Catalogue 2015

# SM6 modular units

## Air insulated switchgear up to 36 kV

Medium Voltage Distribution

schneider-electric.com

Life Is On | Schneider Electric

# General Contents

# Your requirements

## Safety

## Reliability

## Flexibility

# Our solutions

- Enclosures able to withstand internal arcing
  3 or 4 sides internal arc protection IAC: A-FL and A-FLR.
  Internal arc withstand: 12.5 kA 1s, 16 kA 1s and 20 kA 1s
- Mechanical and electrical interlocks, to prevent incorrect operations.

- 1,400,000 functions installed world-wide
- 100% factory-tested without the need for further tests on site.

- Easy upgraded to meet your need and adapted to the extension of your installations
- Integration in factory-built outdoor substations for which the SM6 is particularly well designed.

# SM6,

a truly professional **solution!**

More than **1,400,000** cubicles installed **world-wide.**

# Our solutions

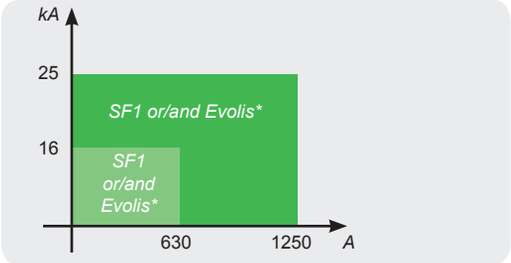
Schneider Electric has developed protection, monitoring and control solutions specifically dedicated to Medium Voltage networks for over 40 years.

SM6 switchgear has been specifically designed on the basis of that extensive experience.

It also incorporates some very new solutions, giving the best in terms of continuity of service and operators' safety.


PE57150

## High-performance breaking devices




*(*) Not available at 36 kV.*

## A comprehensive solution

SM6 switchgear is fully compatible with

- PowerMeter metering units.
- Sepam multi-function protection relays
  - Protection
  - Measurements and diagnosis.
- VIP protection self powered relay for protection.
  SM6 swithchboards can thus be easily integrated into any monitoring
  and control system.
  - Local & remote indication and operation.


AV9662-50

## Enclosures able to withstand internal arcing

Internal Arc Classification: A-FL and A-FLR.

- 3-sides internal arc protection IAC: A-FL,
  12.5 kA 1 s, 16 kA 1 s and 20 kA 1s for SM6-24 and 16 kA 1 s for SM6-36.
- 4-sides internal arc protection IAC: A-FLR,
  12.5 kA 1s, 16 kA 1 s and 20 kA 1 s for SM6-24.
- Choice of exhaust:
  - downwards exhaust
  - upwards exhaust for SM6-24.

# Presentation

# Presentation

## Contents

# The experience of a world leader

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 24 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 2,500 000 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.

PM103194

### 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.

### 2014 - A leading position:
With over 1,400,000 SM6 cubicles installed around the world, Schneider Electric consolidates its position as uncontested leader in the Medium Voltage field.

# 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
- Tian he 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 Riyad, 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
- Coca-cola Zurich, Switzerland

# The range's advantages

## 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 connection compartments
- Clear and animated display diagrams
- Switching lever with an "anti-reflex" function
- Compartmented cubicles.

## SM6: a range designed with control and monitoring in mind

SM6 switchgear is perfectly adapted to control and monitoring 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.

## 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.

## 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 control and monitoring of your installations.

## 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 intented to function with reduced maintenance under normal operating conditions
- Enhanced electrical endurance when breaking.

# Protecting the environment

Schneider Electric's recycling service for SF6 products is part of a rigorous management process.

## Environmental performance

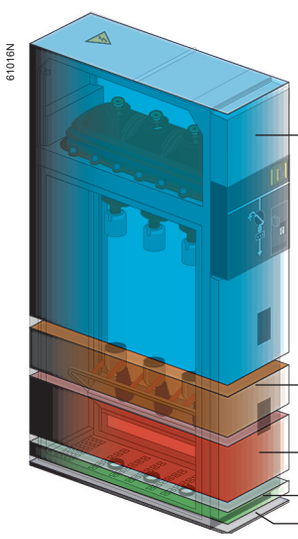
Schneider Electric is committed to a long-term environmental approach.

All necessary measures have been taken in conjunction with our services, suppliers and subcontractors to ensure that the materials used in the composition of the equipment do not contain any substances prohibited by regulations and directives.

Schneider Electric's ambition is to reduce the environmental impact of its products throughout their whole life cycle, by offering end-of-life SF6 recycling solutions. Up to 98% of its equipment can be recycled for re-use.

Our Air Insulated Switchgear is designed with environmental protection in mind:

- The materials used, insulators and conductors are identified, easily separable and recyclable
- The SF6 can be recovered at the end of the equipment's life and reused after Treatment
- The environmental management system adopted by Schneider Electric's production sites for the manufacture of our Air Insulated Switchgear has been assessed and recognised as conforming to the requirements of the ISO 14001 standard.




| | 24 kV | | 36 kV | |
|---|---|---|---|---|
| | Switch unit | Circuit breaker unit | Switch unit | Circuit breaker unit |
| Ferrous metal | **84%** | **65%** | **74%** | **82 %** |
| Non-ferrous metal | **4%** | **10.6%** | **8%** | **7.8 %** |
| Thermohardening | **9.5%** | **22%** | **15%** | **8 %** |
| Thermoplastics | **2.35%** | **2.3%** | **2%** | **2 %** |
| Fluid | **0.15%** | **0.1%** | **1%** | **0.2 %** |

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.

# Quality assurance

## Quality certified to ISO 9001

## 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 **F**rench **Q**uality **A**ssurance **A**ssociation (**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.**

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## 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.

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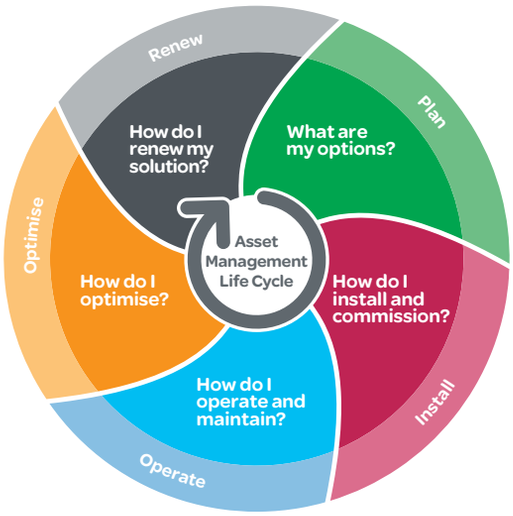
## Mean Operating Time To Failure (MTTF)

As result of Schneider Electric quality assurance system, SM6 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.

- MTTF (cumulative) = 3890 years for SM6-24
- MTTF (cumulative) = 6259 years for SM6-36.

# Schneider Electric Services

## Peace of mind throughout your installation life cycle




### When it comes to your electrical distribution installation, we can help you:

- Increase productivity, reliability, and safety
- Mitigate risk and limit downtime
- Keep equipment up to date and extend lifespan
- Cut cost and increase savings
- Improve your return on investment.

### New improve the efficiency on maintenance:

Access automatically to your SM6 equipment maintenance planning by flashing the QR code. Find the QR codes on your products or on the catalogue product data sheet.

Flash only with Facility Hero app
Free Download:

> Download the free version of Facility Hero

## Plan

Schneider Electric helps you to plan the full design and execution of your solution, looking at securing your process and optimising your time:

- **Technical feasibility studies:** Accompany customer to design solution in his given environment.
- **Preliminary design:** Accelerate turn around time to come to a final solution design.

## Install

Schneider Electric will help you to install efficient, reliable and safe solutions based on your plans.

- **Project Management:** Designed to help you complete your projects on time and within budget.
- **Commissioning:** Ensures your actual performance versus design, through on site testing & commissioning, tools & procedures.

## Operate

Schneider Electric helps you maximise your installation uptime and control your capital expenditures through its services offering.

- **Asset Operation Solutions:** The information you need to increase safety, enhance installation training performance, and optimise asset maintenance and investment.
- **Advantage Service Plans:** Customised services plans which cover preventive, predictive and corrective maintenance.
- **On site Maintenance services:** Extensive knowledge and experience in electrical distribution maintenance. For Diagnosis services see on pages from F1 to F3.
- **Spare parts management:** Ensure spare parts availability and optimised maintenance budget of your spare parts.
- **Technical Training**: To build up necessary skills and competencies in order to properly operate your installations in safety.

## Optimise

Schneider Electric propose recommendations for improved safety, availability, reliability & quality.

- **MP4 Electrical Assessment:** Define improvement & risk management program.

## Renew

Schneider Electric extends the life of your system while providing upgrades. Schneider Electric offers to take full responsibility for the end-of-life processing of old electrical equipments.

- **ECOFIT™:** Keep up to date & improve performances of your electrical installations (LV,MV, Protection Relays…).
- **MV product End of life:** recycle & recover outdated equipment with end of life services.

