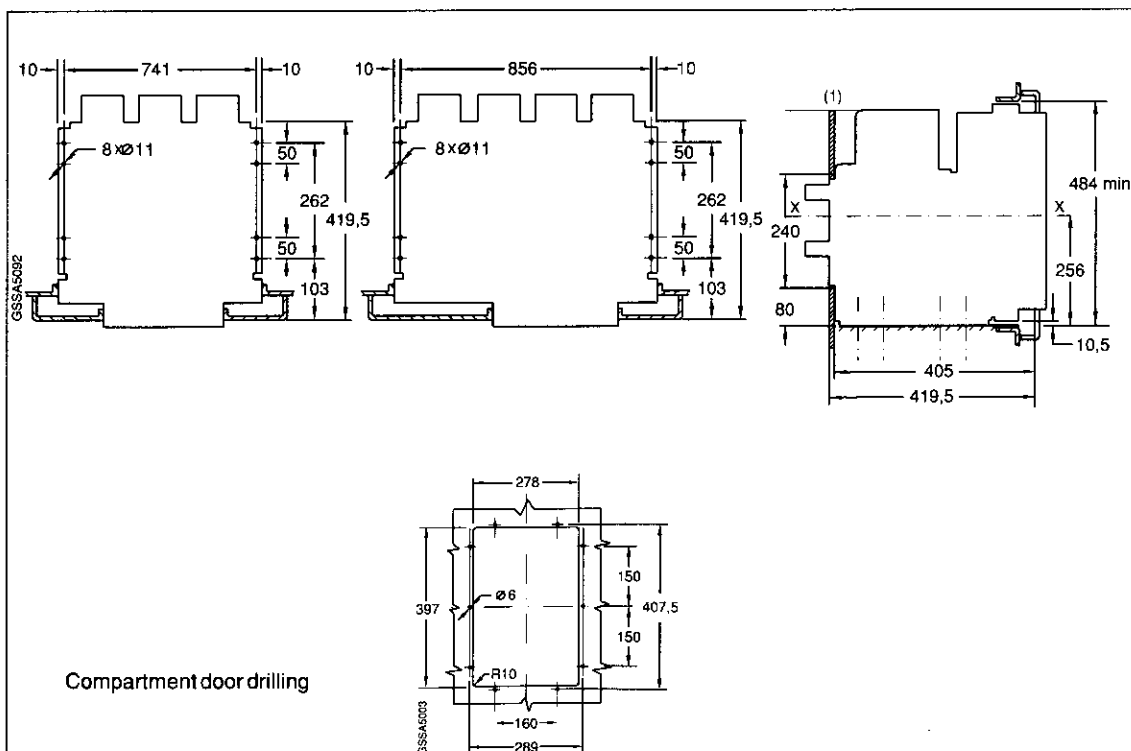
Flat terminals



3200 A



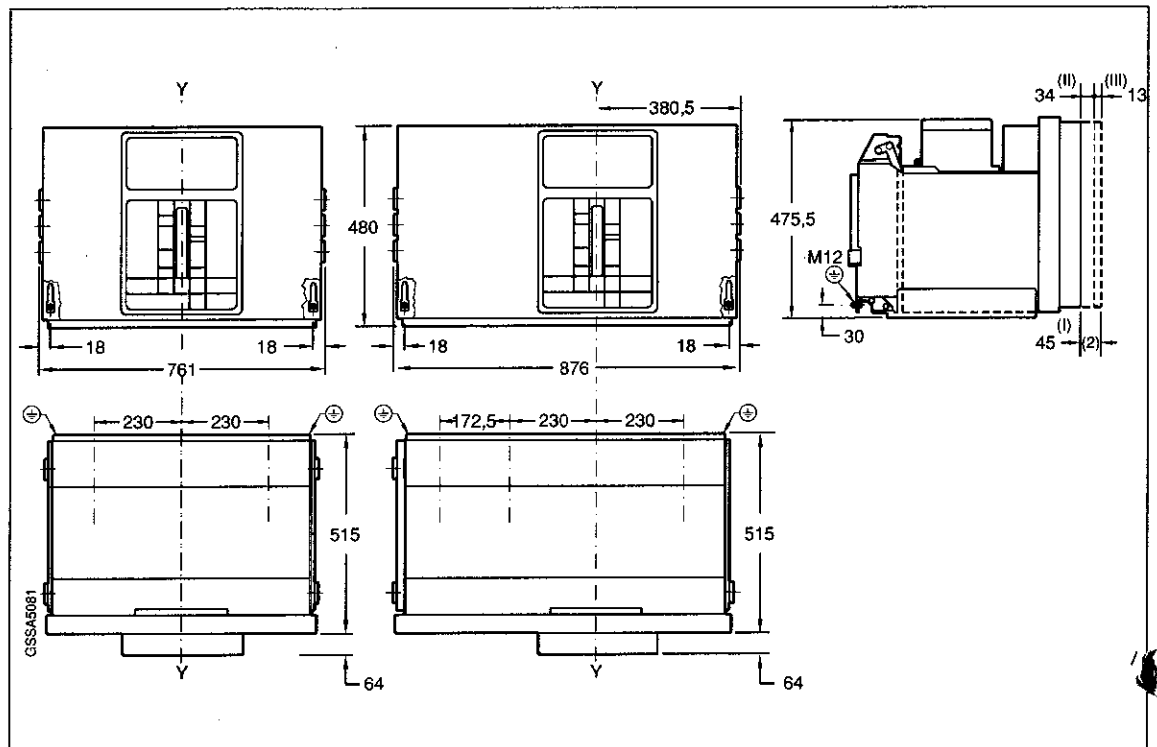
Arrangement of connections: 7 busbars 100 x 5 per terminal

3.9. F5 fixed circuit-breakers**Dimensions****Fixing drillings****Notes**

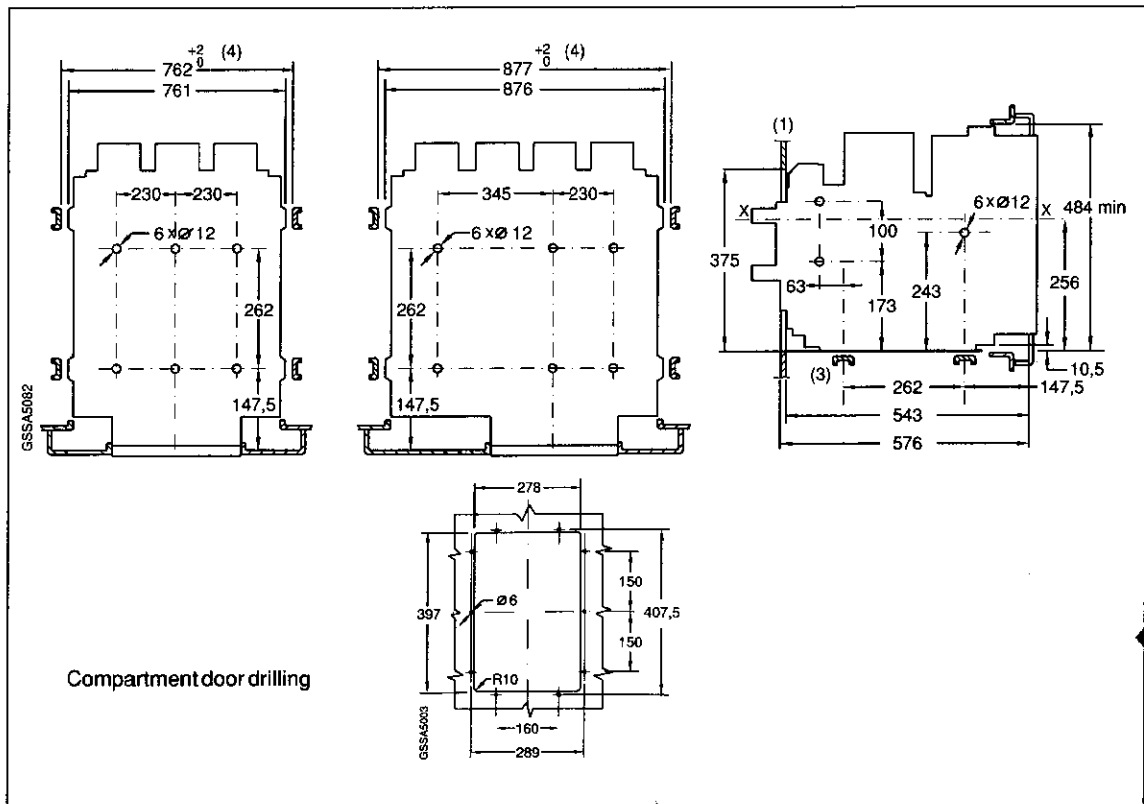
- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.

3.10. F5 draw-out circuit-breakers

Dimensions



Fixing drillings

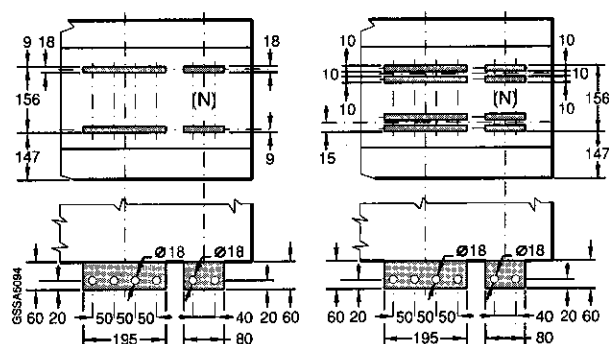


Notes

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated for test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

Terminals

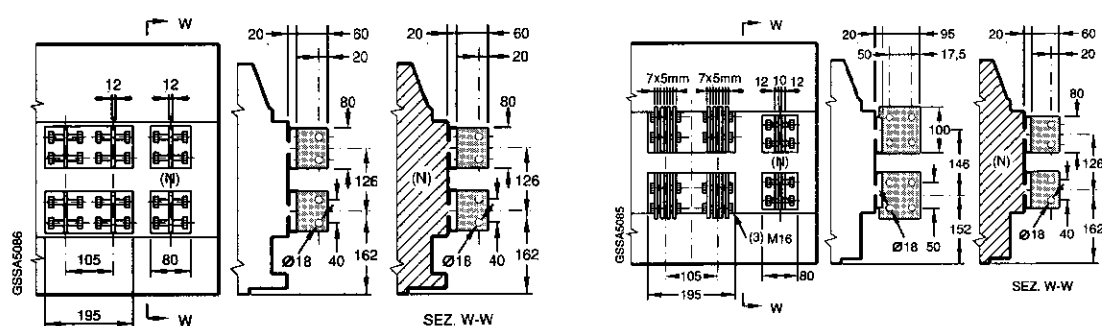
Horizontal rear terminals



3200 A

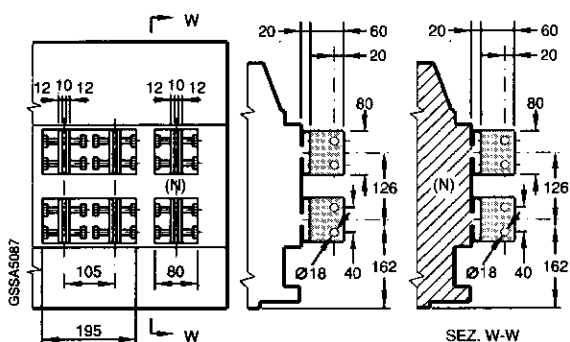
4000 A

Vertical rear terminals

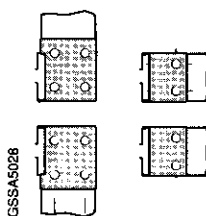


3200 A

5000 A



4000 A

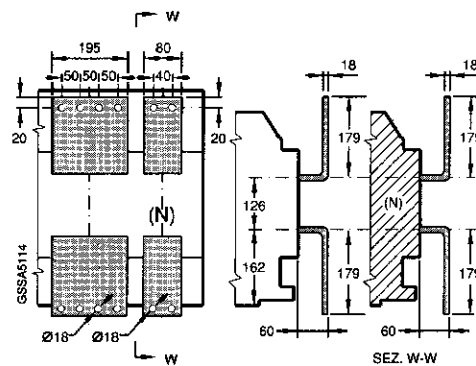


Arrangement of connections: 10 busbars 100 x 5 per terminal

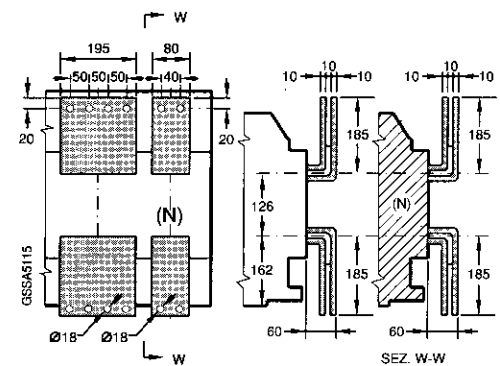
3.10. F5 draw-out circuit-breakers

Terminals

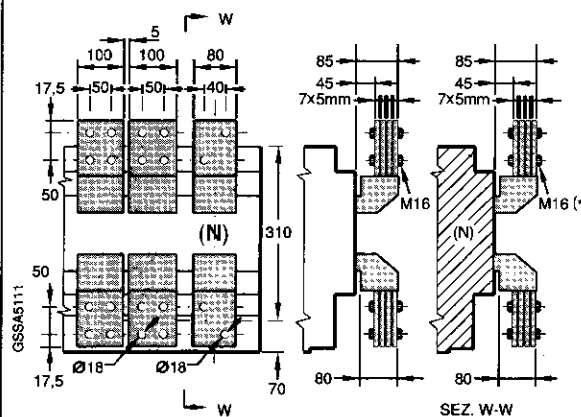
Front terminals



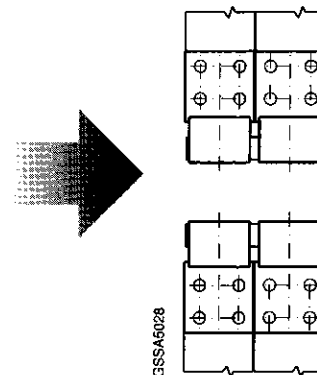
3200 A



4000 A



5000 A

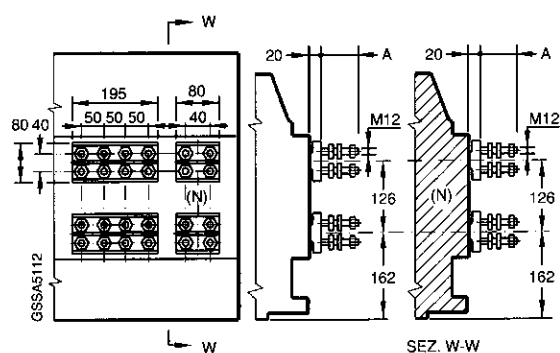


(*) included in the supply

Arrangement of connections: 10 busbars 100 x 5 per terminal

Terminals

Flat terminals

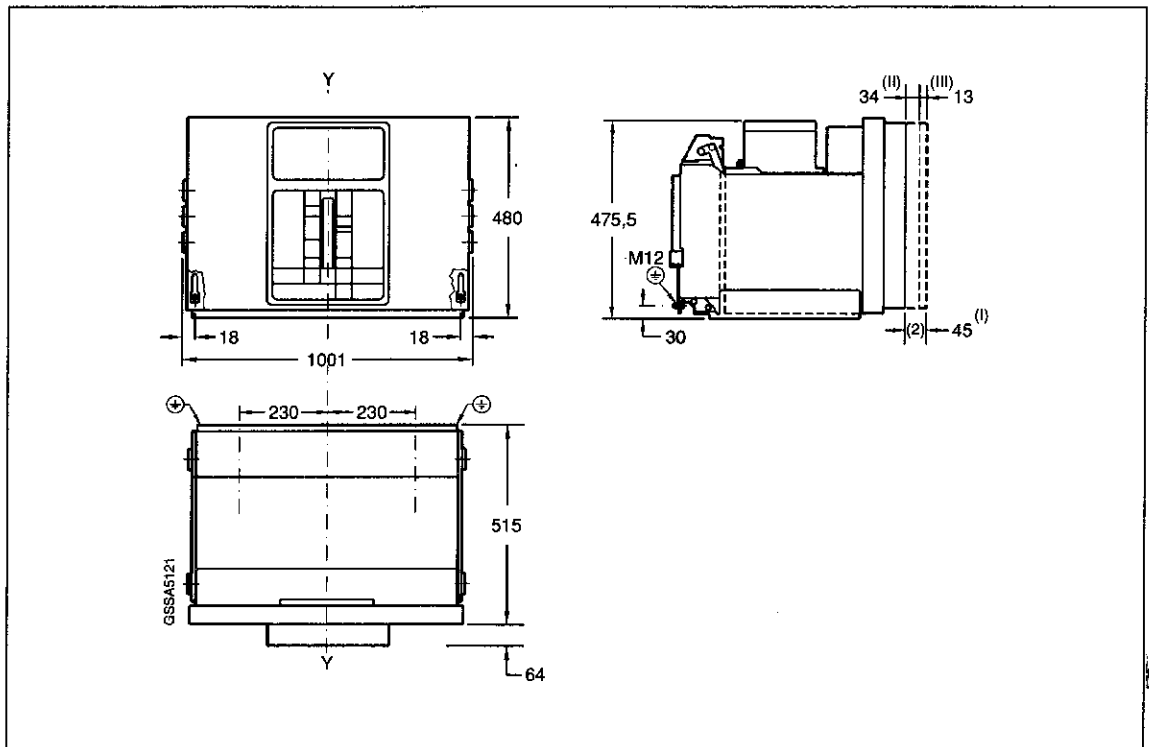


	A (mm)
F5 3200	45
F5 4000	62

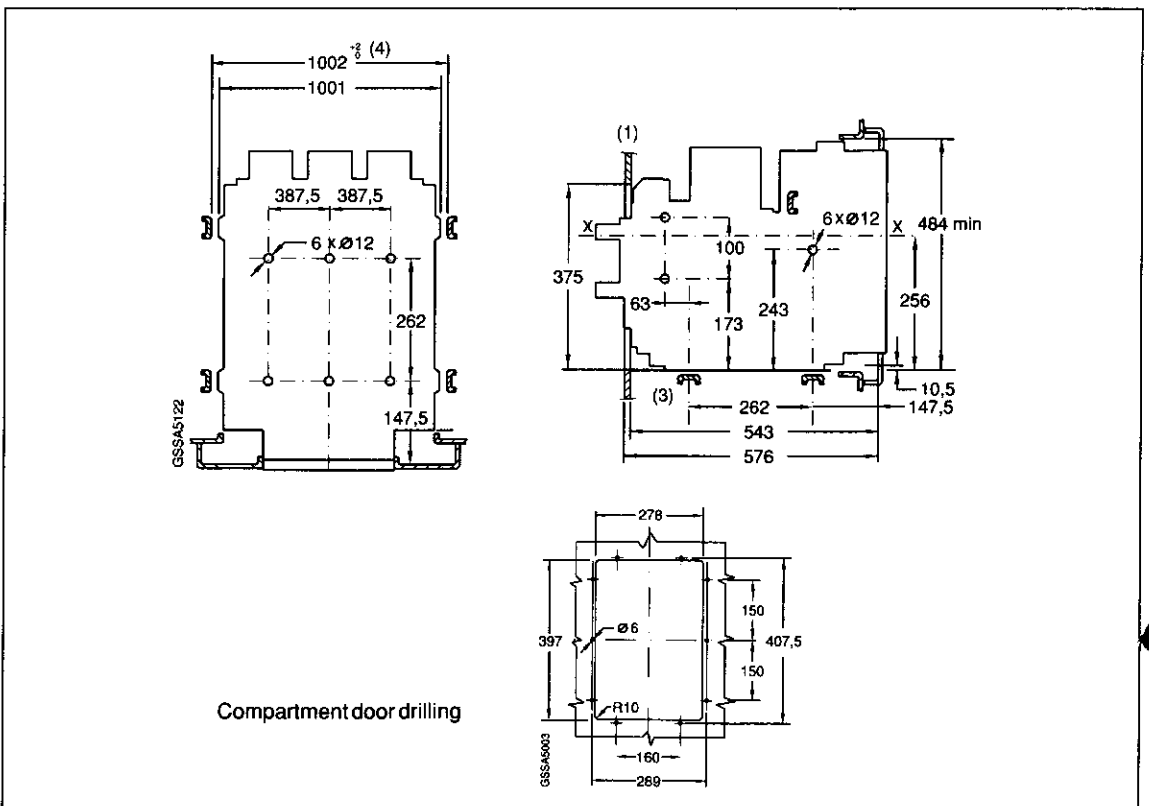
3200 - 4000 A

3.11. F6 draw-out circuit-breakers

Dimensions



Fixing drillings

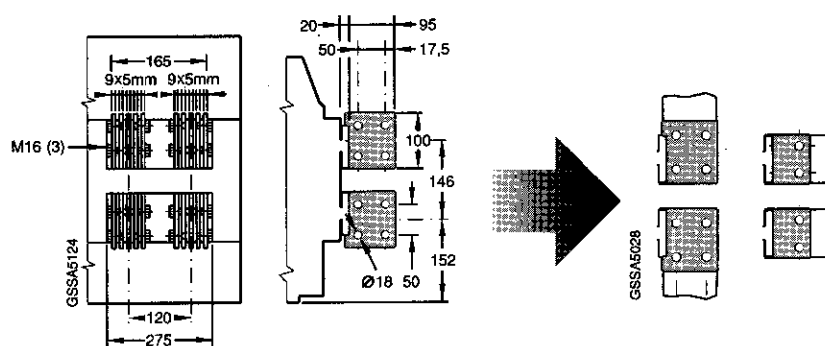


Notes

- (1) Any segregation of rear part containing the connections, at customer's care. Width of empty part equal to that of circuit-breaker.
- (2) Isolating distance:
 - from connected to isolated position (I), for circuit-breaker with isolation by lever;
 - from connected to isolated for test position (II), and from isolated for test to isolated position (III), for circuit-breaker with isolation possible with door closed.
- (3) Included in the supply.
- (4) Clearances to be taken up through adequate shims.

