

MERLIN GERIN

M.V. distribution
factory built
assemblies

Vercors M6
system
3 to 24 kV



mastering electrical power



MERIN GERIN

VM6

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contents

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VM6

general

introduction

The Vercors M6 system consists of a range of air insulated cubicles of uniform construction equipped with SF6 switchgear.

The Vercors M6 switchgear units allow switchboards to be built up for MV/LV transformer, MV power supply or distribution substations up to 24 kV in public and industrial distribution. Modular busbars of different ratings allow full switchboard extension possibilities. Duplicate bus schemes can be implemented using duplex switchboards.

functions

Available functions include:

■ incoming units:

- IM, IMC switches,
- DDM duplicate feeder,
- NSM main standby,
- SM, SMC, SM2 disconnectors,
- GAM, GAM2 incoming cable-connection.

■ control and protection units:

- PM, PMC switches with fuses,
- QM, QMC fuse-switch combinations,
- QCS fuse-switch combination and load-side disconnector,
- DM12 single isolation circuit-breaker,
- DM23 double isolation circuit-breaker,

n BCM capacitor bank control switch,

- CRM contactor,
- lightning arrester units.

■ metering and bus units:

- CM, GMT voltage measurement,
- GMC, GMC2 current measurement,
- GCT voltage and current measurement,
- TM LV supply of auxiliaries,
- GBM, GBM2, GIM connection ducts.

standards

The Vercors M6 system complies with the following standards:

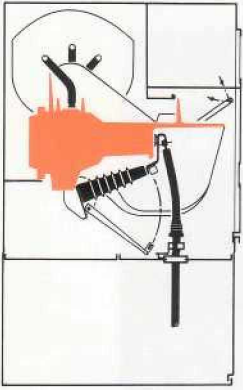
- international EC (298...),
- British (BS), German (VDE),
- American (ANSI),
- French (UTE and EDF).



VM6

three SF6 switching devices

Vercors M6 switch-disconnector



The Vercors M6 switch-disconnector ensures the following functions:

- load break switch, using the SF6 puffer principle,
- disconnector.

It can be equipped to various degrees to give switches of different characteristics (rated current, breaking capacity) for use in IM, DDM, NSM, BCM, PM, QM and QMC units as well as disconnectors for SM, CM, TM, CRM and QCS cubicles.

Rated voltage 7.2 to 24 kV.

Rated normal current 400 or 630 A.

Opening time 50 ms.

Closing time 85 ms.

Arcing time 12 ms.

Safety device:

The Vercors M6 switch-disconnector provides **positive break indication** as defined by IEC standard 129.

It incorporates:

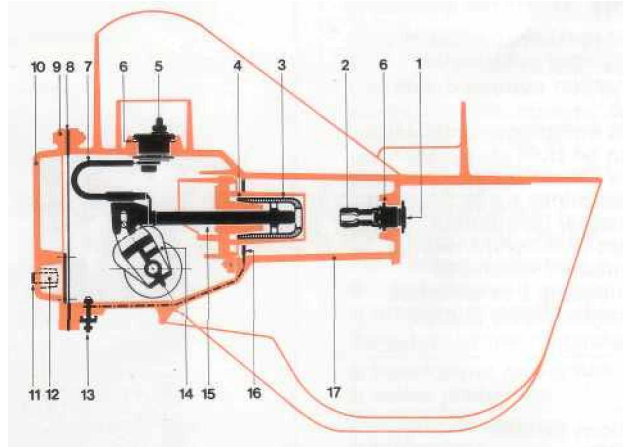
- a contact position-indicating device,
- a guard ring connected to earth to prevent any discharge phenomenon across the isolating distance.

Gas tightness

The enclosure is filled with SF6 at a relative pressure of 0.5 bars. Each enclosure is sealed after filling. Gas tightness is systematically checked at factory by means of a halogen leak detector. This high level of gas tightness meets the "sealed for life" requirements of IEC standards.

Safety

Pressurization when the switch interrupts its rated current is very small. Any accidental internal pressure of the SF6 module would be limited to 2.5 bars by a pressure relieving weak point designed into the rear of the enclosure. Gas exit then would be downwards and behind the cubicle without any frontal projection or other effects.



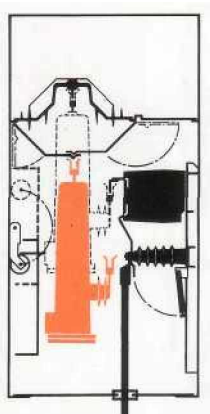
Sectional view of the enclosure with the switch-disconnector in open position

- 1 Terminal pad for cable connection
- 2 Fixed contact
- 3 Nozzle and piston
- 4 Guide cylinder
- 5 Terminal pad for busbar connection
- 6 O-ring of bushings
- 7 Braid
- 8 Polymerisable gasket
- 9 Enclosure assembling bolts
- 10 Cover
- 11 SF6 filling plug (sealed after leak test)
- 12 Molecular sieve (adsorbent material)
- 13 Earthing connection
- 14 Moving contact drive cam
- 15 Moving contact
- 16 Earthing ring
- 17 Megelit enclosure



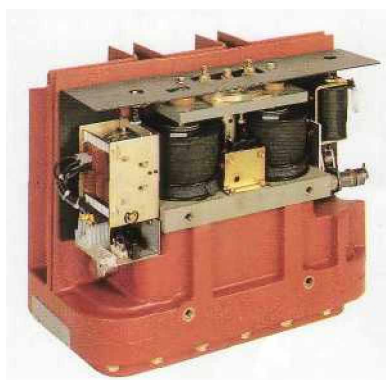
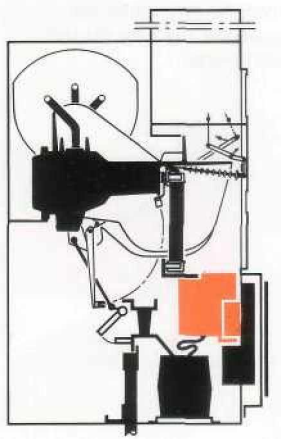
Switch-disconnector enclosure

Fluarc FB4 circuit-breaker



The Fluarc FB4 circuit-breaker interrupts currents using the SF6 puffer principle. It is installed on a withdrawable truck in the DM12 cubicle and on a withdrawable frame in the DM23 cubicle. Gas tightness and safety characteristics are the same as for the Vercors M6 switch-disconnector. The relative pressure of the SF6 is 1.5 bars. Rated voltage 7.2 to 24 kV. Rated normal current 400, 630 or 1250 A.

Rollarc contactor



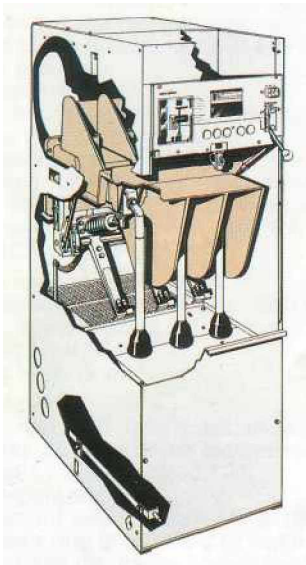
The Rollarc contactor interrupts currents using the SF6 rotating arc technique. It is installed in the CRM cubicle, either alone or combined with fuses. Rated voltage 7.2 to 12 kV. Rated normal current 400 A.

VM6

description

general layout

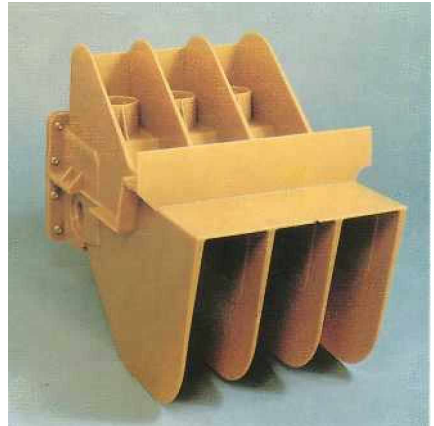
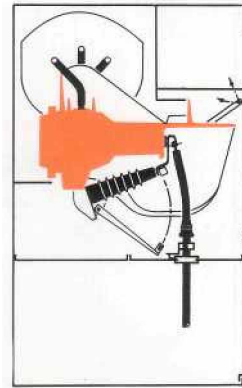
The Vercors M6 switchgear units are designed for installation indoors (IP305). They are of compact design: width 500 mm, height 1500 mm, depth 920 mm, making installation possible where space is limited or in compact prefabricated substations. Cable connection is made fast and easy by the frontal layout of the phases. Operation is simplified by grouping together all controls on a front panel.



four compartments

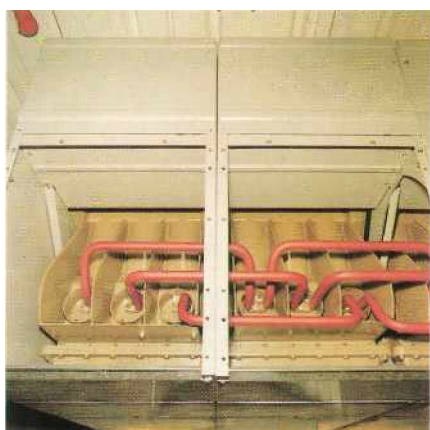
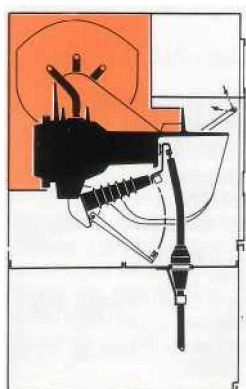
The cubicles include four distinct compartments, separated by metallic or insulating partitions:

switchgear compartment



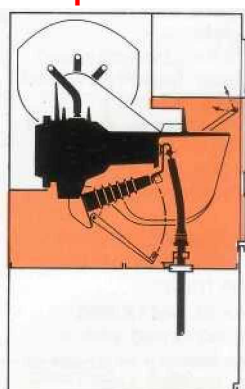
The switching device enclosure makes up the switchgear compartment and forms a permanent barrier between the busbar compartment and the cable-connection compartment.

busbar compartment



The busbar consists of 3 embedded copper bars in a "fan" arrangement, bolted onto the upper terminal pads of the enclosure. Modular design provides full alteration or extension possibilities. Ratings 400, 630 or 1250 A (for 2000 A, please consult us).

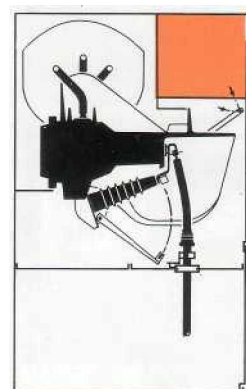
cable-connection compartment



Single or three-core cables from the line are connected to the lower terminal pads of the switchgear, with:
■ simplified ends for dry-type cables,
■ heat-shrink jackets for paper insulated cables.

Depending on cable cross-sections, several cables can be connected in parallel (see p. 33). This compartment cannot be reached unless the earthing switch is closed. This switch is equipped with a quick-make operating mechanism, independent of the action of the operator. The blades carrying the contact fingers are equipped with reflector plates which can be seen through the inspection windows in the access cover.

low voltage compartment

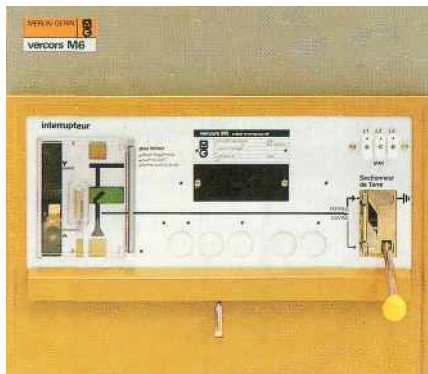


This compartment contains the operating mechanisms of both the functional switchgear device and the earthing switch.

It is designed for easy installation of locks and all conventional LV auxiliaries (auxiliary switches, coils, gear motors, relays, terminal blocks, etc.). This compartment is accessible without it being necessary to de-energize the cables or busbars or to isolate the substation.

For larger size relays, an enclosure fitted with a door is mounted on top of the LV compartment.

control and signalling



CIT operating mechanism

The mechanisms and devices required for operation of the **switch-disconnector** cubicles are located on a single **frontal plate**.

Three types of switch-disconnector operating mechanisms exist:

CIT operating mechanism (tumbler type).

Opening and closing by a lever.

Standard equipment on IM and PM cubicles.

CM operating mechanism



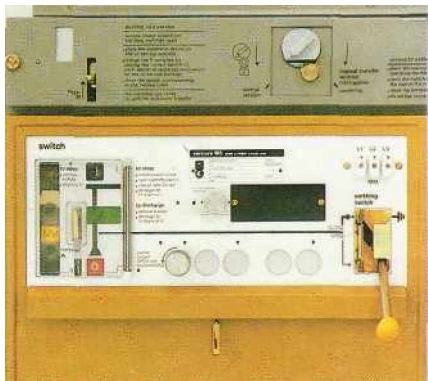
CI1 operating mechanism

Charging of the mechanism by a lever and automatic closing of the switch on completion of charging.

Opening by push-button.

Standard equipment on QM cubicles.

CI2 operating mechanism



CI2 operating mechanism

Charging of the mechanism by a lever. Closing and opening by two push-buttons.

CI2 operating mechanism is standard equipment on DDM, NSM and BCM cubicles.

Operating mechanisms can be changed on a live cubicle.

Models CM and CI2 can be equipped on request with a gear motor powered via an auxiliary supply, enabling:

- charging of the mechanism followed by automatic closing of the switch on completion of charging, for the CM,
- charging of the mechanism, for the CI2.

In this case, a switch is included on the front panel to turn on or off the power supply to the motor.

The circuit-breakers of DM 12 and DM23 cubicles are equipped with a GMh operating mechanism (manual or electrical charging; closing and opening by two push-buttons).

additional equipment

Indirect trip and closing releases

CM operating mechanism

- 1 trip release:

□ Mitop self-powered (with Statimax relay),

□ or, shunt or undervoltage type (powered by an auxiliary supply via push-buttons or relaying contacts).

CI2 operating mechanism:

□ 1 shunt trip release (aux. supply),

- 1 shunt closing release (aux. supply).

GMh operating mechanism:

- 1 shunt trip release (a),

- 1 Mitop or undervoltage release (b),

- 1 single max. I release (c),

- 1 double max. I release (d).

