SM6

Modular units

Air insulated switchgear up to 36 kV
General contents

Presentation 3

Generalities 11

Characteristics of the functional units 43

Connections 83

Installation 91

Appendices 99
Order form
## Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The experience of a world leader</td>
<td>4</td>
</tr>
<tr>
<td>The range’s advantages</td>
<td>5</td>
</tr>
<tr>
<td>Protecting the environment</td>
<td>6</td>
</tr>
<tr>
<td>A full range of services</td>
<td>7</td>
</tr>
<tr>
<td>The references of a leader</td>
<td>8</td>
</tr>
<tr>
<td>Quality assurance</td>
<td>9</td>
</tr>
</tbody>
</table>
The Schneider Electric experience’s extends over forty years in factory-built cubicles and over thirty years in SF6 breaking technology for Medium Voltage switchgear.

This experience means that today Schneider Electric can propose a complementary range: vacuum type circuit breaker cubicles up to 36 kV and standard or enhanced internal arc withstand cubicles to reinforce the safety of people according to the IEC standard.

This gives you the advantage of unique experience, that of a world leader, with over 2,000,000 SF6 Medium Voltage units installed throughout the world.

Putting this experience at your service and remaining attentive to your requirements is the spirit of active partnership that we want to develop in offering you the SM6.

The modular SM6 is a range of harmonised cubicles equipped with SF6 or vacuum breaking technology switchgear with 30 years life span.

These cubicles allow you to produce all your Medium Voltage substation requirements up to 36 kV by superposing their various functions.

The result of in-depth analysis of your requirements, both now and in the future, SM6 cubicles mean that you can take advantage of all the features of both a modern and proven technology.

1975: innovation
Sulphur hexafluoride (SF6) is first used in an MV switch for an MV/LV transformer substation, with the VM6.

1989: experience
Over 300,000 VM6 cubicles equipped networks throughout the world.

1991: innovation and experience
Cumulated with the second generation of SM6 modular SF6 cubicles.

2010: a leading position
With over 1,000,000 SM6 cubicles installed around the world, Schneider Electric consolidates its position as uncontested leader in the Medium Voltage field.
The range’s advantages

Upgradability
SM6, a comprehensive range
- a comprehensive offer covering your present and future requirements
- a design adapted to the extension of your installations
- a catalogue of functions for all your applications
- a product designed to be in compliance with standards constraints
- options to anticipate the telecontrol of your installations.

Compactness
SM6, an optimised range
- compact units, with low increment cubicles
- rationalised space requirement for switchboard installation
- reduction of civil works costs
- easy integration in factory-built outdoor substations for which the SM6 is particularly well designed.

Maintenance
SM6, a range with reduced maintenance
- the active parts (breaking and earthing) are integrated in an SF6-filled, “sealed for life” unit
- the control mechanisms, are intended to function with reduced maintenance under normal operating conditions
- enhanced electrical endurance when breaking.

Ease of installation
SM6, a simple range to incorporate
- reduced dimensions and weights
- only one civil works layout
- a solution adapted to cable connection
- simplified switchboard busbar design.

Ease and safe to operate
SM6, a proven range
- a three position switch to block incorrect switching
- the earthing disconnector has full closing capacity
- positive breaking of position indicators
- internal arc withstand in the cable and switchgear compartments
- clear and animated display diagrams
- switching lever with an “anti-reflex” function
- compartmented cubicles.

SM6: a range designed with telecontrol in mind
SM6 switchgear is perfectly adapted to telecontrol applications. Motorised, either when installed or at a later date on-site without any interruption in service, SM6 combines with the Easergy T200 remote control interface. You therefore benefit from a ready-to-connect unit that is easy to incorporate providing guaranteed switchgear operation.

SM6: a range with adapted protection devices
With the SM6, Schneider Electric proposes solutions for network management; the Sepam and VIP or relay ranges protect installations, providing continuity of electrical supply and reducing downtime.
Schneider Electric’s recycling service for SF6 products is part of a rigorous management process.

Schneider Electric is committed to a long term environmental approach. As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product’s recyclability.

The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable. It was performed in conformity with ISO 14040 “Environmental management: life cycle assessment - principle and framework”.

At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular without any gas being released to the atmosphere nor any polluting fluids being discharged.

SM6 is compliant with the RoHS directive. RoHS restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.

The environmental management system adopted by Schneider Electric production sites that produce the SM6 have been assessed and judged to be in conformity with requirements in the ISO 14001 standard.
A full range of services

Schneider Electric is capable of offering a full range of services either associated or not with the supply of the SM6 unit.

**To improve the quality of your electrical power:**
- network study, harmonics study, etc.
- reactive energy compensation
- consumption monitoring
- optimisation of your electrical power supply contracts.

**To accompany the purchase and installation of your SM6 equipment:**
- adaptation of our equipment to provide a better response to your requirements
- on site assembly, testing and commissioning of your equipment
- customised financing solutions
- warranty extension
- operator training.

**To accompany your installation throughout its life and upgrading your equipment:**
- upgrading your existing equipment: functional adaptation, control motorisation, renovation of protections units, etc.
- on site work
- supply of replacement parts
- maintenance contracts
- end of life recycling.

For more information on all the services proposed by Schneider Electric, please contact your Schneider Electric Sales Office.
Presentation

The references of a leader
SM6, a world-wide product

Asia/Middle East
- Canal Electrical Distribution Company, Egypt
- General Motors Holden, Australia
- Pasteur Institute, Cambodia
- Tianhe City, China
- Sanya Airport, China
- Bank of China, Beijing, Jv Yanta, China
- Plaza Hotel, Jakarta, Indonesia
- Bali Airport, Indonesia
- Wakasa Control Center, Japan
- Otaru Shopping center, Japan
- New City of Muang, Thong Than, Kanjanapas, Thailand
- Danang and Quinhon Airport, Vanad, Vietnam
- British Embassy, Oman
- KBF Palace Riyadh, Saudi Arabia
- Raka Stadium, Saudi Arabia
- Bilkent University, Turkey
- TADCO, BABOIL development, United Arab Emirates
- Melbourne Tunnel City Link, Australia
- Campus KSU Qassim Riyadh, Saudi Arabia

Africa
- ONAFEX, Hilton Hotel, Algeria
- Yaounde University, Cameroon
- Karoua Airport, Cameroon
- Libreville Airport, Gabon
- Ivarto Hospital, CORIF, Madagascar
- Central Bank of Abuja, ADEFEMI, Nigeria
- OCI Dakar, Oger international, CGE, Senegal
- Bamburi cement Ltd, Kenya
- Ivory Electricity Company, Ivory Coast
- Exxon, New Headquarters, Angola

South America/Pacific
- Lamentin Airport, CCIM, Martinique
- Space Centre, Kourou, Guyana
- Mexico City Underground System, Mexico
- Santiago Underground System, Chile
- Cohiba Hotel, Havana, Cuba
- Iberostar Hotel, Bavaro, Dominican Republic
- Aluminio Argentino Saic SA, Argentina
- Michelin Campo Grande, Rio de Janeiro, Brazil
- TIM Data Center, São Paulo, Brazil
- Light Rio de Janeiro, Brazil
- Hospital Oswaldo Cruz, São Paulo, Brazil

Europe
- Stade de France, Paris, France
- EDF, France
- Eurotunnel, France
- Nestlé company headquarters, France
- TLM Terminal, Folkestone, Great Britain
- Zaventem Airport, Belgium
- Krediebank Computer Centre, Belgium
- Bucarest Pumping station, Romania
- Prague Airport, Czech Republic
- Philipp Morris St Petersburg, Russia
- Kremlin Moscow, Russia
- Madrid airport, Spain
- Dacia Renault, Romania
- Lafarge cement Cirkovic, Czech Republic
- Caterpillar St Petersburg, Russia
- Ikea Kazan, Russia
- Barajas airport, Spain
- Barajas airport, Switzerland

Schneider Electric
A major advantage

Schneider Electric has integrated a functional organisation into each of its units. The main mission of this organisation is to check the quality and the compliance with standards. This procedure is:
- uniform throughout all departments
- recognised by many customers and approved organisations.

But it is above all its strict application that has enabled recognition to be obtained by an independent organisation: The French Quality Assurance Association (FQAA).

The quality system for the design and manufacture of SM6 units has been certified in conformity with the requirements of the ISO 9001: 2000 quality assurance model.

Meticulous and systematic controls

During manufacture, each SM6 is subject to systematic routine testing which aims to check the quality and conformity:
- sealing testing
- filling pressure testing
- opening and closing rate testing
- switching torque measurement
- dielectric testing
- conformity with drawings and plans.

The results obtained are written and reported on the test certificate for each device by the quality control department.

Mean Operating Time To Failure (MTTF)

As result of Schneider Electric quality assurance system, SM6 24 kV has negligible “Mean Down Time (MDT)” in comparison to the “Mean Up Time (MUT)”, thus “Mean Operating Time Between Failures (MTBF)” is as similar as to the MTTF.

\[ \text{MTTF (cumulative)} = 3890 \text{ years} \]
Contents

Field of application 12
Units for all functions 14
Operating conditions 20
Standards 21
Main characteristics 22
Factory-built cubicles description 24
Compartments description 26
Safety of people 28
   By switchgear 28
   By operating mechanism safety 30
   By internal arc protection 31
MV electrical network management 32
Fault indicators 34
Ammeter 35
Description of the control/monitoring & protection functions 36
   Sepam selection guide for all applications 36
LPCT protection chain 41
   TLP130, CLP2 sensors and Sepam series 20, 40, 80 protection units 41
Web Remote Monitoring 42
The SM6 is made up of modular units containing fixed, disconnectable or withdrawable metal-enclosed switchgear, using sulphur hexafluoride (SF6) or vacuum:
- switch-disconnector
- SF1, SFset or Evolis circuit breaker
- Rollarc 400 or 400 D contactor, or vacuum contactor
- disconnector.

SM6 units are used for the MV section in MV/LV transformer substations in public distribution systems and MV consumer or distribution substations up to 36 kV.

**MV/LV transformer substations**

<table>
<thead>
<tr>
<th>HV/MV substation</th>
<th>UTE standard (EDF)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MV consumer substation</strong> (MV metering)</td>
<td><strong>Substation</strong></td>
</tr>
<tr>
<td>IM IM CM DM2 QM PM IM</td>
<td>GAM2 QM</td>
</tr>
</tbody>
</table>

Other standards:

**MV consumer substations** (LV metering)

| IM IM DM1-D GBC-A QM DM1-S |

Such substations are used for MV consumer or distribution substations up to 36 kV.
Field of application

Industrial distribution substations

Unit definitions

Below is the list of SM6 units used in MV/LV transformer substations and industrial distribution substations:
- IM, IMC, IMB switch
- PM fused switch
- QM, QMC, QMB fuse-switch combination
- CRM, CVM contactor and contactor with fuses
- DM1-A, DM1-D, DM1-S single-isolation disconnectable SF6 type circuit breaker
- DMV-A, DMV-D, DMV-S single-isolation vacuum type circuit breaker frontal
- DMVL-A, DMVL-D single-isolation disconnectable vacuum type circuit breaker lateral
- DM1-W, DM1-Z withdrawable single-isolation SF6 type circuit breaker
- DM2 double-isolation disconnectable SF6 type circuit breaker
- DM2-W withdrawable double-isolation SF6 type circuit breaker only for 36 kV
- CM, CM2 voltage transformers
- GBC-A, GBC-B current and/or voltage measurements
- NSM-cables for main incoming and standby
- NSM-busbars for main incoming and cables for standby
- GIM intermediate bus unit
- GEM extension unit
- GBM connection unit
- GAM2, GAM incoming cable connection unit
- SM disconnector
- TM MV/LV transformer unit for auxiliaries
- Other units, consult us
- Special function EMB busbar earthing only for 24 kV.
Generalities

Units for all functions

Connection to the networks

- **IM**
  Switch unit
  - 24 kV: 375 or 500 mm
  - 36 kV: 750 mm

- **IMC**
  Switch unit
  - 24 kV: 500 mm
  - 36 kV: 750 mm

- **IMB**
  Switch unit with or without earthing disconnector
  - Right or left outgoing line
  - 24 kV: 375 mm
  - 36 kV: 750 mm

Fuse-switch protection

- **QM**
  Fuse-switch combination unit
  - 24 kV: 375 or 500 mm
  - 36 kV: 750 mm

- **QMC**
  Fuse-switch combination unit
  - 24 kV: 625 mm
  - 36 kV: 1000 mm

- **QMB**
  Fuse-switch combination unit
  - Right or left outgoing line
  - 24 kV: 375 mm
  - 36 kV: 750 mm

- **PM**
  Fuse-switch unit
  - 24 kV: 375 mm
  - 36 kV: 750 mm
Generalities

Units for all functions

Motor starter

CRM
Fuse-contactor unit
24 kV: 750 mm

CVM
Fuse-contactor unit
24 kV: 750 mm

SF6 circuit-breaker protection

DM1-A
Single-isolation, disconnectable circuit breaker unit
24 kV: 750 mm
36 kV: 1000 mm

DM1-D
Single-isolation, disconnectable circuit breaker unit
right or left outgoing line for 24 kV
right outgoing line for 36 kV
24 kV: 750 mm
36 kV: 1000 mm
Generalities

Units for all functions

SF6 circuit-breaker protection

DM1-W
Withdrawable single-isolation circuit breaker unit
24 kV: 750 mm
36 kV: 1000 mm

DM1-S
Single-isolation, disconnectable circuit breaker unit with autonomous protection
24 kV: 750 mm

DM1-Z
Withdrawable single-isolation circuit breaker unit right outgoing line
24 kV: 750 mm

DM2
Double-isolation, disconnectable circuit breaker unit right or left outgoing line
24 kV: 750 mm
36 kV: 1500 mm

DM2-W
Withdrawable double-isolation circuit breaker unit right outgoing line
36 kV: 1500 mm

Vacuum circuit-breaker protection

DMV-A
Single-isolation circuit breaker unit
24 kV: 625 mm

DMV-D
Single-isolation circuit breaker unit right outgoing line
24 kV: 625 mm

DMV-S
Single-isolation circuit breaker unit with autonomous protection
24 kV: 625 mm
Generalities

Units for all functions

Vacuum circuit-breaker protection

- DMVL-A: Single-isolation, disconnectable circuit breaker unit
  - 24 kV: 750 mm
- DMVL-D: Single-isolation, disconnectable circuit breaker unit right outgoing line
  - 24 kV: 750 mm

MV metering

- CM: Voltage transformers for mains with earthed neutral system
  - 24 kV: 375 mm
  - 36 kV: 750 mm
- CM2: Voltage transformers for mains with insulated neutral system
  - 24 kV: 500 mm
  - 36 kV: 750 mm

GBC-A: Current and/or voltage measurement unit
- Right or left outgoing line
  - 24 and 36 kV: 750 mm
- GBC-B: Current and/or voltage measurement unit
  - 24 and 36 kV: 750 mm
**Generalities**

**Units for all functions**

**Casings**

- **GBM**
  - Connection unit right or left outgoing line
  - 24 kV: 375 mm
  - 36 kV: 750 mm

- **GEM**
  - Extension unit VM6/SM6
  - 24 kV: 125 mm

- **GIM**
  - Intermediate bus unit
  - 24 kV: 125 mm
  - 36 kV: 250 mm

- **GAM2**
  - Incoming cable-connection unit
  - 24 kV: 375 mm
  - 36 kV: 750 mm

- **GAM**
  - Incoming cable-connection unit with earthing
  - 24 kV: 500 mm
  - 36 kV: 750 mm
Generalities

Units for all functions

Other functions

SM
Disconnector unit
24 kV: 375 mm or 500\(^{(1)}\) mm
36 kV: 750 mm
\(^{(1)}\) only for 1250 A units.

TM
MV/LV transformer unit for auxiliaries
24 kV: 375 mm
36 kV: 750 mm

EMB
Busbar earthing compartment
24 kV: 375 mm

NSM-cables
Cables power supply for main incoming line and standby line
24 kV: 750 mm

NSM-busbars
Busbars power supply for main incoming line on right or left and cables for standby line
24 kV: 750 mm

NSM-cables
Cables power supply for main incoming line and standby line
36 kV: 1500 mm

NSM-busbars
Busbars power supply for main incoming line on right or left and cables for standby line
36 kV: 1500 mm
Generalities

SM6 units are designed for indoor installations. Their compact dimensions are:

- 375 to 1500 mm width
- 1600 to 2250 mm height
- 840 to 1400 mm depth

... this makes for easy installation in small rooms or prefabricated substations. Cables are connected via the front. All control functions are centralised on a front plate, thus simplifying operation. The units may be equipped with a number of accessories (relays, toroids, instrument transformers, surge arrester, control and monitoring, etc.).

Normal operating conditions

- **Ambient air temperature:**
  1) less than or equal to 40°C
  2) less than or equal to 35°C on average over 24 hours
  3) greater or equal to –5°C.

- **Altitude**
  1) less than or equal to 1000 m
  2) above 1000 m, a derating coefficient is applied (please consult us).

- **Solar radiation**
  1) no solar radiation influence is permitted.

- **Ambient air pollution**
  1) no significant pollution by dust, smoke, corrosive and/or flammable gases, vapours or salt.

- **Humidity**
  1) average relative humidity over a 24 hour period, less than or equal to 95%
  2) average relative humidity over a 1 month period, less than or equal to 90%
  3) average vapor pressure over a 24 hour period, less than or equal to 2.2 kPa
  4) average vapor pressure over a 1 month period, less than or equal to 1.8 kPa.

For these conditions, condensation may occasionally occur. Condensation can be expected where sudden temperature changes occur in periods of high humidity. To withstand the effects of high humidity and condensation, such as breakdown of insulation, please pay attention on Civil Engineering recommendations for design of the building or housing, by suitable ventilation and installation.

Severe operating conditions (please consult us).
SM6 units meet all the following standards and specifications:

- **IEC standards**
  - 62271-200 High-voltage switchgear and controlgear - Part 200: A.C. metal-enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV.
  - 62271-1 High-voltage switchgear and controlgear - Part 1: Common specifications.
  - 60265-1 High voltage switches - Part 1: switches for rated voltages above 1 kV and less or equal to 52 kV.
  - 62271-105 High-voltage switchgear and controlgear - Part 105: High voltage alternating current switch-fuse combinations.
  - 60255 Electrical relays.
  - 62271-100 High-voltage switchgear and controlgear - Part 100: High-voltage alternating current circuit breakers.
  - 62271-102 High-voltage switchgear and controlgear - Part 102: High-voltage alternating current disconnectors and earthing switches.
  - 60044-1 Instrument transformers - Part 1: Current transformers.
  - 60044-8 Instrument transformers - Part 8: Low Power Current Transducers.
  - 61958 High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems.

- **UTE standards for 24 kV**
  - NFC 13.100 Consumer substation installed inside a building and fed by a second category voltage public distribution system.
  - NFC 13.200 High voltage electrical installations requirements.
  - NFC 64.130 High voltage switches for rated voltage above 1 kV and less than 52 kV.
  - NFC 64.160: Alternating current disconnectors and earthing switches

- **EDF specifications for 24 kV**
  - HN 64-S-41 A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 24 kV.
  - HN 64-S-43 Electrical independent-operating mechanism for switch 24 kV - 400 A.
Generalities

Main characteristics

The hereunder values are for working temperatures from -5°C up to +40°C and for a setting up at an altitude below 1000 m.

Electrical characteristics

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Ur</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
<th>36</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Insulation level</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>Ud</td>
<td>50/60 Hz, 1 min (kV rms)</td>
<td>20</td>
<td>28</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>Isolation</td>
<td>Ud</td>
<td>50/60 Hz, 1 min (kV rms)</td>
<td>23</td>
<td>32</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>Insulation</td>
<td>Up</td>
<td>1.2/50 μs (kV peak)</td>
<td>60</td>
<td>75[^1]</td>
<td>95</td>
<td>125</td>
</tr>
<tr>
<td>Isolation</td>
<td>Up</td>
<td>1.2/50 μs (kV peak)</td>
<td>70</td>
<td>85</td>
<td>110</td>
<td>145</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breaking capacity</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer off load</td>
<td>A</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cables off load</td>
<td>A</td>
<td>31.5</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current</td>
<td>Ir</td>
<td>400 - 630 - 1250</td>
<td>630-1250</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-time withstand current</td>
<td>Ib/tk[^2]</td>
<td>kA/1 s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformer off load</td>
<td>A</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>Cables off load</td>
<td>A</td>
<td>70</td>
<td>85</td>
<td>110</td>
<td>145</td>
<td>195</td>
</tr>
<tr>
<td>Rated current</td>
<td>Ir</td>
<td>400 - 630 - 1250</td>
<td>630-1250</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Making capacity (50 Hz)</th>
<th>Ima</th>
<th>kA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer off load</td>
<td>A</td>
<td>62.5</td>
</tr>
<tr>
<td>Cables off load</td>
<td>A</td>
<td>630</td>
</tr>
<tr>
<td>Rated current</td>
<td>Ir</td>
<td>400 - 630</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum breaking capacity (Isc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units IM, IMC, IMB, NSM-cables, NSM-busbars</td>
</tr>
<tr>
<td>QM, QMC, QMB</td>
</tr>
<tr>
<td>PM</td>
</tr>
<tr>
<td>CRM</td>
</tr>
<tr>
<td>CRM with fuses</td>
</tr>
<tr>
<td>CVM</td>
</tr>
<tr>
<td>CVM with fuses</td>
</tr>
<tr>
<td>SF6 circuit breaker range</td>
</tr>
<tr>
<td>DM1-A, DM1-D, DM1-W, DM2</td>
</tr>
<tr>
<td>DM1-S</td>
</tr>
<tr>
<td>DM1-Z</td>
</tr>
<tr>
<td>DM2-W</td>
</tr>
<tr>
<td>Vacuum circuit breaker range</td>
</tr>
<tr>
<td>DMV-A, DMV-D, DMV-S</td>
</tr>
<tr>
<td>DMVL-A</td>
</tr>
<tr>
<td>DMVL-D</td>
</tr>
</tbody>
</table>

NA: Non Available
[^1]: 60 kV peak for the CRM unit
[^2]: 3 phases
[^3]: In 20 kA/3 s, consult us
[^4]: In 800 A, consult us.