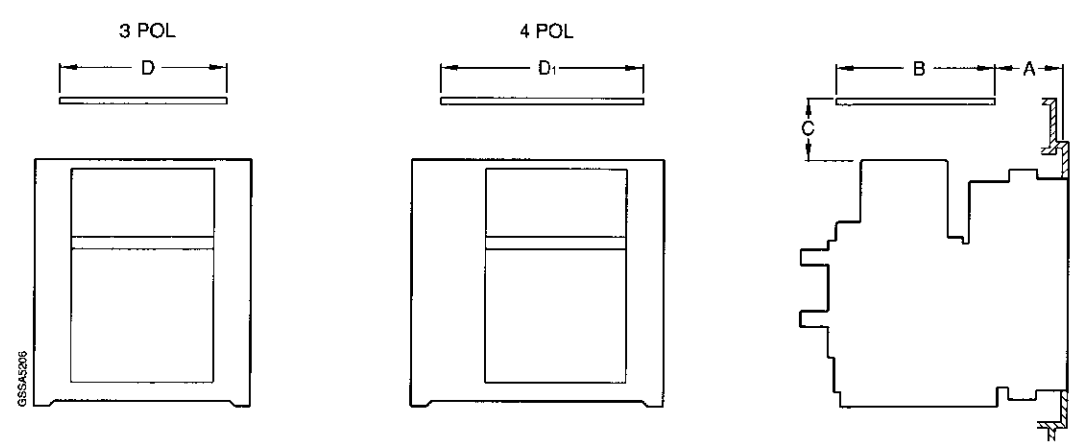
Terminals

Vertical rear terminals



6300 A

Arrangement of connections: 12 busbars 100 x 5 per terminals

3.12. Notes for installation**Clearances for circuit-breakers within compartment**


Circuit-breaker	Fixed version					Draw-out version				
	A	B	C	D	D1	A	B	C	D	D1
F1B - F1N - F1S 1250 1600 2000	50	300	100	329	425	130	300	100	329	425
F1H - F1V - F1L 1250 1600	50	300	80	329	425	130	300	80	329	425
F2S 2500 3000	50	300	80	410	506	130	300	80	410	506
F2H - F2V - F2L 2000 2500	50	300	80	410	506	130	300	80	410	506
F3S 2000 2500 3000	105	350	150	410	526	150	350	150	410	526
F4S 3200 3600	105	350	150	531	646	150	350	150	531	646
F5S - F5H 3200 4000 5000	105	300	150	756	871	150	350	150	756	871
F6S - F6H 6300	—	—	—	—	—	150	350	150	996	—

Notes

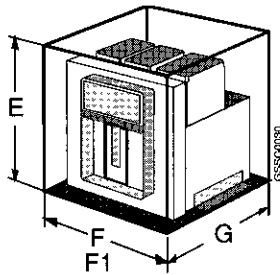
- The "C" dimension is the minimum distance from circuit-breaker to insulated or earthed wall protected with min. 3 mm thick insulating sheet.
 - Data are applicable for use with service voltage of 690 V or less.
- The compartment height is referred to upper walls protected with an insulating sheet.

Installation positions

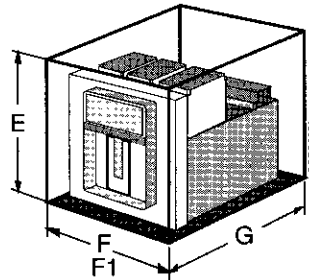
The circuit-breakers must be mounted in vertical position only.

Dimensions of the compartment

The table below indicates the overall dimensions of a circuit-breaker compartment for installation in a L.V. switchboard.



Fixed version



Draw-out version

Dimensions

	Fixed version				Draw-out version			
	E	F (3 POL)	F1 (4 POL)	G	E	F (3 POL)	F1 (4 POL)	G
F1	485	384	479	356	485	384	479	514
F2	485	466	561	356	485	466	561	514
F3	625	466	581	467,5	625	466	581	576
F4	625	586	701	467,5	625	586	701	576
F5	625	811	926	467,5	625	811	926	576
F6	—	—	—	—	625	1051	—	576

3.13. Table of circuit-breaker weights

Weights are deemed to apply to circuit-breakers complete with SACE PR1 releases and with the relevant current transformers, any other accessories being excluded.

Weights of draw-out circuit-breakers include the moving part plus the fixed part with horizontal rear terminals (or vertical terminals, if the horizontal ones are not provided).

Circuit-breaker type		Fixed version		Draw-out version	
		3 POL (kg)	4 POL (kg)	3 POL (kg)	4 POL (kg)
F1 B-N	1250 A	40	50	55	66
	1600 A	42	52	57	68
	2000 A	53	63	69	80
F1 S	1250 A	45	55	60	71
	1600 A	48	58	63	74
	2000 A	53	63	69	80
F1 H-V	1250 A	46	59	67	86
	1600 A	50	63	70	91
F1 L	1250 A	44	57	65	84
	1600 A	48	61	68	89
F2 S	2500 A	68	76	97	103
	3000 A	80	98	110	127
F2 H-V	2000 A	70	78	99	105
	2500 A	73	81	102	135
F2 L	2000 A	68	76	97	103
	2500 A	71	79	100	133
F3 S	2000 A	88	108	130	160
	2500 A	88	108	130	160
	3000 A	93	118	135	170
F4 S	3200 A	106	128	160	195
	3600 A	112	140	167	207
F5 S-H	3200 A	165	200	225	280
	4000 A	175	210	245	310
	5000 A	215	255	285	350
F6 S-H	6300 A			315	

4.1.	SACE PR1 microprocessor-based overcurrent releases for alternating current	48
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4.1. SACE PR1 microprocessor-based overcurrent releases for alternating current

For the a.c. protection of SACE Megamax F air circuit-breakers are used the solid-state microprocessor-based releases of SACE PR1 series, of advanced conception, which have been specifically designed to ensure a full protection in installations with the highest level of automation and monitoring. These releases, besides, enable the collection of a large range of information related to the installation and to the control interaction with the centralized operating system for the automatic control.

The SACE PR1 releases offer the following advantages:

- high accuracy
- easy of use
- reduction of dead times in the operation of the installation for checking and maintenance works
- restricted designing and running costs for the installation
- compliance with the international Standards IEC 68-2 as regards the endurance to mechanical stresses (shocks and vibrations)
- availability of an efficacious means of checking the operation through the TS1 test apparatus which is obtainable as accessory.

The SACE PR1 solid-state microprocessor-based releases consist of following elements:

- **PR1/P protection unit.** This unit achieves various protective functions and is usually supplied with the circuit-breaker arranged for the basic L and I protections (S and G functions can be added on request).

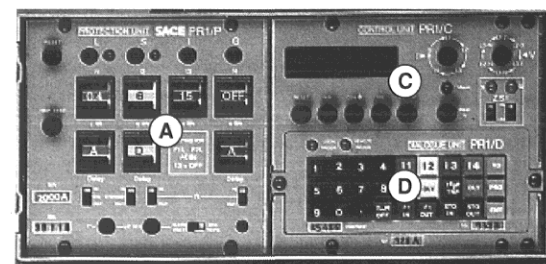
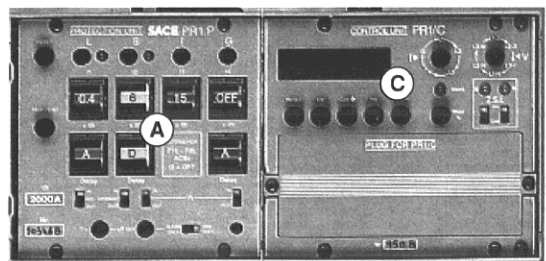
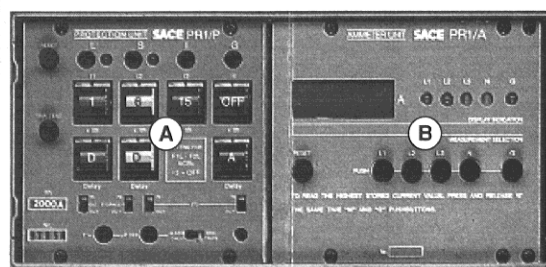
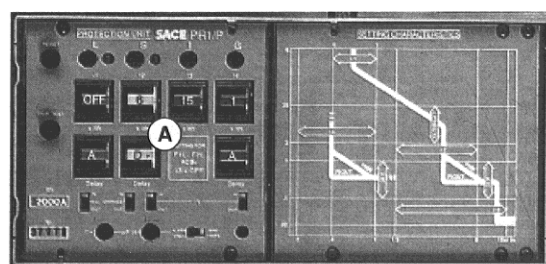
- **PR1/A amperometric unit.** This unit performs the measuring of line and earth fault currents which are shown on the LCD display, without the need of amperometric transformers in the installation. It is supplied on request.

- **PR1/C control unit.** This unit carries out the measuring of circuit-breaker and line parameters, which are shown in display, and makes the release available for use in an installation with zone selectivity interlocking. It is supplied on request and requires the presence of the PR1/P protection unit.

- **PR1/D dialogue unit.** This unit carries out the bidirectional dialogue between circuit-breakers and centralized system, and permits the electronic local or remote protection programming. It is supplied on request and requires the presence of the PR1/C control unit.

- **Current transformers.** They are mounted on the output terminals of the circuit-breaker poles. Always three current transformers are delivered for three-pole circuit-breakers and four for the four-pole circuit-breakers. A loose transformer, to be mounted outside the circuit-breaker, will be supplied later, on request, for the three-pole circuit-breaker in the presence of the G protective function against earth faults.

For further details on the composition of SACE PR1 releases see paragraphs 4.1.4-5-6-7.



A

PR1/P protection unit

B

PR1/A amperometric unit

C

PR1/C control unit

D

PR1/D dialogue unit

Power supply

The PR1/P protection unit requires no auxiliary external power supply; for the other units, instead, an external power supply is necessary, which should meet the following characteristics:

Rated r.m.s. value:	100 - 130 V a.c. 200 - 250 V a.c.
Voltage stability in static service conditions:	± 2%
Frequency:	50 - 60 Hz
Wave form:	sinusoidal
Harmonic distortion:	< 5%
Power required for a complete unit:	10 VA max.

The indicated characteristics can be achieved by means of a static continuity group branched from a busbar system located ahead of the circuit-breaker.

This continuity group may be the same as that normally used for the calculating units present in the installations with centralized control system.

The SACE SD-S1 converter can be used, when an auxiliary 48 V d.c. voltage is available (see chapter "Accessories and spare parts"):

V in = 48 V d.c.
V out = 220 V a.c.
f out = 50 Hz
P out = 20 VA.

Note

The amperometric unit, the control unit and the dialogue unit are of the plug-in type. They can be fitted by the customer himself into the release case which, therefore, maintains its external dimensions unchanged. In the protection unit there is an accumulator battery which is used for the trip test and to restore the magnetic indicators. The PR1 keeps the accumulator battery charged by means of a minimum constant current taken from CTs, when the circuit-breaker is crossed by a current greater than $0,1 \times I_n$. Before switching the installation on, it is necessary to check that the accumulator is fully charged, otherwise it must be recharged by use of the battery charger mod. BC3 (supplied on request).

The performance of the PR1/P protective functions is in any case fully warranted even if the accumulator battery is missing, defective or down.

4.1.1. Rated currents of releases

Circuit-breaker type	Phase												
	250 125	400 200	800 400	1250 625	1600 800	2000 1000	2500 1250	3000 1500	3200 1600	3600 2000	4000 2000	5000 2500	6300 3200
F1	1250												
	1600												
	2000												
F2	2000												
	2500												
	3000												
F3	2000												
	2500												
	3000												
F4	3200												
	3600												
F5	3200												
	4000												
	5000												
F6	6300												

4.1.2. Protective functions and set values of SACE PR1 releases

Protection against	Overload	Short-circuit	Short-circuit
Trip	Inverse long delay	Inverse short delay	Definite short delay
Symbol	L	S (2)	S (2)
Set values (hand adjustment by steps)	$I_1 = 0,4-0,5-0,6-0,7-0,8-0,9-0,95-1 \times I_n$ $t_1 = 5 \text{ curves A...E (1)}$	$I_2 = 1-1,5-2-3-4-6-8 \times I_n$ $t_2 = 7 \text{ curves A...G (1)}$	$I_2 = 1-1,5-2-3-4-6-8 \times I_n$ $t_2 = A=0,1 - B=0,2 - C=0,3$ $D=0,4 - E=0,6 - F=0,8$ $G=1s$
Set values (electronic adjustment) with dialogue unit	$I_1 = 0,4 \dots 1 \times I_n$ $t_1 = 2,5 \dots 30 \text{ s (4)}$	$I_2 = 1 \dots 8 \times I_n$ $t_2 = 0,1 \dots 1 \text{ s (5)}$	$I_2 = 1 \dots 8 \times I_n$ $t_2 = 0,1 \dots 1 \text{ s}$
Protection against	Short-circuit	Earth fault	Earth fault
Trip	Instantaneous adjustable	Inverse short delay	Definite short delay
Symbol	I (7)	G (2)	G (2)
Set values (hand adjustment by steps)	$I_3 = 1,5-2-3-4-6-8-10-15 \times I_n$	$I_4 = 0,2-0,3-0,4-0,6-0,8-1 \times I_n$ (3) $t_4 = 6 \text{ curves A...F (1)}$	$I_4 = 0,2-0,3-0,4-0,6-0,8-1 \times I_n$ (3) $t_4 = A=0,1 - B=0,25 - C=0,4$ $D=0,6 - E=0,8 - F=1s$
Set values (electronic adjustment) with dialogue unit	$I_3 = 1,5 \dots 15 \times I_n$	$I_4 = 0,2 \dots 1 \times I_n$ $t_4 = 0,1 \dots 1 \text{ s (6)}$	$I_4 = 0,2 \dots 1 \times I_n$ $t_4 = 0,1 \dots 1 \text{ s}$

I_n = Release rated current (corresponding to the rated primary current of current transformers).

- (1) Time-current curves with I^2t = constant characteristic.
 (2) Types of trip selectable through change-over switch. Function G requires 4 current transformers (see electrical circuit diagram, sect. 6).
 (3) The function is inhibited for current values higher than $5 \times I_n$.

(4) Values obtained at $6 \times I_1$.

(5) Values obtained at $10 \times I_n$.

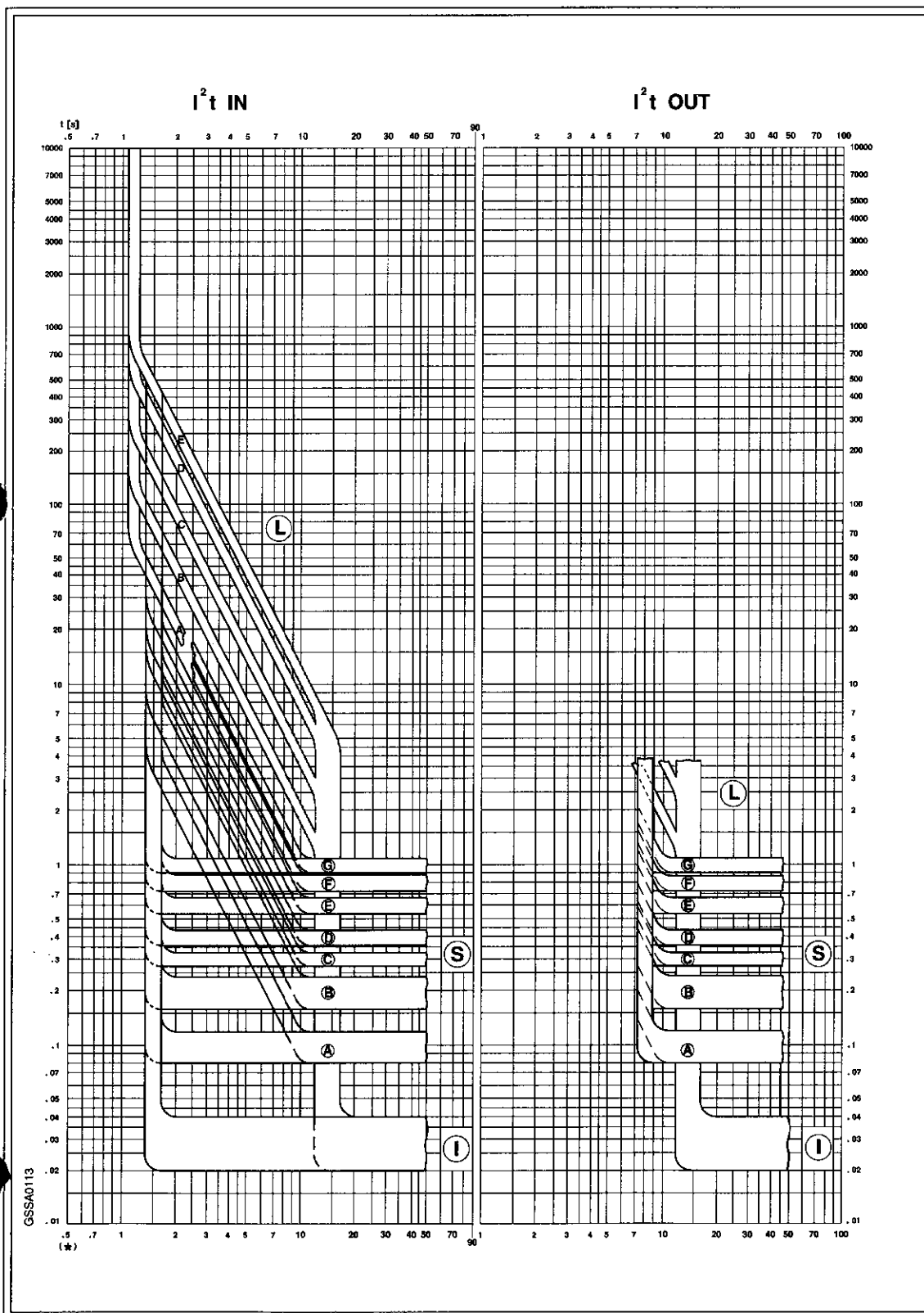
(6) Shortest trip times.

(7) When selector is in OFF position, a trip current threshold at $18 \times I_n$ with 1,2 s time is automatically inserted.

Note: the L, S, I and G functions can be cut out by the OFF position.