Maximum combinations:

(a) + (b) + (c)

(a) + (d)

2 x (a) + (b)

2 x (a) + (c)

- 1 shunt closing release.

Electrical data:

- shunt release

rated voltage (*)	dc	24	48	110	127	220	380
permanent current (A)		9.8	4.8	1.65	3.2	2.6	1.5

Opening: powering time = response time = 30 to 36 ms.

Closing: powering time = 60 to 70 ms, response time = 70 to 80 ms.

Operating temperature range:

- 5° to + 40° C.

Powering time and response time:

add 20% for minimum voltage.

- undervoltage release

Un (*)	dc	24	48	110	ac	127	220
pick-up current (A)		3.6	1.85	0.6		2.20	2.50
permanent current (A)		0.5	0.2	0.1		0.4	0.2

Operation guaranteed for supply voltage -20%.

(*) Other voltages: please consult us.

- Mitop:

□ mechanical response time (no load): 6 ms,

□ supply voltage obtained from sensors: 20 to 48 Vdc.

Gear motor

For installation on operating mechanism CI 1 or CI 2 (automation, remote control, etc.)

Un(*)	dc			ac	
	24	48	110	127	220
1 max startup (A)	11.6	5.9	2	2.35	1.15
1 mean (A)	3.7	1.7	0.63	0.75	0.48
powering time (s)	3.4	3.2	3.6	3.2	3.6
with CM, closing response time	3.1	2.8	3.5	3.1	3.5

(*) Other voltages: please consult us.

Auxiliary contacts:

These contacts are linked to the positions of the switchgear and are used for monitoring and electrical interlocking.

Type of auxiliary contact

	functional device	earthing switch	charged position	fuse blown	breaking capacity
rotating contact	■	■			10A - 220 VAC 3A - 220 VDC
micro-contact		■ (DM12)	■	■	16A - 220 VAC 0.9A - 127VDC 4A - 48 VDC

Auxiliary contacts in blocks of 3, 5, 9 or 12 (5, 10, 17 for circuit-breaker).

Maximum quantities

	functional device	isolating switch	earthing switch	fuse blown
IM, ICM, BCM	12		9	
DDM, NSM	12		5	
PM, PMC, QM, QMC	12		5	2
SM	12		5	
CM	5		5	2
GAM			5	
CRM	12		5	2
TM	5		5	2
DM12	17	5	4	
DM23	12	6	4	
SM2		5	4	

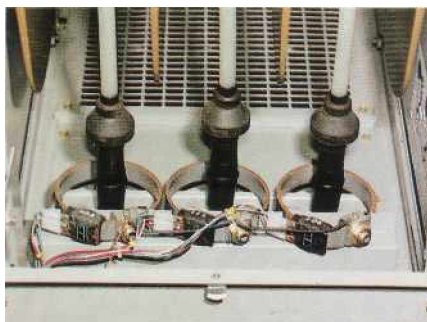
Charged position indication:

■ CI1 mechanism: 1 contact

■ GMh mechanism (DM12 and DM23): 1 contact

Toroids

For fault detection or zero-phase sequence protection of each cable.

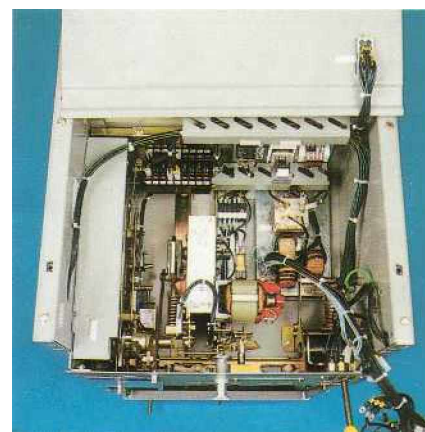


Current and potential transformers

(see p. 22).

Heating element

150 W - 220 V 50/60 Hz



Remote-controlled cubicle

VM6

unit selection

main ratings and VM6 series selection

The Vercors M6 system comprises six equipment series, designated series 12, 14, 16, 20, 25 and 30).

Each series corresponds to a maximum thermal withstand and a voltage rating.

The basic cubicles are available in all the series with the same dimensions.

Unit identification

Vercors M6 units are identified by a sequence of letters and numbers corresponding to:

- the function designation letters: IM, QM, etc.,
- the series designation: 12, 14, etc.,
- when necessary, the rated current of the device: 400 A, 630 A, etc.

Example: IM20-400

This designates a series 20 switch unit with a 400 A normal current rating. It can be installed on a network with maximum specifications as follows:

- short circuit current: 21 kA rms for 1 sec.
- short circuit fault level 545 MVA
- rated voltage: 17.5kV.

Series selection

■ rated voltage (kV)	7.2	12	17.5	24d)
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■ rated insulation level

50 Hz - 1 mn (kV rms)	20	28	38	50
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impulse 1.2/50 fjs wave (kV peak)	60	75	95	125
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■ service voltage (kV)	3	3.3	4.16	5	5.5	6	6.6	10	11	13.8	15	20	22
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series	thermal electro-withstand (kA rms 1 s)	Electro-dynamic withstand* (kA peak)	equivalent fault level (MVA)										
12	12.5	31.5	65	70	90	110	120	130	145	215	240	300	325 435 475
14	14.5	36.5	75	85	105	125	135	150	165	250	275	345	375 500 550
16	16	40	85	90	115	140	150	165	185	280	305	385	415 555 610
20	21	52.5	110	120	150	180	200	220	240	365	400	500	545
25	26.3	65.5	135	150	190	230	250	275	300	455	500		
30	31.5	79	165	180	230	275	300	330	360				

(1) For service voltages exceeding 20 kV, heating is provided by a 150 W 220 V - 50/60 Hz element in each cubicle, for which the power supply must be provided by the user.

* The electrodynamic withstand corresponds (as per IEC definition) to the first asymmetrical peak with a magnitude equal to 2.5 times the thermal withstand considered. Note that the thermal withstand is the maximum short circuit current value permitted on a network once the symmetrical regime has been established and which must be born by the switchgear considered for 1 second.

characteristics of functional switching devices

switch-disconnector incorporated in cubicles IM, DDM, NSM, QM, QCS	■ rated voltage			7.2 to 24 kW			
	■ rated current			400 or 630 A (1)			
	■ breaking capacity (A rms)						
	switch			400 or 630 A			
	cubicles with breaking capacity						
	Un (kV)	24	17.5	13.8	12	11	7.2
switch-disconnector incorporated in cubicle PM	B.C. (kA)	2.5	2.5	2.5	2.8	2.8	3
	■ rated voltage			7.2 to 24 kW			
	■ rated current			200 A			
	■ breaking capacity (A rms)						
	switch			200 A			
	Without breaking capacity						
circuit-breaker incorporated in cubicles DM23 (2) and DM12	■ rated voltage			7.2 to 24 kW			
	■ rated current			400, 630 or 1250 A			
	■ breaking capacity (A rms)						
	Un (kV)	24	17.5	13.8	12	11	7.2
	B.C. (kA)	16	20	21	25	26.3	31.5
	contactor incorporated in cubicle CRM	■ rated voltage			7.2 a 12 kW		
■ rated current			400 A				
■ breaking capacity (A rms)							
Un (kV)		7.2	12				
B.C. (kA)		10	6				

(1) 400 or 630 A: see details according to cubicle type on p. 11 to 19.
(2) DM23 cubicle maximum rated normal current 630 A.

Mechanical and electrical endurance:

- for cubicles SM, IM, DDM, NSM, BCM, QM, QCS, CM, TM incorporating functional switch-disconnectors:
 - mechanical endurance: 1000 operations in accordance with standards (possibility of carrying out 3000 operations or 5000 with reinforced operating mechanism and operation counter),
 - electrical endurance: 100 breaking operations at I_n , PF = 0.7 (IEC 265), 3 breaks at 7 x fuse rated current, PF = 0.2 (EC 420),
- for cubicles DM12 and DM23 incorporating Fluarc circuit-breaker:
 - mechanical endurance: 10,000 operations,
 - 50 drawing-in/-out operations of Fluarc breaker for DM12 cubicle,
 - electrical endurance: 40 breaking operations at 12,500 A or 10,000 at I_n (IEC 56).
- for cubicle CRM incorporating the Rollarc contactor: 300,000 operations at 250 A.

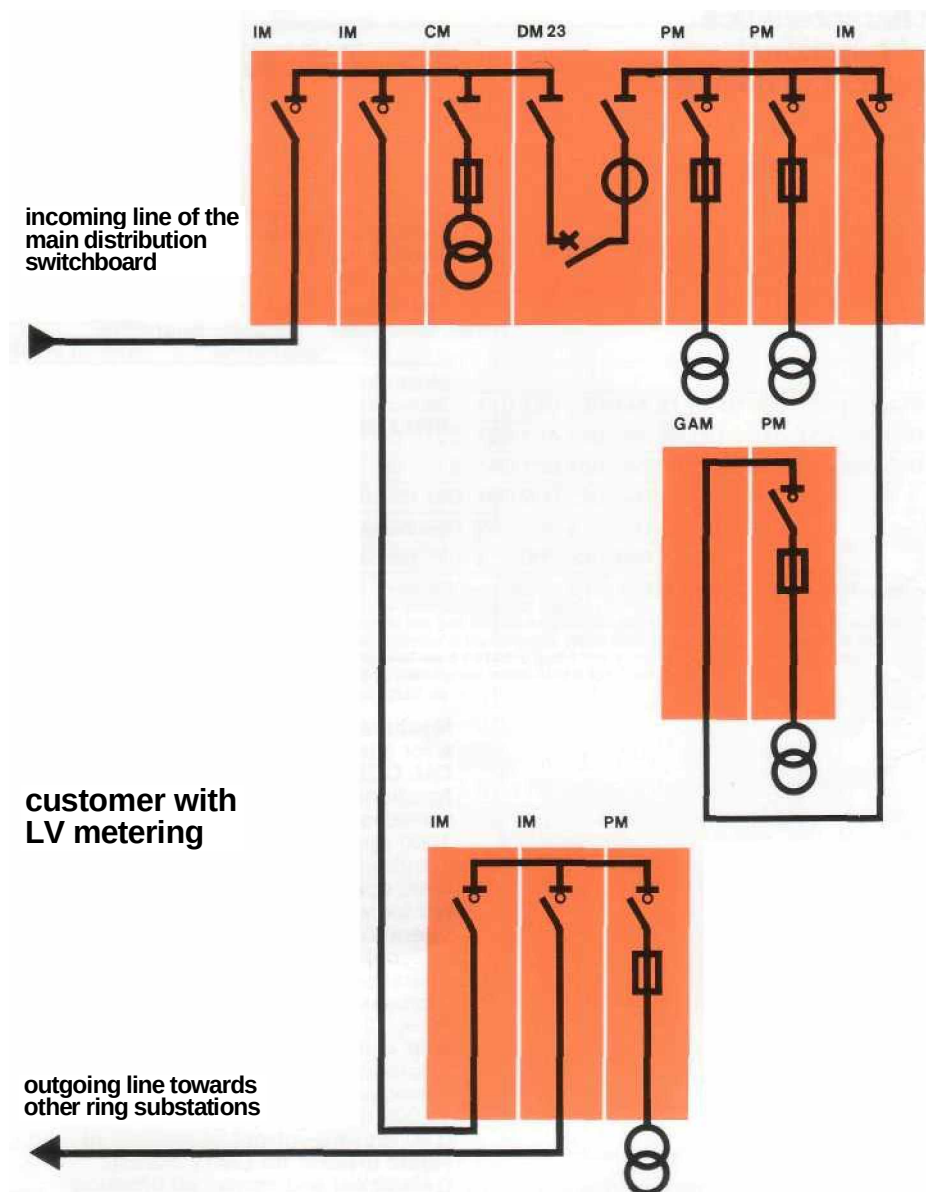
VM6

field of application

MV/LV transformer substation

The various Vercors M6 units used in composing MV/LV transformer substations are:

- IM, IMC switch-disconnector,
- DDM duplicate feeder,
- NSM main standby unit,
- GAM, GAM2 incoming cable-connection unit,
- PM, PMC switch with fuses,
- QM, QMC fuse-switch combination,
- QCS, SQC fuse-switch combination and load-side disconnector,
- DM23 double isolation circuit-breaker,
- CM medium voltage measurement unit,
- GIM intermediate bus unit,
- lightning arrester unit.



D32 transformer substation equipped with Vercors M6 cubicles



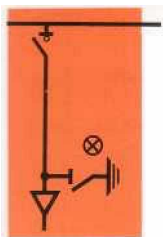
Substation with general protection and M.V. metering

VM6

selection of functions

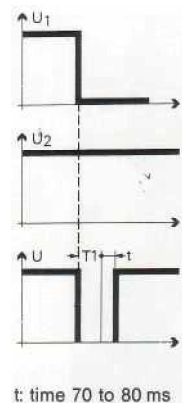
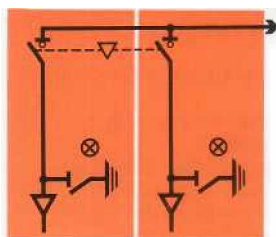
IM, IMC (with CT)

Incoming or outgoing switch unit



DDM

Duplicate feeder
(French EDF specification)



Rated current:

400 or 630 A for series 12, 14 and 16
630 A for series 20, 25 and 30.

Basic equipment:

- switch-disconnector,
- three-phase busbars,
- earthing switch,
- CIT operating mechanism,
- neon voltage indicators,
- 1 to 3 CT's on IMC.

Options:

- auxiliary contact block,
- low voltage box,
- operating mechanism CI1 or CI2 with or without trip or closing releases and charging gear motor (see p. 6).

Rated current:

400 A for series 12 with type S or I transfer switch.

Basic equipment:

- 2 switch-disconnectors with mechanical interlocking and possibility of parallel operation,
- three-phase busbars,
- earthing switch on each incomer,
- CI2 operating mechanisms,
- neon indicators on each incomer,
- automatic transfer equipment (details below),
- 1 shunt closing release and 1 trip release for each incomer.

Options:

- auxiliary contacts,
- LV box.

