M.V. distribution factory built assemblies

Vercors M6 system
3 to 24 kV

mastering electrical power
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<td></td>
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<td>Fixing of the cubicles, dimensions and weights</td>
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<td></td>
</tr>
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<td>Installation</td>
<td>Layout examples</td>
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<td></td>
</tr>
</tbody>
</table>
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,
  - 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.
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.

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.
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).

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.

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.
VM6
description (cont.)

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

Opening and closing by a lever.

Standard equipment on IM and PM cubicles.

CI2 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 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

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>DC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>9.8</td>
<td>4.8</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>DC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick-up</td>
<td>3.6</td>
<td>1.85</td>
</tr>
<tr>
<td>Permanent</td>
<td>0.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

- Operation guaranteed for supply voltage -20%.

- Mitop:
  - mechanical response time (no load): 6 ms.
  - supply voltage obtained from sensors: 20 to 48 Vdc.

(*) Other voltages: please consult us.
Gear motor

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

<table>
<thead>
<tr>
<th>Un(*)</th>
<th>dc 24</th>
<th>48</th>
<th>110</th>
<th>127</th>
<th>220</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 max startup (A)</td>
<td>11.6</td>
<td>5.9</td>
<td>2</td>
<td>2.35</td>
<td>1.15</td>
</tr>
<tr>
<td>1 mean (A)</td>
<td>3.7</td>
<td>1.7</td>
<td>0.63</td>
<td>0.75</td>
<td>0.48</td>
</tr>
<tr>
<td>powering time (s)</td>
<td>3.4</td>
<td>3.2</td>
<td>3.6</td>
<td>3.2</td>
<td>3.6</td>
</tr>
<tr>
<td>with CM, closing response time</td>
<td>3.1</td>
<td>2.8</td>
<td>3.5</td>
<td>3.1</td>
<td>3.5</td>
</tr>
</tbody>
</table>

(*) 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

<table>
<thead>
<tr>
<th>functional device</th>
<th>earthing switch</th>
<th>charged position</th>
<th>fuse blown</th>
<th>breaking capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>rotating contact</td>
<td>■</td>
<td>■</td>
<td></td>
<td>10A - 220 VAC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3A - 220 VDC</td>
</tr>
<tr>
<td>micro-contact</td>
<td>■ (DM12)</td>
<td>■</td>
<td>■</td>
<td>16A - 220 VAC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9A - 127 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4A - 48 VDC</td>
</tr>
</tbody>
</table>

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

Maximum quantities

<table>
<thead>
<tr>
<th>functional device</th>
<th>isolating switch</th>
<th>earthing switch</th>
<th>fuse blown</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, ICM, BCM</td>
<td>12</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>DDM, NSM</td>
<td>12</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>PM, PMC, QM, QMC</td>
<td>12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>SM</td>
<td>12</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>CM</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>GAM</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRM</td>
<td>12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>TM</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>DM12</td>
<td>17</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>DM23</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>SM2</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

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
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.

<table>
<thead>
<tr>
<th>Series selection</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24d</th>
</tr>
</thead>
<tbody>
<tr>
<td>rated voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rated insulation level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Hz - 1 min (kV rms)</td>
<td>20</td>
<td>28</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>impulse 1,2/50 fjs wave (kV peak)</td>
<td>60</td>
<td>75</td>
<td>95</td>
<td>125</td>
</tr>
<tr>
<td>service voltage (kV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.3</td>
<td>4.16</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>series</td>
<td>thermal withstand (kA rms 1 s)</td>
<td>Electrodynamic withstand (kA peak)</td>
<td>equivalent fault level (MVA)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>125</td>
<td>31.5</td>
<td>65</td>
<td>70</td>
</tr>
<tr>
<td>14</td>
<td>14.5</td>
<td>36.5</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>40</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>52.5</td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>25</td>
<td>26.3</td>
<td>65.5</td>
<td>135</td>
<td>150</td>
</tr>
<tr>
<td>30</td>
<td>31.5</td>
<td>79</td>
<td>165</td>
<td>180</td>
</tr>
</tbody>
</table>