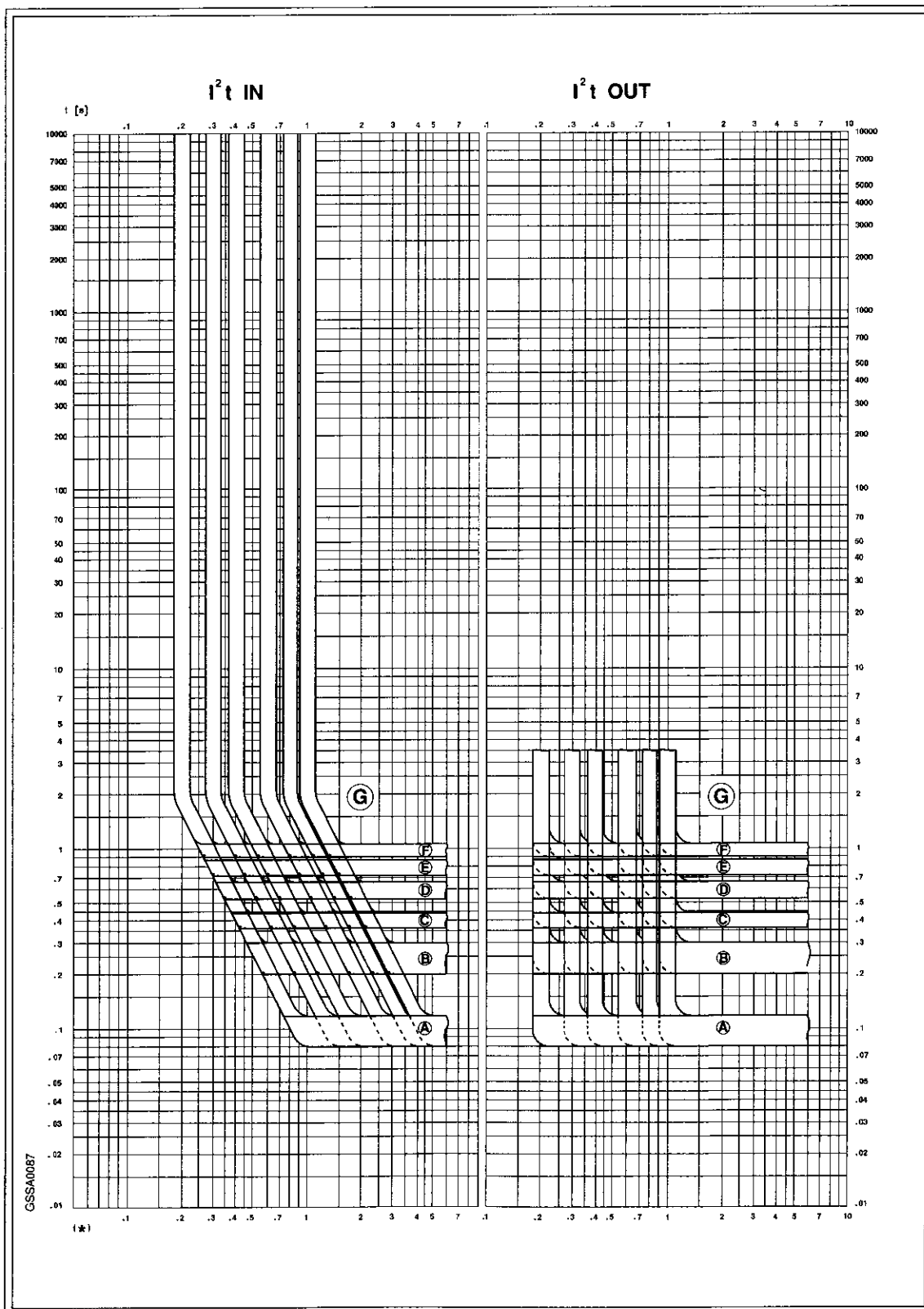
4.1.3. Time-current curves of SACE PR1 releases

Functions L-S-I

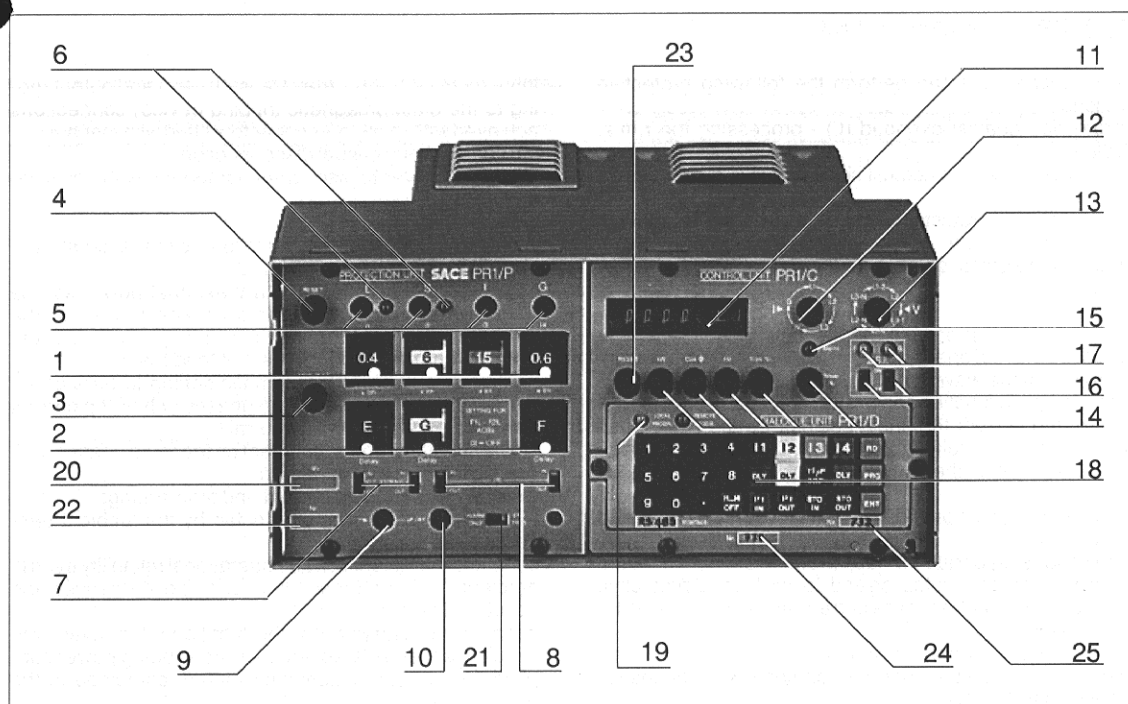


4.1.3. Time-current curves of SACE PR1 releases

Functions G



(*) For function G: multiples of the release rated current (I_n).



- 1 Trip current threshold setting selector switches
- 2 Trip time setting selector switches
- 3 Opening test pushbutton
- 4 Pushbutton for resetting the trip, microprocessor malfunction and temperature rise indications
- 5 Magnetic tripping indicators
- 6 Prealarm and alarm signal lamp to indicate overcurrent
- 7 Selector switches for cutting in and out the thermal memory (L-S protections)
- 8 Selector switches for the choice of the time-current curve (S-G protections)
- 9 Limit temperature magnetic indicator (with signalling only or tripping and signalling possibility). It automatically resets when temperature falls below 70 °C
- 10 Microprocessor malfunction magnetic indicator (with signalling only or tripping and signalling possibility)
- 11 LED display for measured quantities
- 12 Pushbutton for current measuring (three phases, neutral and earth current)
- 13 Pushbutton for displaying the phase voltage and line voltage measuring

- 14 Pushbuttons for measuring cos φ - kW - Hz - No. of operations and the per cent contacts wear
 - 15 Signal lamp warning that the circuit-breaker main contacts need servicing
 - 16 Selector switches for zone selectivity interlocking insertion
 - 17 Zone selectivity interlocking inserted indicators
 - 18 Keyboard for electronic local protection programming and for programmed parameters reading
 - 19 Local/remote programming selection indication
 - 20 I_{th} = I_n rated current of release (corresponding to the rated primary current of current transformers)
 - 21 Selector switch for selecting alarm only or circuit-breaker tripping due to malfunctions as per items 9 and 10 above.
- Note:** the "tripping" position SHOULD NOT BE USED if only the PR1/P protection unit is present. It can, instead, be used in the PR1/PA - PR1/PC - PR1/PCD configurations.
- 22 Serial number of PR1/P release
 - 23 Control unit reset pushbutton
 - 24 Serial number of the PR1/C control unit
 - 25 Serial number of the PR1/D dialogue unit

4.1.4. PR1/P protection unit

The protection unit can perform the following protective functions:

- protection against overload (L) - processing the r.m.s. value
- selective protection against short-circuit (S) - processing the r.m.s. value
- instantaneous protection against short-circuit (I) - processing the $I_p/\sqrt{2}$ value
- protection against earth fault (G) - processing the r.m.s. value.

The r.m.s. value processed in the functions L, S and G expresses the real energy content of the let-through current regardless of the wave form.

Each protective function can be cut out by hand through the relevant trip current threshold selector switch (OFF position); care must be taken to ensure that not all 4 protection functions are left in the above OFF position.

The protection unit is provided with the following devices and functions:

- indications (separate for each protective function) of the operation of each protection and, for the L and S protective functions, display of the line current value prevailing at the time of tripping
- microprocessor operation control
- control of the limit temperature attainment inside the release case (70 °C)
- pushbutton for resetting the protection operation, microprocessor malfunction and temperature rise indications
- function test pushbutton (causing the circuit-breaker to trip)
- hand planning of protection functions
- electromagnetic tripping device for circuit-breaker

(¹) In case of four poles having the same cross-section, the neutral setting is the same as that of the other poles.

- input (coming from current transformers) and output (going to the electromagnetic tripping device) connections achieved with multipole connectors fitted with mechanical lock against any casual disconnection
- protection cover to discourage tampering with adjusting devices.

The protection unit features the following characteristics:

- operation from -25 °C to +85 °C
- operation requiring no auxiliary external power source since the current transformers provide power for the release and the electromagnetic tripping device is taken from the current transformers that feed the unit
- neutral protection with automatic setting to 50% of the current values present on the phases (when the current transformer is present on neutral (¹))
- single simultaneous adjustment on the three phases and, when provided, on the neutral
- wide range of tripping current and time settings
- tripping characteristics unaffected by the ambient temperature
- constant characteristics and operational reliability even in ambients with the presence of strong disturbances and polluting agents
- possibility of carrying out the functional test even with circuit-breaker isolated, the test circuit being power supplied through an accumulator battery contained in the release case
- possibility of selecting an instantaneous reset or delayed reset after tripping due to overload. The latter simulates the cooling characteristics of a thermal overcurrent device.

4.1.5. PR1/A amperometric unit (on request)

In addition to the protections described in item 4.1.4, it also performs the following functions:

- It measures the r.m.s. value.
Tolerance: $\pm 10\%$ from 0,04 to $0,15 \times I_n$
 $\pm 3\%$ from 0,15 to $1,2 \times I_n$
 $\pm 10\%$ up to $6,0 \times I_n$.
- Current measuring is carried out through the same CTs used by the PR1/P protection unit and mounted in the circuit-breaker.
- It continuously displays the current of the most loaded phase.

- Values of currents on the remaining phases, the neutral and the earth current may be displayed by keeping the relevant pushbutton depressed.
- By concurrently pressing and releasing the "N" and "G" pushbuttons, the highest line current stored after the last operation of the relevant "Reset" pushbutton will be displayed.
- Minimum current displayed: phase current $0,08 \times I_n$
neutral current $0,04 \times I_n$
earth current $0,04 \times I_n$.
- The maximum current that can be displayed is 9999 A; in case of higher values, the display will show "—". (¹)

4.1.6. PR1/C control unit (on request)

The control unit makes it possible to display the electrical quantities related to the protected line, to achieve the zone selectivity interlocking and the control of electrical devices through power relays housed in the release case. Indications and operational possibilities of the control unit are as shown below. (²)

Measuring of electrical quantities with LED display

- Currents
 - a) Value of the current on the phase with the greatest load, continuously displayed.
 - b) Values of the currents on the remaining phases and on the neutral as well as the earth current may be displayed by means of a pushbutton.
 - c) Storage of the current interrupted on the most loaded phase in case of circuit-breaker tripping by operation of the protection unit. Reset is only possible by use of the proper Reset pushbutton.

- Line and phase voltages can be displayed by pushbutton. Voltage measuring is carried out through a special ABB SACE voltage transformer cod. 56089 not belonging to the SACE PR1 release but available on request.
- The active power can be displayed by pushbutton (³).
- The power factor for balanced loads can be displayed via a pushbutton (³).
- Frequency to be displayed by pushbutton in the range of 14 to 88 Hz.

Indications concerning maintenance

- Number of mechanical operations made by the circuit-breaker (manual operations and trippings through the protections) can be displayed by means of a pushbutton.
- Percent indication of contacts wear (0% = perfect contacts) that can be displayed by means of a pushbutton.
- Indication of contacts needing servicing (through LED signal lamp) when contacts wear $\geq 80\%$.

(¹) The amperometric unit must be power supplied by an auxiliary external power source. Selectable supply voltages: 110 V and 200 V - 50/60 Hz.

(²) For its operation, the control unit requires a stabilized auxiliary power source and requires the presence of the PR1/P protection unit. Selectable supply voltages: 110 and 220 V - 50/60 Hz (see par. 4.1.). For d.c. supply, the SACE SD-S1 converter is required (see chapter 7 "Accessories and spare parts").

(³) For this measuring, the presence of the above mentioned VT or the connection of a voltage proportional to the line voltage is required.

Operation commands

– Zone selectivity

Zone means the part of installation comprised between two or more circuit-breakers connected in series. Through a simple connecting wire, every circuit-breaker that perceives a fault, will communicate it to the one installed upstream: the fault area is the one located immediately downstream of the circuit-breaker that perceives the fault but receives no communication from those placed downstream. The zone selectivity permits to shorten the tripping times for the circuit-breaker closer to the fault, with respect to those required by the time-type selectivity.

Trips in definitely shorter times (which for the PR1 are of the order of 50 ms) make it possible to reduce thermal stresses on the protected part of installation.

This type of protection is applicable to the S and G protective functions only. Besides, it is necessary that these functions be preset for the definite delay trip characteristics (otherwise said selectivity will be ignored).

To enable the zone selectivity, besides the aforesaid, also some simple operations should be carried out for each of the S and G functions:

- 1) the connectors X3 of the involved circuit-breakers should be connected to the outputs of the functions K51/ZS out and/or K51/ZG out with the corresponding inputs in the circuit-breakers K51/ZS in and/or K51/ZG in located immediately ahead of them.

If the connections have been carried out correctly, the outputs (out) of the first circuit-breaker in the chain must be no-load, while the inputs (in) of the last circuit-breaker in the chain must be open;

- 2) on the PR1/C unit of each circuit-breaker involved in the zone selectivity, the selector switch or both selector switches ZSI, depending on which function should be enabled, must be set in ON: this operation is confirmed by the corresponding signal lamp.

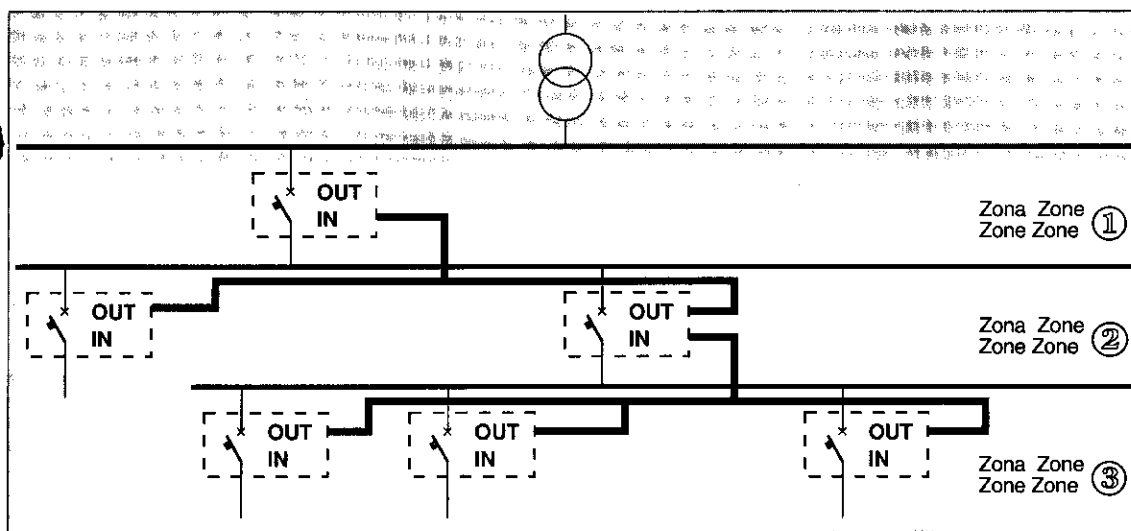
– Indications

For each controlled part, a contact (without potential) is available for remote indications of:

- a) microprocessor malfunctions
- b) temperature rise inside the protection unit case ($\geq 70^{\circ}\text{C}$)
- c) L protection in prealarm
- d) L-S-I-G protections in the tripping band
- e) tripping by the solid-state release (combined with one of the functions in d)
- f) contacts wear (for contacts wear = 100%).

Analog output for PLC or for remote current measuring

- Output 0...20 mA d.c. on ohmic load $\leq 600 \text{ ohm}$ (20 mA corresponds to 1 x In). The output current is related to the current of the most loaded phase.



4.1.7. PR1/D dialogue unit (on request)

The dialogue unit gives information on electrical quantities, alarms and the circuit-breaker conditions detectable by the control unit according to the centralized control protocol of the installation. Besides, it receives the operational commands for the circuit-breaker transmitted by the central system.

The connection of the dialogue unit implies the cut-out of the protection unit manual programming. This is done by simply mounting the opaque protection cover on the trip time and current values selector switches on the unit front side. The programmed values are displayed on the control unit whenever recalled by use of keyboard.

Programming is carried out electronically by use of the keyboard provided on the dialogue unit when the connector of the central system connecting cable is not plugged in. Instead, when this connector is plugged in, programming occurs by remote control via the central operating system. The "local/remote" programming is signalled by two LED displays located on the dialogue unit.

Note: the presence of PR1/P and PR1/C units is required.

Data transmission

The dialogue unit sends the central system all information present in the control unit (with the exception of the analog output for current measuring) and all information concerning the circuit-breaker status (open/closed, connected/isolated, closing springs charged/discharged).

Data reception

The dialogue unit is capable of receiving the following information from the central system:

- a) Protection unit programming
- b) Circuit-breaker opening
- c) Circuit-breaker closing.

Dialogue interface

Standard: serial link RS485.

Communication protocol ABB INSUM.

Transmission speed programmable from 300 bit/s to 19200 bit/s.

4.1.8. Examples of connection with the central control and supervision unit

In the PR1/PCD configuration the releases can dialog and be governed by a central control and supervision unit. From the various possible solutions the best suited, since it has been specifically designed, is shown in the diagrams on page 57. Besides these two solutions, also the interfacing with a personal computer or with other systems is possible, provided they are compatible with the interface and with the transmission system used.

a. SACE INSUM system

The used interface, the RS485, defines a serial communication system which can accept one Master and up to 32 Slaves. In this layout, the Master is the central switchboard unit "BAG"; the slaves are the PR1/PCD releases or the MSG user units of the SACE INSUM system: a central unit can, therefore, connect up to 32 circuit-breakers or a group of circuit-breakers, controlled by PR1/PCD, and other switching devices, controlled by MSG, where their total does not exceed 32.

Each SACE PR1 is identified by its own address selectable by means of 5 bits of the dip-switches located on the dialogue unit.

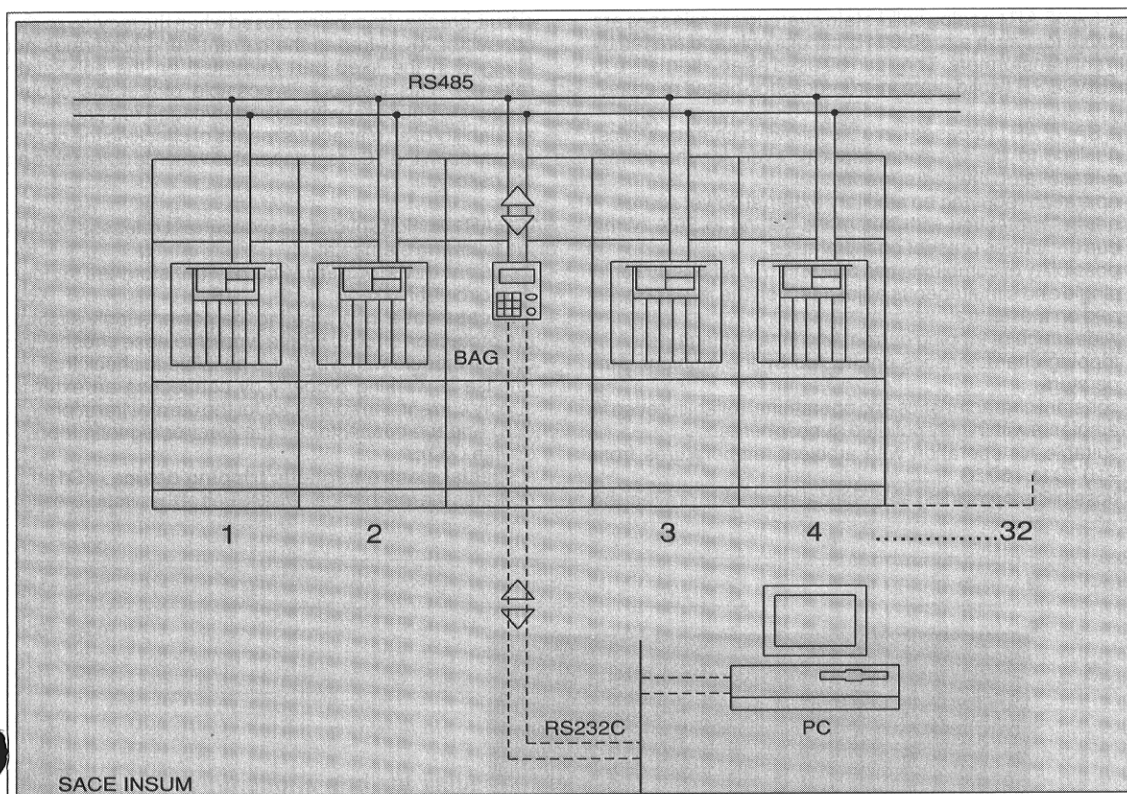
Other dip-switches on the **same unit permit to determine** the communication speed which, in this specific case, should be 9600 bit/s.