Automatic transfer equipment:

Equipment possibilities include:

- two types of automatic transfer assemblies (S or I),
- two regimes (A or B),
- two versions (automatic or automatable),
- type of automatic transfer assembly:
 - simplified (S) with RVH 215S transfer switch without current transformer for lock-out in the event of load-side faults,
 - type I with RVH 2151 transfer switch and 6 toroidal type CT's with rectifiers for detection of load-side faults in order to prevent transfer in the following cases:
 - earth fault greater than 80 A $\pm$ 10%,
 - two-phase fault greater than 1200 A,
 - symmetrical three-phase fault greater than 450 A.

■ regimes:

- regime A: manual charging of CI2 operating mechanisms and an independent 24 V dc power supply unit for the transfer switch and the releases,
- regime B: electrical charging of CI2 operating mechanisms with gear motor powered by an independent 24 V dc power supply unit.

■ versions:

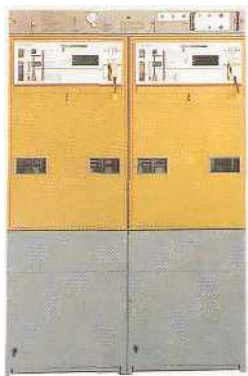
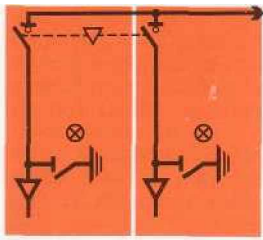
- fully equipped automatic version,
- automatable version without transfer switch and power supply unit (wiring and space provided for the addition of these components).

■ operating sequence:

- transfer (fig. 1)
 - Five conditions are required for transfer to take place:
 - voltage loss on main feeder (U1),
 - voltage present on standby feeder (U2),
 - no load-side fault (for type I assembly),
 - switch operating mechanism in charged position,
 - above conditions maintained for 5 or 25 seconds (T1) (selector switch on switchgear front panel).
 - return to main feeder.
- Return is not automatic and must be actuated deliberately once the fault has been cleared.
- For regime A, the operating mechanism of the faulty feeder must be recharged manually after a transfer has occurred.

NSM

Power supply from main supply with standby provided by another public utility supply or by a generating set.



Rated current:

400 or 630 for series 12, 14 and 16
630 A for series 20, 25 and 30.

Basic equipment:

- 2 switch-disconnectors with mechanical interlocking and possibility of parallel operation for types M, A, D, E and F,
- three-phase busbars,
- earthing switch on each incomer,
- CI2 operating mechanisms,
- neon indicators on each incomer,
- automatic transfer equipment (details below).

Options:

- auxiliary contact blocks for the switches, the earthing switch (LV box necessary for installation).

Automatic transfer equipment:

NSM units are available in seven versions: 1 manual version, 2 automatable versions and 4 automatic versions:

- type M manual version (2 public utility incomers) without any automatic transfer equipment,
- type A automatic version (2 public utility incomers):
 - one RCV 420 transfer switch (possible lock-out in the event of a fault),
 - 2 trip release and 1 shunt closing release per operating mechanism,
 - 2 charging gear motor per operating mechanism,
 - 1 independent 24 V dc power supply unit for the releases and the gear motor,
 - 1 terminal block for possible transfer lock-out order from outside.

- type B automatic version (1 public utility incomer with standby generating set):
 - 1 RNS 11 transfer switch,
 - 2 shunt closing releases and 2 trip releases,
 - 1 charging gear motor per operating mechanism,
 - 1 24 V dc power supply with 2 independent units,
 - 1 LV box on one of the cubicles,
 - 1 terminal block for possible transfer lock-out order from outside.

- type C automatable version
Identical to type B but without transfer switch or with outside transfer switch.
- type D automatable version.
Identical to type A but without transfer switch or with outside transfer switch.

- type E automatic version
 - 1 RVH 215 S transfer switch,
 - 2 shunt closing releases and 2 trip releases,
 - 1 charging gear motor per operating mechanism,
 - 1 independent 24 V dc power supply unit for the releases and the gear motors.

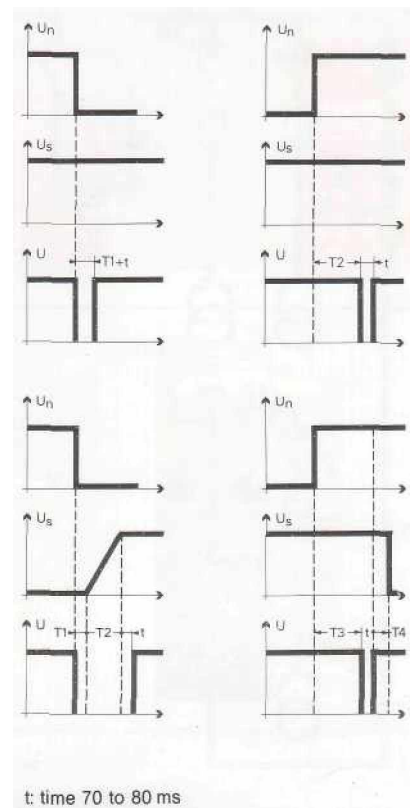
- type F automatic version.
Identical to type E but with RVH 215 I (In = 400 A only).

Operating sequence:

- transfer to another public utility supply with relay RCV 420:
 - transfer to standby power (fig. 2)
 1. voltage loss on the main supply (U_n) for an adjustable period of 0.1, 0.2, 0.4, 0.6, 0.8, 1, 1.5 or 2 seconds (T_1) and voltage present on the standby supply incomer.
 2. transfer.
 - return to main power supply (fig. 3)
 1. voltage return on the main supply (U_n) for an adjustable period of 5, 10, 20, 40, 80, 100 or 120 seconds (T_2).
 2. return transfer.
- transfer to a generating set with relay RNS 11
 - transfer to generating set (fig. 4)
 1. voltage loss on main supply (U_n) for 1 to 15 seconds (T_1 , factory adjusted).
 2. generator set startup (T_2).
 3. transfer when generating set voltage is available (external relay).
 - return to main power supply (fig. 5)
 1. voltage return on the main supply (U_n) for a factory adjusted period of between 60 and 120 seconds (T_3).
 2. return transfer.
 3. generating set shutdown 6 seconds after return transfer (T_4).
- transfer to another public utility supply with relay RVH 215 (see DDM unit, p. 11).

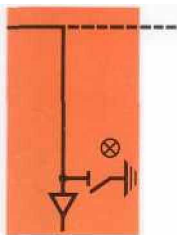
Transfer time between main supply trip order and closing of standby supply is 135 ms.

The independent 24 V dc power supply unit is type URA 20 VR 4 Ic 145, requiring an external 110 or 220 V ac power supply.



GAM

Incoming connection unit



Rated current:

400 or 630 A for series 12, 14 and 16
630 A for series 20, 25 and 30.

Basic equipment:

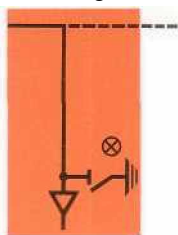
- three-phase busbars,
- neon voltage indicators,
- earthing switch.

Options:

- 1 to 3 CT's,
- auxiliary contact block,
- LV box.

GAM2

Incoming connection unit



Rated current:

400, 630 or 1250 A for series 12 and 14
630 or 1250 A for series 16 to 30.

Basic equipment:

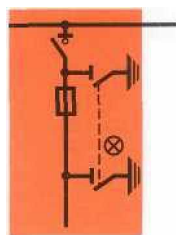
- three-phase busbars,
- neon voltage indicators,
- earthing switch.

Options:

- 1 to 6 type TCM6B current transformers,
- 1 to 3 RTS/A, or 1 to 2 RTC/A, or 1 to 2 RTC/B, with 3 CT's only,
- auxiliary contact blocks,
- LV box.

PM, PMC (with CT)

Transformer protection



A blown fuse does not cause the switch to open but can give rise to a remote indication.

Rated current:

200 A for series 12 to 30
(the actual current rating of the unit is that of the fuses mounted in series).

Basic equipment:

- switch-disconnector,
- three-phase busbars,
- twin-blade earthing switch,
- 3 fuses,
- CIT operating mechanism,
- neon voltage indicators,
- 1 to 3 CT's (on PMC).

Options:

- CM or CI2 operating mechanism with or without trip and closing releases and gear motor (see p. 6),
- auxiliary contact block,
- LV box.

The PM unit has no "circuit-breaker" breaking capacity ($7 \times I_n$ at $PF = 0.2$).

QM QMC (with CT)

Transformer protection



A blown fuse causes the switch to open.

Rated current:

400 A for series 12 to 30

(the actual current rating of the unit is that of the fuses mounted in series).

Basic equipment:

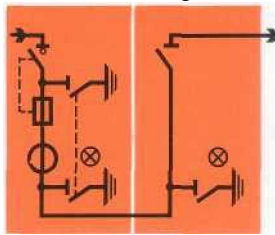
- switch-disconnector,
- three-phase busbars,
- twin-blade earthing switch,
- 3 fuses,
- CI1 operating mechanism,
- neon voltage indicators,
- 1 to 3 CT's (on QMC).

Options:

- CI2 operating mechanism,
- trip and closing releases, gear motor,
- auxiliary contact block,
- LV box.

QCS, SQC

General protection of a substation with MV metering



Rated current:

400 A for series 12 to 30

(the actual current rating of the unit is that of the fuses mounted in series).

Basic equipment:

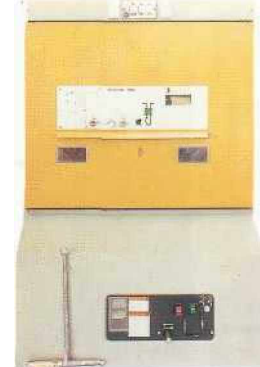
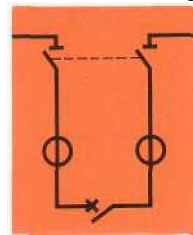
- line-side switch-disconnector,
- twin-blade earthing switch,
- 3 fuses,
- CM operating mechanism,
- 2 sets of neon voltage indicators,
- three-phase busbars,
- load-side disconnector,
- earthing switch on line side of load-side disconnector,
- 1 to 3 CT's.

Options:

- CI2 operating mechanism,
- trip and closing releases and gear motor (see p. 6 and 7),
- auxiliary contact block,
- LV box.

DM23

General protection of a substation with MV metering



Rated current:

400 or 630 A for series 12 and 14

630 A for series 16 and 20.

The double isolation function using 630 A series 25 and 30 and 1250 A series 12 to 30 can be provided by associating DM12 + SM2.

Basic equipment:

- Fluarc FB circuit-breaker,
- 2 air-insulated rotary disconnectors,
- three-pole busbars,
- 1 to 3 dual secondary winding CT's or 6 single secondary winding CT's,
- indirect relay protection (see p. 23).

Options:

- trip and closing releases, electrical charging of operating mechanism,
- auxiliary contact blocks,
- LV box.

CM

Consumer substation with MV metering



Rated current:

100 A for series 12 to 30
(the actual current rating of the unit is that of the fuses mounted in series).

Basic equipment:

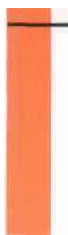
- functional disconnecter,
- three-pole busbars,
- direct manual operating mechanism,
- earthing switch,
- 3 RTM6 with 6.3 A fuses (Solefuse type),
- LV circuit isolating device.

Options:

- auxiliary contact block,
- LV box.

GIM

Intermediate unit



Rated current:

400 or 630 A for series 12, 14 and 16
630 A for series 20, 25 and 30.

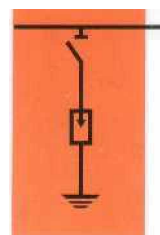
Basic equipment:

- three-phase busbars.

Note:

Cannot be installed alongside DM12 or DM23 units.

lightning-arrester unit



Rated current:

400 A for series 12.

Basic equipment:

- cubicle framework,
- three-phase busbars,
- disconnecter,
- 3 lightning-arresters.

Options:

- discharge counter.

For installation of lightning-arresters in GAM, IM, PM or QM cubicles, please consult us.

VM6

selection of functions (cont)

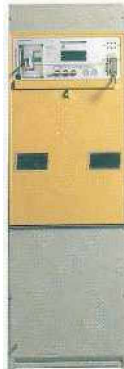
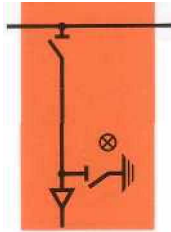
industrial MV/LV transformer and MV distribution substations

The various Vercors M6 units used in composing industrial MV/LV transformer and MV distribution substations are:

- IM, NSM, GAM, PM, QM, QCS, DM22, CM and GIM units used in MV/LV transformer substations,
- SM, DM12, BCM, CRM, GMT, GMC, GCT, TM and GBM units used in industrial transformer and distribution substations,
- **SM, SMC** disconnector,
- **SM2, SM2C** disconnector,
- **DM12** single-isolation circuit-breaker,
- **BCM** capacitor bank switch,
- **CRM** contactor,
- **GMC, GMC2** current measurement unit,
- **GCT** voltage and current measurement unit,
- **TM1, TM2** LV auxiliaries supply unit,
- **GBM, GBM2** bus riser unit.

SM, SMC (with CT)

Unprotected incomer or outgoer



Rated current:

400 or 630 A for series 12, 14 and 16
630 A for series 20, 25 and 30.

Basic equipment:

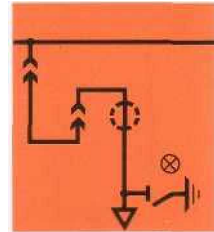
- functional disconnector,
- three-phase busbars,
- neon voltage indicators,
- earthing switch,
- direct manual operating mechanism,
- 1 to 3 CT's (on SMC).

Options:

- auxiliary contact block,
- LV box.

SM2, SM2C (with CT)

Unprotected incomer or outgoer



Rated current:

630 or 1250 A for series 12 to 30
(cubicle limited to 95 kV impulse wave).

Basic equipment:

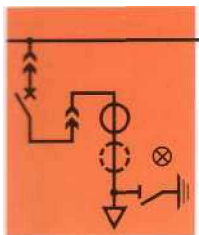
- disconnection by withdrawal of bus bridge,
- three-phase busbars,
- neon voltage indicators,
- direct manual operating mechanism,
- with or without earthing switch,
- 1 to 6 CT's.