[^1]: 60 kV peak for the CRM unit
[^2]: 3 phases
[^3]: In 20 kA/3 s, consult us
[^4]: In 800 A, consult us.
Endurance

<table>
<thead>
<tr>
<th>Units</th>
<th>Mechanical endurance</th>
<th>Electrical endurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units IM, IMC, IMB, PM, QM (5), QMC (5), QMB (5), NSM-cables, NSM-busbars class M1</td>
<td>IEC 60265 1 000 operations</td>
<td>IEC 60265-1 100 breaks at Ir. p.f. = 0.7, class E3</td>
</tr>
<tr>
<td>CRM</td>
<td>Disconnector IEC 62271-102 1 000 operations</td>
<td></td>
</tr>
<tr>
<td>Rollarc 400</td>
<td>IEC 60470 30 000 operations</td>
<td>IEC 60470 100 000 breaks at 320 A 300 000 breaks at 250 A</td>
</tr>
<tr>
<td>Rollarc 400D</td>
<td>100 000 operations</td>
<td>100 000 breaks at 200 A</td>
</tr>
<tr>
<td>CVM</td>
<td>Disconnector IEC 62271-102 1 000 operations</td>
<td></td>
</tr>
<tr>
<td>Vacuum contactor</td>
<td>IEC 60470 2 500 000 operations 250 000 with mechanical latching</td>
<td>IEC 60470 250 000 breaks at Ir</td>
</tr>
</tbody>
</table>

**SF6 circuit breaker range**

| DM1-A | Disconnector IEC 62271-102 1 000 operations |  |
| DM1-D |  |
| DM1-W |  |
| DM1-Z | SF circuit breaker IEC 62271-100 10 000 operations class M2 | IEC 62271-100 30 breaks at 12.5 kA for 24 kV 25 breaks at 25 kA for 24 kV 40 breaks at 16 kA for 36 kV 15 breaks at 25 kA for 36 kV 10 000 breaks at Ir. p.f. = 0.7, class E2 |
| DM1-S |  |
| DM2 |  |
| DM2-W |  |

**Vacuum circuit breaker range**

| DMV-A | Switch IEC 62271-100 1 000 operations | IEC 60265 100 breaks at Ir. p.f. = 0.7, class E3 |
| DMV-D |  |
| DMV-S |  |
| Evolis circuit breaker IEC 62271-100 10 000 operations class M2 | IEC 62271-100 10 000 breaks at Ir. p.f. = 0.7, class E2 |
| DMVL-A | Disconnector IEC 62271-102 1 000 operations |  |
| DMVL-D |  |

(5) As per recommendation IEC 62271-105, three breakings at p.f. = 0.2 800 A under 36 kV; 1400 A under 24 kV; 1730 A under 12 kV; 2600 A under 5.5 kV.

**Internal arc withstand** (in accordance with IEC 62271-200):

- SM6 24 kV:
  - standard: 12.5 kA 1 s, IAC: A-FL
  - enhanced: 16 kA 1 s, IAC: A-FLR & IAC: A-FLR
- SM6 36 kV:
  - standard: 16 kA 1 s, IAC: A-FL

**Protection index**:

- classes: PI (insulating partition)
- loss of service continuity classes: LSC2A
- units in switchboard: IP3X
- between compartments: IP2XC
- Cubicle: IK08.

**Electro-magnetic compatibility**:

- relays: 4 kV withstand capacity, as per recommendation IEC 60801.4
- compartments:
  - electrical field:
    - 40 dB attenuation at 100 MHz
    - 20 dB attenuation at 200 MHz
  - magnetic field: 20 dB attenuation below 30 MHz.

**Temperatures**:

- The cubicles must be stored and installed in a dry area free from dust and with limited temperature variations.
- for stocking: from – 40°C to +70°C
- for working: from – 5°C to +40°C
- other temperatures, consult us.
Factory-built cubicles description

Cubicles are made up of 3 compartments and 2 cabinets that are separated by metal or insulating partitions.

Switch and fuse protection cubicles

1 switchgear: switch-disconnector and earthing switch in an enclosure filled with SF6 and satisfying “sealed pressure system” requirements.

2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

3 connection: accessible through front, connection to the lower switch-disconnector and earthing switch terminals (IM cubicles) or the lower fuse-holders (PM and QM cubicles). This compartment is also equipped with an earthing switch downstream from the MV fuses for the protection units.

4 operating mechanism: contains the elements used to operate the switch-disconnector and earthing switch and actuate the corresponding indications (positive break).

5 low voltage: installation of a terminal block (if motor option installed), LV fuses and compact relay devices.

If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter “Characteristics of the functional units”.

(*) 2 compartments for 36 kV

SF6 circuit breaker cubicles

1 switchgear: disconnector(s) and earthing switch(es), in enclosures filled with SF6 and satisfying “sealed pressure system” requirements.

2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

3 connection and switchgear: accessible through front, connection to the downstream terminals of the circuit breaker.

Two circuit breaker offers are possible:

- SF1: combined with an electronic relay and standard sensors (with or without an auxiliary power supply)
- SFset: autonomous set equipped with an electronic protection system and special sensors (requiring no auxiliary power supply).

4 operating mechanism: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.

5 low voltage: installation of compact relay devices (Statimax) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter “Characteristics of the functional units”.

(*) 2 compartments for 36 kV
Factory-built cubicles
description

Frontal vacuum type circuit breaker cubicles
1 switchgear: load break switch and earthing switch(es), in enclosure filled with SF6 and satisfying and one vacuum circuit breaker, “sealed pressure system” requirements.
2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.
3 connection and switchgear: accessible through front, connection to the downstream terminals of the circuit breaker.
4 operating mechanism: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.
5 low voltage: installation of compact relay devices (VIP) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter “Characteristics of the functional units”.

Lateral vacuum type circuit breaker cubicles
1 switchgear: disconnector(s) and earthing switch(es), in enclosure filled with SF6 and satisfying and one vacuum circuit breaker, “sealed pressure system” requirements.
2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.
3 connection and switchgear: accessible through front, connection to the downstream terminals of the circuit breaker.
4 operating mechanism: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.
5 low voltage: installation of compact relay devices (VIP) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter “Characteristics of the functional units”.

Contactor cubicles
1 switchgear: disconnector and earthing switch and contactor in enclosures filled with SF6 and satisfying “sealed pressure system” requirements.
2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.
3 connection and switchgear: accessible through front.
The compartment is also equipped with an earthing switch downstream.
The contactor may be equipped with fuses.
4 types may be used:
   ■ R400 with magnetic holding
   ■ R400D with mechanical latching
   ■ Vacuum with magnetic holding
   ■ Vacuum with mechanical latching.
4 operating mechanism: contains the elements used to operate the disconnector(s), the contactor and the earthing switch and actuate the corresponding indications.
5 low voltage: installation of compact relay devices and test terminal boxes.
With basic equipment, an additional enclosure is added on top of the cubicle.

Options: please, refer to the chapter “Characteristics of the functional units”.

Options: please, refer to the chapter “Characteristics of the functional units”.
**Busbar compartment**
The three insulated busbars are parallel-mounted. Connection is made to the upper pads of the enclosure using a field distributor with integrated captive screws. Ratings 400 - 630 - 1250 A.

**Switch compartment for 24 kV**
This compartment is separated from the busbar compartment and the connection compartment by the enclosure surrounding the switch, the disconnector and the earthing switch.

**Connection and switch compartment**
The network cables are connected:
- to the terminals of the switch
- to the lower fuse holders
- or to the connection pads of the circuit breaker.

Cables may have either:
- cold fitted cable end for dry-type

With basic equipment, the maximum allowable cross-section for cable is:
- 630 mm² or 2 x 400 mm² for 1250 A incoming or outgoing units
- 240 mm² or 2 x 240 mm² for incoming or outgoing units 400 - 630 A
- 95 mm² for transformer protection cubicles incorporating fuses.

See in functional units characteristics chapter for each unit allowable section.
The earthing switch must be closed before the cubicle may be accessed.
The reduced depth of the cubicle makes for easy connection of all phases.
A stud incorporated in the field distributor makes it possible to position and secure the cable-end lug with a single hand.
Compartments description

Operating-mechanism cover
These covers contain the various operating functions for the:
- switch and earthing switch
- disconnector(s)
- circuit breaker
- contactor
and the voltage presence indicator.
The operating-mechanism cover may be accessed with the cables and busbars energised and without isolating the substation.
It also enables easy installation of padlocks, locks and standard LV accessories (auxiliary contacts, trip units, motors, etc.).

Low-voltage monitoring control cabinet for 24 kV
It enables the cubicle to be equipped with low voltage switchgear providing protection, control, status indication and data transmission.
According to the volume, it is available in 3 versions: cover, wiring duct and cabinet.

A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 1600 mm.

B - LV wiring duct and cabinet: enables a large majority of low voltage configurations to be installed.
It also takes the Sepam series 20 or series 40.
The total cubicle height is then 1690 mm.

C - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 80, converters, changeover and telecontrol units, regulating transformers or dual secondary transformers.
The total height of the cubicle then becomes 2050 mm.

In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.

Low-voltage monitoring control cabinet for 36 kV

A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 2250 mm.

B - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 80, converters, changeover and telecontrol units, regulating transformers or dual secondary transformers.

In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.
Safety of people
By switchgear

Switch or disconnector and earthing switch

- **Gas tightness**
  The three rotating contacts are placed in an enclosure filled with gas to a relative pressure of 0.4 bar (400 hPa) for 24 kV and 1 bar (1000 hPa) for 36 kV. It satisfies “sealed pressure system” requirements and seal tightness is always factory checked, and leakage rate is less than 0.1% for 30 years life span.

- **Operating safety**
  - the switch may be in one of three positions: “closed”, “open”, or “earthed”, representing a natural interlocking system that prevents incorrect operation. Moving-contact rotation is driven by a fast-acting mechanism that is independent of the action of the operator.
  - the device combines the breaking and disconnection functions.
  - the earthing switch placed in the SF6 has a short-circuit making capacity, in compliance with standards.
  - any accidental over-pressures are eliminated by the opening of the safety membrane, in which case the gas is directed toward the back of the unit, away from the operator.

- **Insensitivity to the environment**
  - parts are designed in order to obtain optimum electrical field distribution.
  - the metallic structure of cubicles is designed to withstand and aggressive environment and to make it impossible to access any energised part when in operation.

Rollarc 400 and 400D contactor

- **Gas tightness**
  The three phases are placed in an enclosure filled with SF6 gas to a relative pressure of 2.5 bars (2500 hPa). It satisfies “sealed pressure system” requirements and seal tightness is always checked in the factory.

- **Operating safety**
  Accidental over-pressures are eliminated by the opening of the safety membrane.
Safety of people
By switchgear

SF6 circuit breaker: SF1

- **Gas tightness**
The SF1 circuit breaker is made up of three separate poles mounted on a structure supporting the operating mechanism. Each pole-unit houses all the active elements in an insulating enclosure filled with gas to a relative pressure of 0.5 bar (500 hPa) for 24 kV and 2 bar (2000 hPa) for 36 kV. It satisfies “sealed pressure system” requirements and seal tightness is always checked in the factory.

- **Operating safety**
Accidental over-pressures are eliminated by the opening of the safety membrane.

Vacuum type circuit breaker: Evolis

- **Vacuum tightness**
The Evolis circuit breaker comprises three separate pole units fixed on a structure supporting the control mechanism. Each pole encloses all of the active parts in an insulating enclosure, under vacuum, and its vacuum tightness is systematically checked in the factory.

- **Operating safety**
The magnetic field is applied along the contact axis of the vacuum type circuit breaker. This process diffuses the arc in a regular manner with high currents. It ensures optimum distribution of the energy along the compact surface so as to avoid local hot spots.

The advantages of this technique:
- a simplified vacuum type circuit breaker which is consequently very reliable,
- low dissipation of arcing energy in the circuit breaker,
- highly efficient contacts which do not distort during repeated breaking,
- significant reduction in control energy.

Vacuum type contactor

- **Vacuum tightness**
Vacuum contactor comprises three separate poles fixed on a structure supporting the control mechanism. Each pole encloses all of the active parts in an insulating enclosure under vacuum and its vacuum tightness is checked in the factory.
Generalities

Safety of people
By operating mechanism safety

Reliable operating mechanism
- **Switchgear status indicator:**
  Fitted directly to the drive shaft, these give a definite indication of the contact’s position.
  (appendix A of standard IEC 62271-102).
- **Operating lever:**
  This is designed with an anti-reflex device that stops any attempt to re-open the device immediately after closing the switch or the earthing disconnector.
- **Locking device:**
  Between one and three padlocks enable the following to be locked:
  - access to the switching shaft of the switch or the circuit breaker,
  - access to the switching shaft of the earthing disconnector,
  - operating of the opening release push-button.

Simple and effortless switching
Mechanical and electrical controls are side by side on the front fascia, on a panel including the schematic diagram indicating the device’s status (closed, open, earthed):
- **Closed:** the drive shaft is operated via a quick acting mechanism, independent of the operator. No energy is stored in the switch, apart from when switching operations are taking place.
  For combined switch fuses, the opening mechanism is armed at the same time as the contacts are closed.
- **Opening:** the switch is opened using the same quick acting mechanism, operated in the opposite direction.
  For circuit breakers and the combined switch fuses, opening is controlled by:
  - a push-button,
  - a fault.
- **Earthing:** a specific control shaft enables the opening or closing of the earthing contacts. Access to this shaft is blocked by a cover that can be slid back if the switch is open but which remains locked in place if it is closed.

Visibility of main contacts (option for 24 kV)
The position of main contacts is clearly visible from the front of the cubicle through the window.

Gas pressure indicator (option for 24 kV)
Despite SM6 switch is sealed pressure system and has open and close capacity on rated current at 0 bar relative pressure SF6, to insure you about the internal pressure, we propose on request before sale or on site by after-sales either a pressure switch or an analog manometer on the switch.
These devices are both fitted without any alteration on the switch, they are temperature compensated and compatible with visibility of main contacts if requested.

Voltage presence indicator
This device has integrated VPIS (Voltage Presence Indicating System) type lights, in conformity with IEC standard 61958, enabling the presence (or absence) of voltage to be checked on the cables.
Generalities

Safety of people
By internal arc protection

Standard IEC 62271-200 appendix A indicates a method for testing switchgear in metal enclosures under internal arc conditions. The aim of this test is to show that an operator situated in front of a switchboard would be protected against the effects of an internal fault.

To enhance the safety of people, it is desirable to provide as high a degree of protection as possible by evacuating the effects of internal arc using:

- evacuation systems which direct gases towards the top or the bottom of the switchboard enabling over pressure to be limited in the case of an internal fault in the compartments
- channelling and evacuating hot gases towards an external area, which is not hazardous for the operator
- materials which are non-inflammable in the cubicles
- reinforced panels.

Consequently:
The SM6 is designed to offer a good level of safety

- Control of the architecture:
  - compartment type enclosure.
- Technological control:
  - electrotechnical: modelling of electrical fields,
  - mechanical: parts produced using CAD systems.
- Use of reliable components:
  - choice of materials,
  - earthing switch with closing capacity.
- Devices for total operating safety:
  - voltage presence indicator on the front face,
  - natural reliable interlocking,
  - locking using keys or padlocks.

Internal arc withstand of the cubicles

- 2 versions are available for 24 kV:
  - basic version: 12.5 kA 1 s, IAC: A-FL
  - enhanced internal arc withstand: 16 kA 1 s, IAC: A-FL or IAC: A-FLR.
- 1 version is available for 36 kV:
  - 16 kA 1 s, IAC: A-FL.

SM6 internal arc
(in conformity with IEC 62271-200 appendix A)

In its internal arc version, the SM6 has successfully passed all of the type testing relative to standard IEC 62271-200 (5 acceptance criteria).
The materials used meet the constraints for which the SM6 is designed.
The thermal and mechanical forces that an internal arc can produce are perfectly absorbed by the enclosure.
An operator situated in the front of the SM6 switchboard during an internal fault will not be exposed to the effects of arcing.

SM6 proposes several options to install a standard or enhanced internal arc withstand switchboard

- For 24 and 36 kV 3-sides internal arc protection IAC: A-FL,
  - 12.5 kA 1 s, 16 kA 1 s
SM6 switchboard positioned against the wall, access to the rear of the cubicles is impossible, internal arc protection on three sides is sufficient.
- For 24 kV 4-sides internal arc protection IAC: A-FLR, 16 kA 1 s
For SM6 switchboards installed in the middle of a room, 4-sides internal arc protection is necessary in order to protect an operator moving around the switchboard.
- Choice of exhaust:
  (civil engineering document for internal arc protected cubicles to be considered)
  - For 24 kV upwards exhaust
    A ceiling height greater or equal than 2,800 mm is necessary.
  - For 24 kV downwards exhaust
    Civil engineering with an adequate volume is necessary.
  - For 36 kV downwards exhaust
    Civil engineering with an adequate volume is necessary.
Easergy T200 S

Easergy T200 S is a simplified MV substation control unit for secondary distribution networks enabling remote control of one or two MV substation switches. T200 S, a version of the T200 I unit, is integrated in the SM6 cubicle LV control cabinet. It is limited to control 2 switches. It is intended for remote control applications for source transfer switching and back up generator set switching in NSM cubicle.

Easergy T200 S is a multifunctional "plug and play" interface which integrates all functions required for remote monitoring and control of MV substations:

- acquisition of various data types: switch position, fault detectors, current values, etc.
- transmission of opening and closing orders to the switches
- exchange with the control center.

Particularly used during network incidents, Easergy T200 S has proven its reliability and availability to be able to operate the switchgear at all times. It is easy to implement and operate.

Functional unit dedicated to Medium Voltage applications

Easergy T200 S is installed in the low voltage control cabinet of NSM cubicles for remote control of one or two switches. Easergy notably enables source transfer switching between two switches. It has a simple panel for local operation to manage electrical controls (local/remote switch) and to display switchgear status information.

It integrates a fault current detector (overcurrent and zero sequence current) with detection thresholds configurable channel by channel (threshold and fault duration).

"Plug and play" and secure

Integrated in the low voltage control cabinet of an MV-equipped cubicle, it is ready to connect to the data transmission system. Easergy T200 S has been subject to severe tests on its resistance to MV electrical constraints. A back-up power supply guarantees several hours continuity of service for the electronic devices, motorization and MV switchgear.

Current transformers are of split core type for easier installation.

Compatible with all SCADA remote control systems

Easergy T200 S supplies the following standard protocols: Modbus, DPN3.0 level 2 and IEC 870-5-101.

Data transmission system standards are: RS232, RS485, PSTN, FSK, FFSK, GSM/GPRS.

Other systems are available on request, the radio frequency emitter/receiver is not supplied.

Voltage detection relay for NSM function

VD23 provides accurate information of presence or absence of voltage. Associated with VPIS-Voltage Output, VD23 is typically used in critical power and safety applications.

Various combinations of voltage detection are possible:

- 3 Ph-N and residual voltage: V1 + V2 + V3 + V0
- 3 Ph-N or Ph-Ph voltage: V1 + V2 + V3 or U12 + U13 + U23
- 1 Ph-N or Ph-Ph or residual voltage: V1, V2, V3, U12, U13, U23, V0.

VD23 can display the MV network voltage (in % of service voltage), active the relay output R1 to monitor a loss of voltage on 1 phase at least and active the relay output R2 to monitor a presence of voltage on 1 phase at least.

- Auxiliary power supply: from 24 to 48 Vdc
- Assembly: compact DIN format, mounted in the same place as fault passage indicator (format DIN, integrated in switchgear), terminal connexion fitted with VPIS-Voltage Output
- Compatible with all neutral earthing systems.
Easergy T200 I: an interface designed for telecontrol of MV networks

Easergy T200 I is a “plug and play” or multifunction interface that integrates all the functional units necessary for remote supervision and control of the SM6:

- acquisition of the different types of information: switch position, fault detectors, current values...
- transmission of switch open/close orders
- exchanges with the control center.

Required particularly during outages in the network, Easergy T200 I is of proven reliability and availability, being able to ensure switchgear operation at any moment. It is simple to set up and to operate.

Functional unit designed for the Medium Voltage network

- Easergy T200 I is designed to be connected directly to the MV switchgear, without requiring a special converter.
- It has a simple front plate for local operation, which allows management of electrical rating mechanisms (local/remote switch) and display of information concerning switchgear status.
- It has an integrated MV network fault current detection system (overcurrent and zero sequence) with detection set points that can be configured channel by channel (current value and fault current duration).

Medium Voltage switchgear operating guarantee

- Easergy T200 I has undergone severe MV electrical stress withstand tests.
- It is a backed up power supply which guarantees continuity of service for several hours in case of loss of the auxiliary source, and supplies power to the Easergy T200 I and the MV switchgear motor mechanisms.
- Ready to plug
  - Easergy T200 I is delivered with a kit that makes it easy to connect the motor mechanisms and collect measurements.
  - the telecontrol cabinet connectors are polarized to avoid any errors during installation or maintenance interventions.
  - current measurement acquisition sensors are of the split type, to facilitate their installation.
  - works with 24 Vdc and 48 Vdc motor units.
Generalities

Easergy Flair is a comprehensive range of underground network fault current indicators

Easergy Flair MV underground network fault current passage indicators are a range of products adapted to all neutral earthing systems: insulated, impedant and direct earthing.
- Easergy Flair 21D-22D-23DV, are self-powered with a liquid crystal display, with DIN dimensions for MV cubicle installation.
- Easergy Flair 279 and 219, have a wall-mounted case for the MV cubicles substation or LV compartment and an external power supply which can be backed up.
- Easergy Flair 200C (communicative) has advanced measurement functions and long distance communication features (radio, GSM, RTC, etc.).

<table>
<thead>
<tr>
<th>Usage</th>
<th>Installation</th>
<th>Power supply</th>
<th>Fault detection</th>
<th>Indication</th>
<th>Measurement</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground MV networks, open loop, insulated, impedant and direct neutral earthing systems.</td>
<td>Flush fitted</td>
<td>Self-powered or dual power</td>
<td>Phase-phase and phase-earth for all 3 ranges</td>
<td>LCD display</td>
<td>Current, frequency</td>
<td>SCADA interface by dry contact</td>
</tr>
<tr>
<td>Casing</td>
<td>230 Vac or battery</td>
<td>230 Vac</td>
<td>Indicator light</td>
<td>Indicator light (option)</td>
<td>Current, voltage, power</td>
<td>SCADA interface by dry contact</td>
</tr>
</tbody>
</table>

Easergy Flair 21D - 22D - 23DV
SM6 integrates Flair 21D, Flair 22D and Flair 23DV on every incoming cubicles.

- **High performance indicators**
  - indication of phase-phase and phase-earth faults,
  - faulty phase indication,
  - compatible with HV/MV substation protection devices.

- **Clear and comprehensive display**
  - displaying the faulty phase for earth fault,
  - displaying settings,
  - displaying the load current including peak demand and frequency meter.

- **Maintenance free.**

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Flair 21D</th>
<th>Flair 22D</th>
<th>Flair 23DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-powered</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Dual power supply</td>
<td>(battery)</td>
<td>(external)</td>
<td></td>
</tr>
</tbody>
</table>

**Display of settings**
- Short-circuit fault thresholds
- Earth fault thresholds
- Validation (no current)
- Reset upon return of current
- Reset timer

**Faulty phase and measurements**
- Faulty phase
- Load current
- MV network frequency
- Peak demand current
- Residual current

<table>
<thead>
<tr>
<th>Flair 21D</th>
<th>Flair 22D</th>
<th>Flair 23DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-L2-L3</td>
<td>L1-L2-L3</td>
<td>L1-L2-L3</td>
</tr>
<tr>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
</tr>
</tbody>
</table>
Generalities

- At the leading edge of technology, Amp 21D is suitable for Medium Voltage network load management.
- Self-powered, it ensures a permanent display of currents.
- Compact and in DIN format, it fits naturally into MV cubicles.
- Cost efficient, it uses the CT optimised for Fault Passage Indicator.
- Performant, it displays phase current and maximum of current.

Ammeter

Functions
- Display of 3 phase current: I1, I2, I3. Range: 3 A to 800 A
- Display of 3 phase current maximeter: I1, I2, I3. Range: 3 to 800 A.

Display principle
- Load currents are permanently displayed
  - continuous scrolling of L1, then L2, then L3.
- Maximeter
  - access to maximeter display by pressing a dedicated push button
  - continuous scrolling of M1, then M2, then M3
  - reset of all maximeter by pressing a combination of two push buttons.

Assembly
- Small size enclosure
  - DIN format: 93 x 45 mm
- Secured, extraction-proof mounting
- Terminal connections.