(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

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Description</th>
<th>Rated Voltage (kV)</th>
<th>Rated Current (A)</th>
<th>Breaking Capacity (A rms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch-disconnector IM, DDM, NSM, QM, QCS</td>
<td>Incorporated in cubicles</td>
<td>7.2 to 24</td>
<td>400 or 630 A (1)</td>
<td></td>
</tr>
<tr>
<td>Switch-disconnector PM</td>
<td>Incorporated in cubicle PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit-breaker DM23 (2) and DM12</td>
<td>Incorporated in cubicles</td>
<td>7.2 to 24</td>
<td>400, 630 or 1250 A</td>
<td></td>
</tr>
<tr>
<td>Contactor CRM</td>
<td>Incorporated in cubicle CRM</td>
<td>7.2 to 12</td>
<td>400 A</td>
<td></td>
</tr>
</tbody>
</table>

(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:

- **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 In, PF = 0.7 (IEC 265), 3 breaks at 7 x fuse rated current, PF = 0.2 (IEC 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 In (IEC 56).

- **For cubicle CRM incorporating the Rollarc contactor:**
  - 300,000 operations at 250 A.
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 ± 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.
VM6

selection of functions (cont.)

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 motors,
■ 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 automatic 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 (Un) for an adjustable period of 0.1, 0.2, 0.4, 0.6, 0.8, 1, 1.5 or 2 seconds (T1) and voltage present on the standby supply incomer.
    2. transfer.
  ■ return to main power supply (fig. 3)
    1. voltage return on the main supply (Un) for an adjustable period of 5, 10, 20, 40, 80, 100 or 120 seconds (T2).
    2. return transfer.
■ transfer to a generating set with relay RNS 11
  ■ transfer to generating set (fig. 4)
    1. voltage loss on main supply (Un) for 1 to 15 seconds (T1, factory adjusted).
    2. generator set startup (T2).
    3. transfer when generating set voltage is available (external relay).
  ■ return to main power supply (fig. 5)
    1. voltage return on the main supply (Un) for a factory adjusted period of between 60 and 120 seconds (T3).
    2. return transfer.
    3. generating set shutdown 6 seconds after return transfer (T4).
■ 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

**GAM2**  
Incoming connection unit

**PM, PMC (with CT)**  
Transformer protection

---

**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.  

---

**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.  

---

**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 x In at PF = 0.2).
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.

**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 disconnecter,
- earthing switch on line side of load-side disconnecter,
- 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.

**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 disconnector,
- three-pole busbars,
- direct manual operating mechanism,
- earthing switch,
- 3 RTM6 with 8.3 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,
- disconnector,
- 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

![Diagram of SM, SMC (with CT)](image)

**SM2, SM2C (with CT)**

Unprotected incomer or outgoer

![Diagram of SM2, SM2C (with CT)](image)

**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.

**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,
- 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 In = 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 12 kV.

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 disconnector,
- 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

**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 (Teperefuse type).

**Option:**
- LV box.

### GMC, GMC2
Busbar current measurement

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

**Option:**
- LV box.

### GCT
Busbar current measurement and adjacent cubicle voltage measurement

**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 (Teperefuse type).

**Option:**
- LV box.
**TM1, TM2**
MV/LV transformer for auxiliaries

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

**GBM2**
Connection between busbars and the bottom of DM12 and SM2 units

**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 disconnector,
- 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.

**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.

**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 2RTC/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.

---

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

<table>
<thead>
<tr>
<th>service voltage (kV)</th>
<th>fuse type</th>
<th>Transformer KVA rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

**UTE Standards C13-100 and C64-210**

- **10**
- **15**
  - Fusarc: 6.3, 6.3, 10, 10, 10, 10, 16, 20, 20, 25, 31.5, 31.5, 40, 50, 50, 63, 80, 160(2)
- **20**
  - Fusarc: 6.3, 6.3, 10, 10, 10, 10, 16, 20, 20, 25, 31.5, 31.5, 40, 50, 50, 63, 80, 160(2)