Options:

- 1 to 3 RTS/A, or 2 RTC/A, or 2 RTC/B with 3 TC's only.
- auxiliary contact block.

DM12

Incomer or outgoer protection



Rated current:

400, 630 or 1250 A for series 12 and 14
630 or 1250 A for series 16 to 30
(cubicle limited to 95 kV impulse wave for $I_n = 1250$ A and certain special connection cases).

Basic equipment:

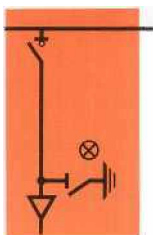
- Fluarc FB4 circuit-breaker on withdrawable truck,
- GMh type operating mechanism,
- three-phase busbars,
- neon voltage indicators,
- earthing switch,
- disconnection by withdrawal of circuit-breaker,
- 1 to 3 single or double secondary winding CT's.

Options:

- 1 to 3 single or double secondary winding CT's,
- 1 to 3 VT's with maximum of 3 CT's,
- electrical charging of operating mechanism,
- 1 Mitop or undervoltage trip release compatible with a shunt trip release and a shunt closing release,
- 1 auxiliary contact block,
- 1 LV box,
- protection by self-powered relays (Statimax), by indirect relays (Vigirack) or by an electronic programmable system (Sepam) (see p. 23).

BCM

Capacitor bank control



Rated current:

200 A for series 12 to 20.

Basic equipment:

- functional switch,
- electrical operating mechanism with releases,
- operation counter,
- three-phase busbars,
- neon voltage indicators,
- earthing switch.

Options:

- auxiliary contact block,
- LV box.

BCM units are used for switching multiple parallel capacitor banks, while the overall protection of the multiple bank is provided elsewhere. A multiple installation may be made up of 2 or 3 banks, each with a maximum power of 3000 kVAR at 20 kV service voltage. The BCM unit allows 1900 capacitive 100 A CO. cycles and 5000 mechanical operations. The QM unit may be used for the control and protection of a single capacitor bank. It allows 20 capacitive 135 A CO. cycles from 3 to 24 kV (maximum of 5600 kVAR at 20 kV: $135 \times 24 \times \sqrt{3}$). The protective fuses should be rated at between 1.6 and 2 times the current rating of the protected capacitor bank. The DM12 unit can also be used to control and protect a single capacitor bank. It allows 10,000 capacitive 300, 500 or 600 A CO. cycles (respectively for switchgear with current ratings of 400, 630 and 1250 A).

CRM

Control and protection of MV motors



Rated current:

400 A for series 12 to 30.

Rated voltage:

7.2 or 12kV.
Must be equipped with fuses for $I_{sc} > 6$ kA at 12 kV or 10 kA at 7.2 kV. Maximum switchable power with and without fuses.
See table on page 21.

Basic equipment:

- Rollarc 400 contactor,
- functional disconnecter,
- 3 Fusarc fuses,
- three-pole busbars,
- 3 neon voltage indicators,
- earthing switch,
- 1 to 3 TCM6A or 1 or 2 TCM6B CT's,
- low voltage box equipped with a 4-module Vigirack relayrack (1):
 - T210 "thermal image" card,
 - D210 "phase reversal or imbalance" card,
 - A310 "two-phase overcurrent" card,
 - module available for H "zero-phase sequence" card (toroid required),
- 1 ammeter, 72 x 72, overload scale,
- 2 "open/close" push-buttons,
- 1 local/remote selector switch,
- 1 auxiliary circuits on/off switch (2 circuits) with fuses,
- 1 terminal block for remote control.

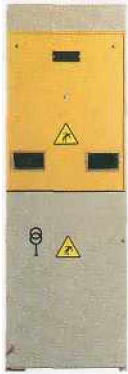
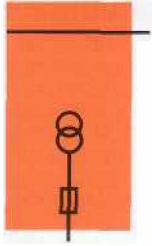
Options:

- 1 RTC/A
 - auxiliary contact blocks.
- Fuse selection, see page 21.

(1) For 6-module Vigirack relay or other manufacturer, please consult us.

GMT

Voltage measurement of adjacent cubicle



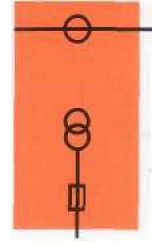
GMC, GMC2

Busbar current measurement



GCT

Busbar current measurement and adjacent cubicle voltage measurement



Rated current:

400, 630 or 1250 A for series 12 to 30 (cubicle limited to 95 kV impulse wave for $I_n = 1250$ A).

Basic equipment:

- three-phase busbars,
- 3 RTM6 (p. 22) with 0.3 A fuses (Tepefuse type).

Option:

- LV box.

Rated current:

GMC:
400 or 630 A for series 12 to 20.

GMC2:
400, 630 or 1250 A for series 12 to 14
630 or 1250 A for series 16 to 30.

Basic equipment:

- GMC:**
- three-phase busbars,
 - 1, 2 or 3 TCM6A2 CT's (p. 22).

GMC2:

- three-phase busbars,
- 1, 2 or 3 TCM6B CT's (p. 22).

Option:

GMC and GMC2:

- LV box.

Rated current:

400 or 630 A for series 12 to 20.

Basic equipment:

- three-phase busbars,
- 1, 2 or 3 TCM6A2 CT's,
- 1, 2 or 3 RTM6 (p. 22) with 0.3 A fuses (Tepefuse type).

Option:

- LV box.



Cubicle GMC2

TM1, TM2

MV/LV transformer for auxiliaries



Rated current:

100 A for series 12 to 30
(the actual current rating of the unit is that of the fuses mounted in series).

Basic equipment:

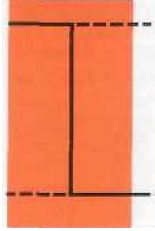
- functional disconnecter,
- LV circuits isolating device,
- three-phase busbars,
- earthing switch,
- 1 single-phase VT (p. 22) up to 2500VA in TM1 unit,
- 1 TPM6V(2x500VA) in TM2 unit,
- 3 fuses (Solefuse type).

Options:

- auxiliary contact block,
- LV box.

GBM

Connection between busbars and the bottom of IM, SM, DDM and NSM units



Rated current:

400 or 630 A for series 12 to 25
400 A for series 30.

Basic equipment:

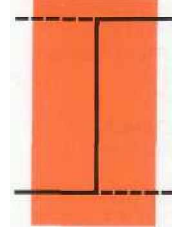
- three-phase busbars,
- bus riser.

Option:

- LV box.

GBM2

Connection between busbars and the bottom of DM12 and SM2 units



Rated current:

630 A for series 25 and 30
1250 A for series 12 to 30.

Rated voltage:

17.5 kV maximum.

Basic equipment:

- three-phase busbars,
- bus riser.

Options:

- LV box,
- 1 to 3 RTS/A, or 1 to 2 RTC/A, or 1 to 2 RTC/B.

VM6

selection of fuses

transformer protection selection of fuses⁽¹⁾

The current rating of fuses installed in Vercors M6 type PM, QM and QCS units depends on the maximum design voltage and kVA rating of the transformer to be protected.

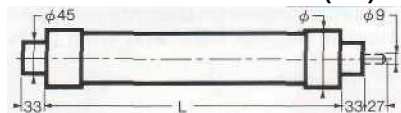
Two types of fuses may be used:

- Solefuse type fuses (to French standard UTE C64-210),
- Fusarc or other type fuses (to IEC 282-1 standards and DIN 43-625 dimensions).

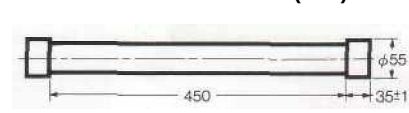
Example:

For the protection of a 400 kVA transformer at 11 kV, select either Solefuse fuses rated 31.5 A or Fusarc fuses rated 40 A.

Dimensions of Fusarc Fuses (DIN)



Dimensions of Solefuse fuses (UTE)



rated voltage (kV)	rating	L (mm)	dia. (mm)	weight (kg)
3.6	250	292	88	3.3
7.2	125 to 200	292	88	3.3
	250	442	88	5
12	6.3 to 63	292	55	1.4
	80 to 100	292	88	3.3
	125 to 200	442	88	5
17.5	10 to 25	292	55	1.4
	31.5 to 40	292	88	3.3
	100	442	88	5
24	6.3 to 40	442	55	1.4
	50 to 160 ⁽¹⁾	442	88	5

(1) Driescher fuse-links.

Selection table (fuse ratings in A - for use without overloads at 20° C < 0 < 40° C)

service voltage (kV)	fuse type	Transformer KVA rating																
		25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
UTE Standards C13-100 and C64-210																		
20	Solefuse	6.3	6.3	6.3	6.3	16	16	16	16	43	43	43	43	43	63			
15	Solefuse	6.3	6.3	16	16	16	16	16	43	43	43	43	43	63				
10	Solefuse	6.3	6.3	16	16	31.5	31.5	31.5	63	63	63	63						
5.5	Solefuse	6.3	16	31.5	31.5	63	63	63	63	63								
General case																		
22	Solefuse	6.3	6.3	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	43	63		
	Fusarc	6.3	6.3	10	10	10	16	20	20	25	31.5	31.5	40	50	50	63	80	160 ⁽²⁾
20	Solefuse	6.3	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	43	63			
	Fusarc	6.3	6.3	10	10	16	16	20	20	31.5	31.5	40	50	50	63	80	80	160 ⁽²⁾
15	Solefuse	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	43	63	80	80		
	Fusarc	6.3	6.3	10	16	16	20	20	31.5	31.5	40	50	50	63	80	80	100	160 ⁽²⁾
13.8	Solefuse	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	63	63	80			
	Fusarc	6.3	6.3	10	16	20	20	25	31.5	31.5	40	50	63	63	80	100	160 ⁽²⁾	160 ⁽²⁾
11	Solefuse	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	63	63	80	100			
	Fusarc	6.3	10	16	20	20	25	31.5	31.5	40	50	63	63	80	100	125	160	200 ⁽³⁾
10	Solefuse	6.3	6.3	16	16	16	31.5	31.5	31.5	43	43	63	80	80	100			
	Fusarc	6.3	10	16	20	20	31.5	31.5	40	50	50	63	80	80	100	125	160	200 ⁽³⁾
6.6	Solefuse	6.3	16	16	16	31.5	31.5	31.5	63	63	80	80	100	125				
	Fusarc	10	16	20	25	31.5	40	40	50	63	80	80	100	125	160	200	250 ⁽³⁾	
6	Solefuse	6.3	16	16	31.5	31.5	31.5	63	63	63	80	100	100	125				
	Fusarc	10	16	25	31.5	31.5	40	50	50	63	80	80	100	125	160	200	250 ⁽³⁾	
5.5	Solefuse	6.3	16	16	31.5	31.5	31.5	63	63	63	80	100	125					
	Fusarc	10	16	25	31.5	40	40	50	63	63	80	100	125	160	200	250 ⁽³⁾		
4.16	Solefuse	6.3	16	31.5	31.5	31.5	63	63	80	80	100	125						
	Fusarc	10	20	31.5	40	50	50	63	80	80	100	125	160	200	250 ⁽³⁾			
3.3	Solefuse	16	16	31.	31.5	63	63	80	80	100	125							
	Fusarc	16	20	40	50	50	63	80	80	100	125	160	200	250 ⁽³⁾				
3	Solefuse	16	16	31.	63	63	63	80	100	100	125							
	Fusarc	16	25	40	50	50	63	80	80	100	125	160	200	250 ⁽³⁾				

(1) For fuse replacement instructions, see p. 21

(2) Driescher fuses

(3) Do not use with Buchholz type protection

motor protection with CRM units selection of fuses

The current rating of fuses installed in CRM units depends on:

- motor current rating I_n ,
- starting current I_d ,
- starting time,
- frequency of starts.

The fuse rating is calculated such that a current equal to twice the starting current does not blow the fuse within a period equal to the starting time.

The adjacent table indicates the ratings which should be used, based on the following assumptions:

- direct on-line startup,
- $I_d/I_n < 6$,
- $PF = 0.8$ ($P < 500$ kW) or 0.9 ($P > 500$ kW),
- $\eta = 0.9$ ($P < 500$ kW) or 0.94 ($P > 500$ kW).

The indicated values are for Fusarc fuses (to DIN standard 43-625).

Example:

Consider a 950 kW motor at 5 kV.

$$I_n = \frac{P}{\sqrt{3} \cdot U \cdot \eta \cdot PF} = 130 \text{ A}$$

$$I_d = 6 \times I_n = 780 \text{ A.}$$

In the "starting current" column, select the next higher value, i.e. 790 A.

For six 5-second starts per hour, select fuses rated 200 A.

Note

The same motor could not be protected for 12 starts per hour since the maximum service voltage for the required 250 A rated fuses is 3.3 kV.

use without fuses

For the case of protection with fuses (table below), motor power is limited by the maximum fuse rating which can be used in the unit.

Note that CRM units can be used without fuses on networks with short-circuit current not exceeding the following values:

$I_{sc} < 10,000$ A (3) for $U_n < 6$ kV.

$I_{sc} < 6,000$ A (3) for $U_n < 6$ kV.

In this case $I_n \text{ max} = 320$ A.

starting current (A)	Starting time (s)	5		10		20		maximum service voltage (kV)
		6	12	6	12	6	12	
1410		250						3.3
1290		250	250	250				
1140		250	250	250	250	250		
1030		250	250	250	250	250	250	
890		250	250	250	250	250	250	
790		200	250	250	250	250	250	
710		200	200	200	250	250	250	
640		200	200	200	200	200	250	
610		200	200	200	200	200	200	6.6
540		160	200	200	200	200	200	
480		160	160	160	200	200	200	
440		160	160	160	160	160	200	
310		160	160	160	160	160	160	
280		125	160	160	160	160	160	
250		125	125	125	160	160	160	
240		125	125	125	125	125	160	
230		125	125	125	125	125	125	
210		100	125	125	125	125	125	
180		100	100	100	100	100	125	
170		100	100	100	100	100	100	11

Maximum switchable power (kW)								
(direct on-line startup, six 5-sec. starts per hour)								
service voltage (kV)	3.3	4.16	5	5.5	6	6.6	10	11
without fuses	1550	1960	2360	2590	2830	3110	4710	5180
with fuses								
100 A	140	180	215	240	260	285	435	480
200 A	635	800	960	1060	1155	1270		
250 A	1135							

changing fuses

When the clearing of a fault is accompanied by the blowing of one or more fuses, only those fuses which have actually blown are often replaced. However the characteristics of the fuses which were apparently unaffected are generally weakened by the stresses resulting from the short-circuit. Continued use under these conditions leads to the risk of inadvertently blown fuses at very low overcurrent values.