## Frequency of maintenance intervention

Schneider Electric equipment manufacturers recommend a schedule for maintenance activities to extend Electrical Distribution equipment performance over time. Frequencies under normal/healthy operation (minor equipment criticality and optimal environmental conditions) can be generally defined as follows:

| Maintenance | Minimal frequency (1) (every) | Who | | |
|---|---|---|---|---|
| | | Manufacturer | Certified Partner | End user |
| Exclusive | 4 years | ☒ | | |
| Advanced | 2 years | ☒ | ☒ | |
| Light | 1 years | ☒ | ☒ | ☒ |

*(1) Recommended under normal operating conditions (minor equipment criticality and optimal environmental conditions).However, this recommended frequency should increased according to: a) the level of criticality (low, major, critical) b) the severity of environment conditions (i.e. corrosive, naval, offshore) following recommendations of Manufacturer's services.*

# Facility Hero

## Preventive & predictive maintenance using QR codes

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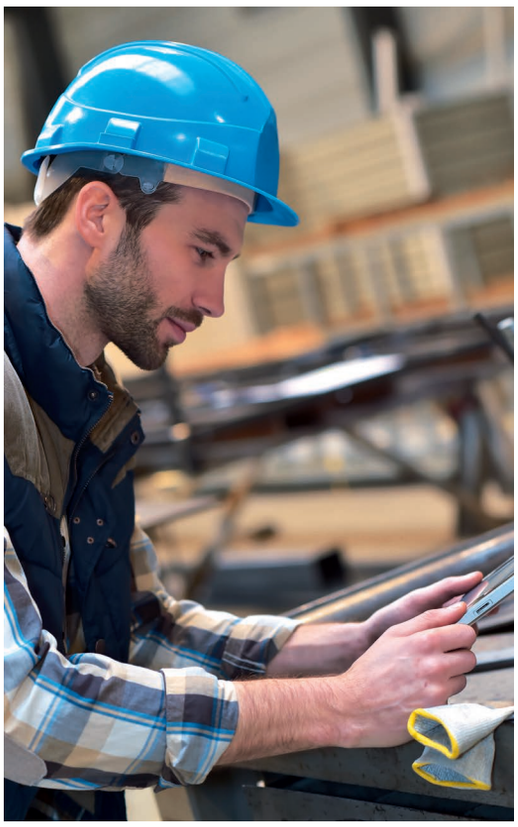

## What is Facility Hero?

Facility Hero is a smart maintenance log book that can be accessed from any smartphone, tablet, or computer. This 100% collaborative, connected system keeps maintenance technicians in the field in constant contact with their maintenance community: manager, customer, contractors and peers for fast and effective interventions.

### Accessible by anyone, anywhere, anytime

Facility Hero works on 3G, 4G, and Wi-fi networks and can also be used offline. Simply download the application right to your smartphone or tablet, set up an account, and get started.

### The right information, fast

- Overall view of equipment (status, tasks, the week's reminders)
- Full maintenance logs (breakdowns, maintenance reports)
- Fast access to history equipment maintenance logs via the QR code on the equipment
- Rich maintenance reports including voice memos, notes, photos, and measurements.

### The right decision and the right action at the right time

- Quickly add a new piece of equipment
- Access periodic reading measurements, recent malfunctions, etc.
- Locate equipment by GPS in real time
- Monitor equipment remotely and in real time

### Manage your maintenance teams and interventions effectively

- Real-time work orders sharing, and reporting with selected users
- Get inspection reports by mail and share them in just two clicks
- Monitor all regular operations such as scheduling, and incomplete or upcoming tasks.

### Facility Hero benefits

Enhance the efficiency of maintenance operations and insure your uptime:

- Access automatically to the maintenance recommendations of your equipments by flashing the QR codes
- Cloud Logbook to organise and follow your maintenance
- Remote alarming on connected equipments.

> Download the free version of Facility Hero

# QRcode for SM6 functions

| SM6 24 kV cubicle | |
|---|---|
| circuit breaker function | |
| switch function | |
| fuse-switch function | |
| other functions | |

| SM6 36 kV cubicle | |
|---|---|
| circuit breaker function | |
| switch function | |
| fuse-switch function | |
| other functions | |

# General characteristics

# General characteristics

## Contents

# Field of application

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
- 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

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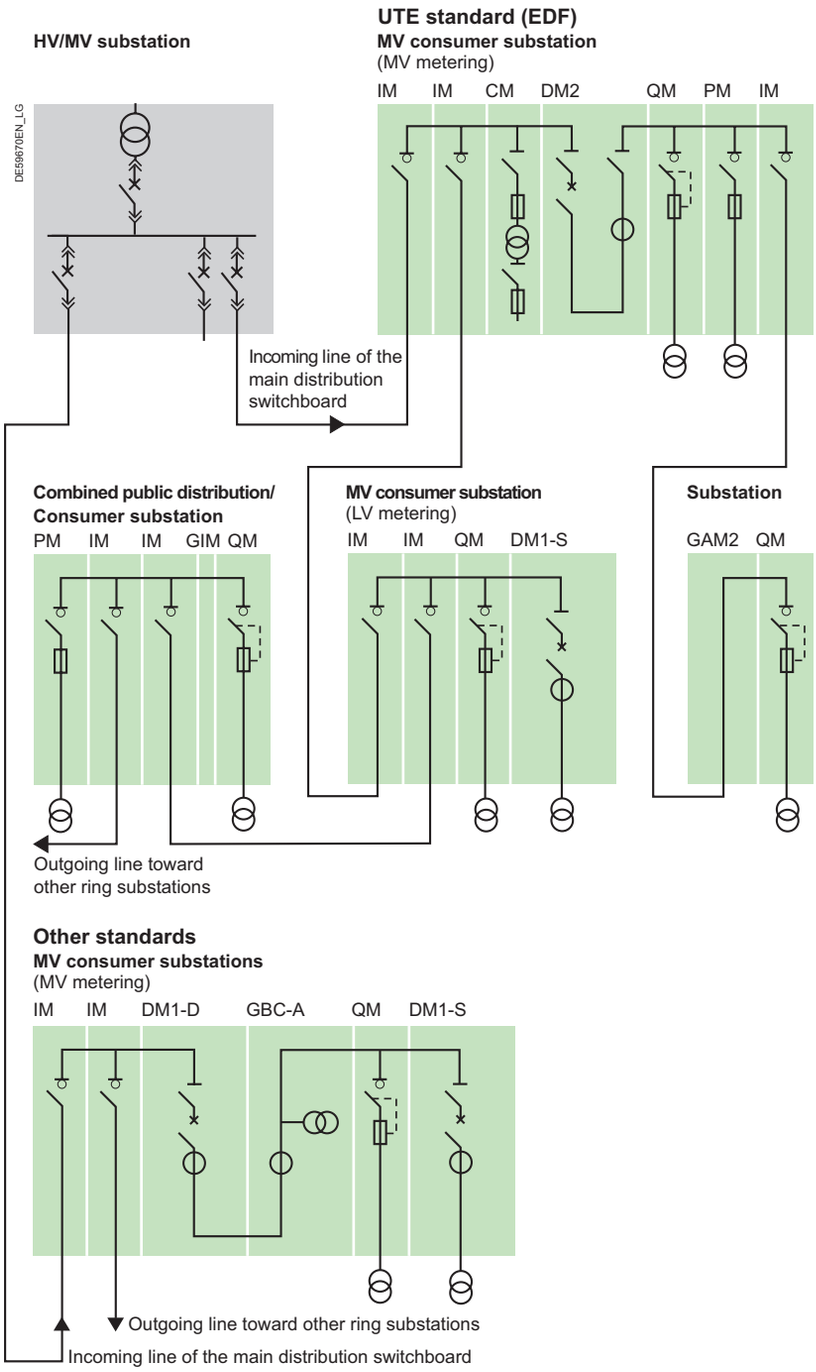
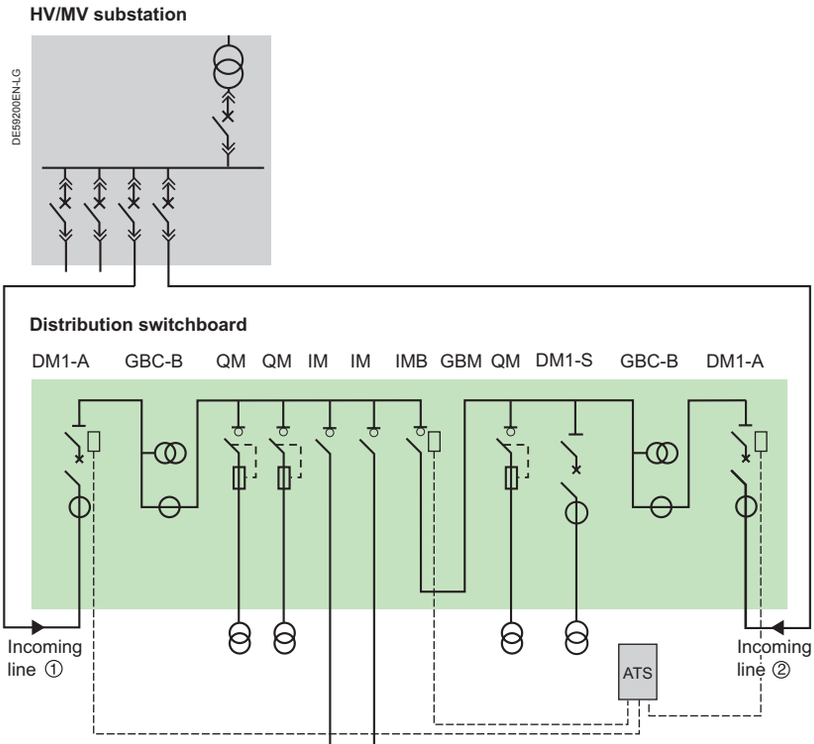
PM103309