Technical data

<table>
<thead>
<tr>
<th>Application</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>50 Hz and 60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load current</td>
<td>Minimum current: &gt; 3 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>Phase current: 3 to 800 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accuracy (I &lt; 630 A): ± 5%, ± 2 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset of maximeter</td>
<td>Manual from device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self power</td>
<td>From the current sensors</td>
<td></td>
<td>I load &gt; 3 A</td>
</tr>
<tr>
<td>Battery</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary supply</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display: 4 digits LCD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current per phase: Yes (resolution 1 A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximeter per phase: Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phase CTs: 3 split core CT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test: Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dielectric: IEC 60255-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electromagnetic: IEC 61000-4-4 (level 4)</td>
<td></td>
<td>Insulation 10 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-12</td>
<td>Shock wave 20 kV</td>
</tr>
<tr>
<td></td>
<td>Climatic: Operating temperature: – 25°C to + 70°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage temperature: – 40°C to + 85°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Salt fog: 200 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60068-2-6</td>
<td>Vibration 10 to 500 Hz: 2 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60068-2-29</td>
<td>Protection IP23</td>
<td></td>
</tr>
</tbody>
</table>

The SM6 integrates ammeter Amp 21D on all incoming cubicles and the fuse-switch cubicles.
Generalities

The Sepam range of protection and metering is designed for the operation of machines and electrical distribution networks of industrial installations and utility substations for all levels of voltage. It consists of complete, simple and reliable solutions, suited to following four families:
- Sepam series 10,
- Sepam series 20,
- Sepam series 40,
- Sepam series 80.

Description of the control/monitoring & protection functions
Sepam selection guide for all applications

A range adapted at your application
- Protection of substation (incoming, outgoing line and busbars).
- Protection of transformers.
- Protection of motors, and generators.

Simplicity
Easy to install
- Light, compact base unit.
- Optional modules fitted on a DIN rail, connected using prefabricated cords.
- User friendly and powerful PC parameter and protection setting software to utilize all of Sepam's possibilities.

User-friendly
- Intuitive User Machine Interface, with direct data access.
- Local operating data in the user's language.

Series 10
![Series 10 Diagram]
Series 20
![Series 20 Diagram]
Series 40
![Series 40 Diagram]

Protections

<table>
<thead>
<tr>
<th>Protections</th>
<th>Series 10</th>
<th>Series 20</th>
<th>Series 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specifics</td>
<td>Phase and earth fault overcurrent</td>
<td>Breaker failure by rate of change of frequency</td>
<td>Directional earth fault and phase overcurrent</td>
</tr>
</tbody>
</table>

Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Substation</th>
<th>Series 10</th>
<th>Series 20</th>
<th>Series 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation</td>
<td>10A, 10B</td>
<td>S10</td>
<td>S20</td>
<td>S40</td>
</tr>
<tr>
<td>Busbar</td>
<td></td>
<td>B10</td>
<td>B20</td>
<td>B30</td>
</tr>
<tr>
<td>Transformer</td>
<td>10A, 10B</td>
<td>T10</td>
<td>T20</td>
<td>T40</td>
</tr>
<tr>
<td>Motor</td>
<td>10A, 10B</td>
<td>M10</td>
<td>M20</td>
<td>M40</td>
</tr>
<tr>
<td>Generator</td>
<td>10A, 10B</td>
<td>G10</td>
<td>G20</td>
<td>G40</td>
</tr>
<tr>
<td>Capacidtor</td>
<td></td>
<td>Li10</td>
<td>Li20</td>
<td>Li40</td>
</tr>
</tbody>
</table>

Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Series 10</th>
<th>Series 20</th>
<th>Series 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic inputs</td>
<td>4</td>
<td>0 to 10</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Logic outputs</td>
<td>7</td>
<td>0 to 10</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Temperature sensors</td>
<td>31 + Io</td>
<td>31 + Io</td>
<td>31 + Io</td>
</tr>
<tr>
<td>Communication ports</td>
<td>3V + Vo</td>
<td>3V + Vo</td>
<td>3V + Vo</td>
</tr>
<tr>
<td>IEC61850 Protocol</td>
<td>1 to 2</td>
<td>1 to 2</td>
<td>1 to 2</td>
</tr>
<tr>
<td>Control Matrix</td>
<td>Logic equation editor</td>
<td>Logic equation editor</td>
<td>Logic equation editor</td>
</tr>
<tr>
<td>Other</td>
<td>Memory cartridge with settings</td>
<td>Lithium battery</td>
<td>Back up battery for 48 hours</td>
</tr>
</tbody>
</table>

(1) LPCT: low-power current transformer complying with standard IEC 60044-8.
(2) Control matrix for simple assignment of information from the protection, control and monitoring functions.
(3) Logipam ladder language (PC programming environment) to make full use of Sepam series 80 functions.
Generalities

**Description of the control/monitoring & protection functions**

*Sepam selection guide for all applications*

---

**Accurate measurement and detailed diagnosis**
- Measuring all necessary electrical values.
- Monitoring switchgear status: sensors and trip circuit, mechanical switchgear status.
- Disturbance recording.
- Sepam self-diagnosis and watchdog.

**Flexibility and evolutivity**
- Enhanced by optional modules to evolve in step with your installation.
- Possible to add optional modules at any time.
- Simple to connect and commission via a parameter setting procedure.

---

**Series 80**

- Directional earth fault
- Directional earth fault and phase overcurrent
- Disconnection by rate of change of frequency
- Transformer & transformer-machine unit differential
- Machine differential
- Voltage and frequency protection for 2 sets of busbars
- Capacitor-bank unbalance

<table>
<thead>
<tr>
<th>S00</th>
<th>S81</th>
<th>S82</th>
<th>S84</th>
</tr>
</thead>
<tbody>
<tr>
<td>B80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T81</td>
<td>T82</td>
<td>T87</td>
<td></td>
</tr>
<tr>
<td>M81</td>
<td>M88</td>
<td>M87</td>
<td></td>
</tr>
<tr>
<td>G82</td>
<td>G88</td>
<td>G87</td>
<td></td>
</tr>
</tbody>
</table>

---

| 0 to 42 | 0 to 42 | 0 to 42 | 0 to 42 |
| 5 to 23 | 5 to 23 | 5 to 23 | 5 to 23 |
| 0 to 16 | 0 to 16 | 0 to 16 | 0 to 16 |
| 3/2 x Io | 3/2 x Io | 3/2 x Io | 3/2 x Io |
| 3V + Vo | 3V + Vo | 2 x 3V + 2 x Vo | 3V + Vo |
| 2 to 4 | 2 to 4 | 2 to 4 | 2 to 4 |
|       |       |       |       |
| Lithium battery | Lithium battery | Lithium battery | Lithium battery |
VIP 35 relay for transformer protection
Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
The VIP 35 is an independent relay without an auxiliary power supply, powered by the current sensors, and actuating a Mitop release unit.

Phase protection
- Phase protection is achieved by a definite time threshold which functions from 1.2 times the operating current (Is).

Earthing protection
- Earthing fault protection functions with the residual current measurement taken from the sum of the secondary currents in the sensors. This is taken via a CRc, 8 A to 80 A gauge.
- Earthing protection is inverse definite time: its threshold and time delay can be set.

Setting the VIP 35 relays
Is: the phase operating current is adjusted directly in accordance with the transformer rating and the operating voltage.
Io: the earth current threshold is adjusted according to the network characteristics.

Setting values of the Is phase operating current for VIP 35

<table>
<thead>
<tr>
<th>Operating voltage (kV)</th>
<th>Transformer rating (kVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>100</td>
<td>125</td>
</tr>
<tr>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>250</td>
<td>315</td>
</tr>
<tr>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>630</td>
<td>800</td>
</tr>
<tr>
<td>1000</td>
<td>1250</td>
</tr>
<tr>
<td>1600</td>
<td>2000</td>
</tr>
<tr>
<td>2500</td>
<td>3150</td>
</tr>
<tr>
<td>4000</td>
<td>5000</td>
</tr>
<tr>
<td>6300</td>
<td></td>
</tr>
</tbody>
</table>

VIP 300 LL protection relay
Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
VIP 300 provides protection against phase-to-phase and phase-to-earth faults. A choice of trip curves and the large number of possible settings mean that it can be used in a large variety of selectivity layouts. VIP 300 is an independent relay powered by the current sensors; it does not require an auxiliary power supply. It actuates a release unit.

Phase protection
- Phase protection is via two independently adjustable thresholds:
  - The lower threshold can be chosen to be inverse definite time or definite time.
  - The definite time curves are in conformity with IEC standard 60255-3. They are either of inverse, very inverse or extremely inverse type.
- The upper threshold is inverse definite time.

Earthing protection
- Protection against phase-to-earth faults uses the residual current measurement, taken from the sum of the secondary currents in the sensors. This is taken via a CRa X1 gauge: 10 to 50 A and X4: 40 to 200 A or via a CRb X1 gauge: 63 to 312 A and X4: 250 A to 1250 A.
- As for phase protection, phase-to-earth protection had two thresholds that can be independently set.

Signalling
- Two indicators show the origin of the trip operation (phase or earth). They remain in position after the relay power supply has been cut.
- Two led indicators (phase and earth) show that the lower threshold has been exceeded and that its time delay is currently in progress.
Generalities

Description of the control/monitoring & protection functions

Sepam series 10 with CRa/CRb sensors for transformer protection
Integrated in the DM1-S cubicle for SM6 24 kV with CRa and CRb sensors and DM1-A cubicle for SM6 36 kV with normal CT’s

Sepam series 10 monitors phase and/or earth-fault currents.
Two models meet a wide range of different needs:
• **10B**: Sepam series 10B protects against overloads, phase-to-phase faults and earth faults.
• **10A**: Sepam series 10A provides the same functions as model B, but with a communication port, more inputs and outputs, and additional protection and monitoring functions.

**Setting of Sepam series 10 for DM1-S 24 kV**

- Is: the phase operating current is adjusted directly in accordance with the transformer rating and the operating voltage.
- Io: the earth current threshold is adjusted according to the network characteristics.

**Setting values of the Is phase operating current**

| Operating voltage (kV) | Transformer rating (kVA) 50 | 75 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 | 3000 | 3500 |
|------------------------|-----------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3                      | 19, 24, 31, 38, 48, 61, 77, 96, 121, 154, 192 | 241, 308, 385, 481, 577 |
| 3.3                    | 22, 28, 35, 44, 55, 70, 87, 110, 140, 175 | 219, 280, 350, 437, 525 |
| 4.2                    | 22, 27, 34, 43, 55, 69, 87, 110, 137, 172 | 220, 275, 344, 412, 481 |
| 5.5                    | 21, 26, 33, 42, 52, 66, 84, 105, 131, 168 | 210, 262, 315, 367 |
| 6                      | 19, 24, 30, 38, 48, 61, 77, 96, 120, 154, 192 | 241, 289, 337 |
| 6.6                    | 22, 28, 35, 44, 55, 70, 87, 109, 140, 175 | 219, 262, 306 |
| 10                     | 23, 29, 36, 46, 58, 72, 92, 115, 144, 173 | 202 |
| 11                     | 21, 26, 33, 42, 52, 66, 84, 105, 131, 157, 184 |
| 13.8                   | 21, 26, 33, 42, 52, 67, 84, 105, 126, 146 |
| 15                     | 19, 24, 31, 38, 48, 62, 77, 96, 115, 135 |
| 20                     | 23, 29, 36, 46, 58, 72, 87, 101 |
| 22                     | 21, 26, 33, 42, 52, 66, 79, 92 |

**Sensors types legend**

- CRa 200/1
- CRb 1250/1
**Generalities**

**Description of the control/monitoring & protection functions**

### Current sensor for VIP 35 and VIP 300LL and Sepam series 10 for 24 kV

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>Weight (kg)</th>
<th>Ratio of transformation</th>
<th>Class of precision</th>
<th>V1P 35</th>
<th>V1P 300LL</th>
<th>Sepam 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRa</td>
<td>143.5 81 37.5</td>
<td>2.18</td>
<td>1/200</td>
<td>± 2% from 10 A to 100 A ± 1% from 100 A to 1600 A On load 5.7 Ω (cal. x 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>± 1% from 10 A to 10 kA On load 0.67 Ω (cal. x 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRb</td>
<td>143.5 81 37.5</td>
<td>1.26</td>
<td>1/1250</td>
<td>± 1% from 10 A to 11 kA On load 5.7 Ω (cal. x 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>± 1% from 10 A to 25 kA On load 0.67 Ω (cal. x 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRc</td>
<td>143.5 81 37.5</td>
<td>2 S1-S2: 1/200</td>
<td>S1-S2: ± 5% from 10 A to 80 A S1-S3: ± 2.5% from 80 A to 600 A S1-S3: ± 2% from 20 A to 2200 A</td>
<td>On load 0.6 Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General common selection of protection units

<table>
<thead>
<tr>
<th>Protection type</th>
<th>Code</th>
<th>Protection units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-phase overcurrent</td>
<td>50 - 61</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /> <img src="3" alt="Symbol" /></td>
</tr>
<tr>
<td>Zero-sequence overcurrent</td>
<td>50N - 51N</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /> <img src="3" alt="Symbol" /></td>
</tr>
<tr>
<td>Directional zero-sequence current</td>
<td>67N</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Undervoltage</td>
<td>27</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Overvoltage</td>
<td>59</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Thermal image</td>
<td>49</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /> <img src="3" alt="Symbol" /></td>
</tr>
<tr>
<td>Zero-sequence overvoltage</td>
<td>59N</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Negative sequence overcurrent</td>
<td>46</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Long start-up and rotor blocking</td>
<td>51LR</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Maximum number of start-ups</td>
<td>66</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Single-phase undercurrent</td>
<td>37</td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td><img src="1" alt="Symbol" /> <img src="2" alt="Symbol" /></td>
</tr>
</tbody>
</table>

---

(1) DT, EI, SI, VI and RI trip curves.
(2) Inverse curve suited to transformer protection.
(3) DT trip curve.
LPCT protection chain
TLP130, CLP2 sensors and Sepam series 20, series 40, series 80 protection units

LPCT sensors are voltage-output current sensors (Low Power Current Transformer) compliant with the IEC 60044-8 standard. These sensors are designed to measure rated current between 5 A and 630 A, with a ratio of 100 A / 22.5 mV.

Sepam series 20, series 40, series 80 protection units are at the heart of the LPCT protection chain. Sepam series 20, series 40, series 80 performs the following functions:

- acquisition of phase currents measured by the LPCT sensors
- utilization of measurements by the protection functions
- tripping of the breaking device in case of fault detection.

Advantages

- Consistent protection chain with the same sensor measures phase currents from 5 A to 630 A
- Simple to install and implement:
  - installation of LPCT sensors
  - TLP130, TLP160 and TLP190 are installed around MV cable
  - CLP2 is installed on the MV circuit
  - LPCT connected directly to Sepam series 20, series 40, series 80
  - accessories available to test the LPCT protection chain by secondary current injection.
- LPCTs range of use
  - LPCT measuring and protection function guaranteeing the accuracy up to the short-time current.
  - Following the range of use of LPCT:
    - from 5 A up to 1250 A respecting the error limits imposed by the accuracy class 0.5
    - from 1250 A up to 50 kA respecting the error limits imposed by the accuracy class 5P.

Connections

1. LPCT sensor, equipped with a shielded cable fitted with an RJ45 connector to be connected directly to the card 3.
2. Sepam series 20, series 40, series 80 protection unit
3. Card interface that adapts the voltage delivered by the LPCT sensors, with microswitch setting of rated current.
   - CCA671 card for series 80
   - CCA670 card for series 20 and 40.

Testing and injection

4. CCA613 remote test plug, flush-mounted in front panel of cubicle, equipped with a 3-m cord to be connected to the CCA670 connector test socket (9-pin Sub D)
5. ACE917 injection interface, used to test the LPCT protection chain with a standard injection box
6. Standard 1A injection box.
Web Remote Monitoring

Description
- The EGX300 is an Ethernet-based device providing a simple transparent interface between Ethernet-based networks and field devices as protective relays (Sepam).
- The EGX300 has the ability to be used as a simple web based monitoring solution providing real-time data views, on-board data logging/trending, and simple control for field devices.
- The DM range of circuit breakers cubicles with Sepam ranges and one EGX300 per switchboard for remote monitoring via the Intranet.
- An RJ45 Ethernet connector on the front of the switchboard, directly accessible from the front panel (option).

For other SM6 configurations (with other devices or other Sepam product ranges), it is possible to integrate Web Remote Monitoring capability, consult your local Schneider Electric correspondent.

Range selection
This chart presents the different SM6 24 kV cubicles proposed with an industrialised Web Remote Monitoring system.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-isolation circuit breaker unit</td>
<td>DM1-A, DMVL-A</td>
</tr>
<tr>
<td>Single-isolation circuit breaker unit, right or left outgoing line</td>
<td>DM1-D</td>
</tr>
<tr>
<td>Withdrawable single-isolation circuit breaker unit</td>
<td>DM1-W</td>
</tr>
<tr>
<td>Withdrawable single-isolation circuit breaker unit, right outgoing line</td>
<td>DM1-Z</td>
</tr>
<tr>
<td>Double-isolation circuit breaker unit, right or left outgoing line</td>
<td>DM2</td>
</tr>
</tbody>
</table>

Typical design
You need to have a Web server in only one CB unit to monitor the whole switchboard.

![Web Remote Monitoring Diagram]

(1) Same cable CCR301 for RS 485 and PSU 24 V DC
# Characteristics of the functional units

## Contents

- **Functional units selection**  
  Network connection 45  
  Fuse-switch protection 45  
  Contactor protection 46  
  SF6 type circuit breaker protection 48  
  Vacuum type circuit breaker protection 50  
  MV metering 53  
  Casings 55  
  Other functions 57  
  Automatic Transfer System for 24 kV 60  
  Automatic Transfer System for 36 kV 62

- **Automatic Transfer System**  
  With NSM unit for 24 kV 61  
  With NSM unit for 36 kV 64

- **Network remote control and monitoring** 65

- **Operating mechanisms** 66

- **Auxiliaries** 69

- **Current transformers for 24 kV** 71  
  Current transformers for 36 kV 73

- **Voltage transformers for 24 kV** 74  
  Voltage transformers for 36 kV 76

- **Motors protection units** 77

- **Protection of transformers** 78

- **Interlocks** 80
Characteristics of the functional units

Functional units selection
Network connection

IM
Switch unit

IMC
Switch unit

IMB
Switch unit with earthing switch
Right or left outgoing

Electrical characteristics

Basic equipment:
- switch and earthing switch
- three-phase busbars
- CIT operating mechanism
- voltage presence indicator
- 150 W heating element for 36 kV
- connection pads for dry-type cables

Versions:
- CI2 operating mechanism
- CI1 operating mechanism
- CI1 operating mechanism for 36 kV
- in 800 A version for 24 kV, consult us

Optional accessories:
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- release units (coil)
- operation counter
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- visibility of main contacts for 24 kV
- pressure indicator device for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- fault indicators
- Connection pads for two dry-type single-core cables for 36 kV
- digital ammeter
- surge arresters (for 36 kV and for 24 kV in 500 mm wide cubicle)
Characteristics of the functional units

Functional units selection
Fuse-switch protection

QM
Fuse-switch combination unit

QMC
Fuse-switch combination unit

QMB
Fuse-switch combination unit

Outgoing line right or left

Electrical characteristics

Basic equipment:
- switch and earthing switch
- three-phase busbars
- CI1 operating mechanism
- voltage presence indicator
- equipment for three DIN striker fuses
- mechanical indication system for blown fuses
- 150 W heating element for 36 kV
- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity
- one to three CTs for 24 kV
- three-phase bottom busbars for outgoing lines (right or left)

Version:
- equipment for three UTE striker fuses for 24 kV
- CI2 operating mechanism
- CI2 operating mechanism for 36 kV

Optional accessories:
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- auxiliary contact for blown fuses
- DIN striker fuses
- release units (coil)
- digital ammeter
- 1250 A three-phase upper busbars
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- visibility of main contacts for 24 kV
- pressure indicator device for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
Characteristics of the functional units

Functional units selection
Fuse-switch protection

PM
Fused-switch unit

Electrical characteristics

<table>
<thead>
<tr>
<th>Current (kA)</th>
<th>UR (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>12</td>
</tr>
<tr>
<td>12.5</td>
<td>17.5</td>
</tr>
<tr>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>25</td>
<td>36</td>
</tr>
</tbody>
</table>

Ir = 200 A
Ik/1s & Isc

Basic equipment:
- switch and earthing switch
- three-phase busbars
- G1T operating mechanism
- voltage presence indicator
- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity
- equipment for three UTE (for 24 kV) or DIN striker fuses
- 150 W heating element for 36 kV

Version:
- CI1 operating mechanism
- CI2 operating mechanism for 36 kV

Optional accessories:
- motor for operating mechanism
- auxiliary contacts
- digital ammeter
- key-type interlocks
- mechanical indication system for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- UTE (for 24 kV) or DIN striker fuses
- visibility of main contacts for 24 kV
- pressure indicator device for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- Release units for 36 kV
Characteristics of the functional units

Functional units selection

Contactor protection

CRM
Contactor unit

CRM
Contactor unit with fuses

Electrical characteristics

Ir = 400 A

Ir = 250 A

Basic equipment:
- SF6 contactor
- disconnector and earthing switch
- three-phase busbars
- contactor operating mechanism with magnetic holding or contactor with mechanical latching
- disconnector operating mechanism CS
- one to three current transformers
- auxiliary contacts on contactor
- connection pads for dry-type cables
- voltage presence indicator
- downstream earthing switch 2 kA rms making capacity
- operation counter on contactor
- enlarged low-voltage control cabinet

Optional accessories:
- cubicle:
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - one to three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - 1250 A three-phase upper busbars
  - 630 A three-phase upper busbars for severe operating conditions
- contactor:
  - mechanical interlocking

equipment for three DIN striker fuses

DIN striker fuses
**Characteristics of the functional units**

**Functional units selection**

**Contactor protection**

**CVM**
- Disconnectable contactor unit

**CVM**
- Disconnectable contactor unit with fuses

**Electrical characteristics**

<table>
<thead>
<tr>
<th>kA</th>
<th>Isc</th>
<th>Ur kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3</td>
<td></td>
<td>7.2</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Basic equipment:**
- vacuum contactor
- disconnector and earthing switch
- three-phase busbars
- contactor operating mechanism with magnetic holding or contactor with mechanical latching
- disconnector operating mechanism CS
- one to three current transformers
- auxiliary contacts on contactor
- connection pads for dry-type cables
- voltage presence indicator
- downstream earthing switch 2 kA rms making capacity
- operation counter on contactor
- enlarged low-voltage control cabinet
- mechanical interlocking between contactor and disconnector/earthing switch
- equipment for three DIN striker fuses
- mechanical indication system for blown fuses
- auxiliary contact for blown fuses

**Version:**
- LPCT (only with Sepam series 20, series 40, series 80)

**Optional accessories:**
- **cubicle:**
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - one to three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - 1250 A three-phase upper busbars
  - 630 A three-phase upper busbars for severe operating conditions
- **contactor:**
  - mechanical interlocking
  - DIN striker fuses
Characteristics of the functional units