**General case**

- **11**
  - Fusarc: 6.3, 6.3, 10, 16, 20, 20, 25, 31.5, 31.5, 31.5, 40, 63, 63, 80, 100, 125
- **10**
  - Fusarc: 6.3, 6.3, 10, 16, 20, 20, 31.5, 31.5, 31.5, 40, 63, 63, 80, 100, 125
- **6.6**
  - Solefuse: 6.3, 16, 16, 16, 31.5, 31.5, 31.5, 40, 40, 50, 63, 80, 80, 100, 125
  - Fusarc: 10, 16, 20, 25, 31.5, 40, 40, 50, 63, 80, 80, 100, 125
- **6**
  - Solefuse: 6.3, 16, 16, 16, 31.5, 31.5, 31.5, 40, 50, 50, 63, 80, 80, 100, 125
  - Fusarc: 10, 16, 20, 25, 31.5, 40, 50, 50, 63, 80, 100, 125, 160, 200
- **5.5**
  - Solefuse: 6.3, 16, 16, 16, 16, 31.5, 31.5, 31.5, 40, 50, 50, 63, 80, 80, 100, 125
  - Fusarc: 10, 16, 20, 31.5, 40, 50, 50, 63, 80, 100, 125, 160, 200
- **4.16**
  - Solefuse: 6.3, 16, 31.5, 31.5, 31.5, 31.5, 63, 63, 80, 80, 100, 125
  - Fusarc: 10, 20, 31.5, 40, 50, 50, 63, 80, 100, 125, 160, 200, 250(3)
- **3.3**
  - Solefuse: 16, 16, 16, 31.5, 31.5, 31.5, 31.5, 63, 63, 63, 80, 80, 100, 125
  - Fusarc: 16, 20, 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

---

Dimensions of Fusarc Fuses (DIM) Dimensions of Solefuse fuses (UTE)

<table>
<thead>
<tr>
<th>rated voltage (kV)</th>
<th>rating</th>
<th>L (mm)</th>
<th>dia. (mm)</th>
<th>weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6</td>
<td>250</td>
<td>292</td>
<td>88</td>
<td>3.3</td>
</tr>
<tr>
<td>7.2</td>
<td>125 to 200</td>
<td>292</td>
<td>88</td>
<td>3.3</td>
</tr>
<tr>
<td>12</td>
<td>6.3 to 63</td>
<td>292</td>
<td>55</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>80 to 100</td>
<td>292</td>
<td>88</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>125 to 200</td>
<td>442</td>
<td>88</td>
<td>5</td>
</tr>
<tr>
<td>17.5</td>
<td>10 to 25</td>
<td>292</td>
<td>55</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>31.5 to 40</td>
<td>292</td>
<td>88</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>442</td>
<td>88</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>6.3 to 40</td>
<td>442</td>
<td>55</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>50 to 160</td>
<td>442</td>
<td>88</td>
<td>5</td>
</tr>
</tbody>
</table>

(1) Driescher fuse-links.
motor protection
with CRM units
selection of fuses

The current rating of fuses installed in CRM units depends on:
- motor current rating In,
- starting current Id,
- 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,
- Id/In < 6,
- PF = 0.8 (P < 500 kW) or 0.9 (P > 500 kW),
- η = 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.

\[ \text{In} = \frac{\sqrt{3} \cdot U \cdot \eta \cdot PF}{P} \]
\[ = \frac{\sqrt{3} \cdot 5 \cdot 0.94 \cdot 0.8}{950} \approx 130 \text{ A} \]

Id = 6 \times \text{In} = 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:
- Isc < 10,000 A (3) for Un < 6 kV.
- Isc < 6,000 A (3) for Un < 6 kV.

In this case In max = 320 A.

<table>
<thead>
<tr>
<th>starting current (A)</th>
<th>Starting time (s)</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>maximum service voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1410 (4)</td>
<td>6</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>1290 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>1140 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>1030 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>890 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>790 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>640 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>140 (4)</td>
<td>6</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>125 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>100 (4)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>6.6</td>
</tr>
<tr>
<td>1170 (4)</td>
<td>6</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Maximum switchable power (kW)
(direct on-line startup, six 5-sec. starts per hour)

<table>
<thead>
<tr>
<th>service voltage (kV)</th>
<th>3.3</th>
<th>4.16</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.6</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>without fuses</td>
<td>1550</td>
<td>1980</td>
<td>2360</td>
<td>2590</td>
<td>2830</td>
<td>3110</td>
<td>4710</td>
<td>5180</td>
</tr>
<tr>
<td>with fuses</td>
<td>100 A</td>
<td>140</td>
<td>180</td>
<td>215</td>
<td>240</td>
<td>260</td>
<td>285</td>
<td>435</td>
</tr>
<tr>
<td></td>
<td>200 A</td>
<td>635</td>
<td>800</td>
<td>960</td>
<td>1060</td>
<td>1155</td>
<td>1270</td>
<td>2350</td>
</tr>
<tr>
<td></td>
<td>250 A</td>
<td>1135</td>
<td>1600</td>
<td>1800</td>
<td>1960</td>
<td>2160</td>
<td>2500</td>
<td>3500</td>
</tr>
</tbody>
</table>

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 where 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.
VM6

instrument transformers

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).