PM102377

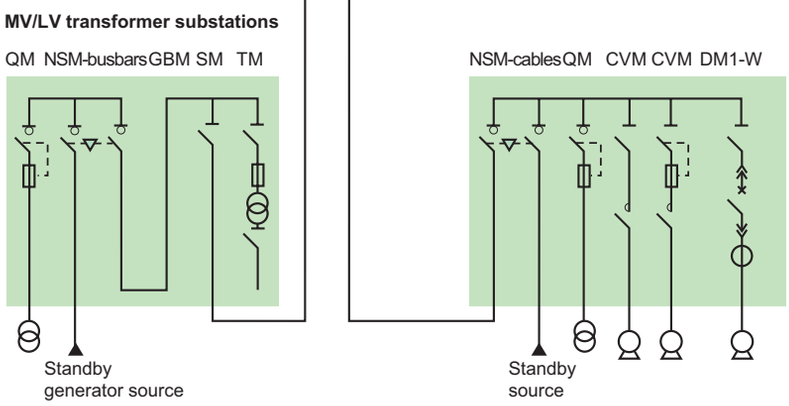


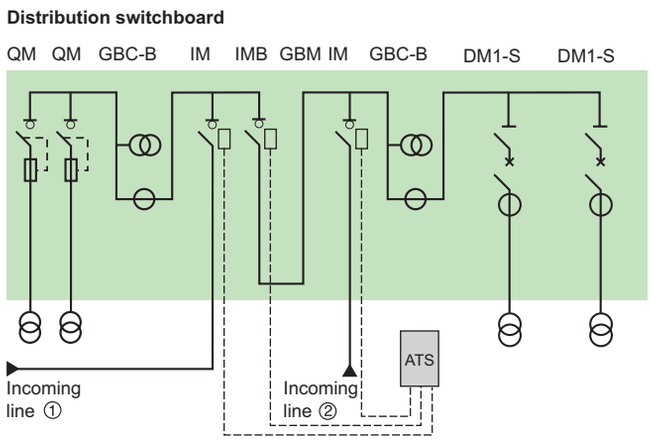
# Field of application

## Industrial distribution substations








*ATS: Automatic Transfer System*

## Unit definitions

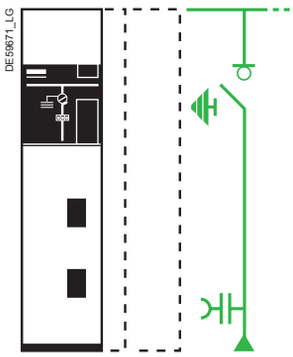
Below is the list of SM6 units used in MV/LV transformer substations and industrial distribution substations:

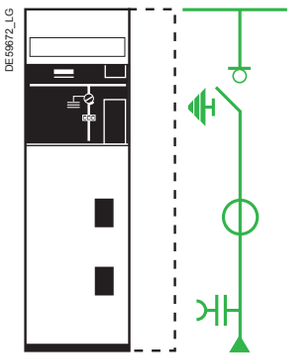
- **IM, IMC, IMB** switch
- **PM** fused switch
- **QM, QMC, QMB** fuse-switch combination
- **CVM** contactor and contactor with fuses
- **DM1-A, DM1-D, DM1-S** single-isolation disconnectable SF6 type circuit breaker
- **DMV-A, DMV-D, DMV-S** single-isolation vacuum type circuit breaker frontal
- **DMVL-A, DMVL-D** single-isolation disconnectable vacuum type circuit breaker lateral
- **DM1-W, DM1-Z** withdrawable single-isolation SF6 type circuit breaker for SM6-24
- **DM2** double-isolation disconnectable SF6 type circuit breaker
- **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 SM6-24.

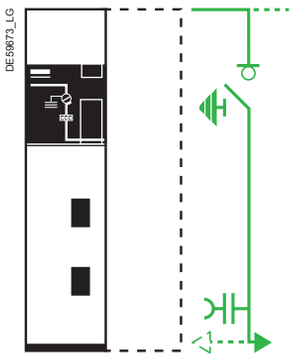
# Units for switching function

See in details on page

## Switching

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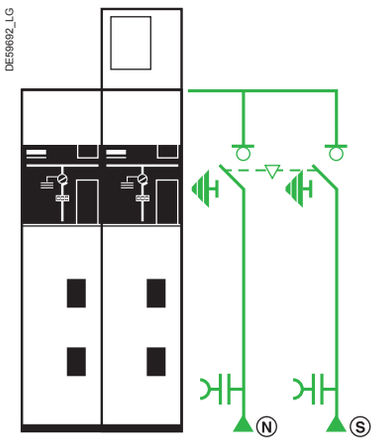
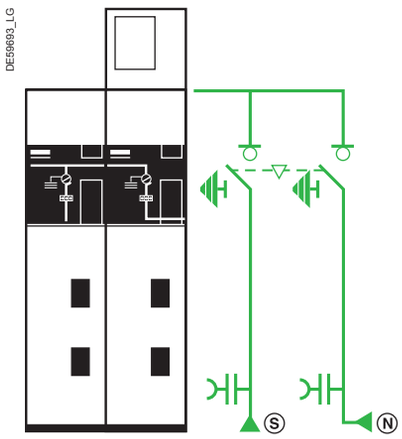
**IM**
**Switch unit**
SM6-24: 375 or 500 mm
SM6-36: 750 mm

**IMC**
**Switch unit**
SM6-24: 500 mm
SM6-36: 750 mm

**IMB**
**Switch unit**
**with earthing disconnector**
**right or left outgoing line**
SM6-24: 375 mm
SM6-36: 750 mm

## Automatic transfer system

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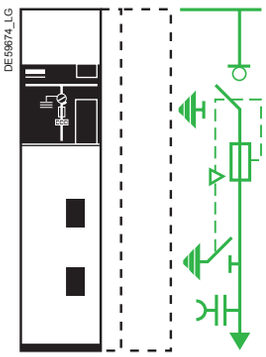
**NSM-cables**
**Cables power supply**
**for main incoming line**
**and standby line**
SM6-24: 750 mm

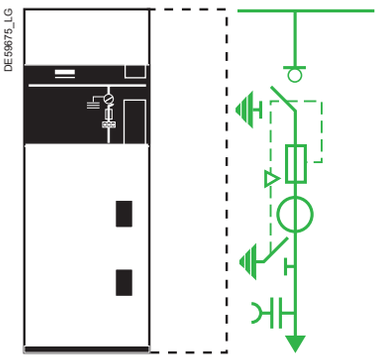
**NSM-busbars**
**Busbars power supply**
**for main incoming line on right or left**
**and cables for standby line**
SM6-24: 750 mm

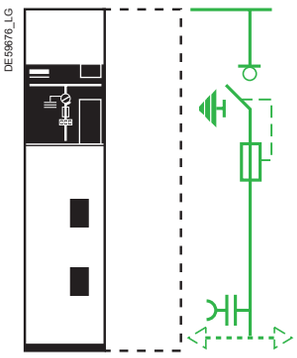
# Units for protection function

See in details on page

## Fuse-switch

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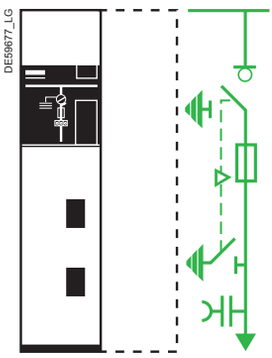
**QM**
**Fuse-switch combination unit**
SM6-24: 375 or 500 mm
SM6-36: 750 mm

**QMC**
**Fuse-switch combination unit**
SM6-24: 625 mm
SM6-36: 1000 mm

**QMB**
**Fuse-switch combination unit right or left outgoing line**
SM6-24: 375 mm
SM6-36: 750 mm

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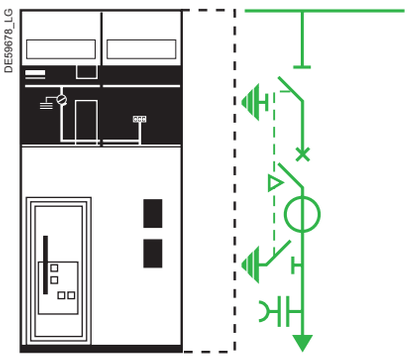
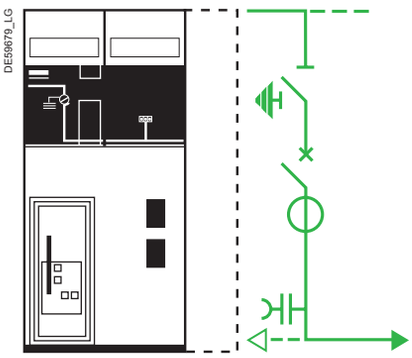
**PM**
**Fuse-switch unit**
SM6-24: 375 mm
SM6-36: 750 mm

## SF6 circuit-breaker

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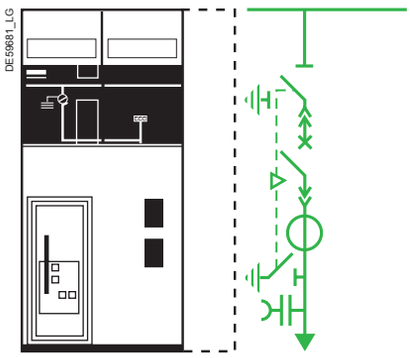
**DM1-A**
**Single-isolation, disconnectable circuit breaker unit**
SM6-24: 750 mm
SM6-36: 1000 mm

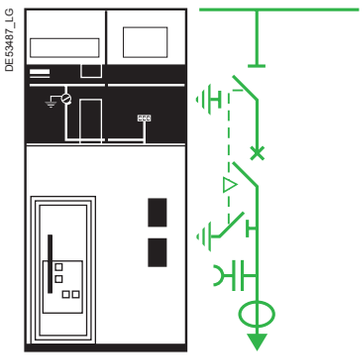
**DM1-D**
**Single-isolation, disconnectable circuit breaker unit right or left outgoing line**
SM6-24: 750 mm
SM6-36: 1000 mm