The BAG unit enables a centralized switchboard control for more circuit-breakers or devices. The same unit may be connected, via the RS232C interface, to a personal computer or to a higher level control system (see CAT 0-61/1).

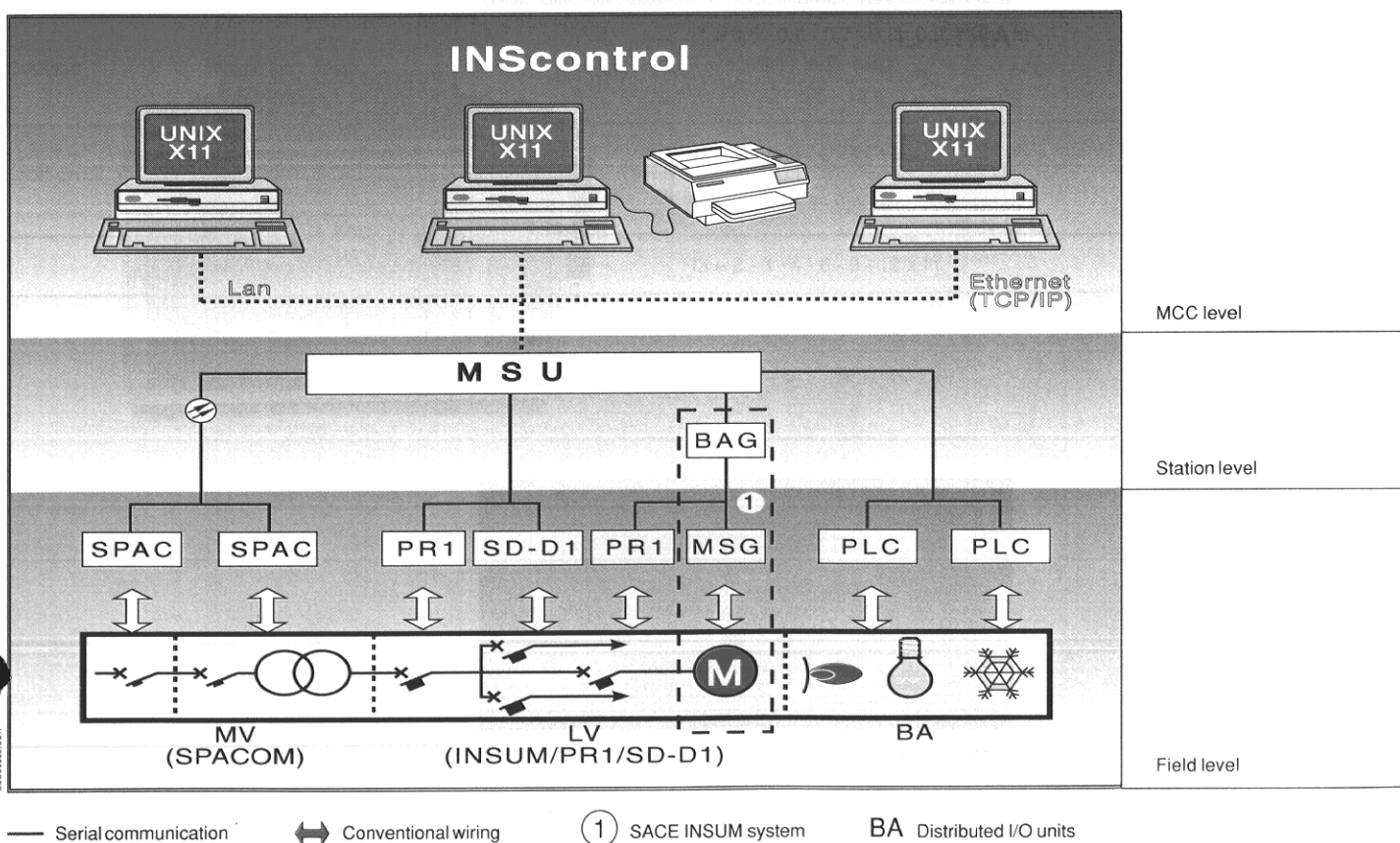
b. SACE INScontrol system

Through this system, the SACE Megamax circuit-breakers are inserted in a larger M.V./L.V. control system. The installation/s connected to the system can be controlled either locally or from a centralized post. For further information and for a close review of the detailed advantages, consult the ABB SACE Systems catalogue CAT 0-61.

SACE INSUM system



SACE INScotrol system



4.2. SACE AR1 analog solid-state overcurrent releases for alternating current

The SACE AR1 analog solid-state overcurrent releases are suitable for use in a.c. 50/60 Hz circuits only and are fed by current transformers. They can be used as an alternative to the SACE PR1 solid-state microprocessor-based releases.

The SACE AR1 releases have the following characteristics:

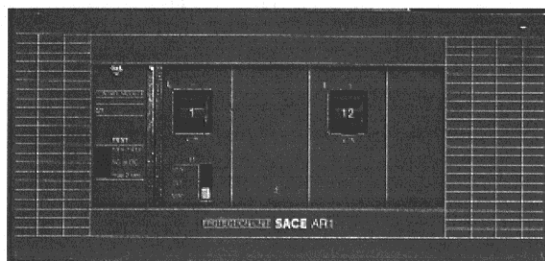
- no limit to the breaking capacity even for the lowest release rated thermal currents
- operation requiring no auxiliary external power source
- neutral protection with automatic setting to 50% of the current values present on the phases
- possibility of combining two protection functions: LS or LI
- single and simultaneous adjustment on the three phases and on the neutral
- wide range of tripping current and time settings
- tripping characteristics unaffected by the ambient temperature
- constant characteristics and operational reliability even in ambients with highly polluted atmospheres
- suitable for operation with ambient temperatures from -10°C to $+60^{\circ}\text{C}$
- possibility of providing an electrical interlock to prevent the

circuit-breaker from being closed when the moving part of connector XK (wired to the current transformers) is not plugged in the fixed part (mounted on the solid-state release). This interlock is possible only if the circuit-breaker is equipped with an undervoltage release

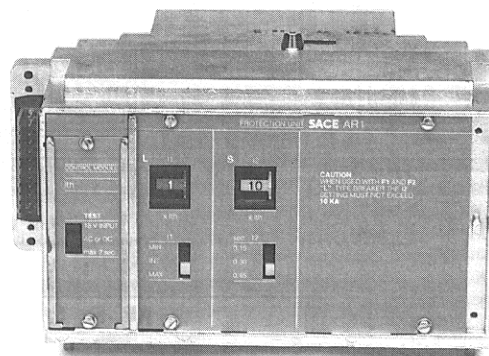
- availability of an efficacious means of checking the operation through the TS1 test apparatus which is obtainable as accessory.

SACE AR1 analog solid-state overcurrent releases consist of the following elements:

- **3 current transformers** (4 current transformers for four-pole circuit-breakers);
- **a release case** incorporating the power supply system, the protection circuits for the type of release chosen, the control module with which it is possible to check that the release is working properly by connecting an external supply current, the connector for the current transformers (XK) and the connector for the electromagnetic tripping device (XO);
- **a special electromagnetic tripping device (YO1)** that operates the mechanical release unit of the circuit-breaker.



AR1 - LI



AR1 - LS

4.2.1. Rated currents

Circuit-breaker type

		F1			F2			F3			F4		F5			F6
Phase	Neutral	1250	1600	2000	2000	2500	3000	2000	2500	3000	3200	3600	3200	4000	5000	6300
250	125	●														
400	200	●														
800	400	●														
1250	625	●	●	●	●			●								
1600	800		●													
2000	1000			●	●	●	●	●	●	●	●	●	●			
2500	1250					●			●							
3000	1500						●			●						
3200	1600										●		●	●		
3600	2000											●				
4000	2000													●	●	
5000	2500														●	
6300	3200															●

4.2.2. Protective functions and set values

Protection against	Trip	Symbol	Set values (adjustment by steps) (See curves)
Overload	Inverse long delay	L ⁽¹⁾	$I1 = 0,5 - 0,6 - 0,7 - 0,8 - 0,9 - 1,0 \times I_n$ $t1 = \frac{\text{MIN} - \text{INT} - \text{MAX}}{2 - 5,5 - 12 \text{ s}} \quad (2) \quad (3)$
Short-circuit	Definite short delay	S	$I2 = 2 - 3 - 4 - 6 - 8 - 10 \times I_n$ $t2 = 0,15 - 0,3 - 0,45 \text{ s}$
	Instantaneous (adjustable)	I	$I3 = 2 - 3 - 4 - 6 - 9 - 12 \times I_n$

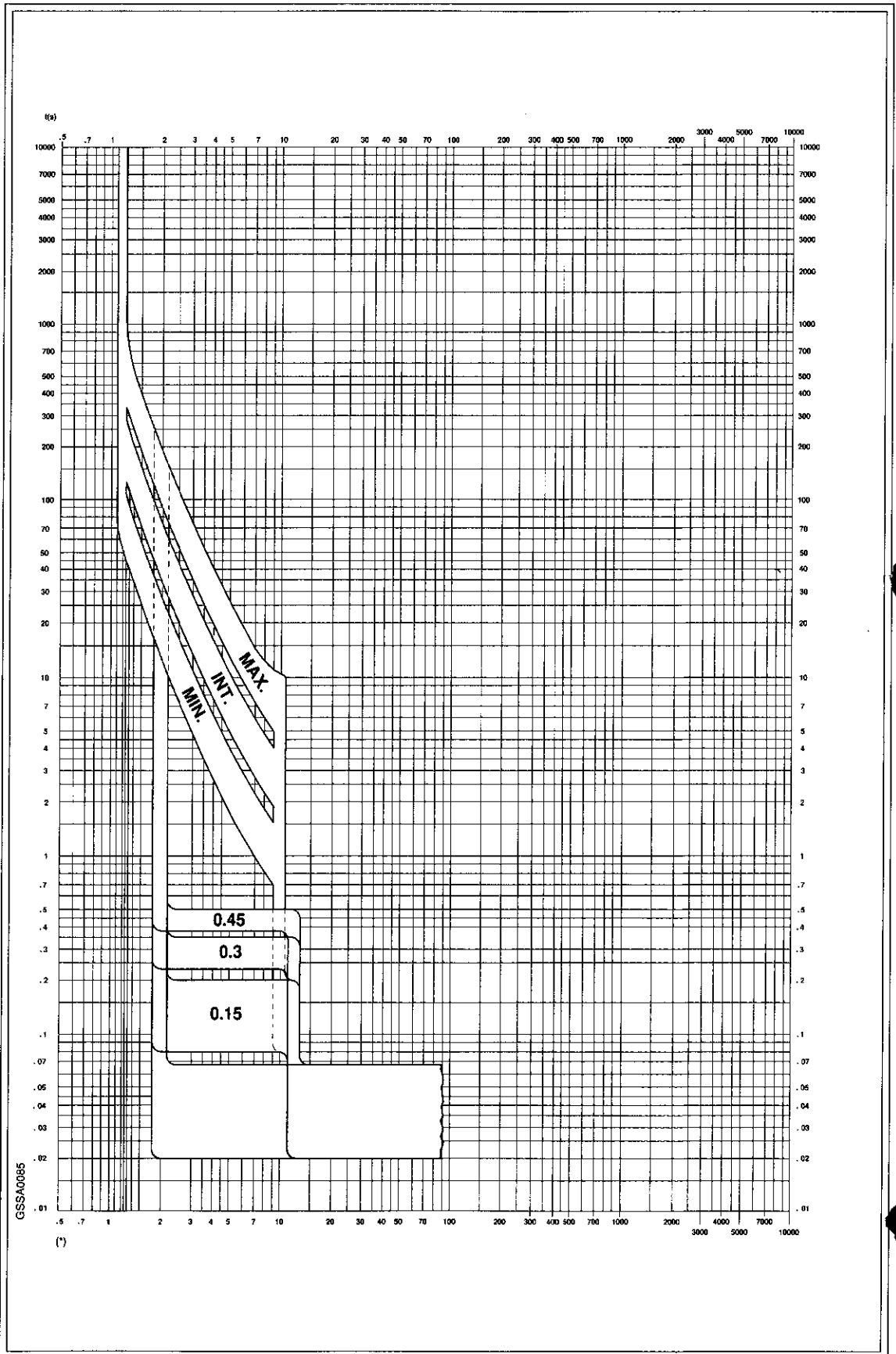
I_n = Release rated current (corresponding to the rated primary steady current of current transformers).

(1) Fitted with protection that operates in presence of a current $I \geq 10 \times I_n$ with 0,45 s trip time. Reset time of the L protective function is 5 s at the most.

(2) Three time-current curves selected by selector switch.

(3) Values obtained at $6 \times I1$.

4.2.3. Time-current curves of SACE AR1 releases



(*) For S and I functions: multiples of the release rated current (I_n).

(*) For L function: multiples of the setting current (I_1).

4.3. SACE EG electromagnetic overcurrent releases for direct current

The electromagnetic overcurrent releases in the SACE EG series suitable for d.c., are of the direct-acting type, with adjustable instantaneous and delayed trip. They are avail-

able for circuit-breakers up to 3600 A in special version for voltages up to 1000 V d.c.

For further information please contact ABB SACE.

4.3.1. Rated currents of releases

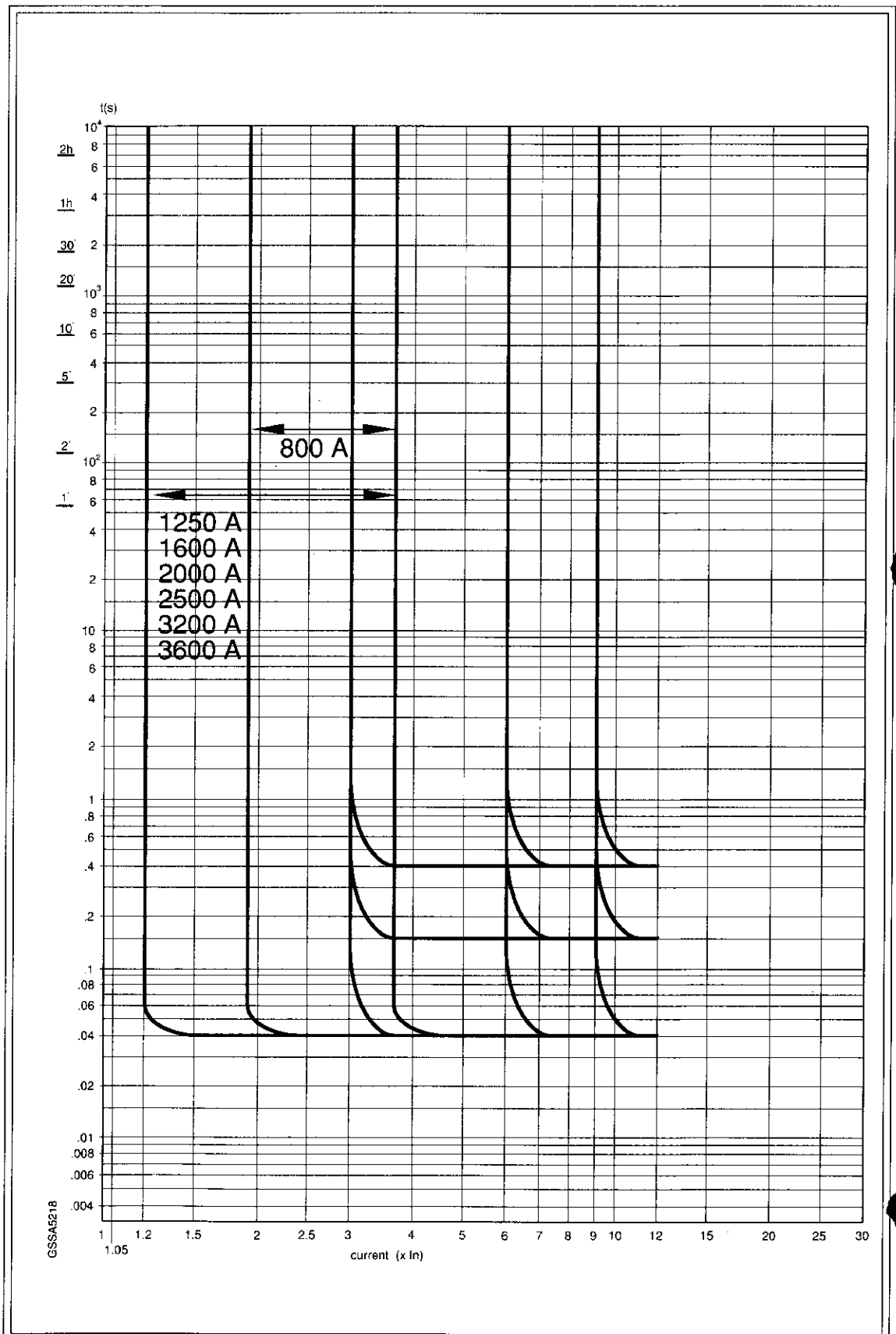
Selection table

Rated current of release In (A)	Low threshold protection ⁽¹⁾	High threshold protection ⁽¹⁾	
	Instantaneous trip	Instantaneous trip	Delayed trip
	$I_m = 1,2 \dots 3,6 \times I_n \text{ (A)}$	$I_m = 3 \dots 9 \times I_n \text{ (A)}$	$I_m = 3 \dots 9 \times I_n \text{ (A)}$ $t = 0,15/0,4 \text{ s}$
800	1500 ... 2900 (2)	2400 ... 7200	2400 ... 7200
1250	1500 ... 4500	3750 ... 11250	3750 ... 11250
1600	1920 ... 5800	4800 ... 14400	4800 ... 14400
2000	2400 ... 7200	6000 ... 18000	6000 ... 18000
2500	3000 ... 9000	7500 ... 22500	7500 ... 22500
3000	3600 ... 10800	9000 ... 27000	9000 ... 27000
3200	3840 ... 11520	9600 ... 28800	9660 ... 28800
3600	4320 ... 12960	10800 ... 32400	10800 ... 32100

(1) These two protections are in alternative

(2) Minimum trip value = 1500 A

4.3.2. Time-current curves of SACE EG releases



5.1.	Derived versions	64
5.2.	Special versions	65
5.3.	Interchangeability of circuit-breakers	66

5.1. Derived versions

The derived versions described below are available for all types of circuit-breakers and for all their respective rated uninterrupted currents.

They are identified by adding, after the circuit-breaker code,

the derived version code as shown in table below.

Note: for circuit-breakers F1 and F3 up to 3000 A, the four-pole version is, on request, supplied with equal poles.

Circuit-breaker	Identification code of derived version			
	MS	CS	MTP	MT
F1	F1 MS	F1 CS	F1 MTP	F1 MT
F2	F2 MS	F2 CS	F2 MTP	F2 MT
F3	F3 MS	F3 CS	F3 MTP	F3 MT
F4	F4 MS	F4 CS	F4 MTP	F4 MT
F5	F5 MS	F5 CS	F5 MTP	F5 MT
F6	F6 MS	F6 CS	F6 MTP	F6 MT

5.1.1. Switch-disconnector (MS)

This version differs from the circuit-breakers only in that it has no overcurrent releases.

The switch-disconnector may be supplied in fixed or draw-out version complete with fixed part.

5.1.2. Sectionalizing truck complete with fixed part (CS)

This version is derived from a draw-out circuit-breaker in which all interruption parts and the operating mechanism have been replaced by simple connections between the

and the lower contact. It is used as a (no-load) isolator where such use is allowed in the plant.

5.1.3. Earthing switch with making capacity (truck only) (MTP)

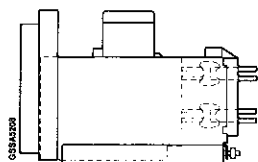
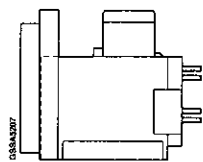
This version is derived from the moving part of a draw-out circuit-breaker in which the overcurrent releases have been removed and the lower or upper isolating contacts have been replaced by short-circuit and earthing connections. The earthing switch is introduced into the fixed part of a draw-out circuit-breaker to carry out inspection or maintenance

works on the external circuit with complete safety and is used in cases in which the earthing of installations may occur with residual or recovery voltage. The earthing switch may, on request, be provided with upper or lower isolating contacts.