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

For DM12 and DM23 units:
Type TCN6 B, transformers, with two secondary windings:
1 secondary for measurements, 5 A,
double primary ratio by tapped secondary winding
1 secondary for protection, either:
protection RAH 411 E, or 5 A, 2.5 VA,
1 A, 1 VA, class 10P30 with Statimax
15 or 30 VA, class 0.5,
10P5 with two primary currents).

Single primary current.
the formula:
the thermal withstand is calculated using
For durations other than 1 s, the
thermal withstand is calculated using the formula:
Peak thermal output (VA)

\[
lth(t) = \frac{lth(1s)}{\sqrt{t}}
\]

Note
For durations other than 1 s, the thermal withstand is calculated using the formula:
Peak thermal output (VA)

Rated thermal short-time current (lth) (in kA)

<table>
<thead>
<tr>
<th>PRIMARY CURRENT (IN A)</th>
<th>12.5</th>
<th>16</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>I primary in A</td>
<td>5</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>lth in kA - 1 s</td>
<td>0.4</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Dual primary ratio by tapped secondary winding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I primary in A</td>
<td>10-20</td>
<td>15-30</td>
<td>20-40</td>
</tr>
<tr>
<td>lth in kA - 1 s</td>
<td>1.6</td>
<td>2.4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

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).

voltage transformers

unit type

<table>
<thead>
<tr>
<th>unit type</th>
<th>DM23 - CM - GMT - GCT</th>
<th>DM12 - SM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>transformer type (VT)</td>
<td>RTM6</td>
<td>RTS</td>
</tr>
<tr>
<td>highest system voltage (kV)</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>primary voltage (kV)</td>
<td>10/-3&quot; - 15/-3&quot; - 20/-3&quot;</td>
<td>20/-3</td>
</tr>
<tr>
<td>secondary voltage (V)</td>
<td>100/-3</td>
<td>100/-3</td>
</tr>
<tr>
<td>rated thermal output (VA)</td>
<td>250</td>
<td>350(^{**})</td>
</tr>
</tbody>
</table>

Accuracy class and rated output

<table>
<thead>
<tr>
<th>transformer</th>
<th>RTM6</th>
<th>RTS</th>
<th>RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>class</td>
<td>0.5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>single primary voltage</td>
<td>30/50/80</td>
<td>100/125/150</td>
<td>175/200</td>
</tr>
<tr>
<td>two primary voltages(^{**})</td>
<td>30/50</td>
<td>80/100/125</td>
<td>150/175</td>
</tr>
</tbody>
</table>

Accuracy class and rated output

<table>
<thead>
<tr>
<th>transformer</th>
<th>RTM6</th>
<th>RTS</th>
<th>RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>class</td>
<td>0.5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>single primary voltage</td>
<td>30/50</td>
<td>50 for 10 kV</td>
<td>100 for 10 kV</td>
</tr>
<tr>
<td>two primary voltages(^{**})</td>
<td>30/50</td>
<td>50 for 20 kV</td>
<td>200 for 20 kV</td>
</tr>
</tbody>
</table>

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

Vigirack relays

Sepam

For DM12, DM23 and QM units (except for Buchholz tripping), 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:
  - 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.

For DM23 and QM units, Statimax protection is the same as for DM12, except that the RAH 411 E relay is replaced by a RAH 413 E relay with 4 settings.

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.

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.

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

- measurements: I, I0 (zero sequence) I max., U, W, VA, Wh, VAh.
- 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](image1)

**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.

Type C1
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.

Type C4

**Caption lock**

- [locking key](image2)
- [free key](image3)
- [imprisoned key panel or door](image4)
**ring units**

Aim
To prevent the simultaneous closing of two switches.

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".

Interlocking between a "disconnecter" cubicle and a "switch" cubicle interconnected by cables via the bottom:
- to prevent on-load operation of the disconnector unless the switch is locked "open".
- to allow off-load operation of the switch.