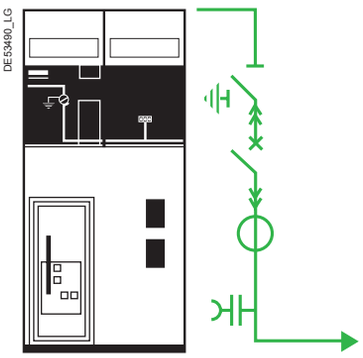
# Units for protection function

See in details on page

## SF6 circuit-breaker

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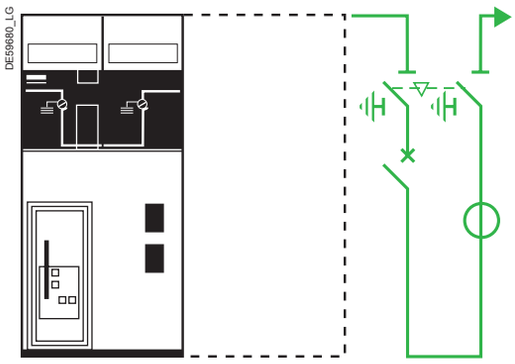
**DM1-W**
**Withdrawable single-isolation circuit breaker unit**
SM6-24: 750 mm

**DM1-S**
**Single-isolation, disconnectable circuit breaker unit with autonomous protection**
SM6-24: 750 mm

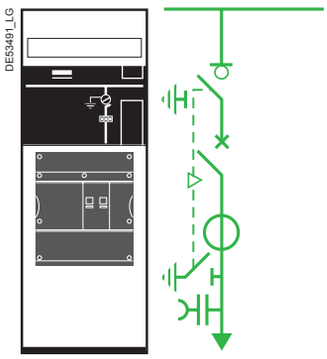
**DM1-Z**
**Withdrawable single-isolation circuit breaker unit right outgoing line**
SM6-24: 750 mm

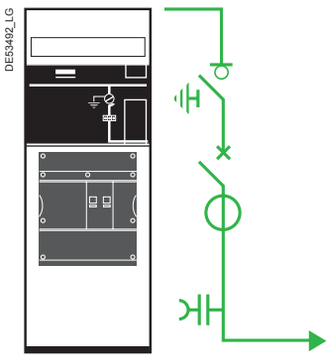


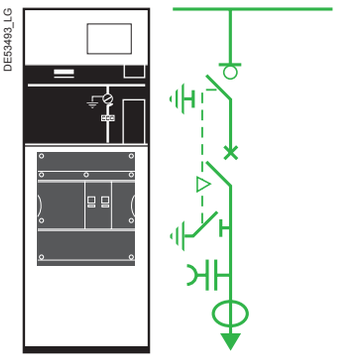

55

**DM2**
**Double-isolation, disconnectable circuit breaker unit right or left outgoing line**
SM6-24: 750 mm
SM6-36: 1500 mm

## Vacuum circuit-breaker




57

**DMV-A**
**Single-isolation circuit breaker unit**
SM6-24: 625 mm

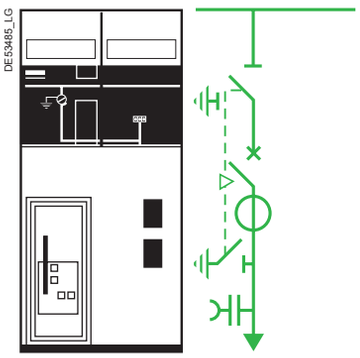
**DMV-D**
**Single-isolation circuit breaker unit right outgoing line**
SM6-24: 625 mm

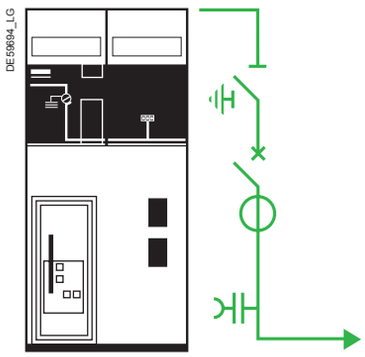
**DMV-S**
**Single-isolation circuit breaker unit with autonomous protection**
SM6-24: 625 mm

# Units for protection function

See in details on page

## Vacuum circuit-breaker



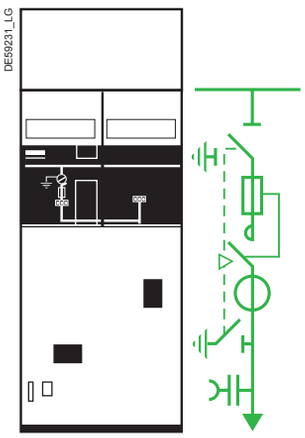



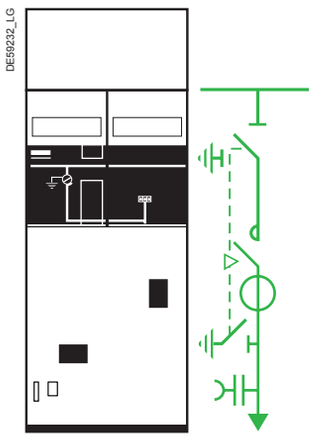

58

**DMVL-A**
**Single-isolation, disconnectable circuit breaker unit**
SM6-24: 750 mm

**DMVL-D**
**Single-isolation, disconnectable circuit breaker unit right outgoing line**
SM6-24: 750 mm

## Vacuum contactor (Direct Motor Starter)



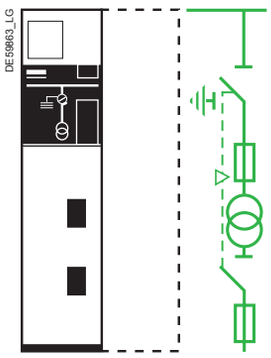

59

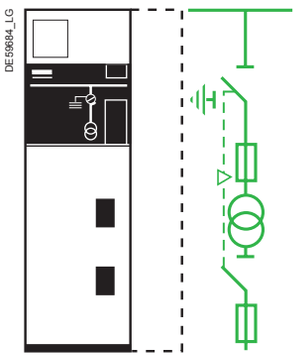
**CVM**
**Fuse-contactor unit**
SM6-24: 750 mm

**CVM**
**Contactor unit**
SM6-24: 750 mm

# Units for metering function

See in details on page

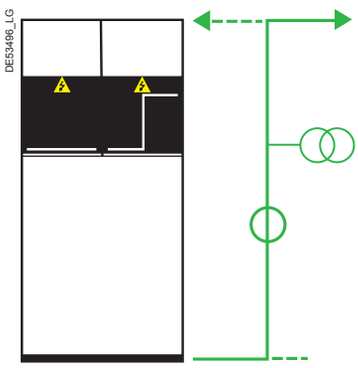


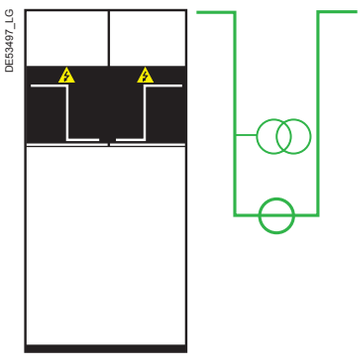




60

**CM**
**Voltage transformers for mains with earthed neutral system**
SM6-24: 375 mm
SM6-36: 750 mm

**CM2**
**Voltage transformers for mains with insulated neutral system**
SM6-24: 500 mm
SM6-36: 750 mm



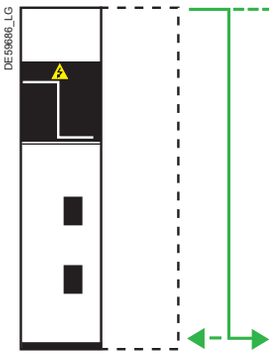

61

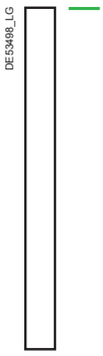
**GBC-A**
**Current and/or voltage measurement unit right or left outgoing line**
SM6-24: 750 mm
SM6-36: 750 mm

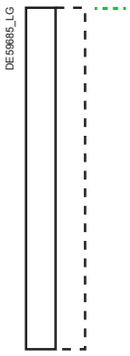
**GBC-B**
**Current and/or voltage measurement unit**
SM6-24: 750 mm
SM6-36: 750 mm

# Units for other functions

See in details on page



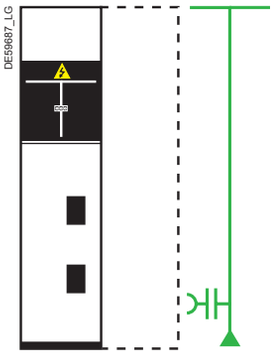



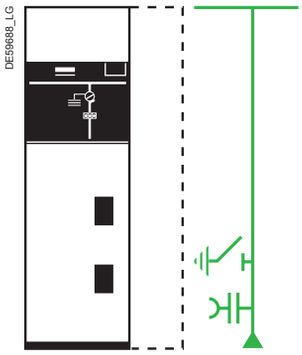

62

**GBM**
**Connection unit**
**right or left outgoing line**
SM6-24: 375 mm
SM6-36: 750 mm

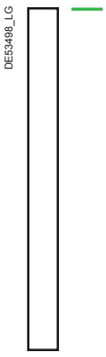
**GEM**
**Extension unit VM6/SM6**
SM6-24: 125 mm

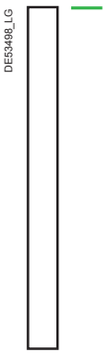
**GIM**
**Intermediate bus unit**
SM6-24: 125 mm
SM6-36: 250 mm





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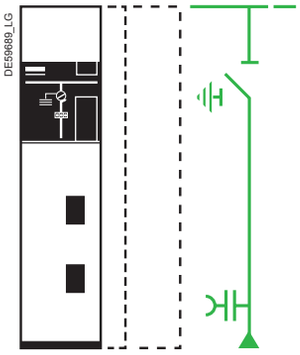
**GAM2**
**Incoming cable-connection unit**
SM6-24: 375 mm
SM6-36: 750 mm