Functional units selection
SF6 type circuit breaker protection

DM1-A
Single-isolation disconnectable CB unit

DM1-D
Single-isolation disconnectable CB unit
Outgoing line on right

DM1-D
Single-isolation disconnectable CB unit
Outgoing line on left

Electrical characteristics

Ir = 400 - 630 - 1250 A

Ir = 630 - 1250 A

Basic equipment:
- SF1 disconnectable circuit breaker
- disconnector and earthing switch
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- voltage presence indicator
- three CTs
- auxiliary contacts on circuit breaker
- mechanical interlocking between circuit breaker and disconnector
- 150 W heating element for 36 kV

- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity at 630 A and 25 kA rms making capacity at 1250 A

Version:
- LPCT (only with Sepam series 20, series 40, series 80)

Optional accessories:
- cubicle:
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - three voltage transformers
  - key-type interlocks
  - 1250 A three-phase upper busbars at Ir 630 A
  - cable connection by the top for 24 kV (no internal arc withstand if selected)
  - surge arresters
- SFset circuit breaker disconnectable (only for 400-630 A performances and 24 kV)
  - 630 A three-phase upper busbars for severe operating conditions for 24 kV
  - enlarged low-voltage control cabinet for 24 kV
  - 50 W heating element for 24 kV
  - Connection pads for two dry-type single-core cables for 36 kV

[Diagram of electrical characteristics]
**Characteristics of the functional units**

**Functional units selection**

SF6 type circuit breaker protection

**DM1-S**
- Single-isolation disconnectable CB unit with independent protection

**DM2**
- Double-isolation disconnectable CB unit
  - Outgoing line on right
  - Outgoing line on left

**Electrical characteristics**

<table>
<thead>
<tr>
<th>Ir = 400 - 630 A</th>
<th>Ir = 630 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>12</td>
</tr>
<tr>
<td>12.5</td>
<td>17.5</td>
</tr>
<tr>
<td>20</td>
<td>24</td>
</tr>
</tbody>
</table>

**DM2**
- Double-isolation disconnectable CB unit
  - Outgoing line on left

**Basic equipment:**
- SF1 disconnectable circuit breaker
- Disconnecter and earthing switch
- Three-phase busbars
- Circuit breaker operating mechanism RI
- Disconnecter operating mechanism CS
- Auxiliary contacts on circuit breaker
- Mechanical interlocking between circuit breaker and disconnecter
- VIP relay
- Three CR sensors for VIP relay protection
- Voltage presence indicator
- Connection pads for dry-type cables
- Downstream earthing switch 2 kA rms making capacity

**Version:**
- Sepam series 10 with auxiliary supply and three CR sensors

**Optional accessories:**
- Cubicle:
  - Three voltage transformers
  - Key-type interlocks
- 1250 A three-phase upper busbars at Ir 630 A
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- Enlarged low-voltage control cabinet for 24 kV
- Connection enclosure for cabling from above for 24 kV
- 50 W heating element for 24 kV

- Circuit breaker:
  - Motor for operating mechanism
  - Release units (coil)
  - Operation counter on manual operating mechanism

- Three CTs
- 150 W heating element for 36 kV

- Three CR sensors for VIP relay protection
- Voltage presence indicator
- Connection pads for dry-type cables
- Downstream earthing switch 2 kA rms making capacity
Characteristics of the functional units

Functional units selection
SF6 type circuit breaker protection

DM1-W
Withdrawable single-isolation circuit breaker unit

DM1-Z
Withdrawable single-isolation CB unit
Outgoing line on right

DM2-W
Withdrawable double-isolation CB unit
Outgoing line on right

Electrical characteristics

Basic equipment:
- SF1 withdrawable circuit breaker
- disconnector and earthing switch
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- voltage presence indicator
- three CTs
- auxiliary contacts on circuit breaker
- 150 W heating element for 36 kV
- mechanical interlocking between circuit breaker and disconnector
- earthing switch operating mechanism CC
- connection pads for dry-type cables
- downstream earthing switch 25 kA rms making capacity

Version:
- LPCT (only with Sepam series 20, 40 and 80)

Optional accessories:
- cubicle:
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - key-type interlocks
  - connection enclosure for cabling from above for 24 kV
  - 50 W heating element for 24 kV
  - enlarged low-voltage control cabinet for 24 kV
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions for 24 kV
  - surge arresters (only for 630 A and 24 kV)
- circuit breaker:
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism
- cubicle:
  - auxiliary contacts on the disconnector
  - key-type interlocks
  - protection using Sepam programmable electronic unit
  - circuit breaker:
    - motor for operating mechanism
    - operation counter on manual operating mechanism
    - opening and closing shunt trips

Ir = 400 - 630 - 1250 A

Ir = 630 - 1250 A
Characteristics of the functional units

Functional units selection
Vacuum type circuit breaker protection

DMV-A
Single-isolation circuit breaker unit

DMV-D
Single-isolation circuit breaker unit
Outgoing line on right

DMV-S
Single-isolation circuit breaker unit
with independent protection

Electrical characteristics

Ir = 400 - 630 - 1250 A
25
20
16
12.5
7.2 12 17.5 24
Ir = 630 - 1250 A
kA
Ik/1s & Isc
Ur
kV

Basic equipment:
- Evolis circuit breaker frontal
- Switch and earthing switch for 400 - 630 A
- Disconnector and earthing switch for 1250 A
- Three-phase busbars
- Circuit breaker operating mechanism P2
- Disconnector and switch operating mechanism CIT
- Voltage presence indicator
- Auxiliary contacts on circuit breaker
- Three CTs
- Sepam series 20 programmable electronic unit
- Connection pads for dry-type cables
- Downstream earthing switch 25 kA rms making capacity

Optional accessories:
- Cubicle:
  - Auxiliary contacts on the disconnector
  - Three voltage transformers
  - Key-type interlocks
  - 50 W heating element
  - Connection enclosure for cabling from above
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions
  - Enlarged low-voltage control cabinet

  Circuit breaker:
  - Motor for operating mechanism
  - Release units (coil)
  - Operation counter on manual operating mechanism

 Schneider
Characteristics of the functional units

Functional units selection
Vacuum type circuit breaker protection

DMVL-A
Single-isolation disconnectable circuit breaker unit

DMVL-D
Single-isolation disconnectable circuit breaker unit

Outgoing line on right

Electrical characteristics

Ir = 630 A

Basic equipment:
- Evolis circuit breaker lateral disconnectable
- disconnector and earthing switch
- mechanical interlocking between circuit breaker and disconnector
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- voltage presence indicator
- auxiliary contacts on circuit breaker
- 3 CTs
- connection pads for dry-type cables

Optional accessories:
- downstream earthing switch 2 kA rms making capacity

Optionally:
- circuit breaker:
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

- cubicle:
  - auxiliary contacts on the disconnector
  - three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - connection enclosure for cabling from above
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions
  - enlarged low-voltage control cabinet
  - Sepam relay protection
  - surge arresters
Characteristics of the functional units

Functional units selection

**MV metering**

**CM**
Voltage transformers unit for network with earthed neutral system

**CM2**
Voltage transformers unit for network with insulated neutral system

### Electrical characteristics

- **Ir** = 50 A
- **Ik/1s**
- **Ur**

### Basic equipment:
- disconnector and earthing switch
- three-phase busbars
- operating mechanism CS
- LV circuit isolation switch
- LV fuses
- three 6.3 A UTE or DIN type fuses
- 150 W heating element for 36 kV
- three-voltage transformers (phase-to-earth)
- two voltage transformers (phase-to-phase)

### Optional accessories:
- auxiliary contacts
- mechanical signalling and auxiliary contact for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
Characteristics of the functional units

Functional units selection

MV metering

GBC-A
Current and/or voltage measurements unit
Outgoing line on right

GBC-A
Current and/or voltage measurements unit
Outgoing line on left

GBC-B
Current and/or voltage measurements unit

Electrical characteristics

Basic equipment:
- one to three CTs for 24 kV
- three CTs for 36 kV
- connection bars
- three-phase busbars
- 150 W heating element for 36 kV

Optional accessories:
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- three voltage transformers (phase-to-earth) or two voltage transformers (phase-to-phase) for 24 kV
- 50 W heating element for 24 kV
Characteristics of the functional units

Functional units selection

Casings

GBM
Connection unit
Outgoing line right or left

GEM
Extension unit VM6/SM6

GIM
Intermediate bus unit

Electrical characteristics

Ir = 400 - 630 - 1250 A

Basic equipment:
- connection bars
- three-phase busbars for outgoing lines right or left
- 150 W heating element for 36 kV

Optional accessories:
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top for 36 kV (no internal arc withstand if selected)
Characteristics of the functional units

Functional units selection
Casings

GAM2
Incoming-cable-connection unit

GAM
Incoming-cable-connection unit

Electrical characteristics

<table>
<thead>
<tr>
<th>kA</th>
<th>Ur (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>1250 A</td>
</tr>
<tr>
<td>12</td>
<td>400 - 630 A</td>
</tr>
<tr>
<td>17.5</td>
<td>630 - 1250 A</td>
</tr>
<tr>
<td>24</td>
<td>1250 A</td>
</tr>
<tr>
<td>36</td>
<td>630 - 1250 A</td>
</tr>
</tbody>
</table>

Basic equipment:
- three-phase busbars
- voltage presence indicator
- connection pads for dry-type cables
- connection bars
- 150 W heating element for 36 kV
- downstream earthing switch 25 kA rms making capacity
- operating mechanism CC for 24 kV
- operating mechanism CS1 for 36 kV

Optional accessories:
- fault indicator
- digital ammeter
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- auxiliary contacts
- key-type interlocks
- surge arresters for 24 kV
- surge arresters for 36 kV
Characteristics of the functional units

Functional units selection

Other functions

SM
Disconnector unit

TM
MV/LV transformer unit for auxiliaries

EMB
Busbars earthing compartment unit

Electrical characteristics

Ir = 400 - 630 - 1250 A

Ir = 630 - 1250 A

Ir = 50 A

Ir = 630 A

Basic equipment:
- disconnector and earthing switch
- three-phase busbars
- operating mechanism CS
- 150 W heating element for 36 kV
- connection pads for dry-type cables
- voltage presence indicator
- two 6.3 A fuses, UTE (for 24 kV) or DIN type
- LV circuit isolating switch
- one voltage transformer (phase-to-phase)

Optional accessories:
- auxiliary contacts
- key-type interlocks
- 1250 A three-phase upper busbars at Ir 630 A
- cable connection by the top for 24 kV (no internal arc withstand if selected)
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- digital ammeter for 24 kV
- mechanical indication system and auxiliary contacts for blown fuses

- earthing switch
- connection bars
- operating mechanism CIT
- installation on 630 A IM 375 mm or DM1-A units (except additional enclosure or connection enclosure for cabling from above)
- require an key-type interlocks adapted to the switchboard network
Characteristics of the functional units

Functional units selection
Automatic Transfer System for 24 kV

NSM-cables
Cables power supply for main incoming line (N) and standby line (S)

NSM-busbars
Cables power supply for main incoming line on left (N) and busbars for standby line (S) on right

NSM-busbars
Busbars power supply for main incoming line on left (N) and cables for standby line (S) on right

Electrical characteristics

Basic equipment:
- switches and earthing switches
- three-phase busbars
- connection pads for dry-type cables
- voltage presence indicator
- mechanical interlocking
- motorised operating mechanism CI2 with open/close coils
- additional enclosure
- automatic-control equipment (T200 S)

Optional accessories:
- auxiliary contacts
- key-type interlocks
- 50 W heating element
- control and monitoring
- visibility of main contacts
- pressure indicator device
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions
Automatic Transfer System
With NSM unit for 24 kV

Characteristics of the functional units

Network back up

<table>
<thead>
<tr>
<th>Vn</th>
<th>Voltage on SW1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>SW1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>SW2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td>T2</td>
</tr>
</tbody>
</table>

TR: transfer switch response time (< 180 ms - depending on switchgear).
- Setting of time delay before switching: configurable from 0.1 s to 2 s (T1) with step of 100 ms.
- Setting of time delay for return to the initial state: configurable from 5 s to 120 s (T2) with step of 5 s.
- Transfer switch configurable with SW1→SW2 or SW2→SW1.

Note: in bold = default configuration.

Generator back up

<table>
<thead>
<tr>
<th>Vn</th>
<th>Voltage on SW1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Command of the generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vg</th>
<th>Voltage on generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>SW1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>SW2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td>T3</td>
</tr>
</tbody>
</table>

TR: transfer switch response time (< 180 ms - depending on switchgear).
- Setting of time delay before switching to the generator: configurable from 1 s to 15 s (T1) with step of 1 s.
- Setting of time delay for return to the initial state: configurable from 60 s to 120 s with step of 5 s (T3).
- Switching when the generator voltage is present.
- Switching back to the main channel in “AUTO” modes is executed if:
  - the priority channel is open
  - the MV voltage on the priority channel is OK for a time period of T2.

Note: in bold = default configuration.

Transfer switch (ACO 1/2)
ACO: Automatic Change-Over

The transfer switch automatic control system gives automatic control and management of sources in the MV secondary distribution network with voltage presence detectors.

Operating modes
Operating mode is selected using the Easergy T200 S configuration tool.
- Semi-Auto mode, SW1 ↔ SW2
  - When the voltage disappears on the channel in service, the automatic control switches to the other channel after a time delay T1. The automatic control does not switch back, unless there is a voltage break on the new channel in service.
- Mode SW1 → SW2, (SW2 → SW1)
  - The automatic control only switches once from channel 1 or 2 to the back up channel.
- Mode Auto-SW1 or Auto-SW2
  - Channel 1 or 2 is priority if its MV voltage is OK. After switching to the back up channel, the mode switches back to the priority channel if the MV voltage on this channel is OK for a period T2.

Switching sequence
- Switching takes place if the following conditions are fulfilled:
  - automatic control on
  - SW1 open/SW2 closed or SW1 closed/SW2 open
  - "transfer locking" off
  - "earthing switch" on both channels off
  - MV voltage on the channel in service is absent
  - MV voltage on the other channel is present
  - no fault current.
- Switching back to the main channel in “AUTO” modes is executed if:
  - the priority channel is open
  - the MV voltage on the priority channel is OK for a time period of T2.

Source transfer locking
A digital input prohibits orders from the local control panel, the automatic control systems and the remote control supervisor.
This input is generally connected to the downstream circuit breaker.
Characteristics of the functional units

Functional units selection
Automatic Transfer System for 36 kV

**NSM-cables**
- **Cables** power supply for main incoming line (N) and standby line (S)

**NSM-busbars**
- **Cables** power supply for main incoming line on left (N) and busbars for standby line (S) on right
- **Busbars** power supply for main incoming line on left (N) and cables for standby line (S) on right

**Electrical characteristics**

Ir = 630 A

**Basic equipment:**
- switches and earthing switches
- three-phase busbars 630 A
- connection pads for dry-type cables
- voltage presence indicator
- mechanical interlocking
- motorised operating mechanism CI2 with shunt trips
- additional enclosure
- automatic-control equipment
- 150 W heating element

**Optional accessories:**
- auxiliary contacts
- key-type interlocks
- telecontrol
Characteristics of the functional units

Automatic Transfer System
With NSM unit for 36 kV

Easergy T200 I automation systems are factory predefined. No on-site programming is required.
- The automation systems can be switched on and off from the local operator panel and disabled using the configurator.
- Switches can be controlled manually in the following circumstances:
  - automation system switched off
  - switch in local mode.

Sectionaliser (SEC)
The sectionaliser automation system opens the switch after a predefined number of faults (1 to 4) during the voltage dip in the reclosing cycle of the top circuit breaker.
- The automation system counts the number of times a fault current followed by a voltage loss is detected. It sends an open order if:
  - the switch is closed
  - the fault has disappeared
  - the MV supply is absent.
- The automation system is reset at the end of the execution time delay.

Transfer switch (ACO 1/2)
ACO: Automatic Change-Over
The transfer switch automation system allows for the automatic control and management of power supply sources in the MV secondary distribution network. It is linked to voltage presence detectors VD23.

Operating modes
The operating mode is selected via the Easergy T200 I configurator.

Semi-auto mode, SW1 < > SW2
When the voltage is lost on the channel that is in use, the automation system switches to the other channel after a time delay T1. The automation system returns no data unless there is a loss of voltage on the new channel.

Semi-auto mode SW1 > SW2, (SW2 > SW1)
The automation system only switches from channel 1 or 2 to the back-up channel.

Auto-SW1 or Auto-SW2 mode
After switching channels, the automation system switches back to the priority channel if the MV supply on that channel is restored.

Switching sequence
Switching takes place if the following conditions are met:
- Automation system switched on
- SW1 open/SW2 closed or SW1 closed/SW2 open
- No “transfer interlock”
- No “earthing switch” on the 2 channels
- MV supply lost on the channel in use
- MV supply present on the other channel
- No fault current.

The automation system switches back to the main channel in “AUTO” mode if:
- The priority channel is open
- The MV supply on the priority channel is correct for the time delay T2.
The close order on the back-up channel is given once the opening of the channel in use is reported.

Source transfer interlock
A digital input can be used to prohibit the issuing of orders from the local operator panel, the automation system and the remote control supervisor. This input is generally connected to the downstream circuit breaker.
Automatic Transfer System
Bus tie coupling (BTA 2/3) for 24 kV and 36 kV

The BTA (Bus Tie Automatism) is an automation system for switching sources between two incoming lines (SW1 and SW2) and a busbar coupling switch (SW3). It must be used in conjunction with voltage presence detectors and the fault current detection function on the busbar incoming lines.

Operating mode
Operating mode is selected using Easergy T200 I configuration tool.

Two operating modes can be configured:
- **Standard mode:**
  - If the voltage is lost on one busbar, the automation system opens the incoming line (SW1 or SW2) and closes the coupling switch SW3. Coupling is conditional upon the absence of a fault current on the main source.
  - Interlock on loss of voltage after switching mode:
    - After execution of the automation system in standard mode, the voltage presence is checked for a configurable period. If the voltage is lost during this period, the coupling switch SW3 is opened and the automation system interlocked.

Coupling sequence
- **Coupling takes place if the following conditions are met:**
  - the automation system is switched on
  - the switches on incoming channels SW1 and SW2 are closed
  - the earthing switches SW1, SW2 and SW3 are open
  - there is no voltage on an incoming line SW1 or SW2
  - there is no fault current detection on SW1 and SW2
  - there is no transfer interlock
  - voltage is present on the other incoming line.

- **The coupling sequence in standard mode is as follows:**
  - opening of the de-energised incoming line switch after a delay T1
  - closing of the coupling switch SW3.

- **The coupling sequence in “Interlock on loss of voltage after coupling” mode is completed as follows:**
  - monitoring of the voltage stability for a delay T3
  - opening of the coupling switch SW3 if this condition is not met
  - locking of BTA automation system.

- **The system returns to standard mode after coupling if:**
  - the “return to SW1 or SW2” option is activated
  - voltage on the channel has been normal for a delay T2
  - the automation system is activated
  - the automation system is not locked
  - there is no coupling interlock.

Coupling interlock
A digital input can be used to prohibit the issuing of orders from the local operator panel, the automation system and the remote control supervisor. This input is generally connected to the downstream circuit breaker.

Locking the automation system
The BTA automation system is locked if one of the following conditions is met during the coupling process:
- Failure of a command to open or close a switch
- Indication that an earthing switch has closed
- Appearance of a fault current
- Switch power supply fault
- Appearance of the coupling interlock
- Manual or remote ON/OFF command from the automation system.
**Characteristics of the functional units**

**Network remote control and monitoring**

**Continuity of service guaranteed by an overall telecontrol offer**

Schneider Electric offers you a complete solution, including:
- the Easergy T200 I telecontrol interface,
- SM6 switchgear that is adapted for telecontrol,
- the Easergy L500 SCADA system.

**SM6 range, more than ready**

SM6 switchgear is perfectly adapted to the telecontrol context, thanks to options such as:
- LV control cabinet including T200 I,
- motorized operating mechanism,
- auxiliary fault and position indication contacts,
- current sensors for fault detection.

**Easergy L500, a low cost solution to immediately improve your SAIDI**

*SAIDI: system average interruption duration index*

Easergy L500 is a SCADA providing all the functions needed to operate the MV network in real time

- Pre-configured with Easergy range products for monitoring and control of MV networks:
  - MV/LV substations equipped with T200 I or Flair 200C
  - overhead LBS equipped with T200 P
  - overhead line equipped with Flite 116/G200
- Broad range of transmission supports: Radio, GSM, GPRS, PSTN, LL, FO.

**Advantages**

- Simple implementation:
  - one to two weeks only for 20 MV/LV units
  - configuration, training and handling within a few days
- Simple and fast evolutions by operations managers
- Short return on investment
- Service quality and operations rapidly improved.
The control devices required for the unit operating mechanisms are centralised on the front panel. The different types of operating mechanism are presented in the table opposite. Operating speeds do not depend on the operator, except for the CS.

### Operating mechanisms

<table>
<thead>
<tr>
<th>Units</th>
<th>Type of operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Switch/disconnector</td>
</tr>
</tbody>
</table>

- Provided as standard
- Other possibility
- (*) 1250 A version

### Operating mechanism types

<table>
<thead>
<tr>
<th>Operating mechanism types</th>
<th>CIT</th>
<th>CH</th>
<th>C12</th>
<th>CS1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit applications</td>
<td>Load-break switch</td>
<td>Fuse switch</td>
<td>Load-break switch</td>
<td>Fuse switch combination</td>
</tr>
<tr>
<td>Main circuit switch</td>
<td>Closing</td>
<td>Opening</td>
<td>Closing</td>
<td>Opening</td>
</tr>
<tr>
<td>Manual operating mode</td>
<td>Hand lever</td>
<td>Hand lever</td>
<td>Hand lever</td>
<td>Push button</td>
</tr>
<tr>
<td>Electrical operating mode (option)</td>
<td>Motor</td>
<td>Motor</td>
<td>Motor</td>
<td>Coil</td>
</tr>
<tr>
<td>Speed of operation</td>
<td>1 to 2 s 1 to 2 s 4 to 7 s 4 to 7 s 35 ms 35 ms 55 ms 35 ms N/A N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network applications</td>
<td>Remote control network management</td>
<td>Remote control transformer protection</td>
<td>Remote control network management, need of quick reconfiguration (generator source, loop)</td>
<td>N/A</td>
</tr>
<tr>
<td>Earthing switch</td>
<td>Closing</td>
<td>Opening</td>
<td>Closing</td>
<td>Opening</td>
</tr>
<tr>
<td>Manual operating mode</td>
<td>Hand lever</td>
<td>Hand lever</td>
<td>Hand lever</td>
<td>Hand lever</td>
</tr>
</tbody>
</table>

### Double-function operating mechanism CIT

- **Switch function**
  Independent-operation opening or closing by lever or motor.
- **Earthing-switch function**
  Independent-operation opening or closing by lever.
  Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
- **Auxiliary contacts**
  - switch (2 O + 2 C) (CIT)
  - switch (2 O + C) and earthing switch (1 O + 1 C) (CIT)
  - switch (1 C) and earthing switch (1 O + 1 C) if motor option.
- **Mechanical indications**
  Fuses blown in unit PM.
- **Motor option**
  (*) Included with the motor option
Characteristics of the functional units

Operating mechanisms

Double-function operating mechanism CI1
- **Switch function**
  - independent-operation closing by lever or motor.
  - independent-operation opening by push-button (O) or trip units.
- **Earthing-switch function**
  - Independent-operation closing and opening by lever.
- **Auxiliary contacts**
  - switch (2 O + 2 C)*,
  - switch (2 O + 3 C) and earthing switch (1 O + 1 C),
  - switch (1 C) and earthing switch (1 O + 1 C) if motor option,
  - fuses blown (1 C).
- **Mechanical indications**
  - Fuses blown in units QM.
- **Opening releases**
  - shunt trip,
  - undervoltage for unit QM.
- **Motor option**
  - (*) Included with the motor option.