When service continuity is essential, replacement of the **entire set of fuses** is therefore recommended as per EC and UTE standards.

(1) For any other starting mode, please consult us.

(2) Starts uniformly distributed over the hour.

(3) These values correspond to the breaking capacity of the Rollarc contactor.

current transformers

For PMC, QMC and QCS, CRM units:
Type **TCM6 A1** transformers, protected by fuses.

Rated output: 15 VA.

Accuracy class: 0.5.

Rated secondary current: 5 A.

One or two primary currents.

For IMC and SMC, GMC, GCT, CRM units:

Type **TCM6 A2**, transformers, to be

protected by supply-side breaker.

Rated secondary current: 5 A.

Single primary current.

Measurement:

Rated output: 15 VA (for 30 VA, consult us).

Accuracy class: 0.5 or 1.

Protection:

Rated output and accuracy class:

15 VA 10P5 or 5 VA 10P10 (or 10 VA 10P5 with two primary currents).

For DM12 and DM23 units:

Type **TCN6 B** transformers, with two secondary windings:

■ 1 secondary for measurements, 5 A, 15 or 30 VA, class 0.5,

■ 1 secondary for protection, either: 1 A, 1 VA, class 10P30 with Statimax protection RAH 411 E, or 5 A, 2.5 VA, class 10P15.

Double secondary CT's can be replaced by single secondary CT's of the same characteristics.

Note

For durations other than 1 s, the thermal withstand is calculated using the formula:

$$I_{th}(t) = \frac{I_{th}(1s)}{\sqrt{t}}$$

Note

A new generation of RCM6 and RTM6 instrument transformers with equivalent or superior characteristics will gradually replace types TCM6 and TPM6 (please consult us).

Rated thermal short-time current (I_{th}) (in kA)

single rated primary current

1 primary in A	5	10	15	20	30	50	75	100
I _{th} in kA - 1 s	0.4	0.8	1.2	1.6	2.4	4	4	4

dual primary ratio by tapped secondary winding

I primary in A	10-20	15-30	20-40	25-50	30-60	50-100
I _{th} in kA- 1 s	1.6	2.4	3.2	4	4	4

Rated thermal short-time current (I_{th}) (in kA)

		12.5		16		21	
accuracy class		0.5	1	0.5	1	0.5	1
I primary (in A)	50	0.2 s	1 s	0.2 s	0.8 s	0.2 s	
	60	0.2 s	1 s	0.2 s	0.8 s	0.2 s	
	75	0.4 s	1 s	0.2 s	1 s	0.2 s	1 s
	100	1 s		1 s		0.2 s	1 s
	200 to 600	1 s		1 s		1 s	

Rated thermal short-time current (I_{th}) (in kA)

	12.5	16	21	26.3	31.5
duration (in sec)	1 0.8 0.4 0.2 1 0.8 0.4 0.2 1 0.8 0.4 0.2 1 0.8 0.4 0.2 1 0.8 0.4 0.2				
rated primary current (in A)	10				
	15				
	20				
	25				
	30				
	40				
	50				
	60				
	75				
	100 to 250				
	300 to 600				
	750 to 1250				

D 15 VA, class 0.5 and 1 VA 10P30
■ 30 VA, class 0.5 and 1 VA 10P30.

voltage transformers

unit type	DM23 - CM - GMT - GCT	DM12- SM2
transformer type (VT)	RTM6	RTS RTC
highest system voltage (kV)	24	24
primary voltage (kV)	10/-/3"- 15/-/3- 20/-/3"	20/-/3 20
secondary voltage (V)	100/-/3	100/-/3 100
rated thermal output (VA)	250	350 ⁽¹⁾ 500

Accuracy class and rated output

transformer	RTM6	RTS	RTC
class	0.5 1 3	0.5 1 3	0.5 1 3
single primary voltage	30/50/80 100/125/150 175/200	30/50 80/100 125/150 175/200 300 max	30/50 80/100 125/150 175/200 400 max
two primary voltages ⁽²⁾	30/50 80/100/125 150/175	50 125 200	50 125 200
special VT with two primary voltage 10 or 20 kVA/3"	30/50 50 for 10 kV 100 for 20 kV	100 for 10 kV 200 for 20 kV	

Single primary voltage and two secondary windings (please consult us).

(1) For type RTS transformers with two separate secondary windings, the thermal output is 175 kV per secondary.

(2) The ratio of the two primary voltages should not exceed 1.35.

VM6

protection and monitoring equipment

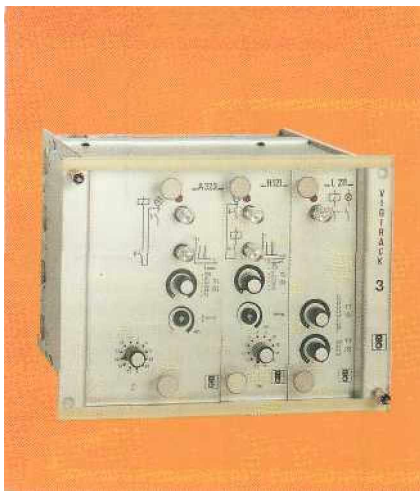
Statimax protection



For DM12, DM23 and QM units (except for Buchholz tripping). Operating **without auxiliary power**, the Statimax system includes:

- sensors made up of:
 - 3 low voltage matching toroids,
 - 1 zero phase sequence protection transformer,
 - an RAH 411 E relay with 3 settings adjustable on the front panel:
 - z phase threshold between 1 and 78 primary In with In/1 A CT, or 1 to 15.6 primary In with In/5 A CT,
 - zero sequence threshold between 0.06 and 0.8 primary In with In/1 A CT, or 0.12 to 1.6 primary In with In/5 A CT,
 - trip delay between 100 and 400 ms.
- The energy produced by the protection CT's is used to operate the relay. When the fault current exceeds one of the pre-set thresholds and after the adjusted time setting, all the energy supplied by the CT's is used to power the Mitop release which controls the tripping of the circuit-breaker or switch.
- 1 Mitop 1500H trip release. This release is based on a low-consumption bistable electromagnet. It is automatically reset at the end of the opening of the circuit-breaker or switch.
- No-load mechanical response time: 6 ms.
Full details concerning the Statimax system are presented in document AC35E

Vigirack relays



The name Vigirack covers a range of modular static relays in the form of cards which are plugged into racks (see document AC35E and specific literature).

The following are the main cards used:
A: overcurrent,
H: zero sequence overcurrent.

Sepam



Measurement, protection, automatic control and teletransmission functions are performed by a programmable electronic system:

- measurements: I, Io (zero sequence) I max., U, W, VAR, Wh, VARh.
 - protections: three-phase overcurrent, zero sequence overcurrent, single-phase undercurrent, delayed start-up or locked motor rotor, negative sequence overcurrent (unbalance), thermal image, number of start-ups control, undervoltage overvoltage, phase current directional (1) zero sequence current directional (1).
 - automation: the automation programme contained in a memory cartridge can be reprogrammed. It replaces the conventional relaying usually performed by discrete elements.
 - remote transmission: the Sepam is equipped with a serial transmission coupler to establish conversation with a centralized system: programmable controller or computer.
 - permanent self-monitoring with alarm
 - the Sepam performs permanent self-diagnosis of its internal functions
 - confidential access code for parameter modification.
- See document AC68E.

(1) Consult us.

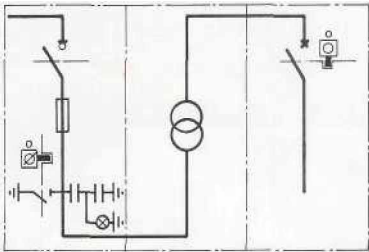
VM6

interlocks

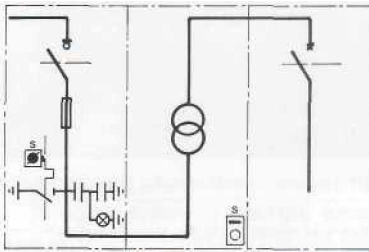
description

- the functional switching device can only be closed if the earthing switch is open and the front panel in place,
 - the earthing switch can only be closed if the functional switching device is open,
 - the functional switching device is locked in open position when the access panel is removed. The earthing switch can then be operated.
- In addition to functional interlocks, each cubicle includes:
- built-in padlocking facilities (padlocks not supplied),
 - five knock-out holes for the installation of locks (locks supplied on request) for possible intercubicle interlocking.

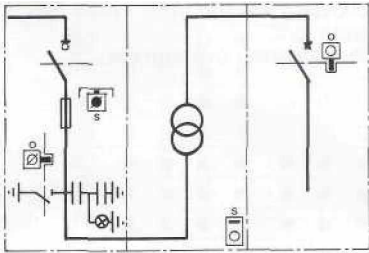
principle examples of interlocks



Type A1



Type C1



Type C4

outgoing units

Aim

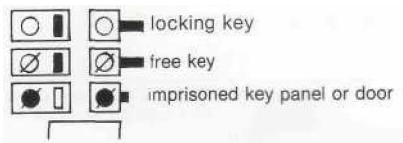
To prevent the closing of the earthing switch of a transformer protection switch cubicle (and thus access to the medium voltage fuses) unless the LV circuit-breaker is locked in "open" or "disconnected" position.

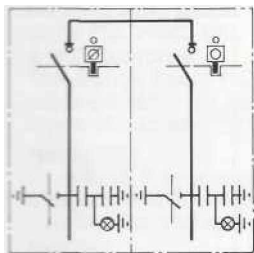
To prevent access to the transformer until the earthing switch of its "protection" cubicle has been locked in "closed" position.

To prevent closing of the earthing switch and access to the medium voltage fuses on a transformer protection "switch" cubicle unless the LV circuit-breaker is locked in "open" or "disconnected" position.

To prevent access to the transformer until the earthing switch has been closed.

Caption lock



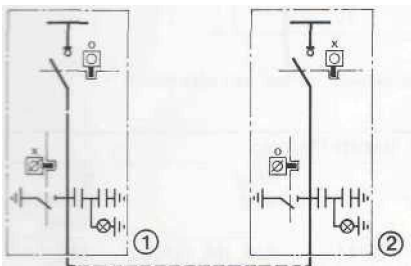


Type A4

ring units

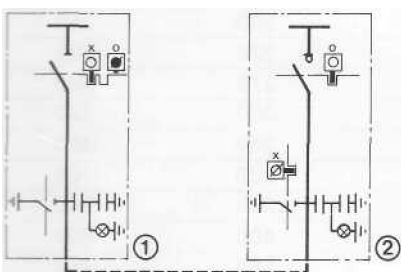
Aim

To prevent the simultaneous closing of two switches.



Type P1

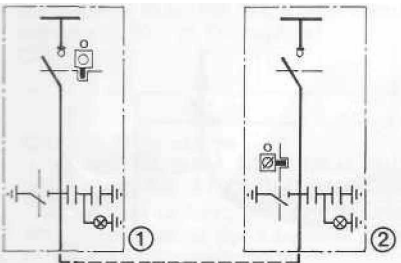
Interlocking between two "switch" cubicles interconnected by cables via the bottom:
to prevent closing of the earthing switch unless the switch of the other cubicle is locked "open".



Type P2

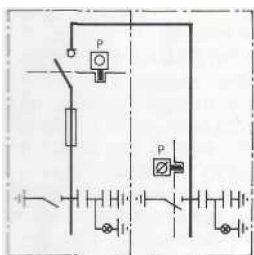
Interlocking between a "disconnecter" cubicle and a "switch" cubicle interconnected by cables via the bottom:

- to prevent on-load operation of the disconnecter unless the switch is locked "open",
- to allow off-load operation of the switch.



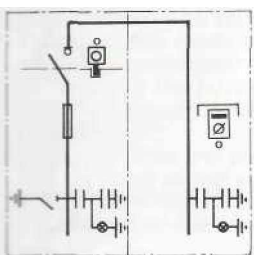
Type A3

To prevent the closing of the earthing switch of a load-side cubicle unless the line-side switch is locked "open".



Type P5

To prevent the closing of the earthing switch of a "bus" cubicle unless the line-side cubicle is locked in "open" position.



Type R5

To prevent access to the cable heads of a "bus" cubicle unless the switch of a line-side cubicle is locked in "open" position.

VM6
connection

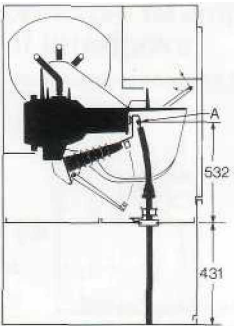
units
 SM, IM, GAM, DDM, NSM,
 BCM, SMC, IMC, PM, PMC,
 QM, QMC, CRM

connection with dry-type cables

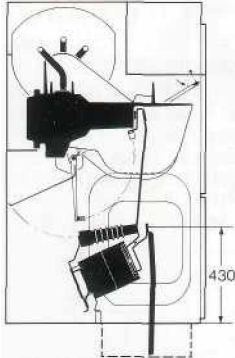
Dry-type cables are connected by simplified terminations:
 ■ with field deflector or linear voltage distributor for type HN33S22 aluminium or copper **single-core cables**,
 ■ with linear voltage distributor for type HN33S23 aluminium **single-core** or **three-core cables**.
 The lugs must be bolted to the terminal pads by means of 12 mm diameter screws tightened to 3.75 daNm.
 Tightening capacity for a screw of 0 8:2.8mdaN.

Three-core cables must be separated before entering the cubicle.
Cabling from below
 units SM, IM, GAM, DDM, NSM, BCM, SMC, IMC.