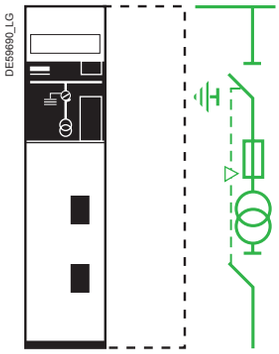
**GAM**
**Incoming cable-connection unit with earthing**
SM6-24: 500 mm
SM6-36: 750 mm

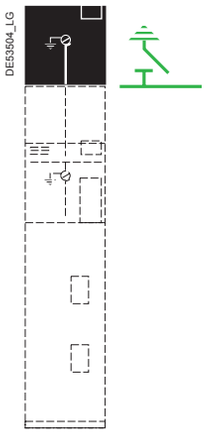
**GFM**
**Extension unit Fluokit M24/M24+ /M9/SM6-24**
SM6-24: 125 mm
**Fluokit M36/SM6-36**
SM6-36: 250 mm

**GMM**
**Extension unit Modularc/ SM6-36**
SM6-36: 250 mm

**GUM**
**Extension unit Unifluorc/ SM6-24**
SM6-24: 125 mm




64

**SM**
**Disconnector unit**
SM6-24: 375 mm or 500 (1) mm
SM6-36: 750 mm
*(1) only for 1250 A units.*

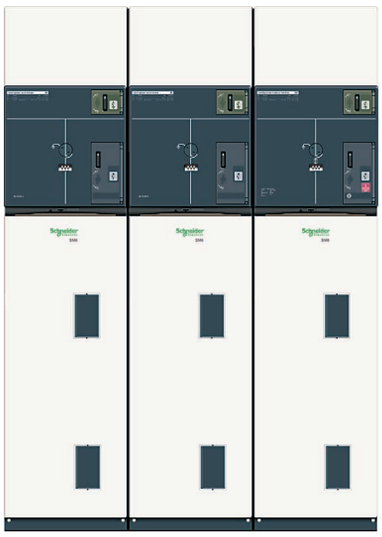
**TM**
**MV/LV transformer unit for auxiliaries**
SM6-24: 375 mm
SM6-36: 750 mm

**EMB**
**Busbar earthing enclosure**
SM6-24: 375 mm

# Operating conditions

In addition to its technical characteristics, SM6 meets requirements concerning safety of life and property as well as ease of installation, operation and protecting the environment.

PE57152



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.

- **Seismic:**
□ **for 24 kV** (optional):
1) Up to 0.5 g (horizontal) and 0.4 g (vertical)
2) Class 2
3) According to standards IEEE-693/2005 and EN 60068-3/1993
□ **for 36 kV** (please contact us).

**Severe operating conditions (please consult us).**

# Standards

SM6 units meet all the following standards and specifications:
- IEC standards
- UTE standards for SM6-24
- EDF specifications for SM6-24
- SEISMIC standards for 24 kV

## 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. |
| 62271-103 | 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. |
| 61869-2 | Instrument transformers - Part 1: Current transformers. |
| 61869-3 | Instrument transformers - Part 2: Voltage transformers. |
| 60044-8 | Instrument transformers - Part 8: Low Power Current Transducers. |
| 62271-206 | High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems. |
| 62271-304 | High-voltage switchgear and controlgear - Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV to be used in severe climatic conditions. |

## SEISMIC standards for 24kV

| | |
|---|---|
| IEE-693 | 2005 IEEE Recommended Practice for Seismic Design of Substations |
| EN600068-3-3 | 1993 Environmental testing-Part 3: guidance, Seismic test methods for equipments |

## 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 swichgear 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. |

# 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

| Rated voltage | Ur | kV | | 7.2 | 12 | 17.5 | 24 | 36 |
|---|---|---|---|---|---|---|---|---|
| **Insulation level** | | | | | | | | |
| Insulation | Ud | 50/60 Hz, 1 min (kV rms) | | 20 | 28 | 38 | 50 | 70 |
| Isolation | Ud | 50/60 Hz, 1 min (kV rms) | | 23 | 32 | 45 | 60 | 80 |
| Insulation | Up | 1.2/50 µs (kV peak) | | 60 | 75 | 95 | 125 | 170 |
| Isolation | Up | 1.2/50 µs (kV peak) | | 70 | 85 | 110 | 145 | 195 |
| **Breaking capacity** | | | | | | | | |
| Transformer off load | | A | | 16 | | | | |
| Cables off load | | A | | 31.5 | | | | 50 |
| Rated current | Ir | A | | 400 - 630 -1250 | | | | 630-1250 |
| Short-time withstand current | Ik/tk (1) | kA/1 s | 25 | 630 - 1250 | | | | 1250 |
| | | | 20 (2) | 630 - 1250 | | | | |
| | | | 16 | 630 - 1250 | | | | |
| | | | 12.5 | 400 - 630 - 1250 | | | | 630-1250 |
| Making capacity (50 Hz) | Ima | kA | 62.5 | 630 | | NA | | |
| | | | 50 | 630 | | | | |
| | | | 40 | 630 | | | | |
| | | | 31.25 | 400 - 630 | | | | 630 |
| **Maximum breaking capacity (Isc)** | | | | | | | | |
| Units IM, IMC, IMB | | A | | 630 - 800 (3) | | | | 630 |
| NSM-cables, NSM-busbars | | A | | 630 - 800 (3) | | | | NA |
| QM, QMC, QMB | | kA | | 25 | | 20 | | 20 |
| PM | | kA | | 25 | | | | 20 |
| CVM | | kA | | 6.3 | NA | | | |
| CVM with fuses | | kA | | 25 | NA | | | |
| SF6 circuit breaker range | | | | | | | | |
| DM1-A, DM1-D, DM1-W (4) | | kA | 25 | 630-1250 | | | | 1250 |
| | | | 20 | 630-1250 | | | | |
| DM1-S | | kA | 25 | 630 | | | | NA |
| DM1-Z | | | 25 | 1250 | | | | NA |
| DM2 | | kA | 20 | 630 | | | | |
| | | | 25 | 630 | | | | 1250 |
| Vacuum circuit breaker range | | | | | | | | |
| DMV-A, DMV-D, DMV-S | | kA | 25 | 630-1250 | | | NA | |
| DMVL-A | | kA | 20 | 630 | | | | NA |
| DMVL-D | | kA | 25 | 630 | | | | NA |

*NA: Non Available*
***(1)** 3 phases*
***(2)** In 20 kA/3 s for SM6-24 only, consult us*
***(3)** In 800 A, consult us.*
***(4)** NA for SM6-36*

# Main characteristics

PE57150

## Endurance

| Units | | Mechanical endurance | Electrical endurance |
|---|---|---|---|
| Units IM, IMC, IMB, PM, QM (5), QMC (5), QMB (5), NSM-cables, NSM-busbars | | IEC 62271-103<br>1 000 operations<br>class M1 | IEC 62271-103<br>100 breaks at Ir,<br>p.f. = 0.7, class E3 |
| CVM | Disconnector | IEC 62271-102<br>1 000 operations | |
| | Vacuum contactor | IEC 60470<br>2 500 000 operations<br>250 000 with mechanical latching | IEC 60470<br>250 000 breaks at Ir |
| **SF6 circuit breaker range** | | | |
| DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 | Disconnector | IEC 62271-102<br>1 000 operations | |
| | SF circuit breaker | IEC 62271-100<br>10 000 operations<br>class M2 | IEC 62271-100<br>30 breaks at 12.5 kA for SM6-24<br>25 breaks at 25 kA for SM6-24<br>40 breaks at 16 kA for SM6-36<br>15 breaks at 25 kA for SM6-36<br>10 000 breaks at Ir,<br>p.f. = 0.7, class E2 |
| | | Operating sequence | O - 0.3 s - CO - 15 s - CO<br>O - 0.3 s - CO - 3 mn<br>O - 3 mn - CO - 3 mn - CO |
| **Vacuum circuit breaker range** | | | |
| DMV-A, DMV-D, DMV-S | Switch | IEC 62271-103<br>1 000 operations<br>class M1 | IEC 62271-103<br>100 breaks at Ir,<br>p.f. = 0.7, class E3 |
| | Evolis circuit breaker | IEC 62271-100<br>10 000 operations<br>class M2 | IEC 62271-100<br>100 breaks at 25kA for SM6-24<br>10 000 breaks at Ir,<br>p.f. = 0.7, class E2 |
| DMVL-A DMVL-D | Disconnector | IEC 62271-102<br>1 000 operations | |
| | Evolis circuit breaker | IEC 62271-100<br>10 000 operations<br>class M2 | IEC 62271-100<br>100 breaks at 16kA for SM6-24<br>100 breaks at 25kA for SM6-24<br>10 000 breaks at Ir,<br>p.f. = 0.7, class E2 |

***(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:
  - □ 12.5 kA 1 s, IAC: A-FLR & IAC: A-FL
  - □ 16 kA 1 s, IAC: A-FLR & IAC: A-FL
  - □ 20 kA 1 s, IAC: A-FLR & IAC: A-FL
- SM6-36:
  - □ 16 kA 1 s, IAC: A-FL.

**Protection index:**
- Classes: PI (insulating partition)
- Loss of service continuity classes: LSC2A (LSC1 for metering GAM/GBM functions)
- Units in switchboard: IP3X
- Between compartments: IP2X for SM6-24, IP2XC for SM6-36
- Cubicle: IK08 for SM6-24, IK07 for SM6-36.