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

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

To prevent access to the cable heads of a "bus" cubicle unless the switch of a line-side cubicle is locked in "open" position.
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 Ø 8.2.8mdaN.

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

Cabling from below 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.

<table>
<thead>
<tr>
<th>Cabling from below through trenches</th>
<th>trench depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>front or rear exit</td>
</tr>
<tr>
<td>cable type</td>
<td>side exit</td>
</tr>
<tr>
<td>SM, IM, GAM, DDM, NSM, BCM, SMC, IMC</td>
<td>SM, IM, GAM, NSM, DDM,BCM</td>
</tr>
<tr>
<td>single-core cable</td>
<td></td>
</tr>
<tr>
<td>25-35-50</td>
<td>370</td>
</tr>
<tr>
<td>70</td>
<td>400</td>
</tr>
<tr>
<td>95</td>
<td>440</td>
</tr>
<tr>
<td>120-150</td>
<td>500</td>
</tr>
<tr>
<td>185</td>
<td>540</td>
</tr>
<tr>
<td>240</td>
<td>590</td>
</tr>
<tr>
<td>50</td>
<td>550</td>
</tr>
<tr>
<td>95</td>
<td>610</td>
</tr>
<tr>
<td>150</td>
<td>670</td>
</tr>
<tr>
<td>240</td>
<td>850</td>
</tr>
</tbody>
</table>

(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.
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.

<table>
<thead>
<tr>
<th>Cable type</th>
<th>X-section (mm²)</th>
<th>Bending radius (mm)</th>
<th>Trench depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM, QM</td>
<td>35</td>
<td>340</td>
<td>350</td>
</tr>
<tr>
<td>PMC, QMC</td>
<td>50</td>
<td>370</td>
<td>400</td>
</tr>
<tr>
<td>CRM</td>
<td>70</td>
<td>400</td>
<td>450</td>
</tr>
<tr>
<td>Single-core cable</td>
<td>95</td>
<td>420</td>
<td>500</td>
</tr>
<tr>
<td>Single or three-core cable</td>
<td>120</td>
<td>500</td>
<td>550</td>
</tr>
</tbody>
</table>

■ 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).

Cabling from above
units SM, IM, GAM, DDM, NSM, BCM,
SMC, IMC, PM, PMC, OM, 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,
  ■ 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.
connection with paper insulated cables
With heat shrink ends
Units SM, IM, GAM, DDM, NSM, BCM, SMC, IMC, PM, PMC, QM, QMC.

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.

<table>
<thead>
<tr>
<th>Single-core cables</th>
<th>trench depth P (mm) for cubicles SM, IM, GAM, DDM, NSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>cable X-section (mm²)</td>
<td>bending radius (mm)</td>
</tr>
<tr>
<td>50</td>
<td>450</td>
</tr>
<tr>
<td>70 to 95</td>
<td>530</td>
</tr>
<tr>
<td>120-150</td>
<td>560</td>
</tr>
<tr>
<td>240</td>
<td>600</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Three-core cables</th>
<th>trench depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cable X-section (mm²)</td>
<td>bending radius (mm)</td>
</tr>
<tr>
<td>16 to 50</td>
<td>520</td>
</tr>
<tr>
<td>70</td>
<td>560</td>
</tr>
<tr>
<td>95</td>
<td>610</td>
</tr>
<tr>
<td>120</td>
<td>680</td>
</tr>
<tr>
<td>150 to 185</td>
<td>720</td>
</tr>
<tr>
<td>240</td>
<td>780</td>
</tr>
<tr>
<td>300</td>
<td>830</td>
</tr>
</tbody>
</table>

(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.

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

<table>
<thead>
<tr>
<th>Cabling from below through trenches</th>
<th>cable type</th>
<th>X-section (mm²)</th>
<th>bending radius (mm)</th>
<th>trench depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>50 to 95</td>
<td>440</td>
<td>550</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single-core cable</td>
<td>120 to 150</td>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single-core cable</td>
<td>185</td>
<td>540</td>
<td>650</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single-core cable</td>
<td>240</td>
<td>590</td>
<td>700</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single-core cable</td>
<td>300</td>
<td>640</td>
<td>750</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single or three-core cable</td>
<td>95</td>
<td>610</td>
<td>700</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single or three-core cable</td>
<td>150</td>
<td>680</td>
<td>750</td>
</tr>
<tr>
<td>DM12 unit with 6 CT's or 3 CT's + 3 VT's</td>
<td>single or three-core cable</td>
<td>240</td>
<td>780</td>
<td>950</td>
</tr>
</tbody>
</table>

connection with paper insulated cables
With heat shrink ends.