Double-function operating mechanism CI2
- **Switch function**
  - independent-operation closing in two steps:
    1 - operating mechanism recharging by lever or motor,
    2 - stored energy released by push-button (I) or trip unit.
  - independent-operation opening by push-button (O) or trip unit.
- **Earthing-switch function**
  - Independent-operation closing and opening by lever.
- **Auxiliary contacts**
  - switch (2 O + 2 C)*,
  - switch (2 O + 3 C) and earthing switch (1 O + 1 C),
  - switch (1 C) and earthing switch (1 O + 1 C) if motor option.
- **Opening release shunt trip**
- **Motor option**
  - (*) Included with the motor option.

Double-function operating mechanism CS
- **Switch and earth switch functions**
  - Dependent-operation opening and closing by lever.
- **Auxiliary contacts**
  - disconnector (2 O + 2 C) for units DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D, CVM and CRM without VT,
  - disconnector (2 O + 3 C) and earthing switch (1 O + 1 C) for units DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D, CVM and CRM without VT,
  - disconnector (1 O + 2 C) for units CM, CM2, TM, DM1-A, DM1-D, DM2, DMVL-A, DMVL-D, CVM and CRM with VT.
- **Mechanical indications**
  - Fuses blown in units CM, CM2 and TM.

Single-function operating mechanism CC
- **Earthing switch function**
  - Independent-operation opening and closing by lever.
  - Earthing switch (1 O + 1 C).
Characteristics of the functional units

Operating mechanisms

Single-function operating mechanism for the SF circuit breakers 24 kV and 36 kV and Evolis 24 kV lateral

- Circuit-breaker function
  - independent-operation closing in two steps.
  - First operating mechanism recharge by motor or lever, then release of the stored energy by push-button (I) or trip unit.
  - independent-operation opening by push-button (O) or trip units.
- Auxiliary contacts
  - circuit breaker (4 O + 4 C).
  - mechanism charged (1 C).
- Mechanical indications
  - Operation counter.
- Opening releases
  - Mitop (low energy).
  - shunt trip.
  - undervoltage.
- Closing release
  - shunt trip.
- Motor option (option and installation at a later date possible).

<table>
<thead>
<tr>
<th>Release type</th>
<th>SF1</th>
<th>SFset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Combinations</td>
<td>Combinations</td>
</tr>
<tr>
<td>Mitop (low energy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shunt trip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undervoltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P2 stored energy operating mechanism for the Evolis circuit breaker 17.5 kV frontal

- Circuit-breaker function
  - independent-switching operating closing in two steps.
  - First operating mechanism recharge by motor or lever, then release of the stored energy by push-button (I) or trip unit.
  - independent-operation opening by push-button (O) or trip units.
  - spring energy release.
- Auxiliary contacts
  - circuit breaker (4 O + 4 C).
  - mechanism charged (1 C).
- Mechanical indications
  - Operation counter.
- Opening releases
  - Mitop (low energy).
  - shunt trip.
  - undervoltage.
- Closing release
  - shunt trip.
- Motor option (option and installation at a later date possible).

Possible combinations between opening releases

<table>
<thead>
<tr>
<th>Release type</th>
<th>SF1</th>
<th>SFset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Combinations</td>
<td>Combinations</td>
</tr>
<tr>
<td>Mitop (low energy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shunt trip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undervoltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Characteristics of the functional units

### Auxiliaries

**Motor option and releases for switch-units**

The operating mechanisms CIT, C11 and C12 may be motorised.

<table>
<thead>
<tr>
<th>Un</th>
<th>DC</th>
<th>AC (50 Hz)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (V)</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Motor option (W)</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>(VA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating time for CIT (s)</td>
<td>1 to 2</td>
<td>1 to 2</td>
</tr>
<tr>
<td>Charging time for C11, C12 (s)</td>
<td>4 to 7</td>
<td>4 to 7</td>
</tr>
</tbody>
</table>

**Opening releases**

<table>
<thead>
<tr>
<th>Shunt trip (W)</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>300</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VA)</td>
<td>400</td>
<td>750</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>35</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Undervoltage**

<table>
<thead>
<tr>
<th>Pick-up (W)</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VA)</td>
<td></td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>280</td>
</tr>
</tbody>
</table>

**Closing release**

<table>
<thead>
<tr>
<th>Shunt trip (W)</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>300</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VA)</td>
<td>400</td>
<td>750</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>55</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Please consult us for other frequencies.

**Motor option and releases for SF6 type circuit breakers and Evolis 24 kV lateral**

Operating mechanism RI may be equipped with the motor option for the recharging function.

<table>
<thead>
<tr>
<th>Un</th>
<th>DC</th>
<th>AC (50 Hz)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (V)</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Motor option (W)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>(VA)</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Charging time (s)</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Opening releases**

<table>
<thead>
<tr>
<th>Mitop (low energy) (W)</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time (ms)</td>
<td>30</td>
</tr>
<tr>
<td>Shunt trip (W)</td>
<td>85</td>
</tr>
<tr>
<td>(VA)</td>
<td>180</td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>45</td>
</tr>
</tbody>
</table>

**Undervoltage**

<table>
<thead>
<tr>
<th>Pick-up (W)</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VA)</td>
<td></td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>280</td>
</tr>
</tbody>
</table>

**Closing release**

<table>
<thead>
<tr>
<th>Shunt trip (W)</th>
<th>85</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VA)</td>
<td>180</td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>65</td>
</tr>
</tbody>
</table>

*Please consult us for other frequencies.
Characteristics of the functional units

**Auxiliaries**

**Motor option and releases for Evolis circuit breakers 17.5 kV frontal**

<table>
<thead>
<tr>
<th>Charging motor and associated mechanism (P2)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td><strong>Vac 50/60 Hz</strong></td>
</tr>
<tr>
<td><strong>Vac 50/60 Hz</strong></td>
<td>24/30</td>
</tr>
<tr>
<td><strong>Threshold</strong></td>
<td>0.85 to 1.1 ( \text{Ur} )</td>
</tr>
<tr>
<td><strong>Consumption</strong></td>
<td>(VA or W)</td>
</tr>
<tr>
<td><strong>Motor overcurrent</strong></td>
<td>2 to 3 ( \text{Ir} ) during 0.1 s</td>
</tr>
<tr>
<td><strong>Charging time</strong></td>
<td>6 s max.</td>
</tr>
<tr>
<td><strong>Switching rate</strong></td>
<td>3 cycles per minute max.</td>
</tr>
<tr>
<td><strong>CH contact</strong></td>
<td>10 A 240 V</td>
</tr>
</tbody>
</table>

**Opening release (MITOP low energy)**

| Power supply | Direct current |  |
| **Threshold** | 0.6 \( \text{A} < i < 3 \text{A} \) |  |
| **Response time to the circuit breaker at \( \text{Ur} \)** | 50 ms (protection relay setting) |  |

**Opening release (MX)**

| Power supply | **Vac 50/60 Hz** | 24 | 48 | 100/130 | 200/250 |
| **Vac 50/60 Hz** | 24/30 | 48/60 | 100/130 | 200/250 |
| **Threshold** | 0.7 to 1.1 \( \text{Ur} \) |  |
| **Consumption** | (VA or W) | Pick-up: 200 (during 200 ms) | Hold: 4.5 |  |
| **Response time to the circuit breaker at \( \text{Ur} \)** | 50 ms ± 10 |  |

**Closing release (XF)**

| Power supply | **Vac 50/60 Hz** | 24 | 48 | 100/130 | 200/250 |
| **Vac 50/60 Hz** | 24/30 | 48/60 | 100/130 | 200/250 |
| **Threshold** | 0.85 to 1.1 \( \text{Ur} \) |  |
| **Consumption** | (VA or W) | Pick-up: 200 (during 200 ms) | Hold: 4.5 |  |

**Auxiliaires contacts for vacuum contactor**

The auxiliary contacts are of the changeover type with a common point.

The following are available:

- 3 NO + 3 NC for the electrically held version (optional 3 NO & 3 NC additional auxiliary contacts).
- 5 NO + 6 NC for the mechanically latched version as standard.

**Characteristics**

| Operating voltage | Minimum | 48 V |  |
| Maximum | 480 V |  |
| Rated current | 10 A |  |
| Breaking capacity | Vdc | 60 W (L/R 150 ms) |  |
| Vac | 700 VA (power factor 0.35) |  |

**Open release characteristics**

| Power supply (Vdc) | 48 | 125 | 250 |  |
| Consumption (W) | 470 | 680 | 640 |  |
| Response time (ms) | 20-40 | 20-41 | 20-40 |  |
Characteristics of the functional units

Current transformers for 24 kV

Synthesis table by unit

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARJP1</td>
<td></td>
<td></td>
<td></td>
<td>630 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARM3</td>
<td></td>
<td></td>
<td></td>
<td>1250 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARJP2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARJP3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLP2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TLP130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transformer ARJP1/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ih (kA)

<table>
<thead>
<tr>
<th>I(n) (A)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>150</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ih (kA)</td>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>6</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>t (s)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Measurement and protection</td>
<td>5 A</td>
<td>15 VA - class 0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 A</td>
<td>2.5 VA - 5P20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transformer ARM3/N2F
- characteristics according to IEC standard 60044-1
- double primary winding
- single secondary winding for measurement and protection.

Short-time withstand current Ih (kA)

<table>
<thead>
<tr>
<th>I(n) (A)</th>
<th>10/20</th>
<th>20/40</th>
<th>50/100</th>
<th>100/200</th>
<th>200/400</th>
<th>300/600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ih (kA)</td>
<td>5</td>
<td>12.5</td>
<td>12.5/21*</td>
<td>12.5/25*</td>
<td>12.5/25*</td>
<td>25</td>
</tr>
<tr>
<td>t (s)</td>
<td>1</td>
<td>0.8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Measurement and 5 A protection</td>
<td>7 A</td>
<td>1 VA - 10P30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 A</td>
<td>5 VA - 5P10</td>
<td>5 VA - 5P15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For 5 A protection
- characteristics according to IEC standard 60044-1
- double primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ih (kA)

<table>
<thead>
<tr>
<th>I(n) (A)</th>
<th>50/100</th>
<th>100/200</th>
<th>200/400</th>
<th>300/600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ih (kA)</td>
<td>14.5</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>t (s)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement and protection</td>
<td>5 A</td>
<td>30 VA - class 0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 A</td>
<td>5 VA - 5P15</td>
<td>7.5 VA - 5P15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 A</td>
<td>7.5 VA - 5P10</td>
<td>15 VA - 5P10</td>
<td></td>
</tr>
</tbody>
</table>
Characteristics of the functional units

Current transformers for 24 kV

Transformer ARJP2/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

<table>
<thead>
<tr>
<th>I₁n (A)</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>400</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ith (kA)</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t (s)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measurement and protection
- 5 A 10 VA - class 0.5
- 15 VA 1A - class 0.5
- 15 VA 2.5 VA - class 0.5
- 5 VA 2.5 VA - class 0.5
- 5 VA 5 VA - class 0.5
- 7.5 VA 5 VA - class 0.5

Transformer ARJP3/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

<table>
<thead>
<tr>
<th>I₁n (A)</th>
<th>1000</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ith (kA)</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>t (s)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Measurement and protection
- 1 A 30 VA - class 0.5
- 1 A 10 VA - 5P20

Measurement and protection
- 5 A 30 VA - class 0.5
- 5 A 10 VA - 5P20

Low Power Current Transformer (LPCT) CLP2
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 24 kV.

Minimum rated primary current 5 A
Rated nominal primary current 100 A
Rated extended primary current 1250 A
Rated nominal secondary output 22.5 mV
Accuracy class for measurement 0.5
Accuracy class for protection 5P
Accuracy limit factor 400
Rated short time thermal current 40 kA 1 s
Highest voltage (Uₘ) 24 kV
Rated power-frequency withstand 50 kV

Low Power Current Transformer (LPCT) TLP130
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 0.72 kV
- internal diameter 130 mm.

Minimum rated primary current 5 A
Rated nominal primary current 100 A
Rated extended primary current 1250 A
Rated nominal secondary output 22.5 mV
Accuracy class for measurement 0.5
Accuracy class for protection 5P
Accuracy limit factor 250
Rated short time thermal current 25 kA 1 s
Highest voltage (Uₘ) 0.72 kV
Rated power-frequency withstand 3 kV
Characteristics of the functional units

Current transformers for 36 kV

For units DM1-A, DM1-D, DM1-W, DM2, DM2-W, IMC, GBC-A, GBC-B

Transformer ARM6T/N1 or N2
- double primary
- double secondary winding for measurement and protection.

Short-time withstand current $I_{th}$ (kA)

<table>
<thead>
<tr>
<th>$I_{th}$ (A)</th>
<th>50-100</th>
<th>75-150</th>
<th>100-200</th>
<th>150-300</th>
<th>200-400</th>
<th>300/600</th>
<th>1000/1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{th}$ (kA)</td>
<td>16 - 20</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement and protection</td>
<td>5 A</td>
<td>7.5 VA - 15 VA - class 0.5</td>
<td>30 VA - class 0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 A</td>
<td>2.5 VA - 5 VA - 5P20</td>
<td>10 VA - 5P20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Low Power Current Transformer (LPCT)

For units DM1-A, DM1-W

Transformer TLP 130, TLP 190
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 0.72 kV
- internal diameter 130 or 190 mm
- in SM6-36, TLP 130 can be used for 630 A, TLP 190 can be used up to 1250 A.

<table>
<thead>
<tr>
<th>TLP 130</th>
<th>TLP 190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum rated primary current</td>
<td>5 A</td>
</tr>
<tr>
<td>Rated extended primary current</td>
<td>1250 A</td>
</tr>
<tr>
<td>Secondary output</td>
<td>22.5 mV @ 100 A</td>
</tr>
<tr>
<td>Accuracy class for measurement</td>
<td>0.5</td>
</tr>
<tr>
<td>Accuracy class for protection</td>
<td>5P</td>
</tr>
<tr>
<td>Accuracy limit factor</td>
<td>250</td>
</tr>
<tr>
<td>Rated short time thermal current</td>
<td>25 kA 1 s</td>
</tr>
<tr>
<td>Highest voltage (U_m)</td>
<td>0.72 kV</td>
</tr>
<tr>
<td>Rated power-frequency withstand</td>
<td>3 kV</td>
</tr>
</tbody>
</table>
Characteristics of the functional units

Voltage transformers for 24 kV

Synthesis table by unit

<table>
<thead>
<tr>
<th>Units</th>
<th>CM</th>
<th>CVM</th>
<th>DM1-A</th>
<th>DM1-D</th>
<th>DMV/L-D</th>
<th>DM1-W</th>
<th>DM2</th>
<th>GBC-A</th>
<th>GBC-B</th>
<th>DMVL-A</th>
<th>DMV-A</th>
<th>DMV-D</th>
<th>CM2</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRQ2-n/S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRFR-n/S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRC2/S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRM3-n/S2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCT24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRC1/S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transformer VRQ2-n/S1 (phase-to-earth) 50 or 60 Hz
 characteristics according to IEC standard 60044-2.

- Rated voltage (kV): 24
- Primary voltage (kV): \(10\sqrt{3}\), \(15\sqrt{3}\), \(15-20\sqrt{3}\), \(20\sqrt{3}\)
- Secondary voltage (V): 100\sqrt{3}
- Thermal power (VA): 250
- Accuracy class: 0.5
- Rated output for single primary winding (VA): 30
- Rated output for double primary winding (VA): 30-50

Transformer VRFR-n/S1 (phase-to-earth) 50 or 60 Hz
 characteristics according to IEC standard 60044-2.

- Rated voltage (kV): 17.5
- Primary voltage (kV): \(10\sqrt{3}\), \(15\sqrt{3}\)
- Secondary voltage (V): 100\sqrt{3}
- Thermal power (VA): 250
- Accuracy class: 0.5
- Rated output for single primary winding (VA): 30

Transformer VRC2/S1 (phase-to-phase) 50 or 60 Hz
 characteristics according to IEC standard 60044-2.

- Rated voltage (kV): 24
- Primary voltage (kV): 10, 15, 20
- Secondary voltage (V): 100
- Thermal power (VA): 500
- Accuracy class: 0.5
- Rated output for single primary winding (VA): 50

Transformer VRM3-n/S2 (phase-to-earth and protected by fuses 0.3 A) 50 or 60 Hz
 characteristics according to IEC standard 60044-2.

- Rated voltage (kV): 12, 17.5, 24
- Primary voltage (kV): \(10\sqrt{3}\), \(15\sqrt{3}\), \(20\sqrt{3}\)
- Secondary voltage (V): 100\sqrt{3} - 100/3
- First secondary:
  - Thermal power (VA): 200
  - Accuracy class: 0.5
  - Rated output for single primary (VA): 30-50
- Second secondary:
  - Thermal power (VA): 100
  - Accuracy class: 3P
  - Rated output: 50
Characteristics of the functional units

### Voltage transformers for 24 kV

**Transformer VRC1/S1** (phase-to-phase) 50 or 60 Hz
- Characteristics according to IEC standard 60044-2.

<table>
<thead>
<tr>
<th>Transformer VRC1/S1</th>
<th>Phase-to-phase</th>
<th>50 or 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>Primary voltage (kV)</td>
<td>3.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Secondary voltage (V)</td>
<td>110</td>
<td>6</td>
</tr>
<tr>
<td>Thermal power (VA)</td>
<td>100</td>
<td>8.6</td>
</tr>
<tr>
<td>Accuracy class</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Rated output for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>single primary winding (VA)</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**Transformer VCT24** (phase-to-phase) 50 or 60 Hz

<table>
<thead>
<tr>
<th>Transformer VCT24</th>
<th>Phase-to-phase</th>
<th>50 or 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Primary voltage (kV)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Secondary voltage (V)</td>
<td>220</td>
<td>20</td>
</tr>
<tr>
<td>Output (VA)</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td></td>
<td>2500</td>
<td>4000</td>
</tr>
<tr>
<td></td>
<td>4000</td>
<td>4000</td>
</tr>
</tbody>
</table>

**Note:** the above mentioned voltage transformers are grounded neutral. For other characteristics, please consult us.

### Surge arresters

**For units IM500, DM1-A, DM1-W, GAM, DMV-A*, DMVL-A**

<table>
<thead>
<tr>
<th>In (A)</th>
<th>400/630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un (kV)</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Note:** the rated voltage of the surge arrester is according to unit’s rated voltage. (*) limited up to 17.5 kV for DMV-A circuit breaker cubicles.
Characteristics of the functional units

Voltage transformers for 36 kV

For units CM, GBC-A, GBC-B
Transformer VRF3n/S2 (phase-to-earth)
- single primary winding
- single secondary

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>36</td>
</tr>
<tr>
<td>Primary voltage (kV)</td>
<td>30√3</td>
</tr>
<tr>
<td>Secondary voltage (V)</td>
<td>100×3 or 110×3</td>
</tr>
<tr>
<td>Thermal power (VA)</td>
<td>450</td>
</tr>
<tr>
<td>Accuracy class</td>
<td>0.5</td>
</tr>
<tr>
<td>Rated output for single primary winding (VA)</td>
<td>30-50 30</td>
</tr>
</tbody>
</table>

For units CM2
Transformer VRC3/S1 (phase-to-phase)
- single primary winding
- single secondary

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>36</td>
</tr>
<tr>
<td>Primary voltage (kV)</td>
<td>30</td>
</tr>
<tr>
<td>Secondary voltage (V)</td>
<td>100 or 110</td>
</tr>
<tr>
<td>Thermal power (VA)</td>
<td>700</td>
</tr>
<tr>
<td>Accuracy class</td>
<td>0.5</td>
</tr>
<tr>
<td>Rated output for single primary winding (VA)</td>
<td>50-100</td>
</tr>
</tbody>
</table>

For units TM
Transformer VRC3/S1 (phase-to-phase)
- single primary winding
- single secondary

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage (kV)</td>
<td>36</td>
</tr>
<tr>
<td>Primary voltage (kV)</td>
<td>30</td>
</tr>
<tr>
<td>Secondary voltage (V)</td>
<td>220</td>
</tr>
<tr>
<td>Thermal power (VA)</td>
<td>1000</td>
</tr>
</tbody>
</table>

Surge arresters

For units IM, DM1-A, SM, GAM2

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>In (A)</td>
<td>630</td>
</tr>
<tr>
<td>Un (kV)</td>
<td>36</td>
</tr>
</tbody>
</table>
Characteristics of the functional units

Motors protection units

The current rating of fuses installed in units depends on:
- motor current rating \( I_n \)
- starting current \( I_d \)
- frequency of starts.

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

The adjacent table indicated the ratings which should be used, based on the following assumptions:
- direct-on-line startup
- \( pf = 0.8 \) (\( P \leq 500 \text{ kW} \)) or \( 0.9 \) (\( P > 500 \text{ kW} \))
- \( \eta = 0.9 \) (\( P \leq 500 \text{ kW} \)) or \( 0.94 \) (\( P > 500 \text{ kW} \)).

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

Example:
Consider a 950 kW motor at 5 kV.

\[
I_n = \frac{P}{\sqrt{3} \cdot U \cdot \eta \cdot pf} = 130 \text{ A}
\]

Then 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.

Selection of fuses for CRM units

The color code is linked to the rated voltage of the fuse.

<table>
<thead>
<tr>
<th>Starting current (A) ( Id/In = 6 )</th>
<th>Starting time (s)</th>
<th>Maximum service voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Number of starts per hour</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>1410</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>1290</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>1140</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>1030</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>890</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>790</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>710</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>740</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>640</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>610</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>540</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>480</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>440</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>310</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>280</td>
<td>125</td>
<td>160</td>
</tr>
<tr>
<td>250</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>240</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>230</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>210</td>
<td>100</td>
<td>125</td>
</tr>
<tr>
<td>180</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>170</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Selection of fuses for CVM units

<table>
<thead>
<tr>
<th>Service voltage (kV)</th>
<th>Starting current (A)</th>
<th>Rated operational current (continuous duty) (A)</th>
<th>Starting time (s)</th>
<th>Number of starts per hour</th>
<th>3</th>
<th>6</th>
<th>3</th>
<th>6</th>
<th>3</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>1100</td>
<td>183</td>
<td></td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>942</td>
<td>157</td>
<td></td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>785</td>
<td>131</td>
<td></td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>628</td>
<td>105</td>
<td></td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>565</td>
<td>94</td>
<td></td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>502</td>
<td>84</td>
<td></td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>439</td>
<td>73</td>
<td></td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>377</td>
<td>63</td>
<td></td>
<td>100</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>314</td>
<td>52</td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>251</td>
<td>42</td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>188</td>
<td>31</td>
<td></td>
<td>80</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>21</td>
<td></td>
<td>50</td>
<td>50</td>
<td>63</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fuse selection method:
- if \( Id \geq 6 \times I_e \), use \( Id \) to select the fuses
- if \( Id < 6 \times I_e \), use \( I_e \) to select the fuses.