**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.

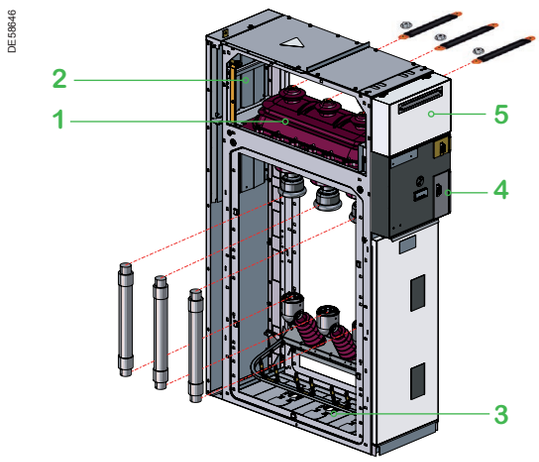
**Temperatures:**
The cubicles must be stored and installed in a dry area free from dust and with limited temperature variations.
- For stocking: from -40°C to +70°C
- For working: from -5°C to +40°C
- Other temperatures, consult us.
- **Seismic:**

□ **for 24 kV** (optional):
1) Up to 0.5 g (horizontal) and 0.4 g (vertical)
2) Class 2
3) According to standards IEEE-693/2005 and EN 60068-3/1993

□ **for 36 kV** (please contact us).

# Factory-built cubicles description

## 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.

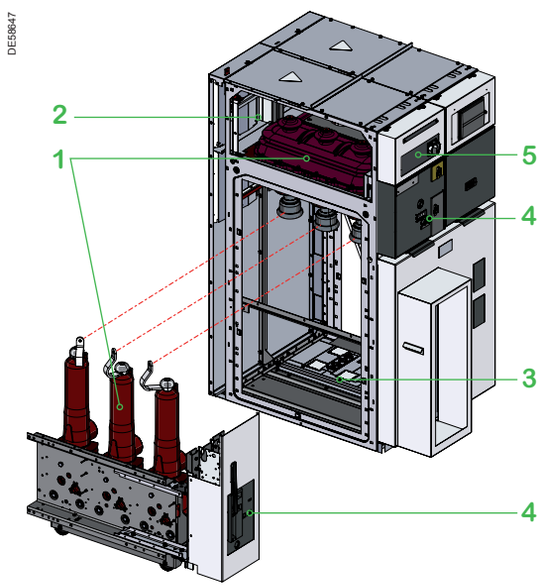
**3 connection**: accessible through front, connection to the lower switch-disconnector and earthing switch terminals (IM cubicles) or the lower fuse-holders (PM and QM cubicles). This compartment is also equipped with an earthing switch downstream from the MV fuses for the protection units.

**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".

## 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).

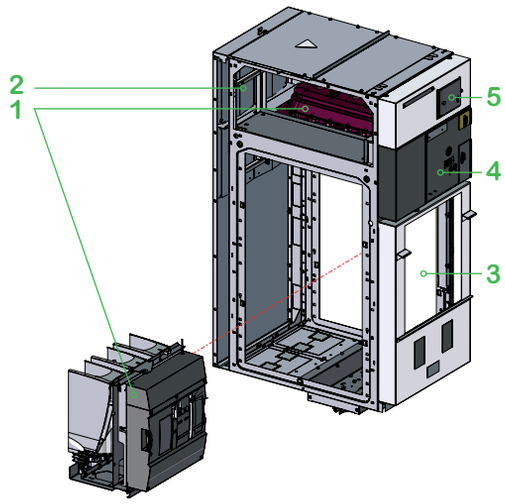
**4 operating mechanism**: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.

**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".

# Factory-built cubicles description

DE58648




## 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.

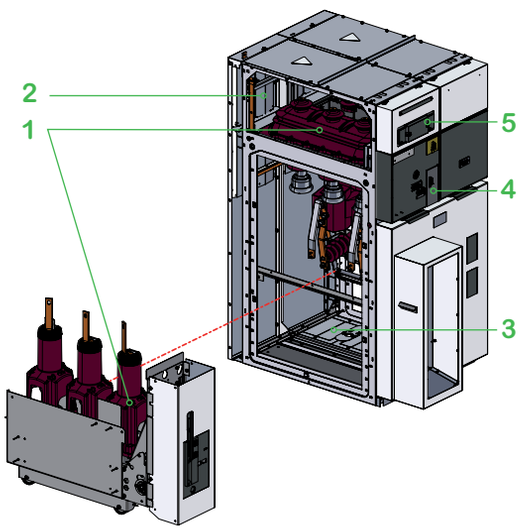
**3 connection and switchgear**: accessible through front, connection to the downstream terminals of the circuit breaker.
- Evolis: device associated with an electronic relay and standard sensors (with or without auxiliary source).

**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".

DE58649




## 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.

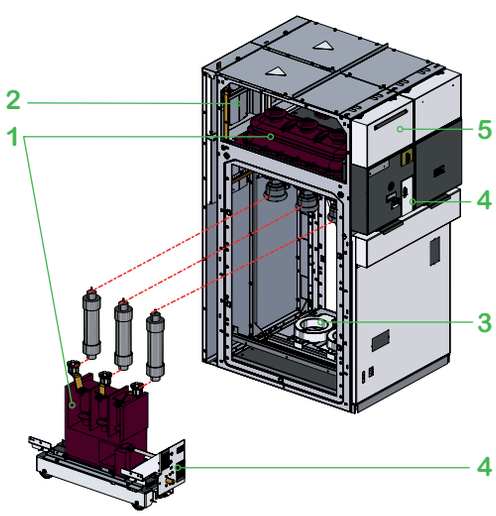
**3 connection and switchgear**: accessible through front, connection to the downstream terminals of the circuit breaker.
- Evolis: device associated with an electronic relay and standard sensors (with or without auxiliary source).

**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".

DE58650




## 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.

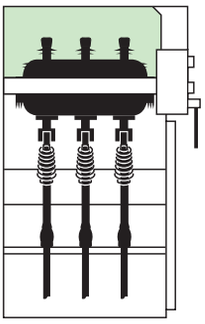
**3 connection and switchgear**: accessible through front.
It is also equipped with an earthing switch downstream. The contactor may be equipped with fuses. 2 types may be used:
- Vacuum with magnetic holding
- Vacuum with mechanical latching.

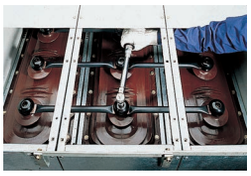
**4 operating mechanism**: contains the elements used to operate the disconnector(s), the contactor and the earthing switch and actuate the corresponding indications.

**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".

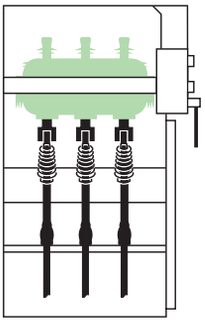
# Compartments and devices description




## Busbar compartment

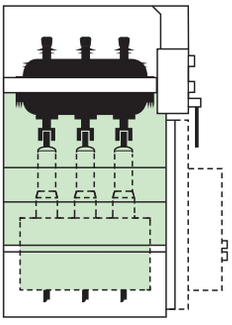
The three insulated busbars are parallel-mounted. Connection is made to the upper pads of the enclosure using a field distributor with integrated captive screws.
Ratings 400 (for SM6-24 only) - 630 - 1250 A.



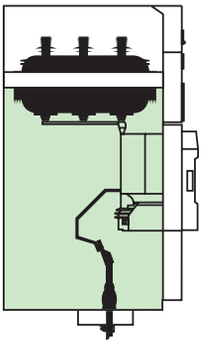


## Switching device

This device is separated from the busbar compartment and the connection compartment by the enclosure surrounding the switch, the disconnector and the earthing switch.




*SF6 and vacuum lateral type circuit breaker*




*Frontal vacuum type circuit breaker*

## Connection 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:

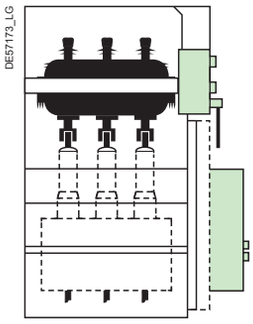
- Cold fitted cable end for dry-type

With basic equipment, the maximum allowable cross-section for cable is:

- 630 $mm^2$ or 2 x 400 $mm^2$ for 1250 A incoming or outgoing units
- 240 $mm^2$ or 2 x 240 $mm^2$ for incoming or outgoing units 400 - 630 A
- 95 $mm^2$ 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 and devices description

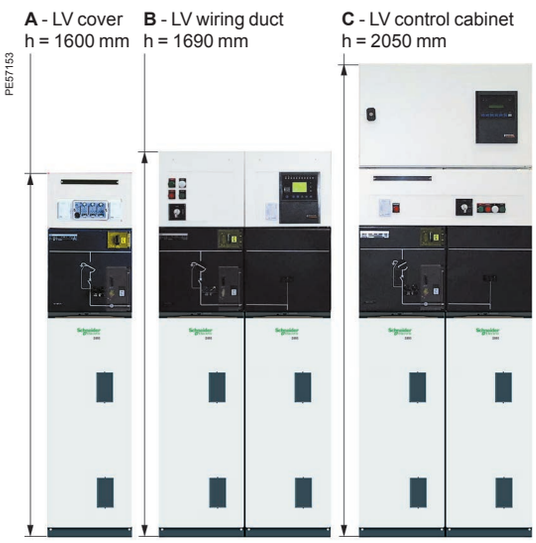




## Operating-mechanism cover

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.).



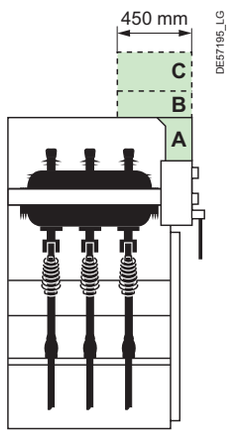

## Low-voltage monitoring control cabinet for SM6-24

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 60 or series 80, converters, control and monitoring units, regulating transformers or dual secondary transformers.
The total height of the cubicle then becomes 2050 mm.