<table>
<thead>
<tr>
<th>Connection only from below with trenches</th>
<th>cable type</th>
<th>X-section (mm²)</th>
<th>bending radius (mm)</th>
<th>trench depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>50 to 95</td>
<td>480</td>
<td>860</td>
</tr>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>120 to 150</td>
<td>530</td>
<td>900</td>
</tr>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>185</td>
<td>560</td>
<td>950</td>
</tr>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>240</td>
<td>600</td>
<td>1000</td>
</tr>
<tr>
<td>DM12 unit with 3 CT's</td>
<td>single-core cable</td>
<td>300</td>
<td>640</td>
<td>1050</td>
</tr>
<tr>
<td>DM2 unit with 3 CT's</td>
<td>three-core cable</td>
<td>50 to 95</td>
<td>610</td>
<td>1000</td>
</tr>
<tr>
<td>DM2 unit with 3 CT's</td>
<td>three-core cable</td>
<td>120 to 150</td>
<td>680</td>
<td>1050</td>
</tr>
<tr>
<td>DM2 unit with 3 CT's</td>
<td>three-core cable</td>
<td>185</td>
<td>730</td>
<td>1130</td>
</tr>
<tr>
<td>DM2 unit with 3 CT's</td>
<td>three-core cable</td>
<td>240</td>
<td>780</td>
<td>1190</td>
</tr>
<tr>
<td>DM2 unit with 3 CT's</td>
<td>three-core cable</td>
<td>300</td>
<td>840</td>
<td>1250</td>
</tr>
</tbody>
</table>

(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

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

**Position of fixing holes**

**Detail of a support**

Concrete  steel

**CRM**

(1) 500 for CRM
(2) 680 for CRM

Trench depth P: see preceding pages.
trench drawings

<table>
<thead>
<tr>
<th>Description</th>
<th>DM12 without pan</th>
<th>DM12 with pan</th>
<th>Through a rear conduit</th>
<th>Through a front conduit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable entry or exit from the RH or LH side through a trench</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>Through a rear conduit</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td>Through a front conduit</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
</tr>
</tbody>
</table>

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 1500 mm free to allow removal or breaker truck.
A connection of several dry cables per phase is presented in the tables below. The tables represent the standard connection possibilities. For other cases, please consult us.

<table>
<thead>
<tr>
<th>Max X-section (mm²)</th>
<th>SM, IM, NSM, BCM</th>
<th>3 dry-type cables</th>
<th>trench</th>
<th>rear&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>side&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>240</th>
<th>50</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 dry-type cables</td>
<td>trench&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>3 x 240 + 3 x 50</td>
<td>3 x 240 + 3 x 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM, IMC, DDM</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>240</td>
<td>50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM, QM, PMC, QMC</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>240</td>
<td>50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAM</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>240</td>
<td>150</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 dry-type cables</td>
<td>trench + rear&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>3 x 240 + 3 x 150</td>
<td>3 x 240 + 3 x 95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRM</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>120</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM2</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>120</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GMT, GCT</td>
<td>3 dry-type cables</td>
<td>trench</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) For termination with field deflector only.
(2) For tension with linear voltage distributor only.

**Units DM12, GAM2**
Cabling through trenches

<table>
<thead>
<tr>
<th>Unit characteristics</th>
<th>In/A 400</th>
<th>630</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>series 12/14</td>
<td>12 to 20</td>
<td>25/30</td>
</tr>
<tr>
<td>CTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VTs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 single-core</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu ≤ 240°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>240° &lt; Alu ≤ 630°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300° &lt; Cu ≤ 500°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oto 6 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oto 3 1 to 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 single-core cables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu ≤ 240°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu ≤ 300° or Alu + Cu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>240° &lt; Alu ≤ 630°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300° &lt; Cu ≤ 500°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oto 6 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oto 3 1 to 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 or 12 single-core cables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu max. 2 x 240° + 1 (or 2) x 95°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu max. 2 x 120° + 1 (or 2) x 50°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu ≤ 400°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 three-core cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 three-core cables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu ≤ 300°</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- □ 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.