Note:
- Fuses are 292 mm long (Fusarc fuses).
- Fuses are only for short circuit protection.
- For 250 A fuses, it is necessary to delay the opening of the contactor.
Protection of transformers

Fuse ratings for SM6 protection units such as PM, QM, QMB and QMC depend, among other things, on the following criteria:

- service voltage
- transformer rating
- fuse technology (manufacturer)

Different types of fuses with medium loaded striker may be installed:

- Solefuse fuses as per standard UTE NCF 64.210
- Fusarc CF fuses as per IEC 60.282.1 recommendation and dimensions are related to DIN 43.625 standard.

For fuse-switch combination unit type QM, QMB, QMC, refer only to the selection table and reference list of fuses. For all other type of fuses, consult us.

Example: for the protection of a 400 kVA transformer at 10 kV, select either Solefuse fuses rated 43 A or Fusarc CF fuses rated 50 A.

Fuse selection table

The color code is linked to the rated voltage of the fuse. Rating in A – no overload at –5°C < t < 40°C.

Please consult us for overloads and operation over 40°C for France Transfo oil immersed type transformers.

<table>
<thead>
<tr>
<th>Type of fuse</th>
<th>Service voltage (kV)</th>
<th>Transformer rating (kVA)</th>
<th>Rated voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solefuse (UTE NFC standards 13.100, 64.210)</td>
<td>5.5</td>
<td>6.3</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solefuse (general case, UTE NFC standard 13.200)</td>
<td>3.3</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>5.5</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>6.6</td>
<td>6.3</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>13.8</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Fusarc CF and SIBA(1) (general case for QM, QMB and QMC cubicle according to IEC 62271-105)</td>
<td>3.3</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>5.5</td>
<td>6.3</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>6.6</td>
<td>6.3</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>13.8</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Fusarc CF for dry type transformers (2)</td>
<td>30</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>34.5</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td>Fusarc CF oil immersed type transformers (2)</td>
<td>30</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>34.5</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) SIBA fuses
(2) This selection table has been prepared according to the technical characteristics of France Transfo.

The characteristics of transformers and fuses may change according to manufacturers and standards.
## Protection of transformers

### Characteristics of the functional units

#### Fuses dimensions

**Solefuse (UTE standards)**

<table>
<thead>
<tr>
<th>Ur (kV)</th>
<th>Ir (A)</th>
<th>L (mm)</th>
<th>Ø (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>6.3 to 125</td>
<td>450</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>100</td>
<td>450</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>17.5</td>
<td>80</td>
<td>450</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>6.3 to 63</td>
<td>450</td>
<td>55</td>
<td>2</td>
</tr>
</tbody>
</table>

**Fusarc CF (DIN standards)**

<table>
<thead>
<tr>
<th>Ur (kV)</th>
<th>Ir (A)</th>
<th>L (mm)</th>
<th>Ø (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>125</td>
<td>292</td>
<td>86</td>
<td>3.3</td>
</tr>
<tr>
<td>12</td>
<td>6.3</td>
<td>292</td>
<td>50.5</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>292</td>
<td>50.5</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>292</td>
<td>50.5</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>292</td>
<td>50.5</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>292</td>
<td>57</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>292</td>
<td>57</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>292</td>
<td>57</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>292</td>
<td>78.5</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>292</td>
<td>78.5</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>292</td>
<td>78.5</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>292</td>
<td>78.5</td>
<td>2.8</td>
</tr>
<tr>
<td>24</td>
<td>6.3</td>
<td>442</td>
<td>50.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>442</td>
<td>50.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>442</td>
<td>50.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>442</td>
<td>50.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>442</td>
<td>57</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>442</td>
<td>57</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>442</td>
<td>57</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>442</td>
<td>78.5</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>442</td>
<td>78.5</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>442</td>
<td>86</td>
<td>5.3</td>
</tr>
<tr>
<td>36</td>
<td>10</td>
<td>537</td>
<td>50.5</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>537</td>
<td>50.5</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>537</td>
<td>57</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>537</td>
<td>78.5</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>537</td>
<td>78.5</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>537</td>
<td>86</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>537</td>
<td>86</td>
<td>6.4</td>
</tr>
</tbody>
</table>

**SIBA**

<table>
<thead>
<tr>
<th>Ur (kV)</th>
<th>Ir (A)</th>
<th>L (mm)</th>
<th>Ø (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>160</td>
<td>292</td>
<td>85</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>292</td>
<td>85</td>
<td>3.8</td>
</tr>
<tr>
<td>12</td>
<td>125</td>
<td>292</td>
<td>67</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>292</td>
<td>85</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>292</td>
<td>85</td>
<td>3.8</td>
</tr>
<tr>
<td>17.5</td>
<td>125</td>
<td>442</td>
<td>85</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>442</td>
<td>85</td>
<td>5.4</td>
</tr>
<tr>
<td>24</td>
<td>125</td>
<td>442</td>
<td>85</td>
<td>5.4</td>
</tr>
</tbody>
</table>
**Characteristics of the functional units**

### Interlocks

**Switch units**
- The switch can be closed only if the earthing switch is open and the access panel is in position.
- The earthing switch can be closed only if the switch is open.
- The access panel for connections can be opened only if the switch is closed.
- The switch is locked in the open position when the access panel is removed. The earthing switch may be operated for tests.

**Circuit-breaker units**
- The disconnector(s) can be closed only if the circuit breaker is open and the front panel is locked (interlock type 50).
- The earthing switch(es) can be closed only if the disconnector(s) is/are open.
- The access panel for connections can be opened only if:
  - The circuit breaker is locked open,
  - The disconnector(s) is/are open,
  - The earthing switch(es) is/are closed.

*Note: it is possible to lock the disconnector(s) in the open position for no-load operations with the circuit breaker.*

**Functional interlocks**

These comply with IEC recommendation 62271-200 and EDF specification HN 64-S-41 (for 24 kV).

In addition to the functional interlocks, each disconnector and switch include:
- Built-in padlocking capacities (padlocks not supplied)
- Four knock-outs that may be used for keylocks (supplied on request) for mechanism locking functions.

### Unit interlock

<table>
<thead>
<tr>
<th>Units</th>
<th>Interlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, IMB, IMC</td>
<td>A1</td>
</tr>
<tr>
<td>CRM, CVM</td>
<td></td>
</tr>
<tr>
<td>DSM, NSM, GAM, SM</td>
<td></td>
</tr>
<tr>
<td>DM2, DM2-W</td>
<td></td>
</tr>
</tbody>
</table>

**Key-type interlocks**

**Outgoing units**

**Aim:**
- To prevent the closing of the earthing switch on a transformer protection unit unless the LV circuit breaker is locked in “open” or “disconnected” position.

- To prevent the access to the transformer if the earthing switch for transformer protection has not first been closed.

- To prevent the closing of the earthing switch on a transformer protection unit unless the LV circuit breaker is locked in “open” or “disconnected” position.

- To prevent the access to the transformer if the earthing switch for transformer protection has not first been closed.

**Legend for key-type interlocks:**
- [ ] no key
- [ ] free key
- [ ] captive key
- [ ] panel or door
Characteristics of the functional units

Interlocks

Ring units

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

- to prevent the simultaneous closing of two switches.

- to prevent the closing of the earthing switch of the casing unit unless the downstream and the upstream switches are locked in the "open" position.

Prevents
- on-load switching of the disconnectors.

Allows
- off-load operation of the circuit breaker with the disconnectors open (double isolation).
- off-load operation of the circuit breaker with the disconnector open (single isolation).

Prevents
- on-load switching of the disconnectors.

Allows
- off-load operation of the contactor with the disconnectors open (double isolation).
- off-load operation of the contactor with the disconnector open (single isolation).

Legend for key-type interlocks:
- no key
- free key
- captive key
- panel or door
Characteristics of the functional units

Interlocks

P1 type

- to prevent the closing of an earthing switch if the switch of the other unit has not been locked in the “open” position.

P2 type

- to prevent on-load operation of the disconnector unless the switch is locked “open”
- to prevent the closing of the earthing switches unless the disconnector and the switch are locked “open”.

P3 type

- to prevent on-load operation of the disconnector unless the switch is locked “open”
- to prevent the closing of the earthing switches with the unit energised, unless the disconnector and the switch are locked “open”
- to allow off-load operation of the switch.

P5 type

- to prevent the closing of the earthing switch of the incoming unit unless the disconnector and the switch is locked “open”.

Legend for key-type interlocks:

- no key
- free key
- captive key
- panel or door
Connections Contents

Connections with dry-type cables for 24 kV 84
Selection table 84

Cable-connection from below for 24 kV 85
Cable positions 85
Trenches depth 86
Trench diagrams example 87
Trench diagrams and floor void drawings enhanced example 88

Connections with dry-type cables for 36 kV 89
Selection table 89

Cable-connection from below for 36 kV 90
Cable positions 90
Connections with dry-type cables for 24 kV
Selection table

The ageing resistance of the equipment in an MV/LV substation depends on three key factors:
- the need to make connections correctly
  New cold fitted connection technologies offer ease of installation that favours resistance over time. Their design enables operation in polluted environments under severe conditions.
- the impact of the relative humidity factor
  The inclusion of a heating element is essential in climates with high humidity levels and with high temperature differentials.
- ventilation control
  The dimension of the grills must be appropriate for the power dissipated in the substation. They must only traverse the transformer area.

Network cables are connected:
- on the switch terminals
- on the lower fuse holders
- on the circuit breaker’s connectors.

The bimetallic cable end terminals are:
- round connection and shank for cables ≤ 240 mm²
- square connection round shank for cables > 240 mm² only.

Crimping of cable end terminals to cables must be carried out by stamping.

The end connectors are of cold fitted type
Schneider Electric’s experience has led it to favour this technology wherever possible for better resistance over time.

The maximum admissible cable cross section:
- 630 mm² for 1250 A incomer and feeder cubicles
- 240 mm² for 400-630 A incomer and feeder cubicles
- 120 mm² for contactor cubicles
- 95 mm² for transformer protection cubicles with fuses.

Access to the compartment is interlocked with the closing of the earthing disconnector. The reduced cubicle depth makes it easier to connect all phases.

A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.

Dry-type single-core cable
Short inner end, cold fitted

<table>
<thead>
<tr>
<th>Performance</th>
<th>Cable end terminal type</th>
<th>X-section mm²</th>
<th>Supplier</th>
<th>Number of cables</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 24 kV</td>
<td>Round connector</td>
<td>50 to 240 mm²</td>
<td>All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 or 2 per phase</td>
<td>For larger x-sections, more cables and other types of cable end terminals, please consult us</td>
</tr>
<tr>
<td>3 to 24 kV</td>
<td>Round connector</td>
<td>50 to 630 mm²</td>
<td>All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 or 2 per phase</td>
<td>400 &lt; 1 ≤ 630 mm² per phase</td>
</tr>
<tr>
<td>3 to 24 kV 1250 A</td>
<td>Round connector</td>
<td>&gt; 300 mm² admissible</td>
<td>All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 or 2 per phase</td>
<td>For larger x-sections, more cables and other types of cable end terminals, please consult us</td>
</tr>
</tbody>
</table>

Three core, dry cable
Short inner end, cold fitted

<table>
<thead>
<tr>
<th>Performance</th>
<th>Cable end terminal type</th>
<th>X-section mm²</th>
<th>Supplier</th>
<th>Number of cables</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 24 kV</td>
<td>Round connector</td>
<td>50 to 240 mm²</td>
<td>All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 per phase</td>
<td>For larger x-sections, more cables and other types of cable end terminals, please consult us</td>
</tr>
<tr>
<td>3 to 24 kV 1250 A</td>
<td>Round connector</td>
<td>50 to 630 mm²</td>
<td>All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 per phase</td>
<td>For larger x-sections, more cables and other types of cable end terminals, please consult us</td>
</tr>
</tbody>
</table>

Note:
- The cable end terminals, covered by a field distributor, can be square, PM/QM type cubicle, round end connections Ø 30 mm max.
Connections

Cable-connection from below for 24 kV
Cable positions

Cable-connection height \( H \)
measured from floor (mm)

<table>
<thead>
<tr>
<th>Product</th>
<th>630 A</th>
<th>1250 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, NSM-cables, NSM-busbars</td>
<td>945</td>
<td>945</td>
</tr>
<tr>
<td>SM</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>IMC</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>PM, QM</td>
<td>430</td>
<td>320</td>
</tr>
<tr>
<td>CRM, CVM</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>DM1-A</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>DMVL-A</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>DMV-S</td>
<td>320</td>
<td>320</td>
</tr>
<tr>
<td>DM1-W</td>
<td>543</td>
<td>313</td>
</tr>
<tr>
<td>GAM2</td>
<td>760</td>
<td></td>
</tr>
<tr>
<td>GAM</td>
<td>470</td>
<td>620</td>
</tr>
<tr>
<td>DMV-A</td>
<td>343</td>
<td></td>
</tr>
<tr>
<td>DMV-A</td>
<td>370</td>
<td>370</td>
</tr>
</tbody>
</table>

IM, NSM-cables, NSM-busbars, SM

IMC, PM, QM, QMC

CRM, CVM

DM1-A, DM1-S, DMVL-A
DM1-W (630 A)

DM1-A, DM1-W (1250 A)

DMV-A, DMV-S (630 A)

DMV-A (1250 A)

X = 330 : 1 single-core cable
X = 268 : 2 single-core cables
X = 299 : Three core cable

X = 330 : 1 single-core cable
X = 268 : 2 single-core cables
X = 299 : Three core cable
Cable-connection from below for 24 kV

Trenches depth

Cabling from below (all units)
- **Through trenches:** the trench depth \( P \) is given in the table opposite for commonly used dry single-core cables type (for tri-core cables consult us).
- **With stands:** to reduce \( P \) or eliminate trenches altogether by placing the units on 400 mm concrete footings.
- **With floor void:** the trench depth \( P \) is given in the table opposite for commonly used types of cables.

### Single-core cables

<table>
<thead>
<tr>
<th>Cable x-section (mm²)</th>
<th>Bending radius (mm)</th>
<th>IM, SM, GSM-cables, NSM-busbars</th>
<th>IMC, DM1-A, DM1-W, DM1-S, DMVL-A, GAM</th>
<th>CRM CVM</th>
<th>DMV-A, DMV-S</th>
<th>PM, QM, QMC (1)</th>
<th>1250 A units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth ( P ) (mm) all orientations</td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
<td>P4</td>
<td>P5</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>370</td>
<td>140</td>
<td>400</td>
<td>400</td>
<td>500</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>400</td>
<td>150</td>
<td>430</td>
<td>430</td>
<td>530</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>440</td>
<td>160</td>
<td>470</td>
<td>470</td>
<td>570</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>470</td>
<td>200</td>
<td>500</td>
<td>500</td>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>500</td>
<td>220</td>
<td>550</td>
<td>550</td>
<td>650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>185</td>
<td>540</td>
<td>270</td>
<td>670</td>
<td>670</td>
<td>770</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>590</td>
<td>330</td>
<td>730</td>
<td>730</td>
<td>830</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>630</td>
<td>940</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Must be installed with a 100 mm depth metal pan.

(2) Must be installed with a 350 mm depth metal pan, in a floor void.

(3) Mounting with a 445 mm depth metal pan compulsory in a floor void.

**Note:** the unit and the cables requiring the greatest depth must be taken into account when determining the depth \( P \) or single-trench installations.

In double-trench installations, depth \( P \) must be taken into account for each type of unit and cable orientations.

---

### Cable trench drawings

**1250 A units** (represented without switchboard side panels)

- **SM, GAM**
  - For single and tri-core cables

- **DMV-A**
  - For single and tri-core cables

- **DM1-A, DM1-W**
  - For single-core cables

**630 A units**

- **DMV-A, DMV-S**
  - For single cables

---
Connections

Cable-connection from below for 24 kV
Trench diagrams example

630 A units
Cable entry or exit through right or left side

Units represented without switchboard side panels

630 A units
Rear entry or exit with conduits

630 A units
Front entry or exit with conduits

Required dimensions (mm)

Note 1: for connection with conduits, the bevel (C) must correspond to the following trench dimensions: P1 = 75 mm or P2/P3 = 150 mm.

Note 2: please refer to chapter “Layout examples” for a site application.

Cabling from above
On each 630 A unit of the range, except those including a low-voltage control cabinet and EMB compartment, the connection is made with dry-type and single-core cables.

Remark: not available for internal arc IEC 62271-200 in busbar compartment.

Height: 450 mm
Connections

Cable-connection from below for 24 kV
Trench diagrams and floor void drawings enhanced example

For enhanced internal arc 16 kA 1 s cubicles

Installation with floor void
Downwards exhaust

Installation with trench
Upwards exhaust

Note: to evacuate gases through the bottom, the floor void volume must be over or equal to 2 m³.
Connections with dry-type cables for 36 kV

Selection table

The ageing resistance of the equipment in an MV/LV substation depends on three key factors:

- **the need to make connections correctly**
  New cold fitted connection technologies offer ease of installation that favours resistance over time. Their design enables operation in polluted environments under severe conditions.

- **the impact of the relative humidity factor**
  The inclusion of a heating element is essential in climates with high humidity levels and with high temperature differentials.

- **ventilation control**
  The dimension of the grills must be appropriate for the power dissipated in the substation. They must only traverse the transformer area.

Network cables are connected:

- on the switch terminals
- on the lower fuse holders
- on the circuit breaker’s connectors.

The bimetallic cable end terminals are:

- round connection and shank for cables ≤ 240 mm².
  Crimping of cable lugs to cables must be carried out by stamping.
  The end connectors are of cold fitted type
  Schneider Electric’s experience has led it to favour this technology wherever possible for better resistance over time.

The maximum admissible copper(*) cable cross section:

- 2 × (1 × 240 mm² per phase) for 1250 A incomer and feeder cubicles
- 240 mm² for 400-630 A incomer and feeder cubicles
- 95 mm² for transformer protection cubicles with fuses.
  Access to the compartment is interlocked with the closing of the earthing disconnector.
  The reduced cubicle depth makes it easier to connect all phases.
  A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.

(*) Consult us for alu cable cross sections

Cabling from below

All units through trenches:

- the trench depth P is given in the table opposite for commonly used types of cables.

### Trench diagrams

#### Cable entry or exit through right or left side

#### Rear entry or exit with conduits

#### Front entry or exit with conduits

### Single-core cables

<table>
<thead>
<tr>
<th>Cable section (mm²)</th>
<th>Bending radius (mm)</th>
<th>IM, IMC, QM, CM, CM2, PM, DM1-A, DM1-W, GAM, GAM2, SM, TM, NSM Depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 35</td>
<td>525</td>
<td>350 550</td>
</tr>
<tr>
<td>1 x 50</td>
<td>555</td>
<td>380 580</td>
</tr>
<tr>
<td>1 x 70</td>
<td>585</td>
<td>410 610</td>
</tr>
<tr>
<td>1 x 95</td>
<td>600</td>
<td>425 625</td>
</tr>
<tr>
<td>1 x 120</td>
<td>630</td>
<td>455 655</td>
</tr>
<tr>
<td>1 x 150</td>
<td>645</td>
<td>470 670</td>
</tr>
<tr>
<td>1 x 185</td>
<td>675</td>
<td>500 700</td>
</tr>
<tr>
<td>1 x 240</td>
<td>705</td>
<td>530 730</td>
</tr>
</tbody>
</table>

**Note:** the unit and the cables requiring the greatest depth must be taken into account when determining the depth P for single-trench installations. In double-trench installations must be taken into account to each type of unit and cable orientations.

### Selection table

**Connections with dry-type cables for 36 kV**

**Selection table**

The ageing resistance of the equipment in an MV/LV substation depends on three key factors:

- **the need to make connections correctly**
  New cold fitted connection technologies offer ease of installation that favours resistance over time. Their design enables operation in polluted environments under severe conditions.

- **the impact of the relative humidity factor**
  The inclusion of a heating element is essential in climates with high humidity levels and with high temperature differentials.

- **ventilation control**
  The dimension of the grills must be appropriate for the power dissipated in the substation. They must only traverse the transformer area.

Network cables are connected:

- on the switch terminals
- on the lower fuse holders
- on the circuit breaker’s connectors.

The bimetallic cable end terminals are:

- round connection and shank for cables ≤ 240 mm².
  Crimping of cable lugs to cables must be carried out by stamping.
  The end connectors are of cold fitted type
  Schneider Electric’s experience has led it to favour this technology wherever possible for better resistance over time.

The maximum admissible copper(*) cable cross section:

- 2 × (1 × 240 mm² per phase) for 1250 A incomer and feeder cubicles
- 240 mm² for 400-630 A incomer and feeder cubicles
- 95 mm² for transformer protection cubicles with fuses.
  Access to the compartment is interlocked with the closing of the earthing disconnector.
  The reduced cubicle depth makes it easier to connect all phases.
  A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.

(*) Consult us for alu cable cross sections

Cabling from below

All units through trenches:

- the trench depth P is given in the table opposite for commonly used types of cables.

### Trench diagrams

#### Cable entry or exit through right or left side

#### Rear entry or exit with conduits

#### Front entry or exit with conduits

### Single-core cables

<table>
<thead>
<tr>
<th>Cable section (mm²)</th>
<th>Bending radius (mm)</th>
<th>IM, IMC, QM, CM, CM2, PM, DM1-A, DM1-W, GAM, GAM2, SM, TM, NSM Depth P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 35</td>
<td>525</td>
<td>350 550</td>
</tr>
<tr>
<td>1 x 50</td>
<td>555</td>
<td>380 580</td>
</tr>
<tr>
<td>1 x 70</td>
<td>585</td>
<td>410 610</td>
</tr>
<tr>
<td>1 x 95</td>
<td>600</td>
<td>425 625</td>
</tr>
<tr>
<td>1 x 120</td>
<td>630</td>
<td>455 655</td>
</tr>
<tr>
<td>1 x 150</td>
<td>645</td>
<td>470 670</td>
</tr>
<tr>
<td>1 x 185</td>
<td>675</td>
<td>500 700</td>
</tr>
<tr>
<td>1 x 240</td>
<td>705</td>
<td>530 730</td>
</tr>
</tbody>
</table>

**Note:** the unit and the cables requiring the greatest depth must be taken into account when determining the depth P for single-trench installations. In double-trench installations must be taken into account to each type of unit and cable orientations.
Connections

Cable-connection from below for 36 kV

Cable positions

Side view

IM, SM units

QM, PM units

DM1-A, DM1-W units

GAM2 unit

Front view

IM, SM

QMC

GAM

GAM2

QM, PM

DM1-A, DM1-W
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions and weights for 24 kV</td>
<td>92</td>
</tr>
<tr>
<td>Units dimensions for 24 kV</td>
<td>93</td>
</tr>
<tr>
<td>Layout examples for 24 kV</td>
<td>95</td>
</tr>
<tr>
<td>Dimensions and weights for 36 kV</td>
<td>96</td>
</tr>
<tr>
<td>Layout examples for 36 kV</td>
<td>97</td>
</tr>
</tbody>
</table>
Installation

**Dimensions and weights**

for 24 kV

<table>
<thead>
<tr>
<th>Unit type</th>
<th>Height (mm)</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, IMB</td>
<td>1600</td>
<td>375/500</td>
<td>940</td>
<td>120/130</td>
</tr>
<tr>
<td>IMC</td>
<td>1600</td>
<td>500</td>
<td>940</td>
<td>200</td>
</tr>
<tr>
<td>PM, QM, QMB</td>
<td>1600</td>
<td>375/500</td>
<td>940</td>
<td>130/150</td>
</tr>
<tr>
<td>QMC</td>
<td>1600</td>
<td>625</td>
<td>940</td>
<td>180</td>
</tr>
<tr>
<td>CRM, CVM</td>
<td>2050</td>
<td>750</td>
<td>940</td>
<td>390</td>
</tr>
<tr>
<td>DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D</td>
<td>1600 (1)</td>
<td>750</td>
<td>1220</td>
<td>400</td>
</tr>
<tr>
<td>DM1-S</td>
<td>1600 (1)</td>
<td>750</td>
<td>1220</td>
<td>340</td>
</tr>
<tr>
<td>DMV-A, DMV-D</td>
<td>1685 (1)</td>
<td>625</td>
<td>940</td>
<td>345</td>
</tr>
<tr>
<td>DMV-S</td>
<td>1600 (1)</td>
<td>625</td>
<td>940</td>
<td>260</td>
</tr>
<tr>
<td>CM</td>
<td>1600 (1)</td>
<td>375</td>
<td>940</td>
<td>190</td>
</tr>
<tr>
<td>CM2</td>
<td>1600 (1)</td>
<td>500</td>
<td>940</td>
<td>210</td>
</tr>
<tr>
<td>GBC-A, GBC-B</td>
<td>1600</td>
<td>750</td>
<td>1020</td>
<td>290</td>
</tr>
<tr>
<td>NSM-cables, NSM-busbars</td>
<td>2050</td>
<td>750</td>
<td>940</td>
<td>260</td>
</tr>
<tr>
<td>GM</td>
<td>1600</td>
<td>125</td>
<td>840</td>
<td>30</td>
</tr>
<tr>
<td>GEM (2)</td>
<td>1600</td>
<td>125</td>
<td>920/1060 (2)</td>
<td>30/35 (2)</td>
</tr>
<tr>
<td>GBM</td>
<td>1600</td>
<td>375</td>
<td>940</td>
<td>120</td>
</tr>
<tr>
<td>GAM2</td>
<td>1600</td>
<td>375</td>
<td>940</td>
<td>120</td>
</tr>
<tr>
<td>GAM</td>
<td>1600</td>
<td>500</td>
<td>1020</td>
<td>160</td>
</tr>
<tr>
<td>SM</td>
<td>1600 (1)</td>
<td>375/500</td>
<td>940</td>
<td>120/150 (3)</td>
</tr>
<tr>
<td>TM</td>
<td>1600</td>
<td>375</td>
<td>940</td>
<td>200</td>
</tr>
<tr>
<td>DM1-A, DM1-D, DM1-W, DM1-Z (1250 A)</td>
<td>1600</td>
<td>750</td>
<td>1220</td>
<td>420</td>
</tr>
</tbody>
</table>

Add to height:
(1) 450 mm for low-voltage enclosures for control/monitoring and protection functions.
To ensure uniform presentation, all units (except GIM and GEM) may be equipped with low-voltage enclosures.