■ through trenches
 The trench depth P is given in the adjacent table for commonly used types of cables.
Note
 To reduce P or eliminate trenches altogether, it is possible to place the cubicles on 350 mm special stands or footings



IM switch cubicle, vertical exit with trench



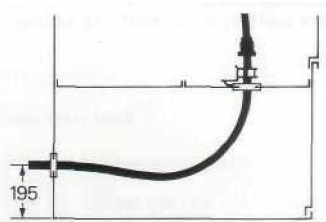
IMC cubicle, vertical exit with trench

Cabling from below through trenches

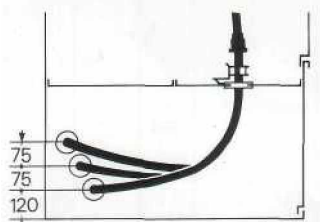
cable type	cable X-section (mm ²)	bending radius (mm)	trench depth P (mm)		
			front or rear exit	side exit	all orientations
			SM, IM, GAM, NSM, DDM, BCM	SM, IM, GAM, NSM, DDM, BCM	IMC SMC
single-core cable	25-35-50	370	150 ⁽¹⁾	175	520
	70	400	150 ⁽¹⁾	220	550
	95	440	150 ⁽¹⁾	225	600
	120-150	500	220 ⁽¹⁾	275	650
	185	540	220 ⁽¹⁾	300	700
	240	590	250 ⁽¹⁾	350	750
single or three-core cable	50	550	220 ⁽¹⁾	330	700
	95	610	250 ⁽¹⁾	350	750
	150	670	300 ⁽¹⁾	400	800
	240	850	550	550	950

(1) For exit with conduit: at least 350 mm.

■ **without trenches or stands**
 Cabling is possible from the rear or from either side, for cable with bending radius ≤ 370 mm.



IM switch cubicle, rear exit without trench



IM switch cubicle, left or right side exit without trench

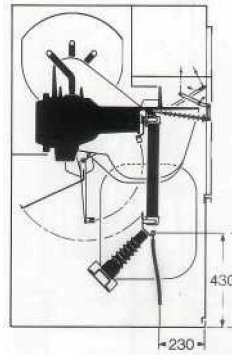
Cabling from below units PM, PMC, OM, QMC, CRM

■ with trenches

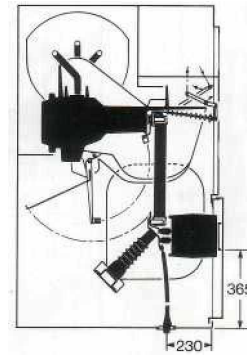
The trench depth P is given in the adjacent table for commonly used types of cables.

Note

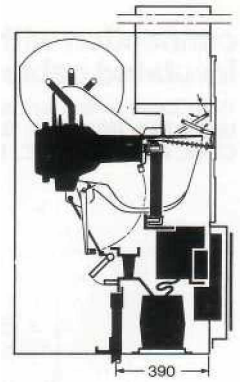
To reduce P or eliminate trenches altogether, it is possible to place the cubicles on 350 mm special stands or footings.



QM protection unit



QMC protection unit



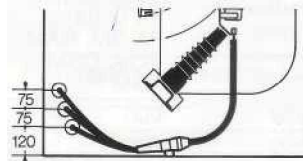
CRM unit

Cabling from below through trenches

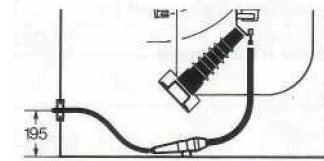
cable type	cable X-section (mm ²)	bending radius (mm)	trench depth P (mm)		
			PM, QM	PMC, QMC	CRM
single-core cable	35	340	350	350	350
	50	370	400	400	400
	70	400	450		450
	95	440	500		500
	120	470			550
single or three- core cable	50	550	600	600	600
	95	610	700		700

■ without trenches or stands

Cabling is possible from the rear or from either side, for cable with bending radius < 370 mm (except for CRM units).



Side exit (PM unit)



Rear exit (QM unit)

Cabling from above units SM, IM, GAM, DDM, NSM, BCM, SMC, IMC, PM, PMC, QM, QMC, CRM

This type of cabling is only possible for single cubicles or for a cubicle located at the end of a switchboard.

Single cubicle without busbars

■ without cable-connection compartment:

1 copper or aluminium cable per phase, up to 240 mm², with cranked lugs, or 2 copper cables per phase, up to 50 mm², lugs of our supply,

■ with cable-connection compartment:

1 cable per phase up to 240 mm²,

□ with simplified cable end.

The compartment is equipped with neon indicators for cable terminals. An external LV compartment cannot be mounted (for CRM, please consult us). Height: 650 mm. Cable tie-down facility: 150 mm.

Switchboard with busbars:

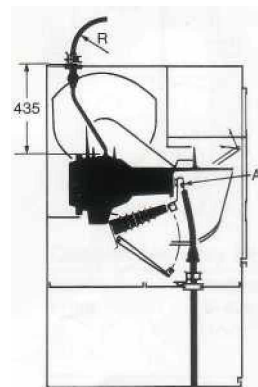
Connection is made to the terminal pads of a switchgear unit at one extremity of the busbar:

■ without cable-connection compartment:

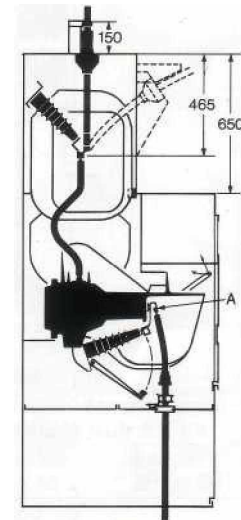
1 copper cable per phase, up to 50 mm², lugs of our supply,

■ with cable-connection compartment:

1 cable per phase up to 240 mm²,



Without cable compartment



With cable compartment

□ with simplified cable end. The compartment is equipped with neon indicators for cable terminals. The external LV compartment cannot be mounted. Height: 650 mm. Cable tie-down facility: 150 mm.

VM6

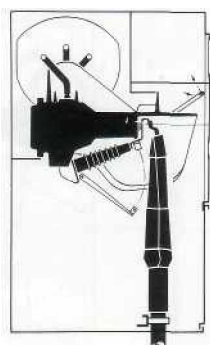
connection (cont.)

units
SM, IM, GAM, DDM, NSM,
BCM, SMC, IMC, PM, PMC,
QM, QMC, CRM

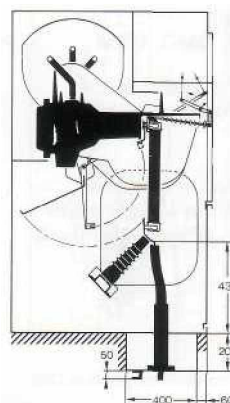
connection with paper insulated cables

With heat shrink ends

Units SM, IM, GAM, DDM, NSM, BCM,
CRM, PM, QM, SMC, IMC, PMC, QMC.



IM switch unit



Units PM and QM

Cabling from below, only with trenches

See the various types of trenches on the following page.

The trench depth P depends on:

- cable cross-section,
- cable orientation before entering the cubicle.

Note

To reduce P or eliminate trenches altogether, it is possible to place the cubicles on 350 mm special stands or footings.

The lugs must be bolted, to the terminal pads (A) by means of a 12 mm diameter screw tightened to 3.75 daN.m.

Tightening capacity for a screw Ø 8:2.8mdaN.

Single-core cables

cable X-section (mm ²)	bending radius (mm)	trench depth P (mm) for cubicles SM, IM, GAM, DDM, NSM	
		front or rear exit	side exit
50	450	150 ⁽¹⁾	300
70 to 95	530	150 ⁽¹⁾	300
120-150	560	200 ⁽¹⁾	350
240	600	250 ⁽¹⁾	350

(1) For exit with conduit: at least 350 mm.

Three-cables

cable X-section (mm ²)	bending radius (mm)	trench depth P (mm)			
		for units: IM, SM, GAM BCM, DDM, NSM ⁽²⁾	IMC SMC	CRM	PM, QM PMC, QMC
16 to 50	520	600	840	840	840
70	560	600	890	890	
95	610	650	940	940	
120	680	700	1020	1020	
150 to 185	720	750	1060		
240	780	800	1130		
300	830	850	1180		

(2) IM, SM, GAM, BCM, DDM, NSM units do not require a bottom pan.

connection with dry-type cables

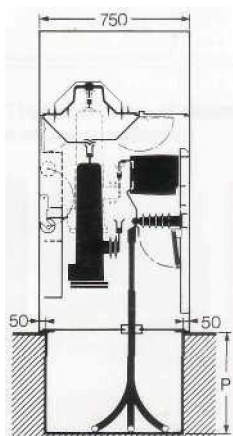
Dry-type cables are connected by simplified terminations:

■ with field deflector or linear voltage distributor for type HN33S22 aluminium or copper **single-core cables**,

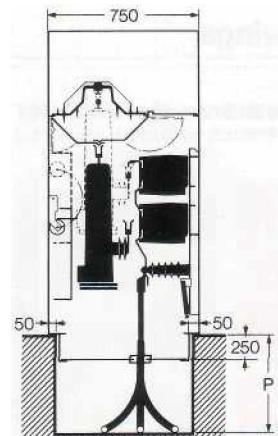
■ with linear voltage distributor for type HN33S23 aluminium **single-core** or **three-core cables**.

The lugs must be bolted to the terminal pads by means of 12 mm diameter screws tightened to 3.75 daN.m.

Three-core cables must be separated before entering the cubicle.



DM12 unit
with 3 CT's



DM12 unit
with 6 CT's or 3 CT's + 3 VT's

Cabling from above

Possible with or without cable compartment (see p. 27).

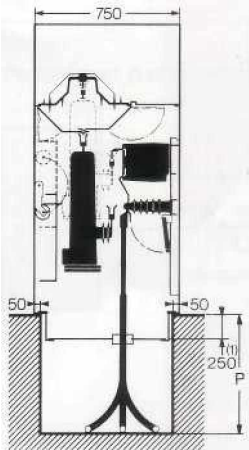
Cabling from below through trenches

cable type	cable X-section (mm ²)	bending radius (mm)	trench depth P (mm)		cubicle with 6 CT's	
			series 12 to 20	series 25 to 30	series 12 to 20	series 25 to 30
single-core cable	50 to 95	440	550		850	
	120 to 150	500	600		900	
	185	540	650		950	
	240	590	700	700	1000	1000
	300	640	750	750	1050	1050
single or three-core cable	95	610	700		1000	
	150	680	750		1050	
	240	780	950	950	1250	1250

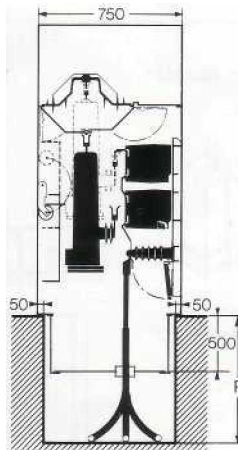
(1) 250 mm bottom pan for 9 or 12 cables.

connection with paper insulated cables

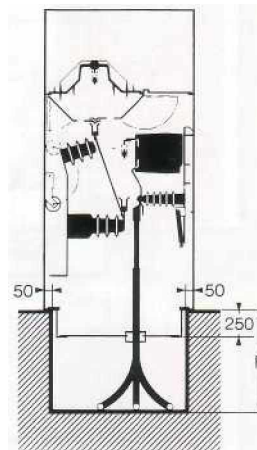
With heat shrink ends.



DM12 unit with 3 CT's



DM12 unit with 6 CT's
or 3 CT's + 3 VT's



SM2 unit with 3 CT's

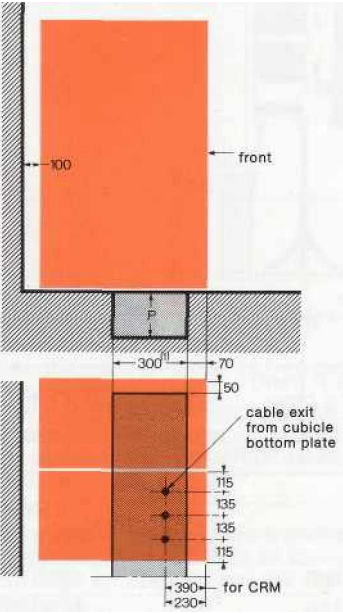
Connection only from below with trenches

cable type	cable X-section (mm ²)	bending radius (mm)	Trench depth P (mm)		cubicle with 6 CT's	
			series 12 to 20	series 25 to 30	series 12 to 20	series 25 to 30
single-core cable	50 to 95	480	860		1160	
	120 to 150	530	900		1200	
	185	560	950	1250		
	240	600	1000	1000	1300	1300
	300	640	1050	1050	1350	1350
three-core cable	50 to 95	610	1000		1250	
	120 to 150	680	1080		1340	
	185	730	1130		1380	
	240	780	1190	1190	1450	1450
	300	840	1250	1250	1500	1500

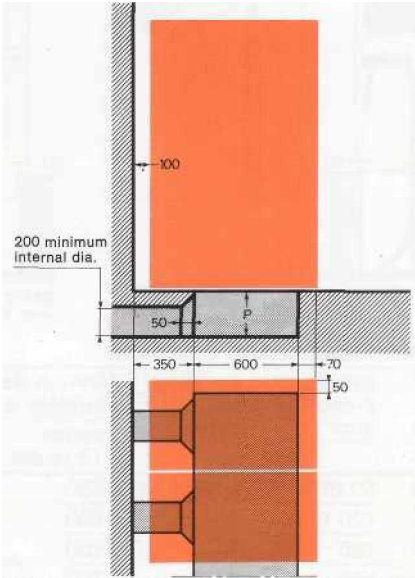
(1) Bottom pan for 500 to 630 A series 25-30 and 1250 A for two three-core cables.

trench drawings

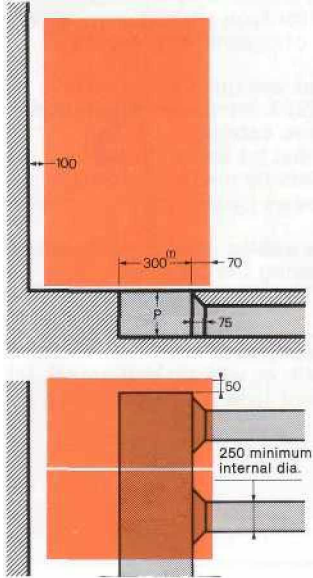
Cable entry or exit from the RH or LH side through a trench