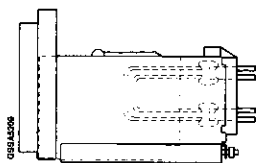
5.1.4. Earthing truck (MT)

Similarly to the sectionalizing truck, this version is derived from the moving part of a draw-out circuit-breaker in which all interruption parts and the operating mechanism have been replaced by simple connections between the upper contact and the lower contact. The lower or upper isolating contacts have been replaced by short-circuited and earthed connections.

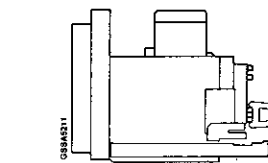
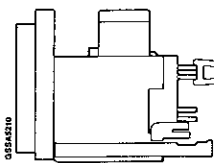
The earthing truck is temporarily introduced into the fixed part of a draw-out circuit-breaker to carry out maintenance works on the external circuit when there is no residual voltage. The earthing truck may, on request, be provided with upper or lower isolating contacts.



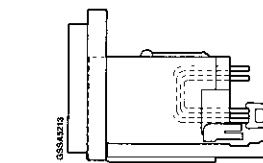
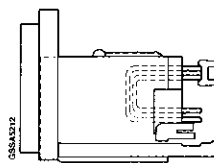
MS



CS



MTP



MT

5.2. Special versions

5.2.1. SACE Megamax 3F2L 6000 high rating current-limiting circuit-breakers

The 3F2L 6000 current-limiting circuit-breaker features particularly short break times and exceptional values as to the rated uninterrupted current and breaking capacity. These features make it suitable for the specific use as "bus-tie breaker" in L.V. installations with high power ratings. The circuit-breaker, in its unique three-pole version, consists of three-pole current-limiting circuit-breakers of the F2L 2500 type.

Each pole of the three F2L 2500 circuit-breakers may be provided with instantaneous electromagnetic overcurrent

releases with 10 kA fixed current setting. The proper operation of each SACE Megamax 3F2L 6000 circuit-breaker is ensured by a logic group, to be installed in the switchboard. Each single pole of the 3F2L 6000 circuit-breaker is, in particular, equipped with a spring charging geared motor, with shunt closing, shunt opening and undervoltage releases, with auxiliary contacts for circuit-breaker and position contacts for the moving part, with circuit-breaker tripped signalling contacts and anything necessary to ensure the simultaneity of operations.

Characteristics

Version:		
Draw-out - rear terminals		
Rated voltage	V ~	690
Rated uninterrupted current (45°C)	A	6000 in air 5500 in switchboard
Rated breaking capacity	450 V ~ kA	170 (cos φ = 0.08)
Total break time	ms	10
Max. difference between poles during closing sequence	ms	5
Fixed current setting for electromagnetic trip	kA	30 approx. (3 x 10 kA)
Total width of circuit-breaker	mm	416 x 3 + 90

5.2.2. F/E circuit-breakers for voltages up to 1000 V

The SACE Megamax circuit-breakers can be supplied, in special version, for voltages up to 1000 V a.c. and d.c. The circuit-breakers in this version are called F/E and derive from the corresponding F types of which they have the same versions and accessories. The F/E circuit-breakers are

particularly suited for installation in mines, electrochemical plants, for traction, etc.

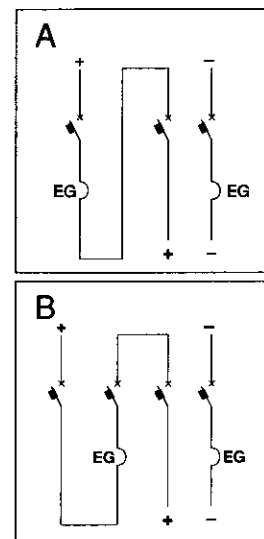
Their electrical characteristics are shown in the table below.

Note: for F1S/E - F3S/E - F4S/E circuit-breakers, the distance of arcing chambers to the insulated wall must be 250 mm.

Circuit-breaker type		F1S/E	F3S/E	F4S/E
Derived from circuit-breaker		F1S 2000	F3S 3000	F4S 3600
Rated uninterrupted current	In A ~	2000 2000	2500 2500	3600 3600
Rated current of EG release for d.c.	In A -	800 1250 1600 2000	1600 2500	3200 3600
Rated ultimate breaking capacity (3)	750 V ~ kA 1000 V ~ kA	40 25	60 40	60 40
Rated d.c. ultimate breaking capacity (T=10-15 ms)	500 V ~ kA 750 V ~ kA 1000 V ~ kA	50 (1) 40 (2) 15 (2)	80 (1) 65 (1) —	100 (1) 75 (1) —

- (1) Connection as shown in fig. A (three-pole circuit-breakers).
(2) Connection as shown in fig. B (four-pole circuit-breakers).

- (3) For the rated breaking capacity at voltages below 750 V a.c., the values on pages 10 - 11 are applicable.



5.2.3. Circuit-breakers for thermonuclear power stations

SACE Megamax circuit-breakers are available (on request) in special version in compliance with ENEL (National Italian

Electricity Board) technical specifications for thermonuclear, thermal, hydroelectric power stations.

5.2.4. Other versions

SACE Megamax circuit-breakers may, on request, be designed in special versions suited for particularly aggressive atmospheres, and for marine and antiseismic installations.

Note: for information concerning the use of circuit-breakers for motor switching and protection, please ask for ABB SACE pamphlet "Technical Information No. 11".

5.3. Interchangeability of circuit-breakers

On account of the high quality and long life of the air circuit-breakers made by ABB SACE, there are low voltage switchboards which have been installed for a long time and are still valuable from a mechanical point of view and in their general operational serviceability; but they are equipped with circuit-breakers which may present spare parts problems or are not, in general, suited for remote control.

The SACE Megamax circuit-breakers have been specifically designed for resolving this problem.

Proper Kits, that include the modern and best functional SACE Megamax circuit-breakers, are made available for the purpose of replacing the old circuit-breakers exploiting all the components of the switchboard. The insertion of the new part into the old one takes place most quickly and without the need of remaking the connections.

The Kit for adaptation purposes includes:

- the complete circuit-breaker, in any version
- any metallic frame parts and copper connections
- drilling template for compartment door
- interconnection diagrams for auxiliary circuits
- instructions.

Kits are precodified to make ordering very easy and to enable short lead times.

The proposed solution offers sure technical and economical advantages as confirmed by important supplies already made or in the process of being finalized with important Italian and foreign companies.

Note

Paragraphs 5.3.2. and 5.3.3. contain some reference patterns for collecting data necessary to finalize the order for the replacement of SACE Otomax circuit-breakers by SACE Megamax circuit-breakers.

5.3.1. Interchangeability table for SACE Otomax air circuit-breakers in three-pole draw-out version with SACE Megamax type circuit-breakers

Type	Breaking capacity	Terminals l x h	Ref. doc.	Type	Breaking capacity	Terminals l x h
				In		
SACE Otomax P1 A 800 A	32 kA	1 - 50x8 mm	TN 10270	SACE Megamax F1B 1250 A	40 kA	2 - 60x8 mm
SACE Otomax P1 B 1000 A	32 kA	1 - 50x8 mm	TN 10270			
SACE Otomax P2 A 800 A	52 kA	1 - 50x8 mm	TN 10270	SACE Megamax F1S 1250 A	55 kA	2 - 60x8 mm
SACE Otomax P2 B 1000 A	52 kA	1 - 50x8 mm	TN 10270			
SACE Otomax P2 C 1000 A	55 kA	1 - 50x8 mm	TN 10270			
SACE Otomax P1 A 1250 A	32 kA	1 - 50x15 mm	TN 10270	SACE Megamax F1B 1250 A	40 kA	2 - 60x8 mm
SACE Otomax P1 B 1600 A	32 kA	1 - 50x15 mm	TN 10270	SACE Megamax F1B 1600 A	40 kA	2 - 60x8 mm
SACE Otomax P2 A 1250 A	52 kA	1 - 50x15 mm	TN 10270	SACE Megamax F1S 1250 A	55 kA	2 - 60x8 mm
SACE Otomax P2 B 1600 A	52 kA	1 - 50x15 mm	TN 10270	SACE Megamax F1S 1600 A	55 kA	2 - 60x8 mm
SACE Otomax P2 C 1600 A	55 kA	1 - 50x15 mm	TN 10270	SACE Megamax F1S 1600 A	55 kA	2 - 60x8 mm
SACE Otomax P1 A 1600 A	35 kA	1 - 80x15 mm	TN 10270	SACE Megamax F1B 1600 A	40 kA	2 - 60x8 mm
SACE Otomax P1 B 2000 A	35 kA	1 - 80x15 mm	TN 10270	SACE Megamax F1B 2000 A	40 kA	2 - 60x8 mm
SACE Otomax P2 A 1600 A	55 kA	1 - 80x15 mm	TN 10270	SACE Megamax F1S 1600 A	55 kA	2 - 60x8 mm
SACE Otomax P2 B 2000 A	55 kA	1 - 80x15 mm	TN 10270	SACE Megamax F1S 2000 A	55 kA	2 - 60x8 mm
SACE Otomax P2 C 2000 A	55 kA	1 - 80x15 mm	TN 10270	SACE Megamax F1S 2000 A	55 kA	2 - 60x8 mm
SACE Otomax P3 A 1600 A	75 kA	1 - 80x15 mm		SACE Megamax F1H 1600 A	85 kA	2 - 60x8 mm
SACE Otomax P3 B 2000 A	75 kA	1 - 80x15 mm		SACE Megamax F2H**2000 A	85 kA	2 - 67x8 mm
SACE Otomax P3 C 2000 A	75 kA	1 - 80x15 mm		SACE Megamax F2H**2000 A	85 kA	2 - 67x8 mm
SACE Otomax P1 A 2000 A	35 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2S 2000 A	65 kA	2 - 67x8 mm
SACE Otomax P1 B 2500 A	35 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2S 2500 A	65 kA	2 - 67x8 mm
SACE Otomax P2 A 2000 A	55 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2S 2000 A	65 kA	2 - 67x8 mm
SACE Otomax P2 B 2500 A	55 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2S 2500 A	65 kA	2 - 67x8 mm
SACE Otomax P2 C 2500 A	55 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2S 2500 A	65 kA	2 - 67x8 mm
SACE Otomax P3 A 2000 A	75 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2H 2000 A	85 kA	2 - 67x8 mm
SACE Otomax P3 B 2500 A	75 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2H 2500 A	85 kA	2 - 67x8 mm
SACE Otomax P3 C 2500 A	75 kA	2 - 80x12 mm	TN 10290	SACE Megamax F2H 2500 A	85 kA	2 - 67x8 mm
SACE Otomax P2 A 3000 A	57 kA	1 - (80x15)x2 mm	TN 10295	SACE Megamax F4S 3200 A	85 kA	2 - 120x10 mm
SACE Otomax P2 B 3000 A	57 kA	1 - (80x15)x2 mm	TN 10295	SACE Megamax F4S 3200 A	85 kA	2 - 120x10 mm
SACE Otomax P2 C 3200 A	57 kA	1 - (80x15)x2 mm	TN 10295	SACE Megamax F4S 3200 A	85 kA	2 - 120x10 mm
SACE Otomax P3* A 3000 A	100 kA	1 - (80x15)x2 mm		SACE Megamax F5S**3200 A	100 kA	1 - 195x10 mm
SACE Otomax P3* B 3000 A	100 kA	1 - (80x15)x2 mm		SACE Megamax F5S**3200 A	100 kA	1 - 195x10 mm
SACE Otomax P3* C 3200 A	100 kA	1 - (80x15)x2 mm		SACE Megamax F5S**3200 A	100 kA	1 - 195x10 mm
SACE Otomax P2 A 4000 A	57 kA	2 - (80x12)x2 mm	TN 10295	SACE Megamax F5S 4000 A	100 kA	2 - 195x10 mm
SACE Otomax P2 B 4000 A	57 kA	2 - (80x12)x2 mm	TN 10295			
SACE Otomax P2 C 4000 A	57 kA	2 - (80x12)x2 mm	TN 10295			
SACE Otomax P3* A 4000 A	100 kA	2 - (80x12)x2 mm	TN 10295	SACE Megamax F5S 4000 A	100 kA	2 - 195x10 mm
SACE Otomax P3* B 4000 A	100 kA	2 - (80x12)x2 mm	TN 10295			
SACE Otomax P3* C 4000 A	100 kA	2 - (80x12)x2 mm	TN 10295			

* Mounted in compartment with h = 1000 mm approx.

** In preparation

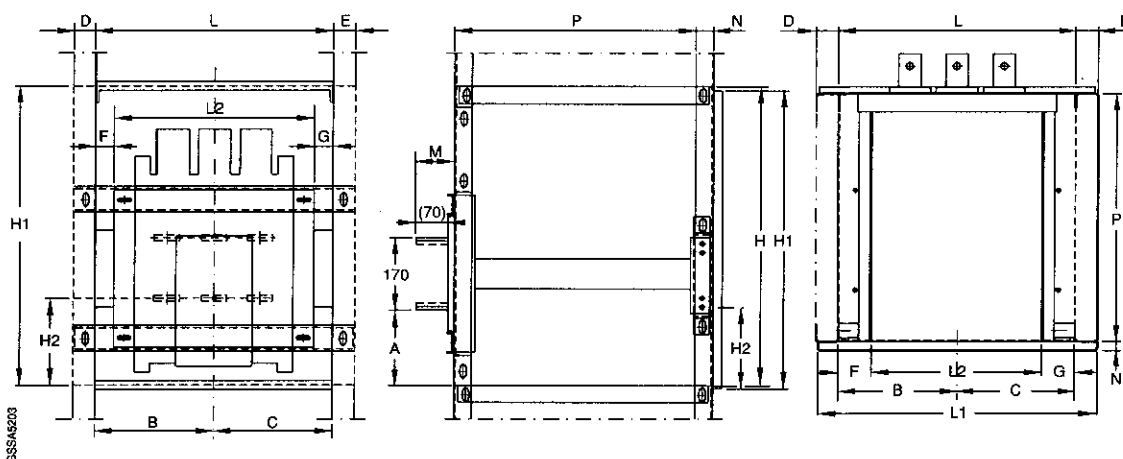
5.3.2. Data to be stated concerning the compartment dimensions and typology of the SACE Otomax draw-out circuit-breaker

Dimensions

A B C D E F

G H H1 H2 L L1

L2 M N P



5.3.3. Determination of the existing circuit-breaker

Circuit-breaker typology	Serial number and year	Overcurrent release YO1 Type	Auxiliary signalling contact "circuit-breaker tripped Sr"
Type/no. poles	Shunt opening release	In	
	YO (BA) V	Motor M	
Rated current	Shunt closing release	V	Microswitches
	YC (BC) V	Aux. contacts	Connected No.
Type of o. mechanism	Undervoltage release	No.	Isolated No.
	YU (mT) V		

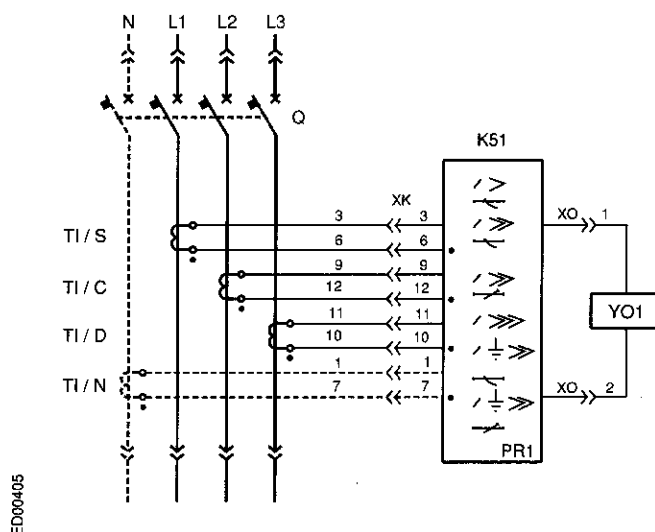
5.3.4. Additional documents supplied by ABB SACE

– **TN 10269:** drillings in cross-pieces, doors and shelves of compartment for fixing the SACE Megamax fixed part.

– **TN 10270:** mounting of SACE Megamax circuit-breaker in SACE Otomax compartment.

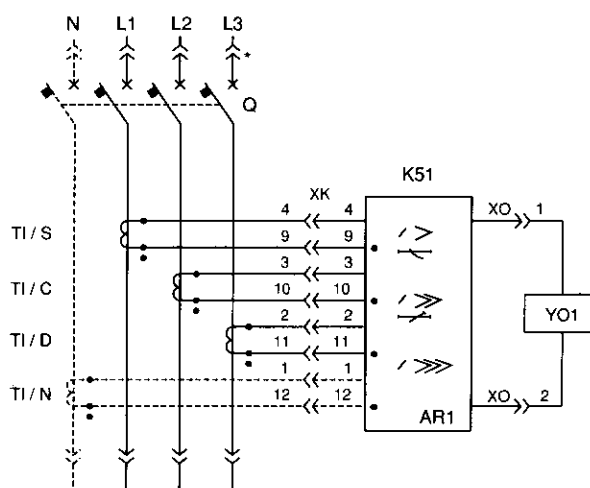
SACE Megamax F circuit-breaker with SACE PR1 solid-state microprocessor-based release

SACE PR1



SACE Megamax F circuit-breaker with SACE AR1 analog solid-state overcurrent releases

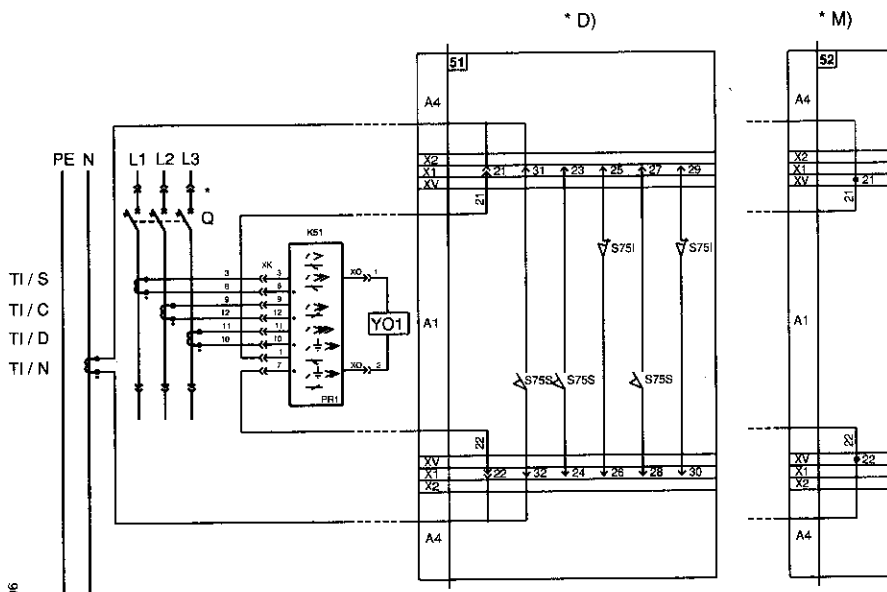
SACE AR1



Notes

- The T1/N current transformer is supplied in case of distributed neutral for the neutral conductor protection and/or for protection against earth faults.
- Caption on page 75.