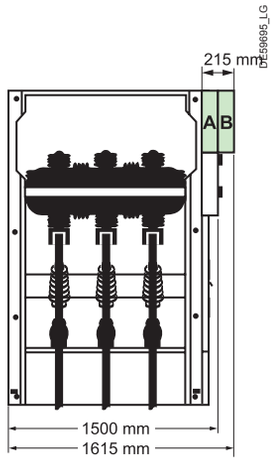

In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.


## Low-voltage monitoring control cabinet for SM6-36

**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 60 or series 80, converters, control and monitoring 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

61010N

*Switch-disconnector for 24 kV*

PE57226

*Switch-disconnector for 36 kV*

## Switch or disconnector and earthing switch

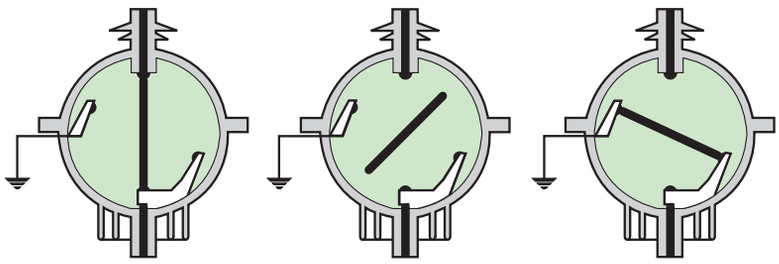
- **Gas tightness**

The three rotating contacts are placed in an enclosure filled with gas to a relative pressure of 0.4 bar (400 hPa) for SM6-24 and 1 bar (1000 hPa) for SM6-36.
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.

MT20184_LG



*Closed position* *Open position* *Earth position*

- **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.

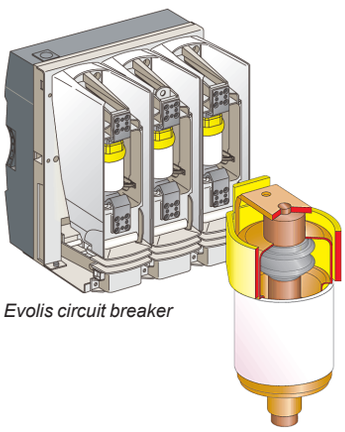
# Safety of people

## By switchgear

61012N

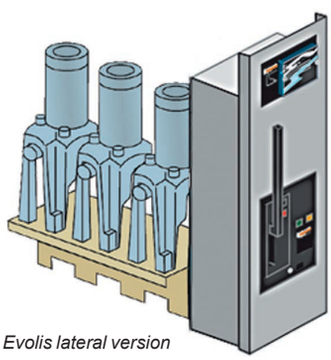
*SF1 circuit breaker*

61058N



*Evolis circuit breaker*

PE50798



*Evolis lateral version*

PE57841

*Vacuum type contactor*

## SF6 circuit breaker: SF1

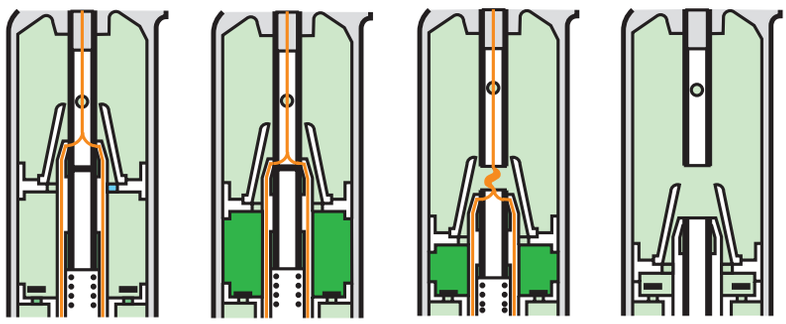
- **Gas tightness**

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.

DE53514



*Contacts closed* *Precompression* *Arcing period* *Contacts open*

## 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.

# Safety of people

## By operating mechanism safety

PE57230

## 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:**

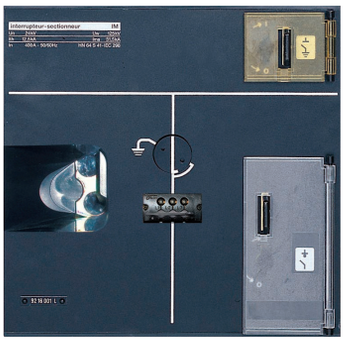
Between one and three padlocks enable the following to be locked:
- access to the switching shaft of the switch or the circuit breaker,
- access to the switching shaft of the earthing disconnector,
- operating of the opening release push-button.

## 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.

PE57231



*Visibility of main contacts*

## Visibility of main contacts (option)

The position of main contacts is clearly visible from the front of the cubicle through the window.

PE57166

## Gas pressure indicator (option)

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.

PE56386

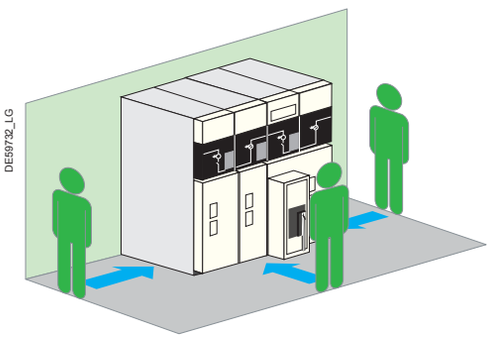
## Voltage Presence Indicating System

VPIS complies with 62271-206 standard allowing to indicate the voltage presence on each phase with LEDs. Designed for harsh environments so that to guarantee high reliability in MV/LV substations worldwide.
Exits in Voltage Output version to provide voltage presence information to VD23 voltage presence relay.

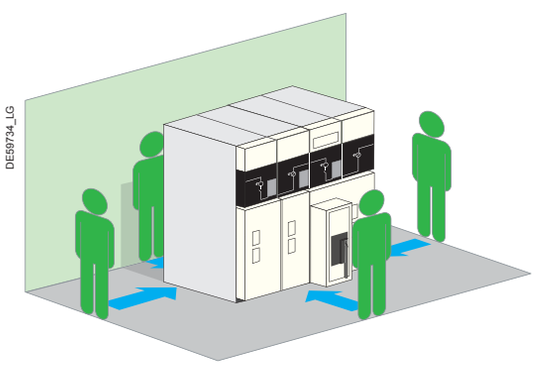
# Safety of people

## By internal arc protection

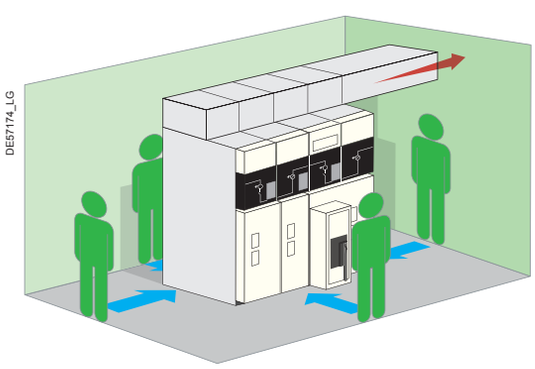
Standard IEC 62271-200 appendix A indicates a method for testing switchgear in metal enclosures under internal arc conditions. The aim of this test is to show that an operator situated in front of a switchboard would be protected against the effects of an internal fault.




*Example of installation of an SM6 switchboard installed against the wall downwards exhaust 12.5 kA 1 s and 16 kA 1 s, IAC: A-FL: 3-sides internal arc protection*




*Example of installation of an SM6-24 switchboard installed in the middle of a room downwards exhaust 16 kA 1 s, IAC: A-FLR: 4-sides internal arc protection*




*Example of installation of an SM6-24 switchboard installed in the middle of a room upwards exhaust 16 kA 1 s and 20 kA 1 s, IAC: A-FLR: 4-sides internal arc protection*

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
## (in conformity with IEC 62271-200)

- **3 versions are available for SM6-24:**
  - 12.5 kA 1 s, IAC: A-FLR & IAC: A-FL
  - 16 kA 1 s, IAC: A-FLR & IAC: A-FL
  - 20 kA 1 s, IAC: A-FLR & IAC: A-FL
- **1 version is available for SM6-36:**
  - 16 kA 1 s, IAC: A-FL.

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

In all internal arc versions, 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 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 internal arc withstand switchboard

- **3-sides internal arc protection IAC: A-FL**,
  12,5 kA 1 s, 16 kA 1 s and 20 kA 1s for SM6-24 and 16 kA 1 s for SM6-36.

SM6 switchboard positioned against the wall, access to the rear of the cubicles is impossible, internal arc protection on three sides is sufficient.

- **4-sides internal arc protection IAC: A-FLR**,
  12,5 kA 1s, 16 kA 1 s and 20 kA 1 s for SM6-24.
  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:**

(Installation requirements manual to be considered)
- **downwards exhaust**

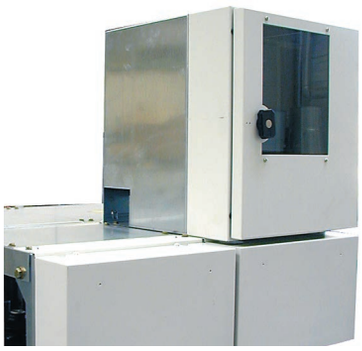
Civil engineering with an adequate volume is necessary.
- **upwards exhaust for SM6-24**

A ceiling height greater or equal than 2 150 mm is necessary, duct at the right or left side of the cubicle (not supplied).