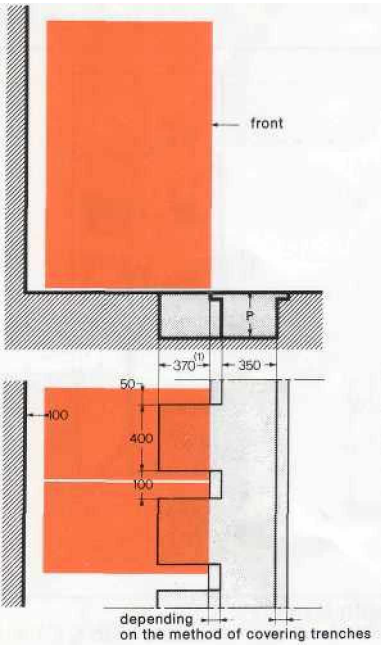
Through a rear conduit



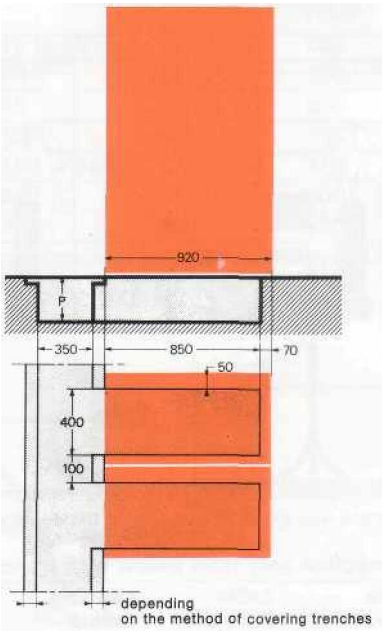
Through a front conduit



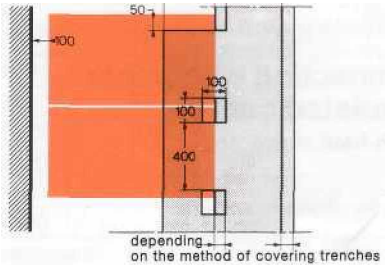
Through a front pit with stand



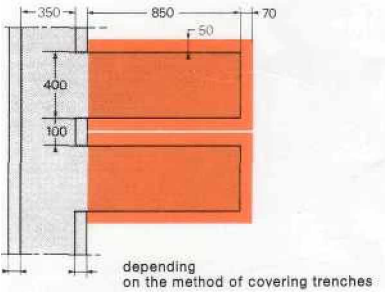
Through a rear pit with stand



Through a front pit with supports between cubicles



Through a rear pit with supports between cubicles

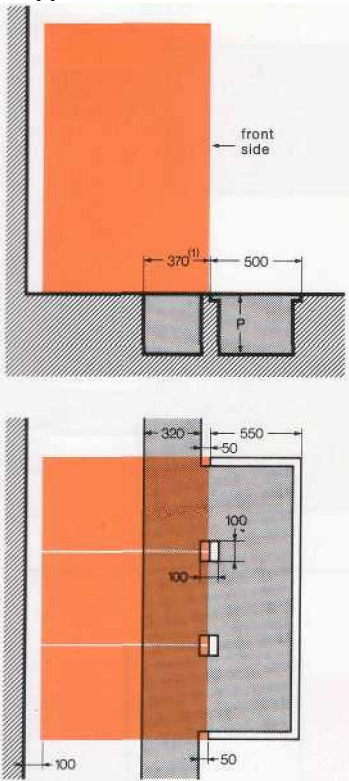


(1) 430 for CRM
(2) 500 for CRM
Trench depth P: see preceding pages.

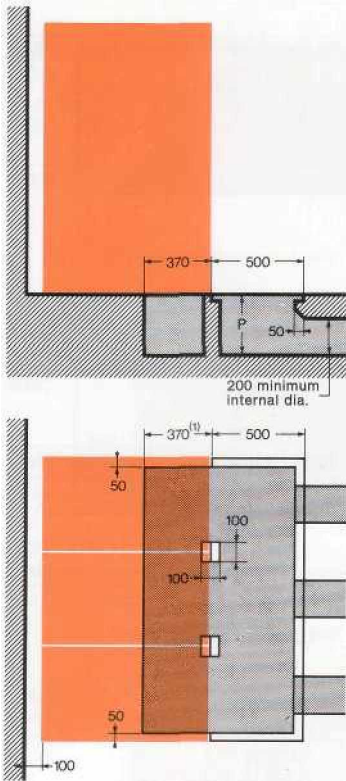
units
SM, IM, GAM, DDM, NSM,
BCM, SMC, IMC, PM, PMC,
QM, QMC, CRM

trench drawings

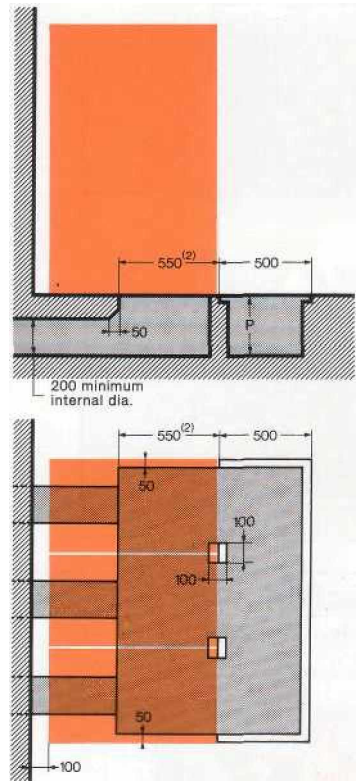
Cable entry or exit from the RH or LH side through a trench and with supports between cubicles



Through a front conduit with supports between cubicles

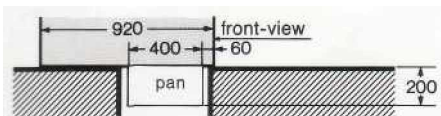
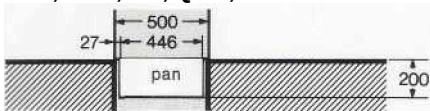


Through a rear conduit with supports between cubicles

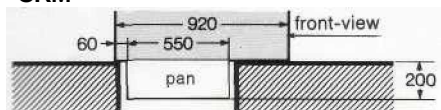


Cubicles requiring a bottom pan (IMC, SMC, PM, PMC, GMC, CRM)
for connection with paper-insulated cables with heat shrink ends. Modify the civil works as indicated below.

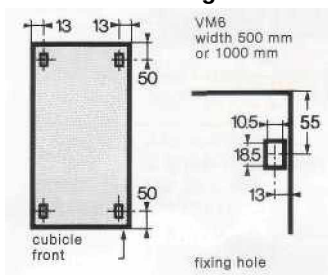
IMC, SMC, PM, QMC, PMC



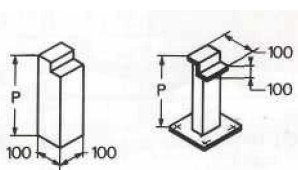
CRM



Position of fixing holes



Detail of a support



Concrete

steel

(1) 500 for CRM

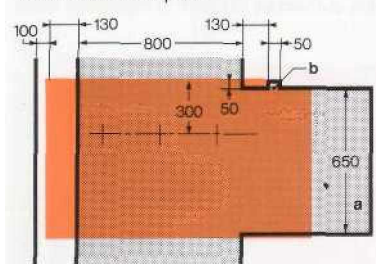
(2) 680 for CRM

Trench depth P: see preceding pages.

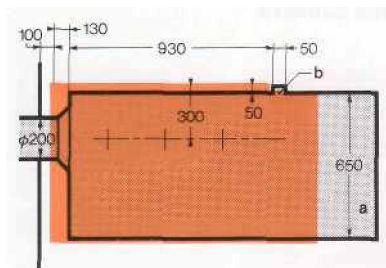
trench drawings

Cable entry or exit from the RH or LH side through a trench

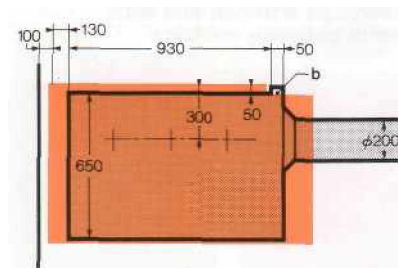
DM12 without pan



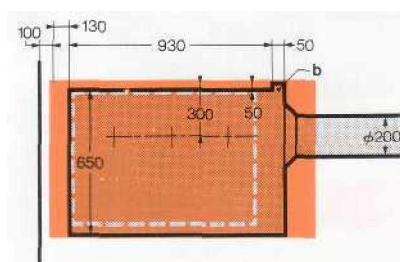
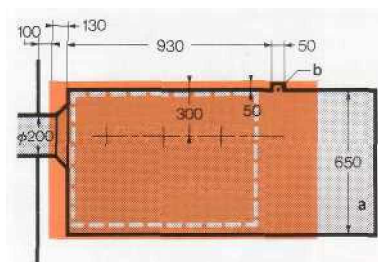
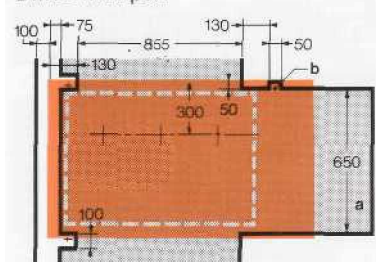
Through a rear conduit



Through a front conduit

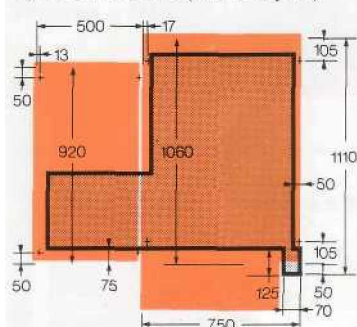


DM12 with pan

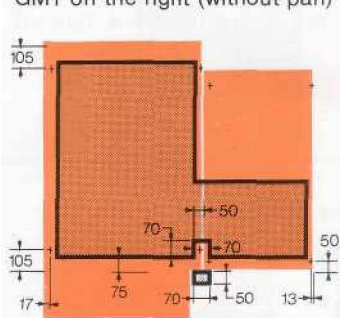


connection with GMT unit

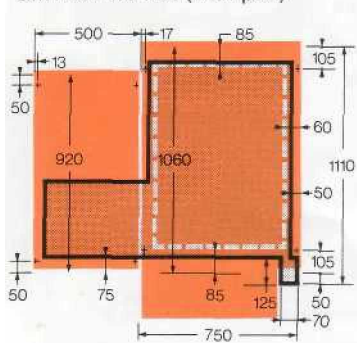
GMT on the left (without pan)



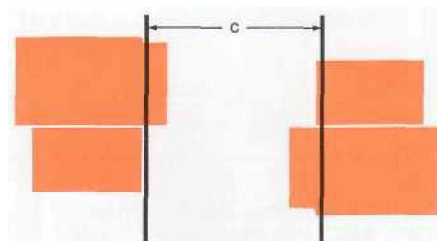
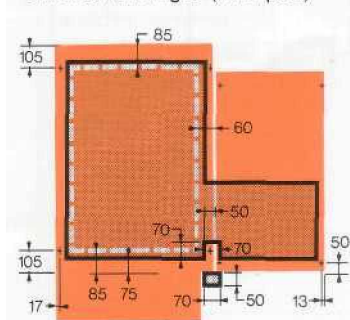
GMT on the right (without pan)



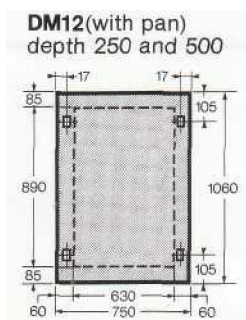
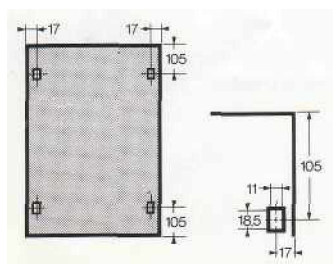
GMT on the left (with pan)



GMT on the right (with pan)



a. Pit to facilitate cable termination preparation.
b. Space for bringing in LV wiring.
c. Front: leave 1500mm free to allow removal or breaker truck.



connection of several dry cables per phase

The tables below represent the standard connection possibilities.
For other cases, please consult us.

Max X-section (mm ²)			
SM, IM, NSM, BCM	3 dry-type cables	trench rear ⁽¹⁾ side ⁽¹⁾	240 50 50
	6 dry-type cables	trench ⁽²⁾ trench+ rear ⁽¹⁾ trench+ side ⁽¹⁾	240 3 x 240 + 3 x 50 3 x 240 + 3 x 50
SMC, IMC, DDM	3 dry-type cables	trench	240
PM, QM, PMC, QMC	3 dry-type cables	trench rear side	50 50 50
	3 dry-type cables	trench rear side ⁽¹⁾	240 150 95
GAM	3 dry-type cables	trench rear side ⁽¹⁾	240 150 95
	6 dry-type cables	trench trench + rear trench + side	240 3 x 240 + 3 x 150 3 x 240 + 3 x 95
CRM	3 dry-type cables	trench	120
	6 dry-type cables	trench	120
SM2	3 dry-type cables	trench	630 alu 500 Cu
	6 dry-type cables	trench	630 alu 500 Cu
	9 or 12 dry-type cables	trench	400 alu 300 Cu
GMT, GCT	3 dry-type cables	trench	50

(1) For termination with field deflector only.

(2) For tension with linear voltage distributor only.