SACE PR1

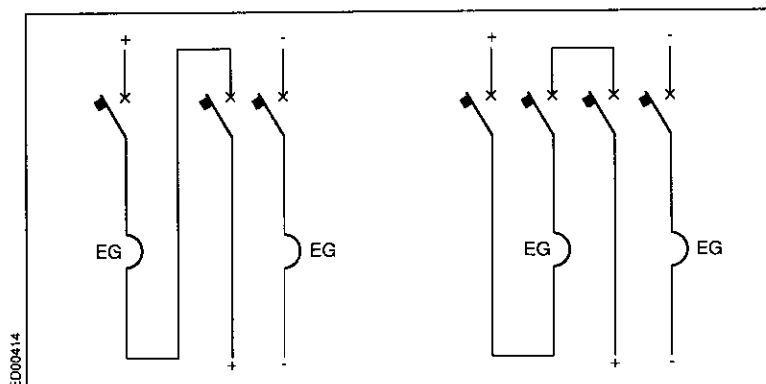


SACE Megamax F circuit-breaker with SACE EG electromagnetic release for continuous current

SACE EG

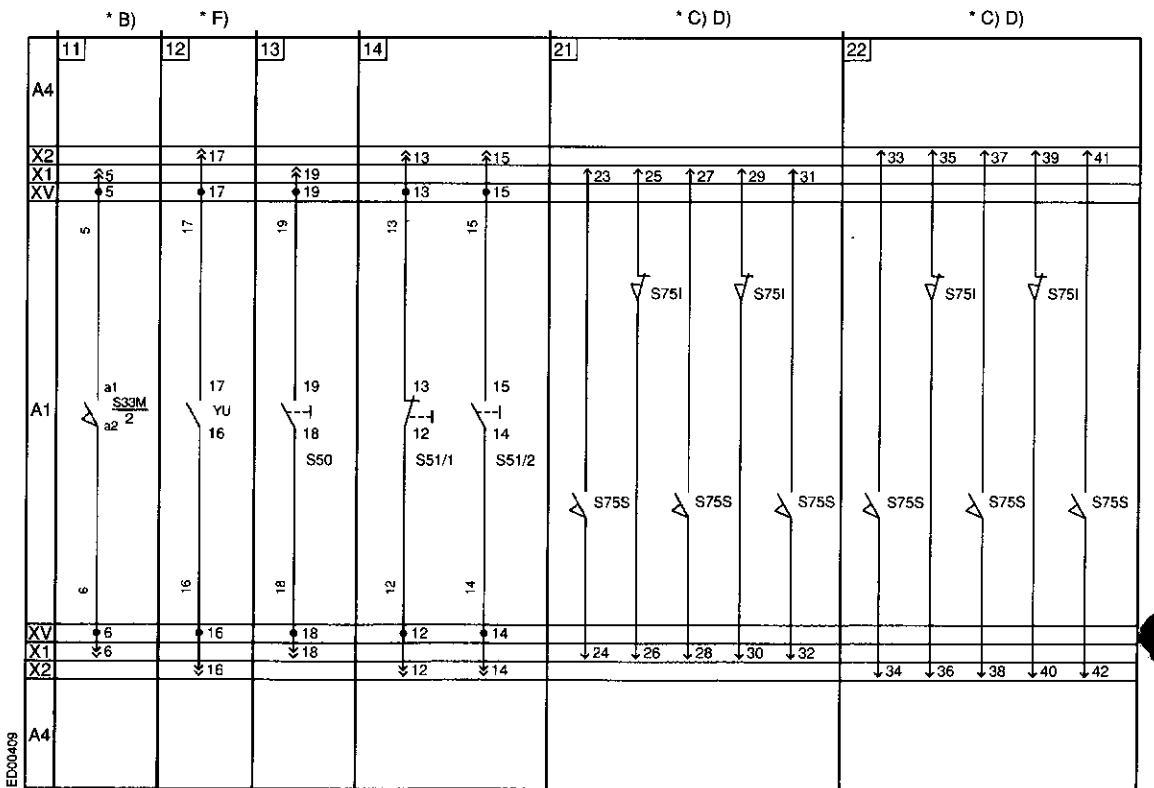
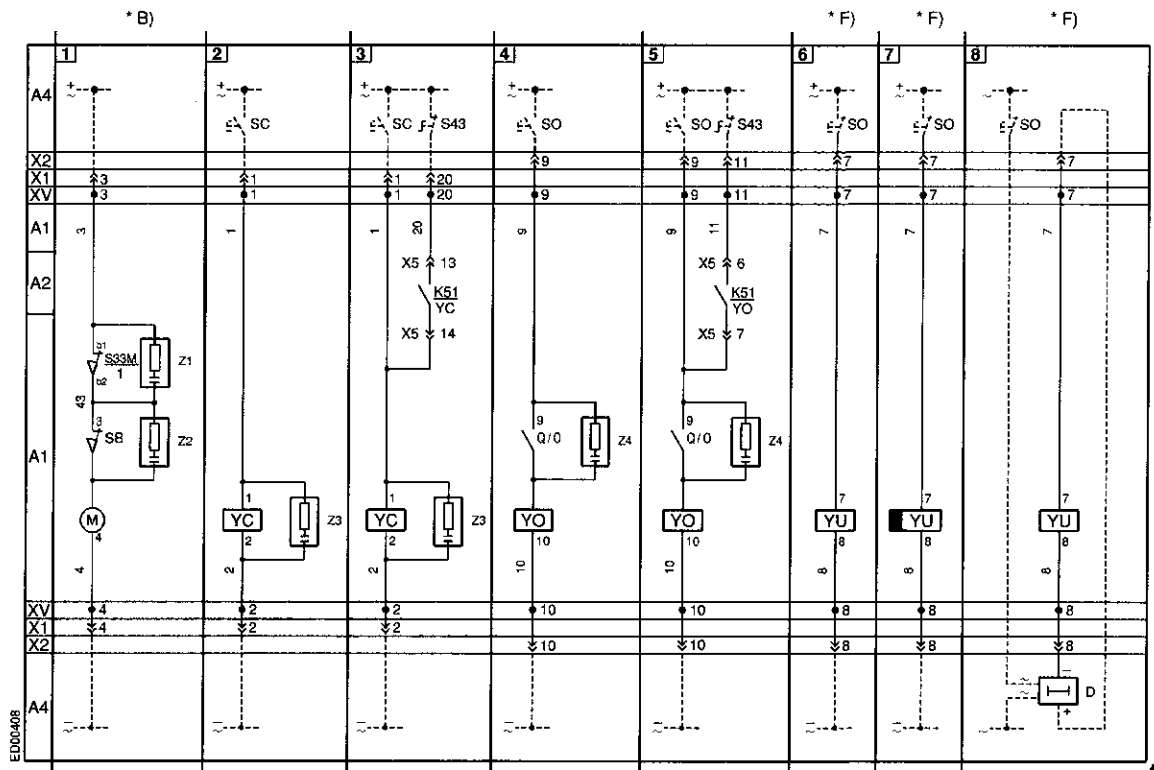
3 POL

4 POL



Notes

- The TI/N current transformer is supplied in case of distributed neutral for the neutral conductor protection and/or for protection against earth faults.
- Caption on page 75.



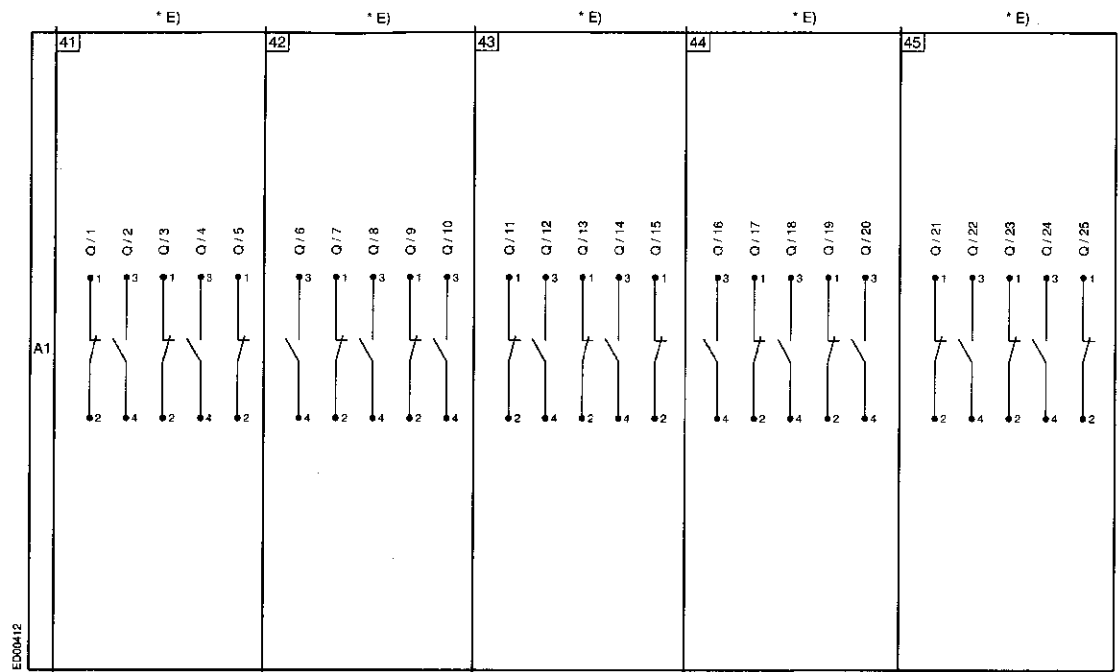
Graphical symbols
See page 74.

Description of figures
See page 75.

Caption - See page 75.

Notes - See page 76.





Description of figures
See page 75.

Caption - See page 75.

Notes - See page 76.

Graphical symbols for electrical diagrams (IEC 617 Standards)

	Electromagnetic effect		Terminal or clamp		Switch-disconnector
	Delay		Plug and socket (male and female)		Circuit-breaker with automatic release
	Manually operated control		Resistor (general symbol)		Control coil (general symbol)
	Rotating mechanism		Capacitor (general symbol)		Control coil of a slow-releasing relay
	Pushbutton operation		Motor (general symbol)		Instantaneous overcurrent relay
	Earth (general symbol)		Current transformer without primary winding, shown with connection polarity indicator		Overcurrent relay with inverse short time delay characteristic
	Mass, frame		Voltage transformer with shield		Overcurrent relay with adjustable short time delay characteristic
	Conductors in shielded cable (two conductors shown)		Make contact		Overcurrent relay with inverse long time delay characteristic
	Stranded cables or conductors (two conductors shown)		Break contact		Earth fault overcurrent relay with inverse short time-delay characteristic
	Connection of conductors		Make position contact (limit switch)		Earth fault overcurrent relay with adjustable short time-delay characteristic
			Break position contact (limit switch)		Low-pass filter

Represented operational state

The diagram is represented under following conditions:

- circuit-breaker in draw-out version, open and connected
- circuits deenergized
- closing springs discharged
- circuit-breaker not automatically tripped.

This diagram shows a circuit-breaker in draw-out version, but it applies to both circuit-breakers in draw-out version and in fixed version.


Versions

Only accessories shown in the following figures can be supplied (figures grouped between brackets cannot be mounted together on the same circuit-breaker):

- Version without overcurrent release:
1, 2, 4, (6 - 7 - 8), 11, 12, 21, 22, 41, 42, 43, 44, 45.
- Version with SACE AR1 solid-state release:
1, 2, 4, (6 - 7 - 8), 11, 12, 14, 21, 22, 41, 42, 43, 44, 45.
- Version with solid-state SACE PR1/P release. The release is equipped with the protection unit only:
1, 2, 4, (6 - 7 - 8), 11, 12, 14, (21 - 51 - 52), 22, 41, 42, 43, 44, 45.
- Version with SACE PR1/PA solid-state release. The release is equipped with the protection and amperometric units:
1, 2, 4, (6 - 7 - 8), 11, 12, 14, (21 - 51 - 52), 22, 30, 41, 42, 43, 44, 45.
- Version with SACE PR1/PC solid-state release. The release is equipped with the protection and control units:
1, 3, 5, (6 - 7 - 8), 11, 12, 14, (21 - 51 - 52), 22, 31, 41, 42, 43, 44, 45.
- Version with SACE PR1/PCD solid-state release. The release is equipped with the protection, control and dialogue units:
1, 3, 5, (6 - 7 - 8), 11, 12, 14, (21 - 51 - 52), 22, 32, 41, 42, 43, 44, 45.
- Version with SACE EG electromagnetic release for d.c.:
1, 2, 4, (6 - 7 - 8), 11, 12, 13, 21, 22, 41, 42, 43, 44, 45.
- Fixed version: the control circuits are provided between the XV clamps and between the X3 connector poles (X1 and X2 connectors are not supplied). Accessories shown in figures 21-22-51 cannot be supplied for this version.
- Draw-out version: the control circuits are provided between the poles of X1, X2 and X3 connectors (the XV terminal box is not supplied). Accessory given in figure 52 cannot be supplied with this version.

- Fig. 6 = Instantaneous undervoltage release (see note F).
- Fig. 7 = Undervoltage release with pneumatic time-lag device (see note F).
- Fig. 8 = Undervoltage releases with solid-state time-lag device mounted outside the circuit-breaker (see note F).
- Fig. 11 = Contact for electrical indication of closing springs charged (see note B).
- Fig. 12 = Contact for electrical indication of undervoltage release energized (see note F).
- Fig. 13 = Contact for electrical indication of circuit-breaker tripped via the EG electromagnetic overcurrent release.
- Fig. 14 = Contacts for electrical indication of circuit-breaker tripped via the "AR1" or "PR1" solid-state overcurrent release.
- Fig. 21-22 = Contacts for electrical indication of circuit-breaker in connected or isolated for test position (see notes C-D).
- Fig. 30 = Auxiliary circuits of the "PR1/PA" solid-state release.
- Fig. 31 = Auxiliary circuits of the "PR1/PC" solid-state release (see notes G-I-L).
- Fig. 32 = Auxiliary circuits of the "PR1/PCD" solid-state release (see notes H-I-L).
- Fig. 41-45 = Auxiliary circuits of circuit-breaker (see note E).
- Fig. 51 = Circuit of current transformer on neutral conductor located outside the circuit-breaker (for circuit-breaker in draw-out version).
- Fig. 52 = Circuit of current transformer for neutral conductor external to the circuit-breaker (for circuit-breaker in fixed version).

Caption

-  = Figure number on diagram
- * = See note indicated by the corresponding letter
- A1 = Accessories of circuit-breaker
- A2 = Accessories of PR1 solid-state release
- A4 = Devices and indicative connections for control and signalling
- D = Solid-state time-lag device for undervoltage release (external to circuit-breaker)
- K50 = EG direct-acting electromagnetic overcurrent release for d.c., with instantaneous or definite short delay trip - Adjustment I3
- K51 = "PR1" or "AR1" solid-state overcurrent release with the following protective functions:
 - L against overload with inverse long delay trip - Adjustment I1
 - S against short-circuit with inverse or definite short delay trip (for the "AR1" release, only with definite delay trip) - Adjustment I2
 - I against short-circuit with instantaneous trip with adjustable current setting - Adjustment I3
 - G against earth fault with inverse or definite short delay trip (only with "PR1" release) - Adjustment I4
- K51/Aout = Analog output for remote current measuring
- K51/Bus = Communication bus of dialogue unit
- K51/G = Electrical alarm indication for G protective function in the tripping band
- K51/I = Electrical alarm indication for I protective function in the tripping band
- K51/L = Electrical alarm indication for L protective function in the tripping band

Description of diagram figures

- Fig. 1 = Circuit of the closing springs charging motor (see note B).
- Fig. 2 = Shunt closing release
- Fig. 3 = Closing command via the "PR1" solid-state release (possible with "PR1/PC" and "PR1/PCD" releases, but operating only with the dialogue unit).
- Fig. 4 = Shunt opening release.
- Fig. 5 = Opening command via the "PR1" solid-state release (possible with "PR1/PC" and "PR1/PCD" releases, but operating only with the dialogue unit).

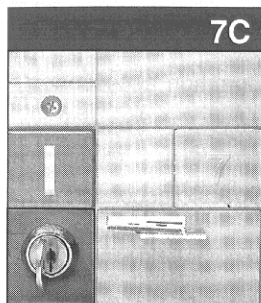
K51/S	= Electrical alarm indication for S protective function in the tripping band	XO	= Connector of YO1 release
K51/T ^o	= Electrical alarm indication for overheating inside the protection unit case	XV	= Delivery terminal board for auxiliary circuits of circuit-breaker in fixed version
K51/YC	= Closing command from "PR1" solid-state release (possible with "PR1/PC" and "PR1/PCD", but operating only with the dialogue unit)	YC	= Shunt closing release
K51/YO	= Opening command from "PR1" solid-state release (possible with "PR1/PC" and "PR1/PCD", but operating only with the dialogue unit)	YO	= Shunt opening release
K51/YO1	= Electrical alarm indication for circuit-breaker tripped via the YO1 release	YO1	= Overcurrent shunt opening release
K51/ZGin	= Zone selectivity interlocking applied to G protective function: input	YU	= Instantaneous or time-delayed undervoltage release (see note F)
K51/ZGout	= Zone selectivity interlocking applied to G protective function: output	Z1-Z5	= Filters
K51/ZSin	= Zone selectivity interlocking applied to S protective function: input		
K51/ZScout	= Zone selectivity interlocking applied to S protective function: output		
K51/maint.	= Electrical alarm indication: maintenance required due to contacts wear		
K51/pL	= Electrical indication for L protective function in pre-alarm band		
K51/μP	= Electrical alarm indication of microprocessor malfunction		
M	= Motor for charging the closing springs		
Q	= Circuit-breaker		
Q/0-25	= Circuit-breaker auxiliary contacts (see note E)		
S33M/1	= Limit contact of springs charging motor		
S33M/2	= Contact for electrical indication of springs charged		
S43	= Change-over contact for remote/local control pre-setting		
S50	= Contact for electrical indication of circuit-breaker tripped by the EG electromagnetic overcurrent release		
S51/1-2	= Contacts for electrical indication of circuit-breaker tripped by the "AR1" or "PR1" solid-state overcurrent release		
S75I	= Sliding contacts for electrical indication of the circuit-breaker "connected" position. They are closed with the circuit-breaker in "connected" position, open with the circuit-breaker in "isolated for test" position and remain open also when the circuit-breaker is "withdrawn for inspection" or "removed out of the compartment" (see notes C-D)		
S75S	= Sliding contacts for electrical indication of circuit-breaker in "isolated for test" position. They are open with the circuit-breaker in "connected" position, closed with the circuit-breaker in "isolated for test" position and remain closed also when the circuit-breaker is "withdrawn for inspection" or "removed out of the compartment" (see notes C-D)		
SB	= Accept contact for springs charging motor, interlocked with the closing mechanism		
SC	= Pushbutton or contact for circuit-breaker closing		
SO	= Pushbutton or contact for circuit-breaker opening		
TI/S-C-D-N	= Current transformers (left-hand / centre / right-hand / on neutral) feeding the "AR1" or "PR1" overcurrent release		
TU	= Set of three single-phase voltage transformers available on request (see note I)		
Uaux.	= Auxiliary voltage supply for the "PR1/PA", "PR1/PC" and "PR1/PCD" releases		
W1	= Interface with the "INSUM" type integrated control, supervision and measuring system: connect the terminals 1A-1B of X3 connector to terminals 12-11 of "BAG" module (RS485 interface)		
W2	= Jumper (see note H)		
X1-X2	= Connectors for the auxiliary circuits of circuit-breaker in draw-out version (see note C)		
X3	= Connector for the auxiliary circuits of the "PR1" solid-state release (for circuit-breaker whether in draw-out or in fixed version)		
X4-X5-X6	= Auxiliary connectors of the "PR1" solid-state release		

Notes

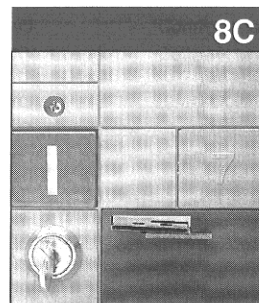
- A) The circuit-breaker is delivered fitted only with the accessories mentioned in order and in the relevant confirmation of order.
- B) The requirement of accessory shown in figure 1 implies also the use of accessory given in figure 11. Accessory given in figure 11 may be required independently of the accessory shown in figure 1.
- C) In case of circuit-breaker in draw-out version, the requirement of any of accessories shown in figures 1-2-3-11-13 implies also the use of accessory given in figure 21, and the requirement of any of accessories shown in figures 4-5-6-7-8-12-14 implies also the need of accessory given in figure 22.
- D) The auxiliary sliding contacts signalling the circuit-breaker position (S75I-S75S) are delivered arranged as shown on the diagram. However, they can be easily converted from S75I to S75S or vice versa by the customer. For conversion, please consult the instruction manual which is always delivered along with the circuit-breaker.
- E) The circuit-breaker auxiliary contacts Q/1-25 are supplied arranged as shown on the diagram. However, they can be easily converted by the customer, as needed, from N.O. to N.C. or vice versa. For conversion, please consult the instruction manual which is always delivered along with the circuit-breaker.
- F) The undervoltage release is designed for power supply taken from the circuit-breaker supply side or from an independent source: the circuit-breaker closing is only possible with release energized (the lock that prevents the closing operates mechanically). In case the same power supply is used for both the shunt closing and the undervoltage releases, and should you want the circuit-breaker to close automatically on return of auxiliary voltage, provision shall be made to delay the energization of the shunt closing release by 30 ms after the undervoltage release accept. This can be achieved through a circuit situated outside the circuit-breaker and including a permanently closed contact, the contact shown in figure 12 and a time-delay relay.
- G) Connect one of the circuit-breaker make contacts indicated in Figs. 41-42-43-44-45 to the X3 connector as shown in Fig. 31.
- H) Connect the S33M/2 contact shown in Fig. 11, one of the circuit-breaker make contacts given in Figs. 41-42-43-44-45 and one of the S75I contacts in Figs. 21-22 to the X3 connector as illustrated in Fig. 31.
In case of circuit-breaker in fixed version, connect the X3-2C socket directly to the X3-2A socket (S75I contact does not exist). The W2 jumper is required for the remote programming. Everytime it is cut in or out, it is necessary to perform a reset so that the new status can be read by the "PR1" solid-state release.
- I) Connect the "TU" voltage transformer as shown in diagram: the common clamp is on the phase L3 and not on the neutral; should the three-phase system have no distributed neutral, connect the A3 clamp of the "TU" voltage transformer as follows:
- to the B3 clamp in case of IT system
- to earth in case of TN or TT system.
- L) A "Reset" pushbutton is provided on the front of the "PR1" solid-state release control unit.
If necessary, it is also possible to send a remote reset command via a 5 V d.c. electric pulse to the X3-13C (+) and X3-10B (-) sockets.
- M) In case of circuit-breaker in fixed version with current transformer on external neutral conductor, in order to remove the circuit-breaker it is necessary to short-circuit the terminals of TI/N current transformer.