<table>
<thead>
<tr>
<th>dimensions and weights</th>
<th>dimensions in mm</th>
<th>weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>type of unit</td>
<td>height</td>
<td>width</td>
</tr>
<tr>
<td>SM</td>
<td>1500 (1)</td>
<td>500</td>
</tr>
<tr>
<td>SM2</td>
<td>1500 (1)</td>
<td>750</td>
</tr>
<tr>
<td>JM</td>
<td>1500 (1)</td>
<td>500</td>
</tr>
<tr>
<td>DDM</td>
<td>1500 (1)</td>
<td>1000</td>
</tr>
<tr>
<td>NSM</td>
<td>1500 (1)</td>
<td>1000</td>
</tr>
<tr>
<td>PM/QM</td>
<td>1500 (1)</td>
<td>500</td>
</tr>
<tr>
<td>QCS</td>
<td>1500 (1)</td>
<td>1000</td>
</tr>
<tr>
<td>DM12</td>
<td>1500 (1)</td>
<td>750</td>
</tr>
<tr>
<td>DM23</td>
<td>1500 (2)</td>
<td>1000</td>
</tr>
<tr>
<td>GAM</td>
<td>1500 (2)</td>
<td>500</td>
</tr>
<tr>
<td>GAM2</td>
<td>1500 (1)</td>
<td>750</td>
</tr>
<tr>
<td>GBM</td>
<td>1500 (2)</td>
<td>500</td>
</tr>
<tr>
<td>GBM2</td>
<td>1500 (1)</td>
<td>750</td>
</tr>
<tr>
<td>GIM</td>
<td>1500 (2)</td>
<td>100</td>
</tr>
<tr>
<td>GMT/GMC/GCT</td>
<td>1500 (3)</td>
<td>500</td>
</tr>
<tr>
<td>GMC2</td>
<td>1500 (1)</td>
<td>750</td>
</tr>
<tr>
<td>CM/TM</td>
<td>1500 (2)</td>
<td>500</td>
</tr>
<tr>
<td>BCM</td>
<td>1500 (2)</td>
<td>500</td>
</tr>
<tr>
<td>CRM</td>
<td>1925 (1)</td>
<td>500</td>
</tr>
</tbody>
</table>

(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.
Minimum distances required in mm

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Power (P)</th>
<th>Distance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>with or without rear cabling by dry-type cables up to 50 mm²</td>
<td>P&gt;1000kVA</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P&lt;1000kVA</td>
<td>565</td>
</tr>
<tr>
<td>B</td>
<td>without lateral cabling (dry-type cables) or earthing connection</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>with earthing connection or with lateral cabling by dry-type cables up to 50 mm²</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>minimum distance for operation and handling</td>
<td></td>
<td>1100</td>
</tr>
<tr>
<td></td>
<td>switchboard without transformer or circuit-breaker unit</td>
<td></td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>switchboard without transformer but with circuit-breaker unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>power (P) &lt; 1000 kVA</td>
<td></td>
<td>2350</td>
</tr>
<tr>
<td></td>
<td>power (P) &gt; 1000 kVA</td>
<td></td>
<td>2800</td>
</tr>
<tr>
<td>L</td>
<td>varies with the transformer kVA output, with or without transformer cubicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(TR50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>MV switchboard, with or without top cabling, with or without transformer cubicle, with type-P6 LV cubicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(TR56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(TR58)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(TR59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(TR58)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(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 primary 20 kV or 10/20 kV (reduced power),
   B2 primary 15/20 kV (reduced power).
VM6
layout examples (cont)

MV power delivery substation

Minimum distances required in mm

<table>
<thead>
<tr>
<th></th>
<th>without rear cabling</th>
<th>without breaker unit</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>with breaker unit</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>with rear cabling, dry-type cables up to</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 mm², without trenches,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with or without breaker unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>without side cabling (dry-type cables)</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or earthing connection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with earthing connection or with side</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cabling by dry-type cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>up to 50 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>minimum distance for operation and handling</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>switchboard without transformer or breaker unit</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>without top cabling</td>
<td>1900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or LV top box</td>
<td>2325</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with LV top box</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with top cabling</td>
<td>1900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>without MV cable compartment</td>
<td>2300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and with MV cable compartment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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