(2) depending on the busbar configuration in the VM6 unit, two types of extension units may be used:
- to extend a VM6 DM12 or DM23 unit, use an extension unit with a depth of 1060 mm
- for all other VM6 units, a depth of 920 mm is required.

(3) for the 1250 A unit.

**Ground preparation**

Units may be installed on ordinary concrete ground, with or without trenches depending on the type and cross-section of cables.

**Fixing of units**

With each other
The units are simply bolted together to form the MV switchboard (bolts supplied). Busbar connections are made using a torque wrench set to 28 mN.

On the ground
- for switchboards comprising up to three units, the four corners of the switchboard must be secured to the ground with using:
  - M8 bolts (not supplied) screwed into nuts set into the ground using a sealing pistol,
  - screw rods grouted into the ground.
- for switchboards comprising more than three units, each unit may be fixed as necessary.
- position of fixing holes b depends on the width a of units:

| a (mm) | 125 | 375 | 500 | 625 | 750 |
| b (mm) | 95  | 345 | 470 | 585 | 720 |

*Note: in circuit-breaker or contactor units, fixing devices are installed on the side opposite the switchgear*
Units dimensions for 24 kV

- IM, IMB, PM, QM, QMB, SM, IMC, QMC, CM, CM2
- NSM-cables, NSM-busbars, CRM, CVM
- GBM, GAM2

- GAM
- GIM
- GEM

- GBC-A, GBC-B
- EMB
Installation

Units dimensions for 24 kV


DM1-A, DM1-W 1250 A

DMV-A 1250 A

DMV-A 630 A

DMV-D

DMV-S

Internal arc enhanced cubicles upwards exhaust

Internal arc enhanced cubicles downwards exhaust
Installation

Layout examples for 24 kV

Prefabricated substation (Kiosk)

![Prefabricated substation image]

Conventional substation (Masonry)

Internal arc cubicles 12.5 kA 1 s

![Conventional substation diagram]

Switchboard extension example

Internal arc cubicles 16 kA 1 s
Installed against a wall for downwards and upwards exhaust

![Switchboard extension example diagram]

Internal arc cubicles 16 kA 1 s
With rear corridor downwards and upwards exhaust

![Internal arc cubicles diagram]

(*) Advised access dimension

(*) Advised access dimension

For upwards exhaust (ceiling height ≥ 2800 mm)
### Dimensions and weights

<table>
<thead>
<tr>
<th>Unit type</th>
<th>Height (mm)</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, SM</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>310</td>
</tr>
<tr>
<td>IMC, IMB</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>420</td>
</tr>
<tr>
<td>QM, PM, QMB</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>330</td>
</tr>
<tr>
<td>QMC</td>
<td>2250</td>
<td>1000</td>
<td>1400 (3)</td>
<td>420</td>
</tr>
<tr>
<td>DM1-A</td>
<td>2250</td>
<td>1000</td>
<td>1400 (2)</td>
<td>600</td>
</tr>
<tr>
<td>DM1-D</td>
<td>2250</td>
<td>1000</td>
<td>1400 (2)</td>
<td>560</td>
</tr>
<tr>
<td>DM1-W</td>
<td>2250</td>
<td>1000</td>
<td>1400 (2)</td>
<td>680</td>
</tr>
<tr>
<td>NSM</td>
<td>2250</td>
<td>1500</td>
<td>1400 (3)</td>
<td>620</td>
</tr>
<tr>
<td>GM</td>
<td>2250</td>
<td>250</td>
<td>1400</td>
<td>90</td>
</tr>
<tr>
<td>DM2</td>
<td>2250</td>
<td>1500</td>
<td>1400 (2)</td>
<td>900</td>
</tr>
<tr>
<td>DM1-W</td>
<td>2250</td>
<td>1500</td>
<td>1400 (2)</td>
<td>920</td>
</tr>
<tr>
<td>CM, CM2</td>
<td>2250</td>
<td>750</td>
<td>1400 (2)</td>
<td>460</td>
</tr>
<tr>
<td>GBC-A, GBC-B</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>420</td>
</tr>
<tr>
<td>GBM</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>260</td>
</tr>
<tr>
<td>GAM2</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>250</td>
</tr>
<tr>
<td>GAM</td>
<td>2250</td>
<td>750</td>
<td>1400 (3)</td>
<td>295</td>
</tr>
</tbody>
</table>

(1) The depth measures are given for the floor surface.  
(2) The depth in these units are 1615 mm with the enlarged low voltage compartment.  
(3) The depth in these units are 1500 mm with the standard low voltage compartment.

### Ground preparation

Units may be installed on ordinary concrete grounds, with or without trenches depending on the type and cross-section of cables. Required civil works are identical for all units.

### Fixing of units

#### With each other

The units are simply bolted together to form the MV switchboard (bolts supplied). Busbar connections are made using a torque wrench set to 28 mN.

#### On the ground

- for switchboards comprising up to three units, the four corners of the switchboard must be secured to the ground using:
  - bolts (not supplied) screwed into nuts set into the ground using a sealing pistol
  - screw rods grouted into the ground
- for switchboards comprising more than three units, the number and position of fixing points depends on local criteria (earthquake withstand capacities, etc.)
- position of fixing holes depends on the width of units.

<table>
<thead>
<tr>
<th>Unit type</th>
<th>A (mm)</th>
<th>B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM, IMC, IMB, QM, PM, SM, CM, CM2, TM</td>
<td>750</td>
<td>650</td>
</tr>
<tr>
<td>GBC-A, GBC-B, GBM, GAM2, IMB, GAM, QMB</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>DM1-A, DM1-D, DM1-W, QMC</td>
<td>1500</td>
<td>1400</td>
</tr>
<tr>
<td>DM2, NSM, DM2-W</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

### Dimensions

**CM, CM2, NSM units**

- **DM1-A, DM1-D, DM1-W, DM2-W units**

---

(96) The depth measures are given for the floor surface.  
(2) The depth in these units are 1615 mm with the enlarged low voltage compartment.  
(3) The depth in these units are 1500 mm with the standard low voltage compartment.
Installation

Layout examples for 36 kV

Conventional substation (Masonry)

Top view

Side view

Minimum required dimensions (mm)
(1) In case of upper incoming option: it must be 2730 mm (no internal arc withstand if selected)
(2) In case of upper incoming option: it must be 2830 mm (no internal arc withstand if selected)
Appendices

Contents

Appendices

Trip curves for VIP 300 LL or LH relays 100
Trip curves for VIP 35 relays 101
Fusarc CF fuses 102
Solefuse fuses 103

Order form

SM6 - Connection to the network 104
SM6 - Fuse switch protection 105
SM6 - Circuit breaker protection 106
SM6 - MV metering 108
SM6 - Casing 109
SM6 - Automatic Transfer System 110
SM6 - Vacuum contactor motor starter for SM6 24 kV 111
SF1 - Lateral disconnectable or withdrawable 112
SFset - Lateral disconnectable for SM6 24 kV 113
Evolis - Frontal fixed version for SM6 24 kV (up to 17.5 kV) 114
Evolis - Lateral disconnectable version for SM6 24 kV (up to 24 kV) 115
Appendices

Trip curves for VIP 300 LL or LH relays

Definite time tripping curves

SI curve

VI curve

EI curve

RI curve
The trip curve shows the time before the relay acts, to which must be added 70 ms to obtain the breaking time.
Fusarco CF fuses
Fuse and limitation curves

Fuse curve 3.6 - 7.2 - 12 - 17.5 - 24 - 36 kV

Time (s)

Current (A)

Limitation curve 3.6 - 7.2 - 12 - 17.5 - 24 - 36 kV

Maximum value of the limited broken current (kA peak)

Rms value of the presumed broken current (kA)

The diagram shows the maximum limited broken current value as a function of the rms current value which could have occurred in the absence of a fuse.
Appendices

Solefuse fuses
Fuse and limitation curves

Fuse curve 7.2 - 12 - 17.5 - 24 kV

The diagram shows the maximum limited broken current value as a function of the rms current value which could have occurred in the absence of a fuse.

Limitation curve 7.2 - 12 - 17.5 - 24 kV
Maximum value of the limited broken current (kA peak)
## Order form

### SM6
Connection to the network

---

**Basic cubicle**

<table>
<thead>
<tr>
<th>Rated voltage Ur (kV)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SM 375</strong></td>
<td>IM 375</td>
</tr>
<tr>
<td><strong>SM 375</strong></td>
<td>IMC 500</td>
</tr>
<tr>
<td><strong>IMB 375</strong></td>
<td>IMB 375</td>
</tr>
<tr>
<td><strong>SM 500</strong> (for 1250 A)</td>
<td>IM 500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short-circuit current Isc (kA)</th>
<th>Rated current Ir (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>24 kV</strong></td>
<td>IM 375</td>
</tr>
<tr>
<td><strong>24 kV</strong></td>
<td>IMC 500</td>
</tr>
<tr>
<td><strong>IMB 375</strong></td>
<td>IMB 375</td>
</tr>
<tr>
<td><strong>36 kV</strong></td>
<td>IM 500</td>
</tr>
<tr>
<td><strong>36 kV</strong></td>
<td>IMC 500</td>
</tr>
<tr>
<td><strong>IMB 375</strong></td>
<td>IMB 375</td>
</tr>
</tbody>
</table>

**Type of cubicle**

- 24 kV: SM 375, IM 375, IMC 500, IMB 375
- 36 kV: SM 750, IM 750, IMC 750, IMB 750

**Position number in the switchboard**
- (from left to right)

**Direction of lower busbars for IMB**
- Left (impossible as first cubicle of switchboard)
- Right

---

**Options**

**Common options**

### Replacement of CIT by CI1/CI2

**Electrical driving motorization**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>SM 375</th>
<th>IM 375</th>
<th>IMC 500</th>
<th>IMB 375</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Signalling contact**

- 1 C on SW and 1 O & 1 C on ES (not applicable on SM cubicle)
- 2 O & 2 C on SW
- 2 O & 3 C on SW and 1 O & 1 C on ES

**Interlocking**

- Standard key type
- Round key type

**Internal arc version 16 kA 1 s (not possible with "top incomer" option)**

**Digital ammeter or fault current indicator**

- AMP 21D
- Flair 21D
- Flair 22D
- Flair 23DV
- Flair 23DV zero sequence

**24 kV options**

### Remote control signalling

- 2 lights
- 2 lights and 2 PB
- 2 lights and 2 PB + 1 switch

**Voltage of the lights (must be the same than electrical driving mechanism)**

- 24 V
- 48 V
- 110/125 V
- 220 V

**Roof configuration**

- A - Cable connection by the top (cable maxi 240 mm² with VPIS)
  - Single core
  - 2 x single core
- B - Low voltage control cabinet (h = 450 mm)
  - With unpunched door
- C - Wiring duct

**50 W heating element**

**Surge arresters for IM 500**

- 7.2 kV
- 10 kV
- 12 kV
- 17.5 kV
- 24 kV

**Operation counter**

- CTs for IMC (quantity)
  - 1
  - 2
  - 3

**Visibility of main contacts**

- Pressure indicator device
  - Analogic manometer without visibility of main contacts
  - Analogic manometer with visibility of main contacts

**Upper field distributor for severe conditions** (only for 630 A)

---

**36 kV options**

**Electrical driving mechanism** (with O/C coils and AC contacts)

**O/C coils without electrical driving mechanism**

**Cable connection by the top** (single core cable maxi 240 mm² with VPIS)

**Cable connection by the bottom** (2 x single core, cable maxi 240 mm², not applicable on IMC)

**Surge arresters** (not applicable on IMB, IMC cubicles)

---

Only one of the boxes (ticked X or filled) by the needed value have to be considered between each horizontal line. Green box X corresponds to none priced functions.
# Order form

## SM6

Fuse switch protection

---

### Basic cubicle

<table>
<thead>
<tr>
<th>Rated voltage Ur (kV)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV QM 375</td>
<td></td>
</tr>
<tr>
<td>24 kV QM 500</td>
<td></td>
</tr>
<tr>
<td>36 kV QM 750</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Service voltage (kV)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12 kV QMB 375</td>
<td></td>
</tr>
<tr>
<td>12 kV QMB 750</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short-circuit current Isc (kA)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV QM 375</td>
<td></td>
</tr>
<tr>
<td>24 kV QM 500</td>
<td></td>
</tr>
<tr>
<td>36 kV QM 750</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated current Ir (A)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV QM 375</td>
<td></td>
</tr>
<tr>
<td>24 kV QM 500</td>
<td></td>
</tr>
<tr>
<td>36 kV QM 750</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of cubicle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV QM 375</td>
<td></td>
</tr>
<tr>
<td>24 kV QM 500</td>
<td></td>
</tr>
<tr>
<td>36 kV QM 750</td>
<td></td>
</tr>
</tbody>
</table>

**Position number in the switchboard (from left to right)**

**Current transformers for QMC 24 kV (to see price structure)**

<table>
<thead>
<tr>
<th>Quantity of CTs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Direction of lower busbars for QMB**

- Left
- Right

### Options

#### Common options

- **Fuses** (see fuse price structure)
  - Service voltage ≤ 12 kV
- **Replacement of mechanism**
  - CIT by CI1 (only for PM)
- **Electrical driving motorization**
  - 24 Vdc: 110 Vdc, 120/127 Vac (50 Hz)
  - 32 Vdc: 120-125 Vdc, 220/230 Vac (50 Hz)
  - 48 Vdc: 137 Vdc, 120/127 Vac (60 Hz)
  - 60 Vdc: 220 Vdc, 220/230 Vac (60 Hz)
- **Shunt trip**
  - Opening (on CI1)
  - Closing and opening (on CI2)
  - 24 Vdc: 110 Vdc, 120/127 Vac (50 Hz)
  - 32 Vdc: 120-125 Vdc, 220/230 Vac (50 Hz)
  - 48 Vdc: 137 Vdc, 120/127 Vac (60 Hz)
  - 60 Vdc: 220 Vdc, 220/230 Vac (60 Hz)
- **Auxiliary contact signalling**
  - 1 C on SW and 1 O & 1 C on ES
  - 2 O & 2 C on SW
  - 2 O & 3 C on SW and 1 O & 1 C on ES
- **Interlocking**
  - A1, C1, C4
  - Standard key type
  - Round key type
- **Replacement of 630 A upper busbar by 1250 A (not possible for QMB)**
- **Blown fuse signalling contact** (for QM, QMB, QMC)

#### 24 kV options

- **Replacement of mechanism**
  - CI1 by CI2 (only for QM)
- **Remote control signalling** (for QM only)
  - 2 lights
  - 2 lights and 2 PB
  - 2 lights and 2 PB + 1 switch
- **Voltage of the lights** (must be the same than electrical driving mechanism)
  - 24 V
  - 48 V
  - 110/125 V
  - 220 V
- **Blown fuse signalling contact** (mechanical indication PM, electrical for the other cubicles)

#### 36 kV options

- **Replacement of mechanism**
  - CI1 by CI2 (only for PM)
- **Cable connection by the top** (single core cable maxi 240 mm² with VPIS)

**Field distributor for severe conditions** (only for 630 A)

**Internal arc version 16 kA 1 s** (not possible with "top incomer" option)

### Other options

- **50 W heating element**
- **Operation counter**
- **Digital ammeter** (not applicable for QMB)
- **Visibility of main contacts**
- **Pressure indicator device**
  - Analogic manometer without visibility of main contacts
  - Analogic manometer with visibility of main contacts
- **Field distributor for severe conditions** (only for 630 A)

**Visibility of main contacts**

- Analogic manometer
  - Without visibility of main contacts
  - With visibility of main contacts

---

Only one of the boxes (ticked X or filled by the needed value) have to be considered between each horizontal line.

Green box X corresponds to none priced functions.
Order form

SM6

Circuit breaker protection

Only one of the boxes (ticked X or filled by the needed value) have to be considered between each horizontal line. Green box X corresponds to none priced functions.

### Basic cubicle

**Quantity**

**Common 24/36 kV**

<table>
<thead>
<tr>
<th>Rated voltage Ur (kV)</th>
<th>Service voltage (kV)</th>
<th>Short-circuit current Isc (kA)</th>
<th>Rated current Ir (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Type of cubicle**

**24 kV**
- For SF1 circuit breaker: DM1-A 750, DM1-D left 750, DM1-Z 750, DM1-W 750, DM2 left 750, DM2 right 750
- For SFset circuit breaker: DM1-D left 750, DM1-D right 750
- For Evolis frontal 630 A CB: DMV-A, DMV-S, DMV-D right
- For Evolis lateral 630 A CB: DMVL-A, DMVL-D

**36 kV**
- For SF1 circuit breaker: DM1-A 1000, DM1-D left 1000, DM1-Z 1000, DM1-W 1000, DM2 left 1500, DM2 right 1500, DM2-W right 1500

**Position number in the switchboard (from left to right)**

**Circuit breaker**
- See specific order form

**Current transformers (CT) and LPCTs**
- See specific order form

### Basic 24 kV

**Busbar (Ir > Ir cubicle)**

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>400 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For DM1-A, DM1-D, DM1-W, DM1-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>1250 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For DMV-A, DMV-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>630 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For DMV-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>630 A</td>
</tr>
</tbody>
</table>

**Protection**

- For DM1-S, DMV-S: VIP35 with CRc, VIP300LL with CRA, VIP300LL with CRb
- For DM1-S: Sepam series 10 with CRA, Sepam series 10 with CRB
- For DMV-A, DMV-D: Sepam series 20/40
- For DM2, DM1-Z, DM1-W: Statimax 5 A, 2 s, Statimax 1 A, 2 s

**Control for DMV-A and DMV-D**

- **Local** (shunt trip coil compulsory)
- **Remote** (opening coil and closing coil compulsory)
- **Local and remote** (opening coil and closing compulsory)

<table>
<thead>
<tr>
<th>Voltage of the auxiliaries</th>
<th>Voltage of signalling</th>
</tr>
</thead>
<tbody>
<tr>
<td>48/60 Vdc</td>
<td>110/125 or 220/250 Vdc, 110/130 or 220/240 Vac (50 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage of signalling</th>
<th>220/250 Vdc, 110/130 Vac (50 Hz)</th>
</tr>
</thead>
</table>

**Cable connection by the bottom**

- For DM1-A, DM1-W, DMVL-A: 3 x single core cable maxi 240 mm², 6 x single core cable maxi 240 mm²

**Current sensors**

- MV type CT
- LPCT ring type for DM1-A 630 A
- LPCT MV type for DM1-D, DM1-W 630 A

**Basic 36 kV**

<table>
<thead>
<tr>
<th>Voltage of the auxiliaries</th>
<th>Voltage of signalling</th>
</tr>
</thead>
<tbody>
<tr>
<td>48/60 Vdc</td>
<td>110/125 or 220/250 Vdc, 110/130 or 220/240 Vac (50 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage of signalling</th>
<th>220/250 Vdc, 110/130 Vac (50 Hz)</th>
</tr>
</thead>
</table>

**Options**

- See following page
Order form

SM6

Circuit breaker protection (cont.)

Only one of the boxes (ticked X or filled ) by the needed value) have to be considered between each horizontal line. Green box X corresponds to none priced functions.

### Options

#### Common options

<table>
<thead>
<tr>
<th>Interlocking</th>
<th>Standard key type</th>
<th>Round key type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signalling contact</th>
<th>2 O &amp; 2 C on SW (not applicable with VTs)</th>
<th>2 O &amp; 3 C on SW and 1 O &amp; 1 C on ES (not applicable with VTs)</th>
<th>1 O &amp; 2 C on SW (available only on cubicle with VTs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VTs (not applicable for DM1-S, DMV-S)</th>
<th>See specific order form</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 24 kV options

**Roof configuration** (not applicable on DMV-A, DMV-S, DMV-D)  
(A, B or C only one choice possible)

- **A - Cable connection by the top** (cable maxi 240 mm² with VPIS)
  - Single core
  - 2 x single core
  - DM2
  - 1 set
  - 2 sets

- **B - Low voltage control cabinet**
  - DM2
  - 1 cabinet
  - 2 cabinets

- **C - Wiring duct**
  - DM2
  - 1 set
  - 2 sets
  - Other cubicles
  - 1 set

**Surge arrester**

- 50 W heating element
- Replacement of 630 A upper busbars 400-630 A by 1250 A
- Field distributor for severe conditions (only for 630 A)
- Internal arc version 16 kA 1 s (not possible with “top incomer” option)

#### 36 kV options

- **Cable connection by the top** (single core cable maxi 240 mm² with VPIS)
- **Cable connection by the bottom** (for DM1-A and DM1-W only)
- **Surge arrester**
- **Sepam relay protection** See specific order form

- 3 x 2 x single core cable maxi 240 mm²
- 36 kV
Order form

SM6
MV metering

Only one of the boxes (ticked \checkmark or filled \blacksquare by the needed value) have to be considered between each horizontal line. Green box \checkmark corresponds to none priced functions.