7.1.	Common accessories	80
7.2.	Specific accessories for the fixed version	82
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7.6.	List of spare parts	85

7C



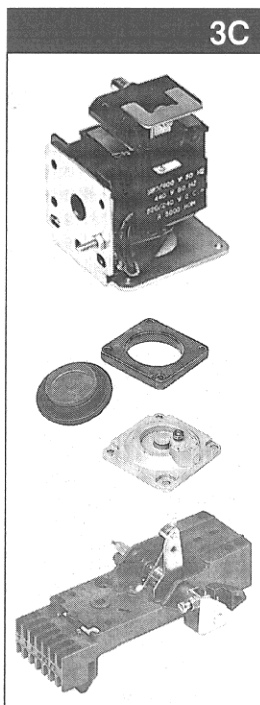
8C



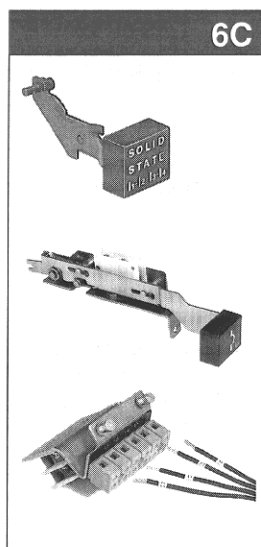
9C



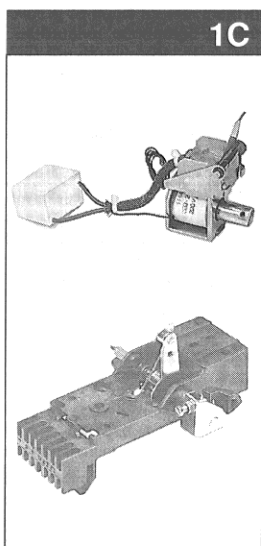
3C



6C



1C

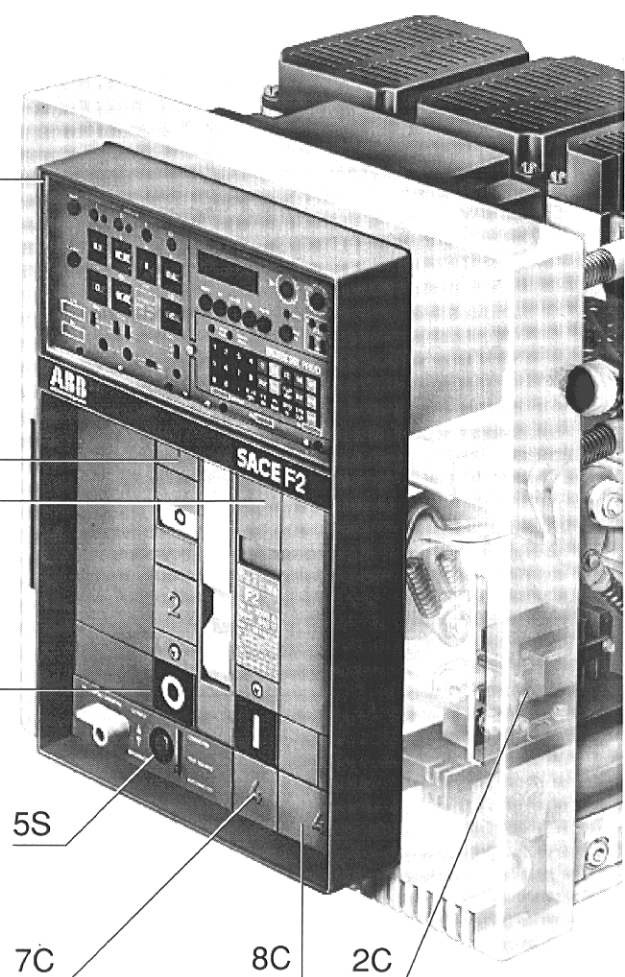


10C

6C

9C

1C/3C



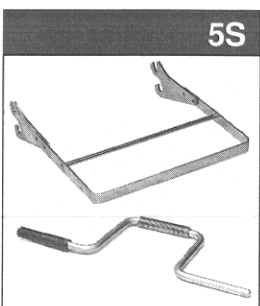
5S

7C

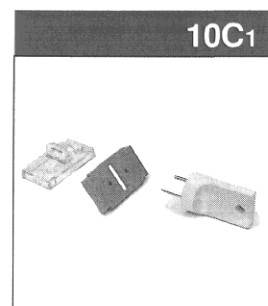
8C

2C

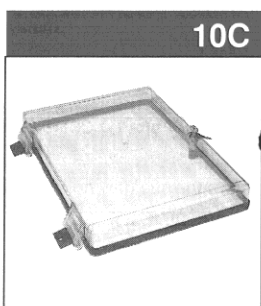
5S



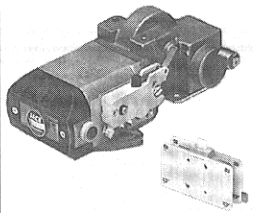
10C1



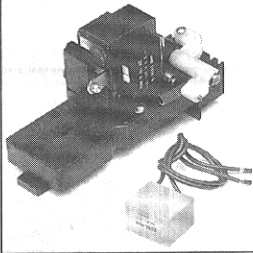
10C



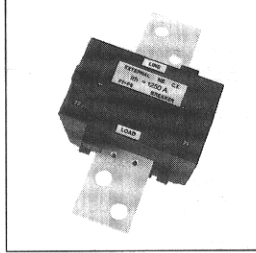
4C - 5C



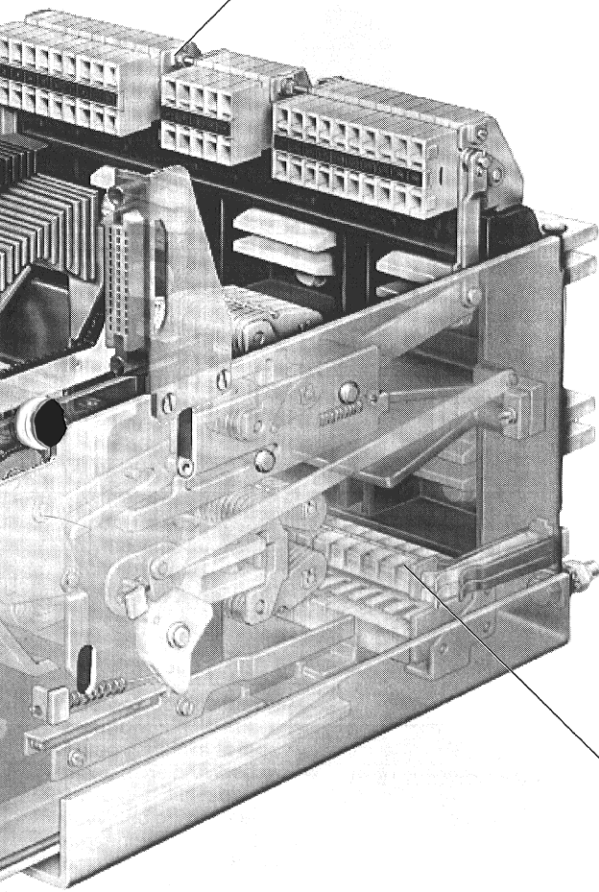
2C



4S

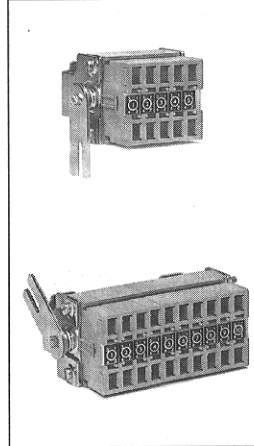


1S

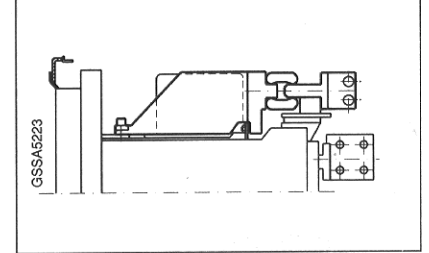


2S

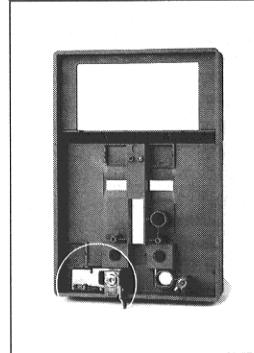
1F



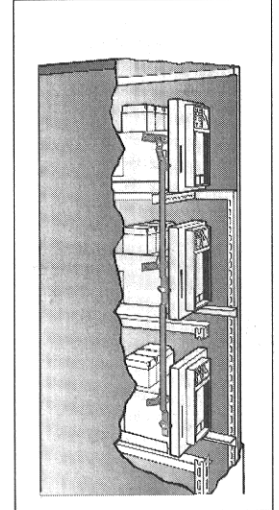
6S



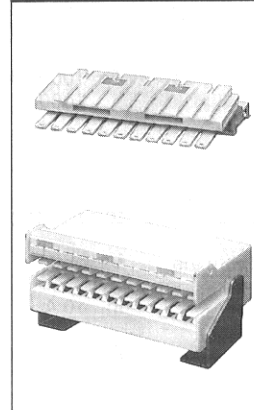
3S



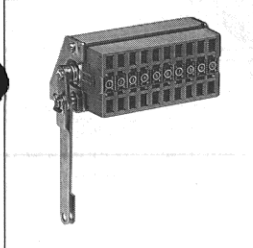
12C



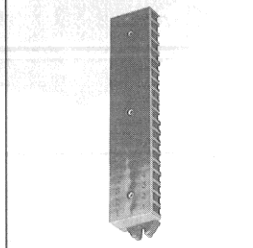
2S



1S



2F



11C



7.1. Common accessories

Accessory Electrical characteristics

1C

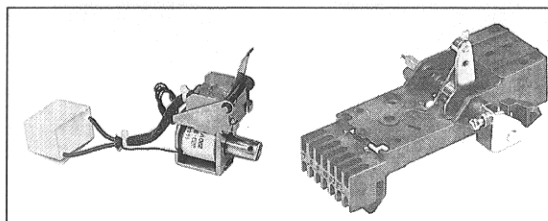
Shunt opening release

This release is connected in series with an auxiliary N.O. contact of the circuit-breaker.

Upon request, the shunt opening release is supplied in special version with output allowing to control winding continuity.

Un 24, 48, 110, 127, 220 V ~ 50 Hz
24, 48, 110, 125, 220, 250 V –
(instantaneous duty)

Ps 200 VA ~
200 W –



2C

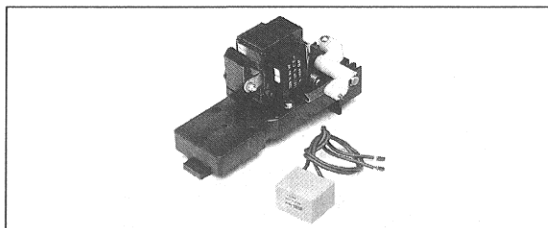
Shunt closing release

Available in versions for a.c. and for d.c.

Un 24, 48, 110, 127, 220 V ~ 50 Hz
24, 48, 110, 125, 220, 250 V –

Ps 200 VA ~
220 W –

Pc 30 VA ~
10 W –



3C

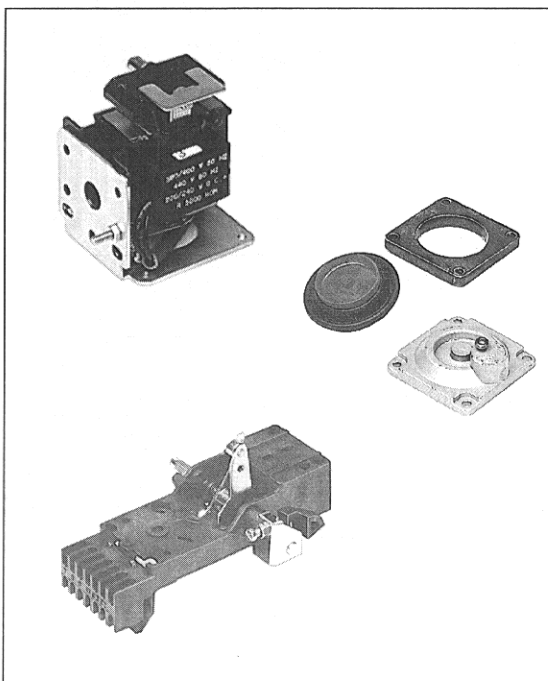
Undervoltage release

Can be fitted, on request, with a pneumatic time-delay device with fixed time delays at choice: 0,5 - 1 - 2 - 3 s and with a contact to signal coil energized. Alternatively, a release can be supplied which is fitted with a solid-state delay device mounted outside the circuit-breaker and has supply voltages of 110/220 V 50-60 Hz, with fixed time delays of 0,5 - 1 - 2 s at choice. In this case the supply voltage of the coil must be 310 V d.c. The undervoltage release is mounted on the same support as the shunt opening release.

Pc 30 VA ~
10 W –

Un 24, 48, 110, 127, 220 V ~ 50 Hz
24, 48, 110, 125, 220, 250 V –

Ps 200 VA ~
220 W –



4C

Geared motor for the automatic charging of closing springs

It always requires the application of 5C.

Un 110 ... 130, 200 ... 250 V ~
50 Hz
24 ... 30, 48 ... 60, 100 ...
130, 200 ... 250 V –

Ps 1000 VA ~
1000 W –

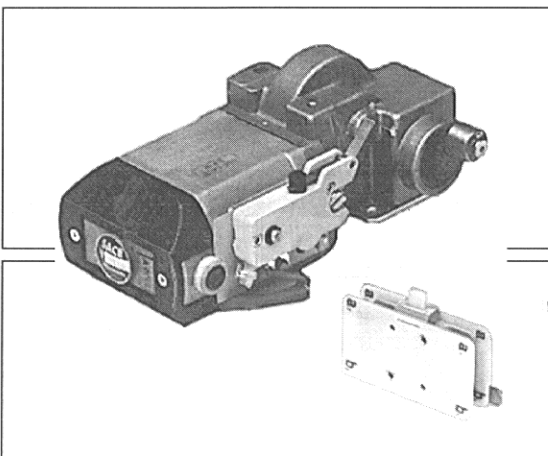
Pc 230 VA ~
230 W –

tc 7 ... 10 s

Un 500 V

In 10 A

Pi 10 A / 380 V ~ $\cos \varphi = 0,4$
5 A / 500 V ~ $\cos \varphi = 0,4$
1 A / 220 V – T = 10 ms



5C

Microswitch for closing springs charged indication

Always combined with the above accessory 4C.

Caption

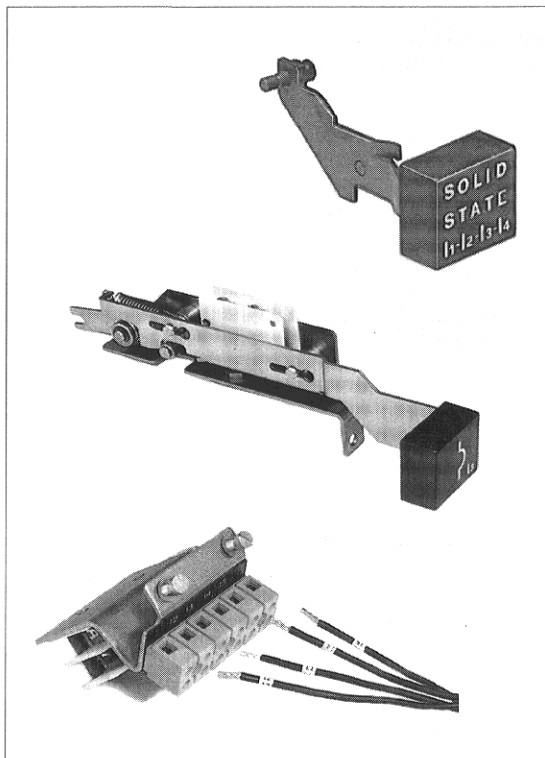
Un = rated voltage
In = rated current
Pi = breaking capacity
Ps = inrush power consumption
Pc = uninterrupted duty power consumption
tc = charging time

Accessory

Indication of tripping by overcurrent releases

The following indications are available:

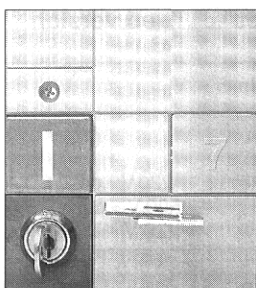
- mechanical and electrical indication of tripping by protections L-S-I-G
- mechanical indication of tripping by protections L-S-I-G
- mechanical and electrical indication of tripping by the fixed instantaneous EF protection (for F1-2/H/V/L circuit-breakers) or by the adjustable instantaneous protection EG for d.c. Reclosing of the circuit-breaker can only occur after the relevant pushbutton has been pressed.



6C

Key lock for open position

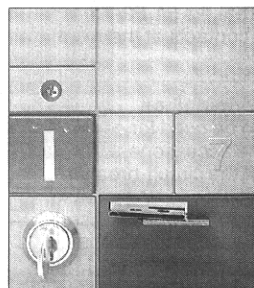
For one circuit-breaker (key specific for each circuit-breaker) or between more circuit-breakers (same key for a group of circuit-breakers).



7C

Padlock device for open position

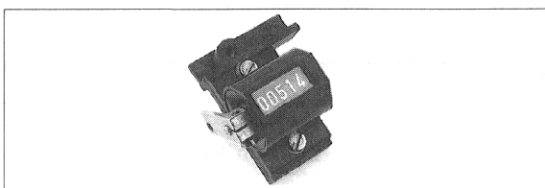
Three padlocks at the most, to be provided by the customer; it can be activated only in the presence of the transparent protection cover on the compartment door (pos. 10C).



8C

Mechanical type operation counter

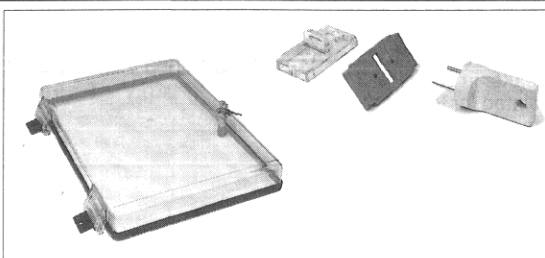
Connected to the operating mechanism through a simple lever mechanism, it indicates the number of mechanical operations made by the circuit-breaker.



9C

Transparent protection covers

Available for the opening and closing pushbuttons, with switching possibility only by means of the special tool supplied, the switchboard compartment door, with key lock; degree of protection IP54.



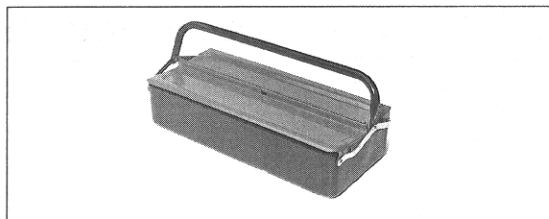
10C/10C1

Accessory

Electrical characteristics

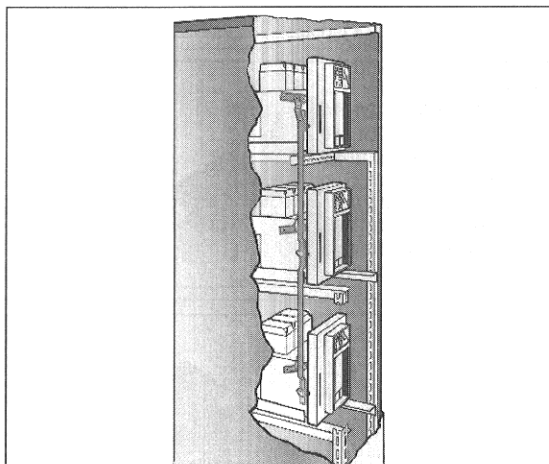
11C

Box with special tools and setting templates
Please ask ABB SACE for further information.



12C

Mechanical interlock between two or three vertically superimposed circuit-breakers
See paragraph 7.7.