Units DM12, GAM2

Cabling through trenches

unit characteristics		In/A series	400 12/14	630 12 to 20	1250 25/30	1250 12 to 30
		CT's	VT's			
3 single-core	Alu ≤ 240 [□]	0 to 6	0	□	□	
	Cu ≤ 300 [□]	0 to 3	1 to 3	□	□	
	240 [□] < Alu ≤ 630 [□]	0 to 6	0		■	■
	300 [□] < Cu ≤ 500 [□]	0 to 3	1 to 3		■	■
6 single-core cables	Alu ≤ 240 [□]	0 to 6	0	□	□	
		0 to 3	1 to 3	□	□	
	Cu ≤ 300 [□]	0 to 6	0	■	■	
	or Alu + Cu	0 to 3	1 to 3	□	□	
	240 [□] < Alu ≤ 630 [□]	0 to 6	0		■	■
	300 [□] < Cu ≤ 500 [□]	0 to 3	1 to 3		■	■
9 or 12 single-core cables	Alu maxi. 2 x 240 [□] + 1	0 to 3	0	□	□	
	(or 2) x 95 [□]	0 to 3	1 to 3	■	■	
	Cu maxi. 2 x 120 [□] + 1	4 to 6	0	□	□	
	(or 2) x 50 [□]					
	Alu ≤ 400 [□]	0 to 3	0		■	■
	Cu ≤ 300 [□]	0 to 3	1 to 3		■	■
1 three-core cable	Alu ≤ 300 [°]	0 to 6	0	□	□	
	Cu ≤ 300 [°]	0 to 3	1 to 3	□	□	
		4 to 6	0	□	□	
2 three-core cables	Alu ≤ 300 [°]	0 to 3	0	□	□	■
	Cu ≤ 300 [°]	0 to 3	1 to 3	□	□	■
		4 to 6	0	□	□	■

□ 125 kV impulse wave

■ 95 kV impulse wave

VM6 installation

preparation

The switchgear units are for erection on simple concrete floor, with or without covered trenches according to the cable cross-section and type.

heightening stands

To reduce the depth of the trenches by 350 mm or even to dispense with them, in many applications, the switchgear units can be mounted on 350 mm high stands. Two types are available:

- metal stands of our manufacture;
- concrete stands made at the time of the civil work.

Heightening the units allows their installation in locations where trenches cannot possibly be cut while it does not hinder the service operations of the substation.

fixing of the units

With each other

The switchgear units are simply bolted together to form the MV switchboard. The fixing bolts are of our supply.

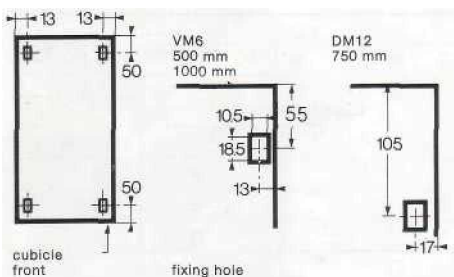
On the floor

■ for switchboards of up to four units, it is necessary that the four corners of the switchboard be secured to the floor by one of the following methods:

- adherence to the floor: clean the concrete surface prior to placing the adhesive strip;
- foundation nuts: place the nuts which receive the screws in position into the floor by means of a sealing pistol;
- foundation screw rods grouted in the floor.

■ for a switchboard of more than four units, floor fixing points should be determined to installation requirements (e.g. earthquake resistance, etc.).

- position of the fixing holes.



dimensions and weights

dimensions in mm				weight in kg
type of unit	height	width	depth on the floor	without CT's or VT's
SM	1500 ⁽¹⁾	500	920	145
SM2	1500 ⁽¹⁾	750	1060	270
JM	1500 ⁽¹⁾	500	920	145
DDM	1500 ⁽¹⁾	1000	920	330
NSM	1500 ⁽⁵⁾	1000	920	340
PM/QM	1500 ⁽¹⁾	500	920	155
QCS	1500 ⁽¹⁾	1000	920	335
DM12	1500 ⁽¹⁾	750	1060 ⁽³⁾	300
DM23	1500 ⁽¹⁾	1000	1050 ⁽³⁾	490
GAM	1500 ⁽¹⁾	500	920	115
GAM2	1500 ⁽¹⁾	750	1060	200
GBM	1500 ⁽¹⁾	500	920	120
GBM2	1500 ⁽¹⁾	750	1060	200
GIM	1500 ⁽¹⁾	100	920	30
GMT/GMC/GCT	1500 ⁽¹⁾	500	920	120
GMC2	1500 ⁽¹⁾	750	1060	200
CM/TM	1500 ⁽¹⁾	500	920	155
BCM	1500 ⁽¹⁾	500	920	150
CRM	1925 ⁽⁴⁾	500	920	250

(1) For LV top box, add 425 mm to the height.

For cabling from above with HV cable-connection compartment, add 650 mm to the height. These values may have to be increased to account for cable bending (see p. 26).

(2) Add 10 kg per TCM6-A2 CT, 22 kg per TCM6-B CT, and 33 kg per VT.

(3) Add 225 mm to the front for the operating mechanism.

(4) The 1925 mm height includes the 435 mm of the LV box designed to house the auxiliaries.

(5) 1925 mm for NSM with automatic generating set startup system

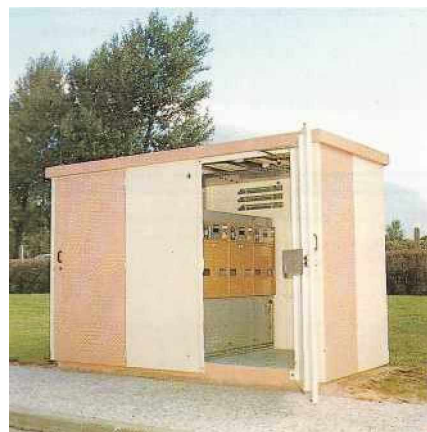
further details

- for substation commissioning and other installation details, see document no. 7895616,
- for service operating instructions of the different units, please consult us,
- for LV cable runs, see document no. 7895804.

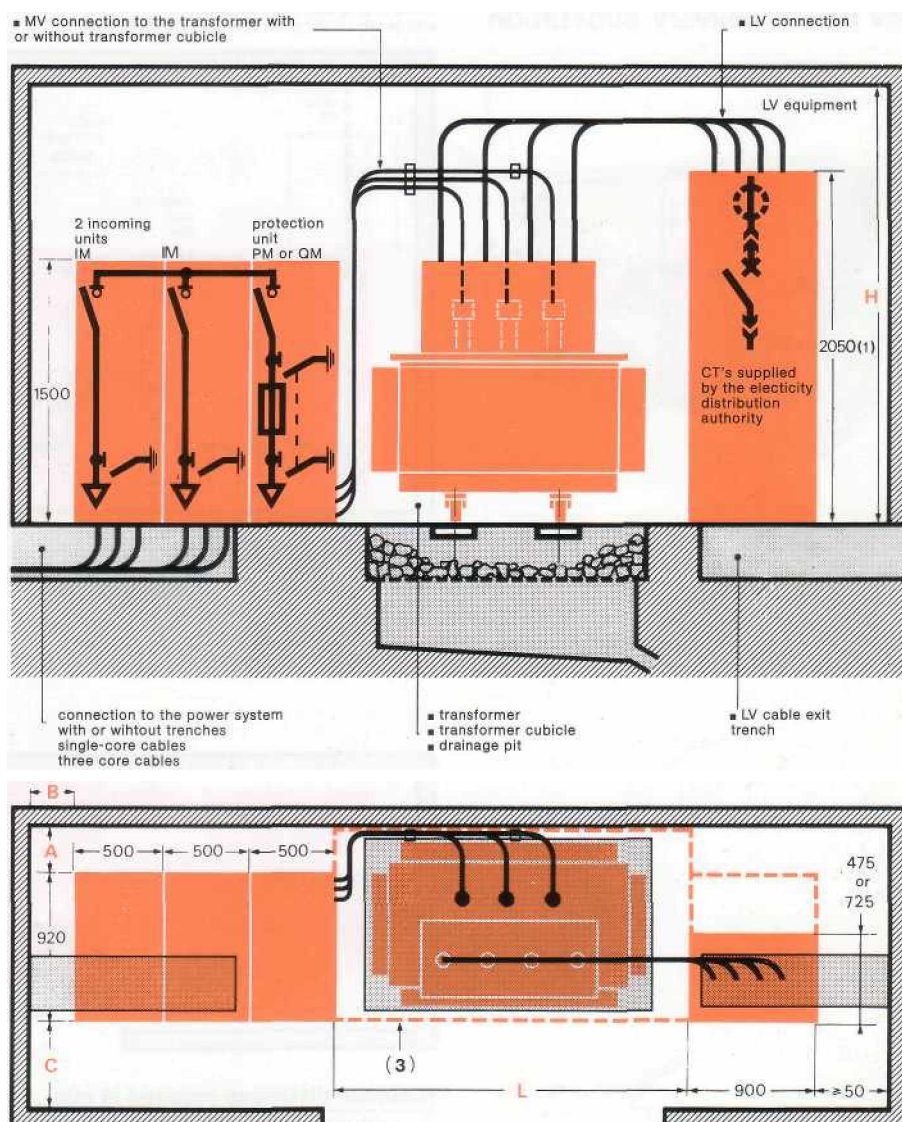
consumer substation with LV metering



B120 transformer substation with Vercors M6 cubicles



D60 transformer substation with Vercors M6 cubicles



Minimum distances required in mm

A	with or without rear cabling by dry-type cables up to 50 mm ²	P > 1000kVA	220 ⁽²⁾
		P < 1000kVA	565 ⁽²⁾
B	without lateral cabling (dry-type cables) or earthing connection		25
	with earthing connection or with lateral cabling by dry-type cables up to 50 mm ²		100
C	minimum distance for operation and handling	switchboard without transformer or circuit-breaker unit	1100
		switchboard without transformer but with circuit-breaker unit	1500
H	MV switchboard, with or without top cabling, with or without transformer cubicle, with type-P6 LV cubicle	power (P) < 1000 kVA	2350
		power (P) > 1000 kVA	2800
L	varies with the transformer kVA output, with or without transformer cubicle (TR50)	50-100 (TR52)	1200
		10-200-250 (TR53)	1600
		315-400-500-630-800-1000 (TR56) ⁽⁴⁾	2000
		1250 (TR58) ⁽⁵⁾	2400

(1) For Merlin Gerin LV equipment.

(2) Side cabling cannot be provided if the units incorporate CT's.

(3) (TR) cubicle depth, if applicable, 1105 or 1450 mm.

(4) TR56 for 1000 kVA transformer:

B1 (220 V) primary 20 kV, 10/20 kV or 15/20 kV (reduced power),

B2 (380 V) primary 15/20 kV (maintained power).

(5) TR58 for 1250 kVA transformer:

B2 primary 20 kV or 10/20 kV,

B1, B2 primary 20 kV or 10/20 kV (reduced power),

B2 primary 15/20 kV (reduced power).

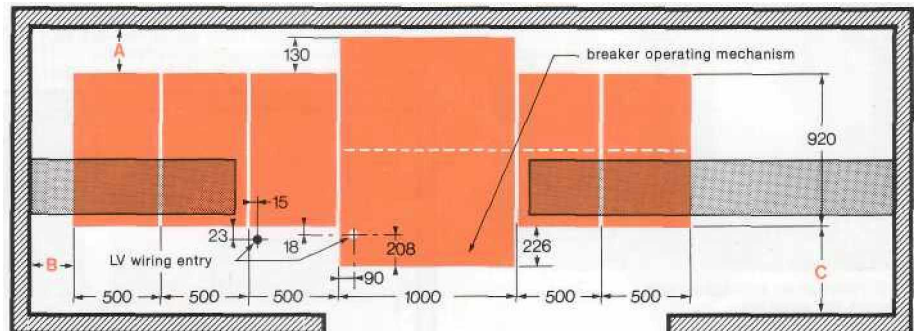
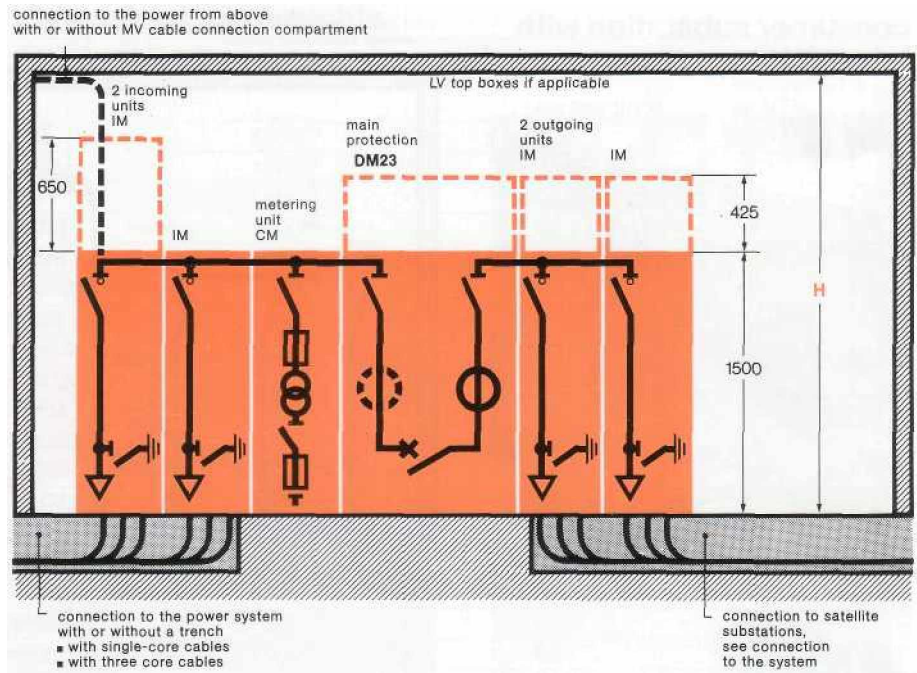
VM6

layout examples (cont)

MV power delivery substation



Substation with general protection and MV metering



Minimum distances required in mm

A	without rear cabling	without breaker unit	100
		with breaker unit	180
	with rear cabling, dry-type cables up to 50 mm ² , without trenches, with or without breaker unit		200
B	without side cabling (dry-type cables) or earthing connection		25
	with earthing connection or with side cabling by dry-type cables up to 50 mm		100 ⁽¹⁾
C	minimum distance for operation and handling	switchboard without transformer or breaker unit	1100
		switchboard without transformer but with circuit-breaker unit	1500
H	without top cabling	or LV top box	1900
		with LV top box	2325 ⁽²⁾
	with top cabling	without MV cable compartment	1900
		and with MV cable compartment	2300 ⁽³⁾

(1) Side cabling cannot be provided if the units incorporate CT's.

(2) 2000 mm only if access to the busbars of the units with LV top box can be arranged from the side.

(3) The curve radius of cables must be taken into consideration. (See detail on p. 26).

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As standards specifications and designs change
from time to time, please ask for confirmation of
the information given in this publication.

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