<table>
<thead>
<tr>
<th>Basic cubicle</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common 24/36 kV</td>
<td></td>
</tr>
<tr>
<td>Rated voltage Ur (kV)</td>
<td></td>
</tr>
<tr>
<td>Service voltage (kV)</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current Isc (kA)</td>
<td></td>
</tr>
<tr>
<td>Rated current Ir (A)</td>
<td></td>
</tr>
</tbody>
</table>

Type of cubicle/upper busbar for 24 kV

<table>
<thead>
<tr>
<th></th>
<th>CM</th>
<th>CM2</th>
<th>TM</th>
<th>GBC-A</th>
<th>GBC-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir = 630 A, Ir busbar = 400 A</td>
<td>\checkmark</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ir = 630 A, Ir busbar = 630 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ir = 630 A, Ir busbar = 1250 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ir = 1250 A, Ir busbar = 1250 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Type of cubicle for 36 kV

<table>
<thead>
<tr>
<th></th>
<th>CM 750</th>
<th>CM2 750</th>
<th>GBC-A 750</th>
<th>GBC-B 750</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Position number in the switchboard (from left to right)

Direction of lower busbars for GBC-A

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
</table>

Signalling contact (for CM, CM2 and TM only)

<table>
<thead>
<tr>
<th></th>
<th>1 O and 1 C on SW</th>
</tr>
</thead>
</table>

Fuses (for CM, CM2 and TM only)

<table>
<thead>
<tr>
<th></th>
<th>See fuse price structure</th>
</tr>
</thead>
</table>

Basic 24 kV

<table>
<thead>
<tr>
<th>VTs for GBC (to see price structure)</th>
<th>Phase/phase</th>
<th>Phase/earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTs for GBC (to see price structure)</td>
<td>Quantity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Ratio choice for GBC

<table>
<thead>
<tr>
<th>Protections</th>
<th>1 secondary</th>
<th>1 high secondary</th>
<th>1 low secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 secondaries</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Basic 36 kV

<table>
<thead>
<tr>
<th>Voltage transformers</th>
<th>See specific order form</th>
</tr>
</thead>
</table>

Options

24 kV options

<table>
<thead>
<tr>
<th>Roof configuration</th>
<th>(A, B or C only one choice possible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Cable connection by the top</td>
<td>(cable max 240 mm² with VPIS)</td>
</tr>
<tr>
<td>B - Low voltage control cabinet</td>
<td>(h = 450 mm)</td>
</tr>
<tr>
<td>C - Wiring duct</td>
<td>With unpunched door</td>
</tr>
</tbody>
</table>

50 W heating element for CM, CM2, TM

Field distributor for severe conditions (only for 630 A and CM, CM2 and TM cubicles)

Blown fuse auxiliary contact (for CM, CM2 and TM only)

<table>
<thead>
<tr>
<th></th>
<th>1 O and 1 C</th>
</tr>
</thead>
</table>

Internal arc version 16 kA 1 s (not possible with “top incomer” option)

36 kV options

<table>
<thead>
<tr>
<th>Current transformers and voltage transformers for GBC</th>
<th>See specific order form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable connection by the top (single core cable max 240 mm² with VPIS)</td>
<td></td>
</tr>
<tr>
<td>Replacement of 630 A busbar by 1250 A (for CM, CM2 and TM only)</td>
<td></td>
</tr>
</tbody>
</table>
## Order form

### SM6 Casing

Only one of the boxes (ticked X or filled by the needed value) have to be considered between each horizontal line. Green box X corresponds to none priced functions.

### Basic Cubicle

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage Ur (kV)</td>
<td></td>
</tr>
<tr>
<td>Service voltage (kV)</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current Isc (kA)</td>
<td></td>
</tr>
<tr>
<td>Rated current Ir (A)</td>
<td></td>
</tr>
</tbody>
</table>

### Type of Cubicle/Upper Busbar for 24 kV

| Ir = 630 A, Ir busbar = 400 A | GAM 500 | GAM 2 375 | GBM 375 |
| Ir = 630 A, Ir busbar = 630 A | GAM 500 | GAM 2 375 | GBM 375 |
| Ir = 1250 A, Ir busbar = 1250 A | GAM 500 | GBM 375 |

### Type of Cubicle for 36 kV

| GAM 750 | GAM 2 750 | GBM 750 |

### Position Number in the Switchboard (from left to right)

### Direction of Lower Busbars for GBM

- Left (impossible on the first cubicle of the switchboard)
- Right

### Options

#### 24 kV Options

**Roof Configuration** (A, B or C only one choice possible)

- **A** - Cable connection by the top (cable maxi 240 mm² with VPIS)
  - Single core
  - 2 x single core
- **B** - Low Voltage Control cabinet (h = 450 mm) With unpunched door
- **C** - Wiring duct

**Wiring duct for GBM**

**ES Auxiliary Contact** (only on GAM 500) 1 O and 1 C

**Surge Arresters for GAM 500, 630 A**

- 7.2 kV
- 10 kV
- 12 kV
- 17.5 kV
- 24 kV

**Interlocking on GAM 500**

- Standard Key Type
- Round Key Type

**Localisation of 2nd lock for P5 Cubicle no.**

**Heat element** (on GAM 500 630 A and on GAM 2)

**Digital ammeter or Fault current indicator**

- AMP 21D (except GBM)
- Flair 21D
- Flair 22D
- Flair 23DV
- Flair 23DV zero sequence

**Internal arc version 16 kA 1 s** (not possible with “top incomer” option)

#### 36 kV Options

**Cable connection by the top** (single core cable maxi 240 mm² with VPIS)

**Replacement of 630 A busbar by 1250 A** (for GAM 2 only)

**Surge Arresters for GAM 2**
Order form

SM6
Automatic Transfer System

Only one of the boxes (ticked X or filled by the needed value) have to be considered between each horizontal line. Green box X corresponds to none priced functions.

### Basic cubicle

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage Ur (kV)</td>
</tr>
<tr>
<td>Service voltage (kV)</td>
</tr>
<tr>
<td>Short-circuit current Isc (kA)</td>
</tr>
<tr>
<td>Rated current Ir (A)</td>
</tr>
</tbody>
</table>

### Type of cubicle/upper busbar for 24 kV

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir = 630 A, Ir busbar = 400 A</td>
</tr>
<tr>
<td>NSM busbar</td>
</tr>
<tr>
<td>NSM cable</td>
</tr>
<tr>
<td>Ir = 630 A, Ir busbar = 630 A</td>
</tr>
<tr>
<td>NSM busbar</td>
</tr>
<tr>
<td>NSM cable</td>
</tr>
<tr>
<td>Ir = 630 A, Ir busbar = 1250 A</td>
</tr>
<tr>
<td>NSM busbar</td>
</tr>
<tr>
<td>NSM cable</td>
</tr>
</tbody>
</table>

### Type of cubicle for 36 kV

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSM busbar</td>
</tr>
<tr>
<td>NSM cable</td>
</tr>
</tbody>
</table>

### Position in the switchboard (from left to right)

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
</tr>
<tr>
<td>Right</td>
</tr>
</tbody>
</table>

### Cable connection by the bottom (cable maxi 240 mm²) for NSM cable

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three core on both</td>
</tr>
<tr>
<td>Single core on both</td>
</tr>
<tr>
<td>2 x single core on both</td>
</tr>
</tbody>
</table>

### Stand by source

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator without paralleling</td>
</tr>
<tr>
<td>Utility without paralleling</td>
</tr>
</tbody>
</table>

### Control unit HMI language

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
</tr>
<tr>
<td>English</td>
</tr>
<tr>
<td>Spanish</td>
</tr>
<tr>
<td>Portuguese</td>
</tr>
<tr>
<td>Chinese</td>
</tr>
</tbody>
</table>

### Options

#### Common options

### Signalling contact

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 C on SW and 1 O &amp; 1 C on ES</td>
</tr>
</tbody>
</table>

### Operation counter

#### Interlocking SM6-SM6

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard key type</td>
</tr>
<tr>
<td>Round key type</td>
</tr>
<tr>
<td>1 x P1</td>
</tr>
<tr>
<td>Right cubicle</td>
</tr>
<tr>
<td>Left cubicle</td>
</tr>
<tr>
<td>2 x P1</td>
</tr>
<tr>
<td>Right and left cubicle</td>
</tr>
<tr>
<td>1 x A3</td>
</tr>
<tr>
<td>Right cubicle</td>
</tr>
<tr>
<td>Left cubicle</td>
</tr>
<tr>
<td>On switch</td>
</tr>
<tr>
<td>On earthing switch</td>
</tr>
<tr>
<td>2 x A3</td>
</tr>
<tr>
<td>Right cubicle</td>
</tr>
<tr>
<td>On switch</td>
</tr>
<tr>
<td>On earthing switch</td>
</tr>
<tr>
<td>Left cubicle</td>
</tr>
<tr>
<td>On switch</td>
</tr>
<tr>
<td>On earthing switch</td>
</tr>
</tbody>
</table>

#### Telecontrol

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol type</td>
</tr>
<tr>
<td>Modem type</td>
</tr>
<tr>
<td>DNP3</td>
</tr>
<tr>
<td>IEC 101/204</td>
</tr>
<tr>
<td>Modbus (by default)</td>
</tr>
<tr>
<td>FSK</td>
</tr>
<tr>
<td>RS485</td>
</tr>
<tr>
<td>RS232 (by default)</td>
</tr>
<tr>
<td>PSTN</td>
</tr>
<tr>
<td>GSM</td>
</tr>
</tbody>
</table>

#### 24 kV options

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 heating elements</td>
</tr>
<tr>
<td>Field distributor for severe conditions (only for 630 A busbar)</td>
</tr>
</tbody>
</table>
## Order form

### SM6

**Vacuum contactor motor starter for SM6 24 kV**

Only one of the boxes (ticked `X` or filled `✓`) by the needed value) have to be considered between each horizontal line.

Green box `X` corresponds to none priced functions.

<table>
<thead>
<tr>
<th>Basic cubicle</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage Ur (kV)</td>
<td>7.2</td>
</tr>
<tr>
<td>Service voltage (kV)</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current Isc (6.3 kA without fuse)</td>
<td></td>
</tr>
<tr>
<td>Rated current Ir (max. 400 A without fuse)</td>
<td></td>
</tr>
<tr>
<td>Position in the switchboard (from left to right)</td>
<td></td>
</tr>
<tr>
<td>Busbar Ir</td>
<td>400 A</td>
</tr>
<tr>
<td></td>
<td>630 A</td>
</tr>
<tr>
<td></td>
<td>1250 A</td>
</tr>
<tr>
<td>Phase current sensors</td>
<td>1 CT</td>
</tr>
<tr>
<td></td>
<td>2 CT</td>
</tr>
<tr>
<td></td>
<td>3 CT</td>
</tr>
<tr>
<td></td>
<td>3 LPCT ring type</td>
</tr>
<tr>
<td>Key interlockings for S2 type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard key type</td>
</tr>
<tr>
<td>Options</td>
<td></td>
</tr>
<tr>
<td>MV fuses</td>
<td>25 A</td>
</tr>
<tr>
<td></td>
<td>31.5 A</td>
</tr>
<tr>
<td></td>
<td>40 A</td>
</tr>
<tr>
<td></td>
<td>50 A</td>
</tr>
<tr>
<td></td>
<td>63 A</td>
</tr>
<tr>
<td></td>
<td>80 A</td>
</tr>
<tr>
<td></td>
<td>100 A</td>
</tr>
<tr>
<td></td>
<td>125 A</td>
</tr>
<tr>
<td></td>
<td>160 A</td>
</tr>
<tr>
<td></td>
<td>200 A</td>
</tr>
<tr>
<td></td>
<td>250 A</td>
</tr>
<tr>
<td>Upper field distributor for severe conditions (only for 630 A busbar)</td>
<td></td>
</tr>
<tr>
<td>Key interlockings for C1 type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard key type</td>
</tr>
<tr>
<td>Voltage transformer (quantity)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

### Contactor

<table>
<thead>
<tr>
<th>Vacuum contactor</th>
<th>Magnetic hold</th>
<th>Mechanical latching</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
</tr>
<tr>
<td></td>
<td>110 Vac/dc</td>
<td>120 Vac/dc</td>
</tr>
<tr>
<td></td>
<td>220 Vac/dc</td>
<td>240 Vac/dc</td>
</tr>
</tbody>
</table>

| Open release     | 125 Vdc       | 250 Vdc             |
|                 | 110 Vac/dc    | 125 Vac/dc          |
|                 | 220 Vac/dc    | 240 Vac/dc          |
| Closing coil     |               |                     |

|                | 110 Vac/dc    | 125 Vac/dc          |
|                | 220 Vac/dc    | 240 Vac/dc          |
|                | 120 Vac/dc    | 250 Vac/dc          |
**SF1**

Lateral disconnectable or withdrawable

---

**Order form**

Only one of the boxes (ticked or filled by the needed value) have to be considered between each horizontal line. Green box corresponds to none priced functions.

---

### Basic circuit breaker

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Rated voltage Ur (kV)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Service voltage (kV)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Impulse voltage Up (kVbil)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Short-circuit current Isc (kA)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Rated current Ir (A)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Frequency

<table>
<thead>
<tr>
<th>60 Hz</th>
<th>50 Hz</th>
</tr>
</thead>
</table>

#### Mechanism position

- Disconnectable: A1
- Withdrawable: B1

---

### Colour for push buttons and indicators

- Push buttons open/close: Red/black
- Indicator open/close: Black/white
- Operating mechanism charged/discharged: White/yellow

---

### Circuit breaker options

#### 1st opening release (see possible choices combination table below)

<table>
<thead>
<tr>
<th>Shunt opening release YO1</th>
<th>24 Vdc</th>
<th>60 Vdc</th>
<th>220 Vdc</th>
<th>220 Vac (50 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 Vdc</td>
<td>110 Vdc</td>
<td>48 Vac (50 Hz)</td>
<td>120 Vac (60 Hz)</td>
</tr>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>110 Vac (50 Hz)</td>
<td>240 Vac (60 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undervoltage release YM</th>
<th>24 Vdc</th>
<th>60 Vdc</th>
<th>220 Vdc</th>
<th>220 Vac (50 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 Vdc</td>
<td>110 Vdc</td>
<td>48 Vac (50 Hz)</td>
<td>120 Vac (60 Hz)</td>
</tr>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>110 Vac (50 Hz)</td>
<td>240 Vac (60 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitop</th>
<th>Without contact</th>
<th>With contact</th>
</tr>
</thead>
</table>

#### 2nd opening release (see possible choices combination table below)

<table>
<thead>
<tr>
<th>Shunt opening release YO2</th>
<th>24 Vdc</th>
<th>60 Vdc</th>
<th>220 Vdc</th>
<th>220 Vac (50 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 Vdc</td>
<td>110 Vdc</td>
<td>48 Vac (50 Hz)</td>
<td>120 Vac (60 Hz)</td>
</tr>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>110 Vac (50 Hz)</td>
<td>240 Vac (60 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undervoltage release YM</th>
<th>24 Vdc</th>
<th>60 Vdc</th>
<th>220 Vdc</th>
<th>220 Vac (50 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 Vdc</td>
<td>110 Vdc</td>
<td>48 Vac (50 Hz)</td>
<td>120 Vac (60 Hz)</td>
</tr>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>110 Vac (50 Hz)</td>
<td>240 Vac (60 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitop</th>
<th>Without contact</th>
<th>With contact</th>
</tr>
</thead>
</table>

#### Remote control

| Electrical motor M | 24…32 Vdc | 110…127 Vdc/ac |
|                   | 48…60 Vdc/ac | 220…250 Vdc/ac |

<table>
<thead>
<tr>
<th>Shunt closing release YF</th>
<th>24 Vdc</th>
<th>60 Vdc</th>
<th>220 Vdc</th>
<th>220 Vac (50 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 Vdc</td>
<td>110 Vdc</td>
<td>48 Vac (50 Hz)</td>
<td>120 Vac (60 Hz)</td>
</tr>
<tr>
<td></td>
<td>48 Vdc</td>
<td>125 Vdc</td>
<td>110 Vac (50 Hz)</td>
<td>240 Vac (60 Hz)</td>
</tr>
</tbody>
</table>

### Different releases combinations

#### Shunt opening releases YO1/YO2

| 1 | 2 | 1 | 1 | 1 |

#### Undervoltage release YM

| 1 | 1 | 1 | 1 | 1 |

#### Mitop

| 1 | 1 | 1 |

---

**Leaflets language**

- French
- English
Order form

SFset
Lateral disconnectable
for SM6 24 kV

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [ ] corresponds to none priced functions.

<table>
<thead>
<tr>
<th>Basic circuit breaker</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage Ur (kV)</td>
<td></td>
</tr>
<tr>
<td>Service voltage (kV)</td>
<td></td>
</tr>
<tr>
<td>Impulse voltage Up (kVbili)</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current Isc (kA)</td>
<td></td>
</tr>
<tr>
<td>Rated current Ir (630 A maximum)</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Mechanism position</td>
<td>A1</td>
</tr>
</tbody>
</table>

Colour for push buttons and indicators
Push buttons open/close: Red/black
Indicator open/close: Black/white
Operating mechanism charged/discharged: White/yellow

<table>
<thead>
<tr>
<th>Control unit and sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP 300P (not available for all electrical characteristics)</td>
</tr>
<tr>
<td>Is = 10 to 50 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VIP 300LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Csa 200/1</td>
</tr>
<tr>
<td>Is = 10 to 50 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit breaker options</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd opening release (see possible choices combination table below)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shunt opening release YOZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
</tr>
<tr>
<td>30 Vdc</td>
</tr>
<tr>
<td>48 Vdc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undervoltage release YM</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
</tr>
<tr>
<td>30 Vdc</td>
</tr>
<tr>
<td>48 Vdc</td>
</tr>
</tbody>
</table>

Remote control

<table>
<thead>
<tr>
<th>Electrical motor M</th>
</tr>
</thead>
<tbody>
<tr>
<td>24...32 Vdc</td>
</tr>
<tr>
<td>48...60 Vdc/ac</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shunt closing release YF</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
</tr>
<tr>
<td>30 Vdc</td>
</tr>
<tr>
<td>48 Vdc</td>
</tr>
</tbody>
</table>

Test box (VAP 6)

<table>
<thead>
<tr>
<th>Leaflets language</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
</tr>
</tbody>
</table>

Different releases combinations

<table>
<thead>
<tr>
<th>Nitop</th>
<th>Shunt opening release YOZ</th>
<th>Undervoltage release YM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Order form

Evolis
Frontal fixed version
for SM6 24 kV (up to 17.5 kV)

Basic fixed circuit breaker

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
</tr>
<tr>
<td>17.5</td>
</tr>
</tbody>
</table>

Service voltage (kV)

<table>
<thead>
<tr>
<th>Short-circuit current Isc</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 kA</td>
</tr>
</tbody>
</table>

Rated normal current Ir (A)

<table>
<thead>
<tr>
<th>Phase distance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>185</td>
</tr>
</tbody>
</table>

Circuit breaker options

Opening release (see possible choices in combination table below)

Shunt opening release MX

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vac</td>
<td>24…30 Vdc, 100…130 Vdc/ac</td>
</tr>
<tr>
<td>48 Vac</td>
<td>48…60 Vdc, 200…250 Vdc/ac</td>
</tr>
</tbody>
</table>

Low energy release Mitop

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vac</td>
<td>24…30 Vdc, 200…250 Vac, 100…130 Vdc/ac</td>
</tr>
<tr>
<td>48 Vac</td>
<td>48…60 Vdc, 200…250 Vdc/ac</td>
</tr>
</tbody>
</table>

Remote control (operation counter already included)

Electrical motor MCH

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>24…30 Vdc</td>
<td>100…125 Vdc, 200…250 Vdc</td>
</tr>
<tr>
<td>48 Vdc</td>
<td>100…130 Vdc, 200…240 Vdc</td>
</tr>
</tbody>
</table>

Shunt closing release XF

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vac</td>
<td>24…30 Vdc, 100…130 Vdc/ac</td>
</tr>
<tr>
<td>48 Vac</td>
<td>48…60 Vdc, 100…130 Vdc/ac</td>
</tr>
</tbody>
</table>

Operation counter CDM

Additional auxiliary contacts OF (4 AC)

| 1 | 2 |

Ready to close contact PF (1 AC)

| 1 | 2 |

Locking of the circuit breaker in the open position

By padlock

or by locks and keys

Standard key type

Round key type

If locks

1 lock

2 identical locks

2 different locks

Disabling of O/C circuit breaker push buttons

Different releases combinations

Shunt opening release MX

| 1 | 1 |

Mitop

| 1 | 1 |
## Order form

**Evolis**  
Lateral disconnectable version  
for SM6 24 kV (up to 24 kV)

### Basic circuit breaker

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage Ur</td>
<td>24 (kV)</td>
</tr>
<tr>
<td>Service voltage (kV)</td>
<td></td>
</tr>
<tr>
<td>Impulse voltage Up (kV/bil)</td>
<td></td>
</tr>
<tr>
<td>Rated normal current Ir</td>
<td>630 A maximum</td>
</tr>
<tr>
<td>Phase distance</td>
<td>250 mm</td>
</tr>
<tr>
<td>Mechanism position</td>
<td>B1</td>
</tr>
</tbody>
</table>

**Colour for push buttons and indicators**
- Push buttons open/close: Red/black
- Indicator open/close: Black/white
- Operating mechanism charged/discharged: White/yellow

### Circuit breaker options

#### 1st opening release

- **Shunt opening release YO1**
  - 24 Vdc: 110 Vdc, 110 Vac (50 Hz)
  - 48 Vdc: 125-127 Vdc, 220-230 Vac (50 Hz)
  - 220 Vdc: 120 Vac (60 Hz)

- **Undervoltage release YM**
  - 24 Vdc: 110 Vdc, 110 Vac (50 Hz)
  - 48 Vdc: 125-127 Vdc, 220-230 Vac (50 Hz)
  - 220 Vdc: 120 Vac (60 Hz)

#### 2nd opening release

- **Shunt opening release YO2**
  - 24 Vdc: 110 Vdc, 110 Vac (50 Hz)
  - 48 Vdc: 125-127 Vdc, 220-230 Vac (50 Hz)
  - 220 Vdc: 120 Vac (60 Hz)

- **Undervoltage release YM**
  - 24 Vdc: 110 Vdc, 110 Vac (50 Hz)
  - 48 Vdc: 125-127 Vdc, 220-230 Vac (50 Hz)
  - 220 Vdc: 120 Vac (60 Hz)

- **Low energy release Mitop**

#### Remote control (operation counter already included)

- **Electrical motor M**
  - 24...32 Vdc: 110...127 Vdc/ac
  - 48...60 Vdc/ac: 220...250 Vdc/ac

- **Shunt closing release YF**
  - 24 Vdc: 110 Vdc, 110 Vac (50 Hz)
  - 48 Vdc: 125-127 Vdc, 220-230 Vac (50 Hz)
  - 220 Vdc: 120 Vac (60 Hz)

- **Operation counter** (already included if remote control supplied)

### Different releases combinations

<table>
<thead>
<tr>
<th>Combination</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shunt opening releases YO1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Shunt opening releases YO2</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Undervoltage release YM</td>
<td>1 1 1 1</td>
</tr>
</tbody>
</table>

---

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line. Green box [X] corresponds to none priced functions.