7.2. Specific accessories for fixed version

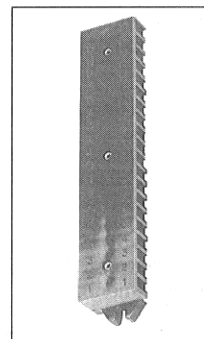
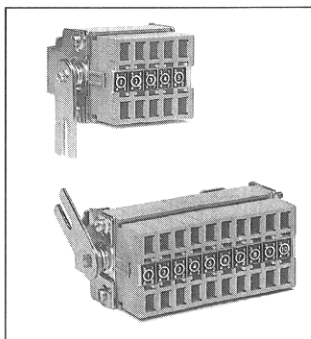
1F

Auxiliary contacts
10 contacts at the most in groups of 5 or 10 (except for three-pole circuit-breakers F1-F2-F3: 5 contacts at the most).

Un 500 V

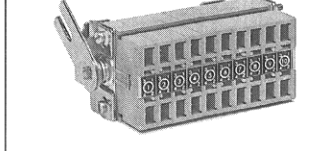
In 10 A

Pi 10 A / 220 V ~ $\cos\phi = 0,4$
5 A / 500 V ~ $\cos\phi = 0,4$
1 A / 220 V – T = 10 ms



2F

Terminalbox
To be used for connecting the accessories provided on the circuit-breaker (shunt opening release, undervoltage release, shunt closing release, geared motor, etc.).



7.3. Specific accessories for draw-out version

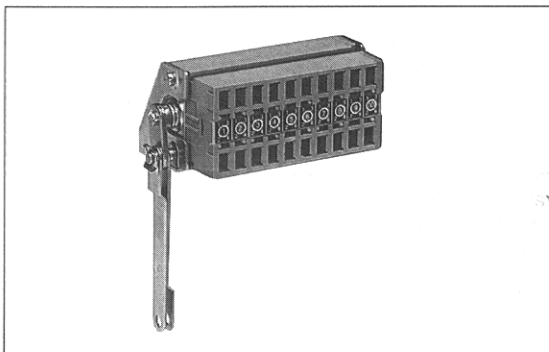
1S

Auxiliary contacts
Maximum available number of 25 contacts in groups of 5 or 10 or 15 placed on the fixed part and operated with circuit-breaker in connected or isolated for test position or, alternatively, in connected position only.

Un 500 V

In 10 A

Pi 10 A / 220 V ~ $\cos\phi = 0,4$
5 A / 500 V ~ $\cos\phi = 0,4$
1 A / 220 V – T = 10 ms



Caption

Un = rated voltage
In = rated current
Pi = breaking capacity

Accessory

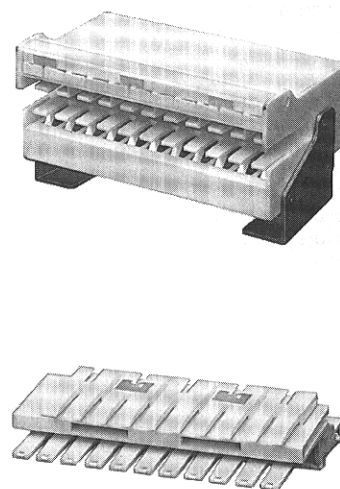
Notes

Sliding contacts for control circuits and position contacts signalling circuit-breaker connected and isolated

Two sets at most, each consisting of 11 contacts. The application of sliding contacts for the circuit-breaker control circuits (shunt opening, undervoltage and shunt closing release, geared motor, etc.) also requires the application of the contacts signalling circuit-breaker connected and isolated for test or withdrawn, which are normally supplied in following quantities per set:

- 2 contacts signalling circuit-breaker connected
- 3 contacts signalling circuit-breaker isolated for test or withdrawn.

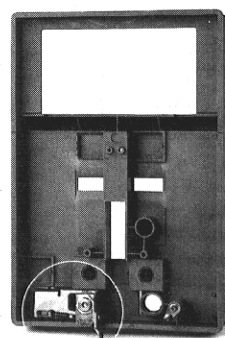
Should it be necessary, these contacts can be transformed (see instruction manual of each circuit-breaker).



2S

Lock of circuit-breaker in connected and isolated for test positions or only in isolated for test position

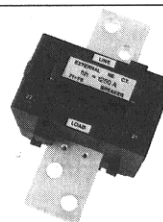
Of the key type, for one circuit-breaker or between two circuit-breakers, and of the padlock type (3 at the most, to be provided by the customer).



3S

Current transformer for external neutral

For three-pole circuit-breakers only. It permits to achieve the neutral protection through proper connection to the overcurrent release. (It is supplied on request).

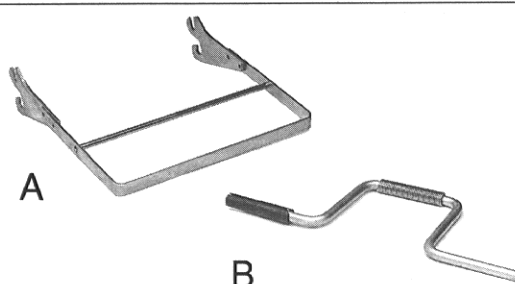


4S

Draw-out lever (fig. A)

Is supplied as standard in versions for: three-four pole circuit-breakers.

When there is the device for breaker racking-in and racking-out with door closed, a proper operation crank will be supplied (fig. B).



5S

Accessory

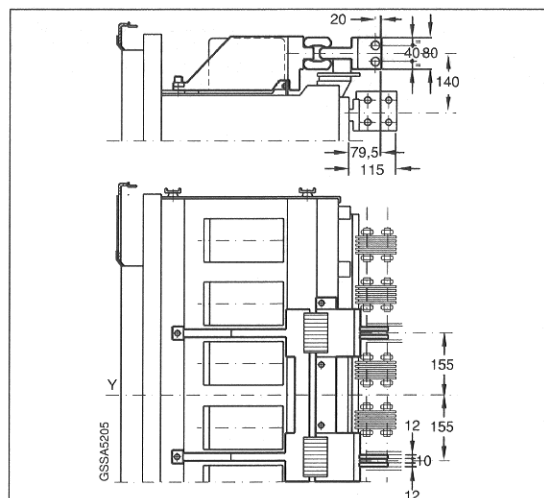
Electrical characteristics

6S

Isolatable neutral

For F6 6300 three-pole draw-out circuit-breakers with rear vertical terminals. The external connections (6 busbars 100x5 mm) must always be horizontal. The rated current of neutral pole is 3150 A.

For the other circuit-breaker dimensions, please refer to the overall dimensions indicated on foregoing pages.

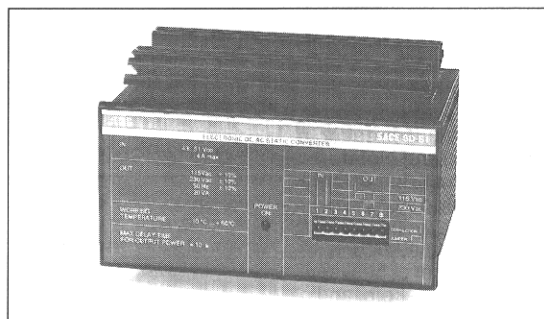
**7.4. Specific accessories for SACE PR1 releases**

1P

SACE SD-S1 voltage converter

Designed to convert a direct voltage at 48 V d.c. into an alternating sinusoidal voltage at 115/230 V a.c. 50 Hz, with 20 VA rated power. On the front panel there is a green led which, when lit, indicates the presence of direct supply voltage.

U_{IN}	43 ... 51 V~
I_{IN}	4 A max
U_{OUT}	115 V~ $\pm 10\%$ 230 V~ $\pm 10\%$
f_{OUT}	50 Hz $\pm 10\%$
P_{OUT}	20 VA

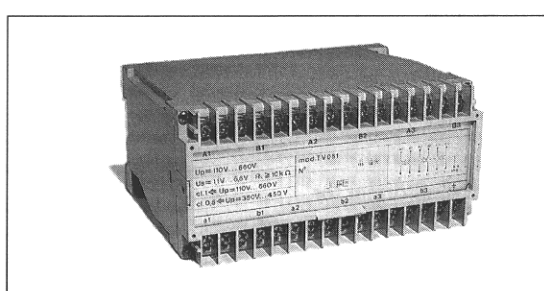


2P

SACE TV051 instrument voltage transformers

Unit containing a group of three VTs capable of detecting the VL1-L3, VL2-L3, VN-L3 voltages displayed by the PR1/C unit.

U_p (cl. 1)	110 V ... 660 V
U_p (cl. 0,5)	350 V ... 450 V
U_s	1,1 V ... 6,6 V
R_L	$\geq 10 \text{ kW}$

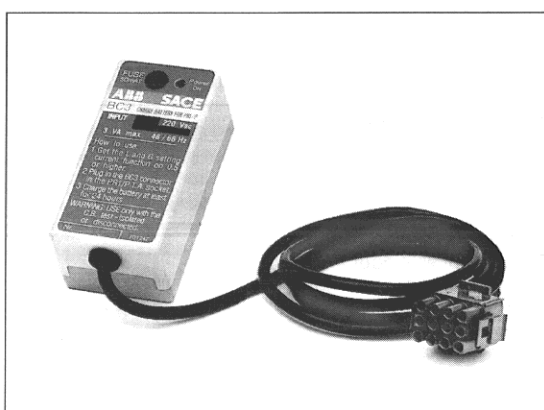


3P

SACE BC3 battery charger

Intended for charging the battery located in the upper part of the PR1/P unit, by use of the proper connector.

U_n	220 V~
P_n	3 VA max
f	48/66 Hz

**Caption**

U_s = secondary voltage
 U_p = measureable voltage range
 P_n = rated power
 R_L = load resistance

7.5. Table of possible combinations of accessories for derived versions

Accessories				
Code	MS	CS	MTP	MT
1C	*			
2C	*			*
3C	*			
4C	*			*
5C	*			*
6C	*			
7C	*			*
8C	*			*
9C	*			
10C	*			*
11C	*			
12C	*			
1F	*			
2F	*			
1S	*			
2S	*	*	*	*
3S	*	*	*	*
4S	*			
5S	*	*		
6S	*			

Note

For the meaning of codes, see paragraph 5.1.; for the meaning of accessories, see paragraphs 7.1. - 7.2. - 7.3. - 7.4

7.6. List of spare parts

Spare parts that can be replaced at customer's works

- Front shield
- Operating mechanism escutcheon plate
- Current transformers for PR1 or AR1 release
- Connection cables between releases and current transformers
- Arcing chamber
- Fixed arcing contact
- Moving arcing contact
- Closing springs
- Jaw-type isolating contact (for draw-out circuit-breakers)
- Earthing sliding contact (for draw-out circuit-breakers)
- Flange for the compartment door
- Tripping solenoid for PR1 or AR1 release
- Overcurrent release PR1 or AR1
- Voltage transformers for PR1 or AR1.

Spare parts that can be replaced at an ABB SACE Service Center

- Main fixed contact
- Set of main moving contacts
- Operating mechanism.

Note

When ordering spare parts, please always state the version and the serial number of circuit-breaker.

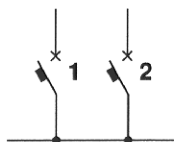
7.7. Constructional details of the mechanical interlock between vertically superimposed circuit-breakers

Between two circuit-breakers

Combinations

Application

Typical diagram

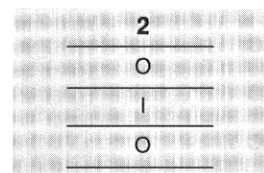
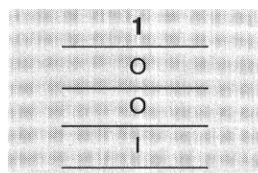


O = Circuit-breaker open

I = Circuit-breaker closed

Emergency power supply

Normal power supply



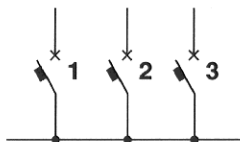
Between three circuit-breakers

Emergency power supply

Normal power supply

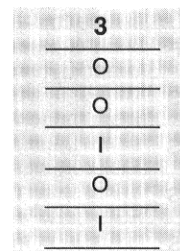
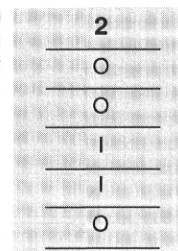
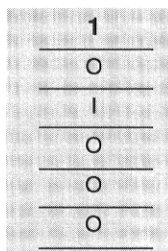
Normal power supply

Typical diagram



O = Circuit-breaker open

I = Circuit-breaker closed



Notes

- A programmable logic control device (PLC) can be supplied, on request, with the interlock.
- For the overall dimensions of the circuit-breakers, see the preceding pages.
- For the dimensions of the drillings necessary for installation, please ask ABB SACE.
- The dimensions S1-S2-S3, L1-L2-L3 of draw-out circuit-breakers can be equally increased for installations in switchboards with compartments having a width different from the one indicated.
- The assembly of each of the three types of interlock is possible also between circuit-breakers with different rated uninterrupted currents and different number of poles, provided they are in the same (fixed or draw-out) version, separately for the two groups F1-F2 and F3-F4-F5-F6.
- The interlock can only be mounted on the left side of the circuit-breakers (viewed from front). In combining circuit-breakers of equal or different overall dimensions, please respect the vertical alignment of the respective left sides.

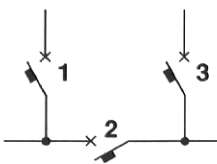
Between three circuit-breakers

Independent line

Bus-tie

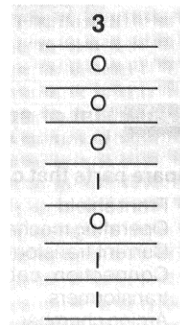
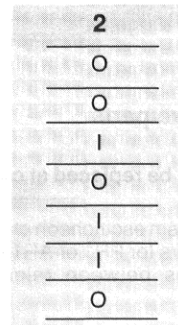
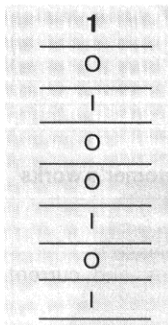
Independent line

Typical diagram



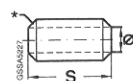
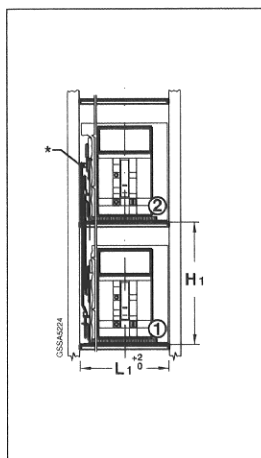
O = Circuit-breaker open

I = Circuit-breaker closed



Note: the assembly requires skilled personnel.

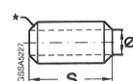
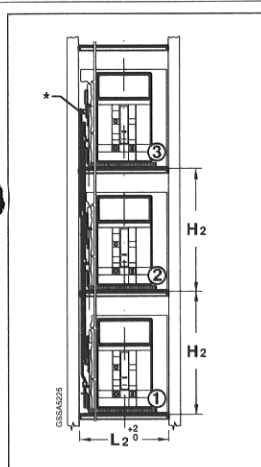
- * No. 3 spacers for each draw-out circuit-breaker, to be provided by the customer.



Fixed circuit-breakers

Draw-out circuit-breakers

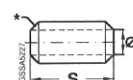
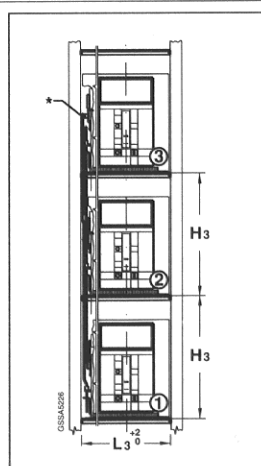
mm		H1	L1	Ø	S1	L1
F1	3 POL 4 POL	490 min	335 430	10 10	25 25	360 455
F2	3 POL 4 POL	560 max	417 512	10 10	25 25	442 537
F3	3 POL 4 POL		417 532	12 12	30 30	447 562
F4	3 POL 4 POL	650 min	537 652	12 12	30 30	567 682
F5	3 POL 4 POL	720 max	762 877	12 12	30 30	792 907
F6	3 POL		—	12	30	1032



Fixed circuit-breakers

Draw-out circuit-breakers

mm		H2	L2	Ø	S2	L2
F1	3 POL 4 POL	490 min	343 438	10 10	28 28	363 458
F2	3 POL 4 POL	525 max	425 520	10 10	28 28	445 540
F3	3 POL 4 POL		425 540	12 12	30 30	447 562
F4	3 POL 4 POL	680 min	545 660	12 12	30 30	567 682
F5	3 POL 4 POL	720 max	770 885	12 12	30 30	792 907
F6	3 POL		—	12	30	1032



Fixed circuit-breakers

Draw-out circuit-breakers

mm		H3	L3	Ø	S3	L3
F1	3 POL 4 POL		359 454	10 10	50 50	385 480
F2	3 POL 4 POL	500	441 536	10 10	50 50	467 562
F3	3 POL 4 POL		441 556	12 12	50 50	467 582
F4	3 POL 4 POL		561 676	12 12	50 50	587 702
F5	3 POL 4 POL	700	786 901	12 12	50 50	812 927
F6	3 POL		—	12	50	1052

Analytical index

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Use of the analytic index

The index contains an alphabetized listing of the main subjects covered in this catalogue with an indication of the corresponding chapter and paragraph in which the subjects are in any way mentioned. All the words (nouns and sometimes adjectives) that have a technical significance pertaining to SACE Megamax switches are listed in general.

Subjects are listed in alphabetical order on the basis of their key word (or the most important word in respect to the meaning); beneath every main subject, indented slightly to right, other specifications pertaining to the same subject are listed in alphabetical order. The key word is not repeated in the sub-entry specifications, but is always indicated by the symbol "#".

An initial capital letter is used for all the main subjects; an initial capital letter is used only when it represents the start of the subject in question in the sub-entries.

Indications provided in between parenthesis and after colon ":", in addition to providing the paragraph numbers, are used to indicate the context or the instrument to which the subject pertains.

We provide two examples of subject listing and sub#entries below:

Accessories

and spare parts	7.
Combinations of # for derived versions (table)	7.5.
Common #	7.1.
of circuit-breaker 3F2L 6000	5.2.1.
Specific # for fixed version	7.2.

Release

Overcurrent # PR1 or AR1: spare part	7.6.
Shunt closing #	7.1.2C
Shunt opening #	7.1.1C
Solid-state # SACE PR1 (view)	2.1.
Undervoltage #	7.1.3C

A**Accessories**

and figures of electrical diagram for each version of circuit-breaker	6.
and spare parts	7.
Combinations of # for derived versions (table)	7.5.
Common #	7.1.
of circuit-breaker 3F2L 6000	5.2.1.
Specific # for draw-out version	7.3.
Specific # for fixed version	7.2.
Specific # for SACE PR1 releases	7.4.

Accumulator

battery present in SACE PR1/P release	4.1.
---------------------------------------	------

Adjustment

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Single simultaneous # on three phases + neutral (PR1/P unit)	4.1.4.

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Circuit-breakers for # atmospheres	5.2.4.
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Antiseismic

Circuit-breakers for # installations	5.2.4.
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Test # TS1 for SACE PR1 releases	4.1.

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Analog solid-state overcurrent releases for a.c.	4.2.
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Assembly

Closing mechanism # (view)	2.1.
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B**BAG**

Central switchboard unit of SACE INSUM system	4.1.8.
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Bar

Upper # with fixed contact: spare part	7.6.
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Battery

Accumulator # present in PR1/P unit	4.1.
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Baud

rate # transmission speed (PR1/D unit)	4.1.7.
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BC3

Battery charger mod. # for PR1/P unit	7.4.3P
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Box

with special tools and setting templates	7.1.11C
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Breaking capacity

No restriction of # with AR1 releases	4.2.
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Rated service short-circuit #	1.1.
Rated ultimate short-circuit #	1.1.

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Dimensions of copper # (in switchboard)	1.4.
---	------

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Circuit-breaker 3F2L 6000 as # breaker	5.2.1.

C**Cables**

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Capacity

Steady current-carrying # in switchboard	1.4.
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Technical and constructional #	2.

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of closing and opening springs	2.2.
--------------------------------	------

Charger

Battery # mod. BC3 for PR1/P unit	7.4.3P
-----------------------------------	--------

Circuit-breaker

Characteristics of Otomax # to be replaced by Megamax	5.3.3.
---	--------

Circuit-breakers

3F2L 6000 special current-limiting #	5.2.1.
F/E special # for voltages up to 1000 V a.c. and d.c.	5.2.2.
F/E #, suited for mines, electrochem. plants, traction, etc.	5.2.2.
Special # for thermonuclear power stations	5.2.3.

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mounted one over the other in switchboard	1.4.
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