# MV electrical network management

## Easergy T200 S for SM6-24

PE15074



*Easergy T200 S for SM6-24: remote control interface in LV control cabinet*

## Easergy T200 S for NSM cubicle

**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 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** 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.

PE56421

*Control command*

PE56423

*Back up power supply*

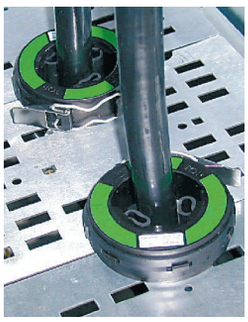
### Functional unit dedicated to Medium Voltage applications

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.

PE15078



*Split core CTs*

### Compatible with all SCADA remote control systems

Easergy T200 S supplies the following standard protocols:
- Modbus serial and IP
- DPN3 serial and IP
- IEC 870-5-101 / 104.

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.

# MV electrical network management

## Easergy T200 I

PE56311

## Easergy T200 I: an interface designed for control and monitoring 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).

PE56421

*Local information and control*

PE56422

*Monitoring and control*

### 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 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.

PE56423

*Back up power supply*

PE56824

*Polarized connectors*

### Compatible with all SCADA remote control systems

Easergy T200 I supplies the following standard protocols:
- Modbus serial and IP
- DPN3 serial and IP
- IEC 870-5-101 / 104.

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.

PE57787

*VD23*

## Voltage detection relay

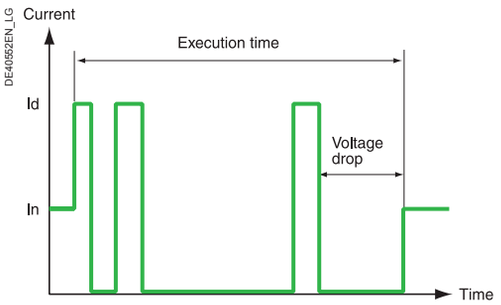
**VD23** provides accurate information of presence or absence of voltage. Associated with VPIS-Voltage Output, VD23 is typically used in critical power and safety applications.

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.

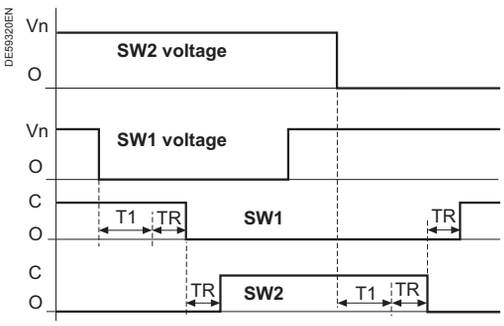
VD23 can display the MV network voltage (in % of service voltage), activate the relay output R1 to monitor a loss of voltage on 1 phase at least and active the relay output R2 to monitor a presence of voltage on 1 phase at least.
- Auxiliary power supply: from 24 to 48 Vdc
- Assembly: compact DIN format, 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**.

# MV electrical network management

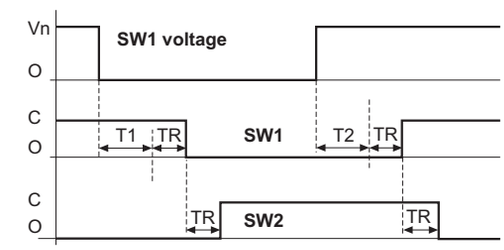
## Automation systems



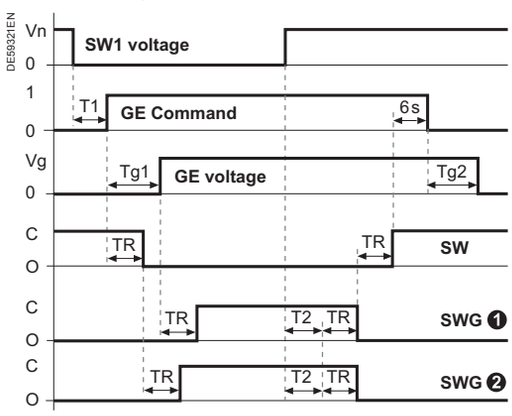

■ Configurable parameters:
□ Number of faults: from 1 to 4
□ Execution time: from 20 s to 4 mins configurable in 5 s steps
□ Automation system valid/invalid.




**Network ATS - Semi-Auto Mode**
(without paralleling upon automatic return)
TR: switch response time




**Network ATS - Auto Mode SW1**
(with paralleling upon automatic return)
TR: switch response time




**Generator ATS - Auto SW mode**
(Without paralleling upon Auto return)
TR: Switch response time
Tg1: Generator starting time (maximum 60 s)
Tg2: Generator stopping time

Case ❶: Generator channel closing after Generator power on (configurable option)

Case ❷: Generator channel closing after Generator start-up command (configurable option)

Easergy T200 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.

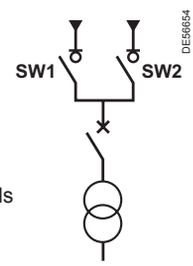
- The automation system counts the number of times a fault current followed by a voltage loss is detected. It sends an open order if:
  - the switch is closed
  - the fault has disappeared
  - the MV supply is absent.

■ The automation system is reset at the end of the execution time delay.

## ATS automatic transfer system (source changeover)

The automatic transfer system performs automatic control and management of sources in the MV secondary distribution network.

Two possible versions for ATS:




**Network ATS version:** control of two MV network channels. The network ATS automatic transfer system requires use of the VD23 relay for detection of voltage presence/absence.

**Generator ATS version:** control of one network channel and one generating set channel (not available on T200 E).

**Note:** ATS automatic transfer system is available only on channels 1 and 2 of each CONTROL module. Generator ATS automatic transfer system is available only on the first CONTROL module (channels 1 to 4).

### Operating modes

The operating mode is selected from the T200 Web server.

**Mode SW1→SW2 or SW2→SW1 (or SW→SWG if Generator ATS):**
Automatic transfer system executes only one changeover from the priority channel to the backup channel. Automatic transfer system then remains on that channel.

**Semi-Auto mode SW1←→SW2 (or SW←→SWG if Generator ATS):**
In the event of a voltage loss on the active channel, automatic transfer system switches to the other channel after a time delay T1. Automatic transfer system executes no return, except in case of voltage loss on the new active channel.

**Auto SW1 or Auto SW2 mode (or Auto SW if Generator ATS):**
After a changeover, return to the priority channel occurs if the MV voltage on that channel is restored. The channel that has priority can be defined according to the state of a dedicated digital input.

### Changeover sequences:

**Network ATS:** in the event of voltage loss on the normal channel, changeover involves opening the normal channel after time delay T1 and then closing the backup channel.
**Note:** in "Auto" mode, the sequence of return to the normal channel depends on configuration of the "Paralleling upon auto return" option (see below).

**Generator ATS:** in the event of voltage loss on the network channel, changeover involves sending the order for opening the network channel and at the same time the Generator start-up order, after time delay T1.
The remainder of the changeover sequence depends on the management of Generator channel closing (configurable option):

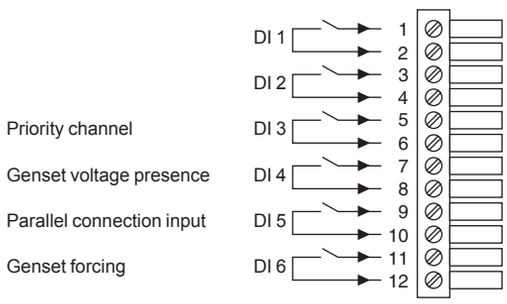
- Case of Generator channel closing after start-up order:
After the Generator start-up order, the closing order is given to the Generator channel, without waiting until the Generator is actually started.
- Case of Generator closing after Generator power on:
The Generator channel closing order is sent only when Generator voltage is detected.

# MV electrical network management

## Automation systems

**Configurable parameters:**
- Automatic transfer system ON/OFF
- Operating mode: Semi-Auto, Auto SW1, Auto SW2, SW1 –> SW2, SW2 –> SW1
- T1: 0 ms to 2 min. in increments of 100 ms
- T2: 0 s to 30 min. in increments of 5 s
- Disabling/enabling transfer upon fault detection:
- Choice of voltage presence detection: DI4 or VD23
- Channel connected to generator: SW1 or SW2
- Type of automatic transfer system: Network ATS or Generator ATS
- Manual control enabled/disabled if ATS in operation
- Paralleling enabled/disabled in auto and/or manual mode
- Choice of type of changeover to Generator: immediately or after detection of Generator power on

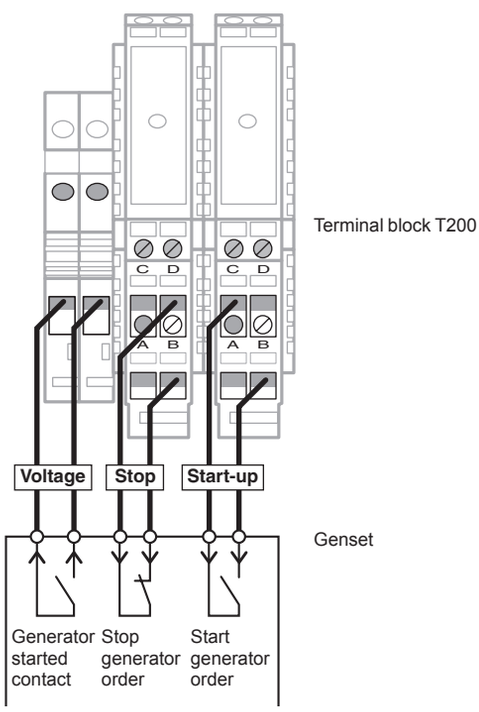
DE59175




*The DIs can be assigned for ATS automation (configurable options)*

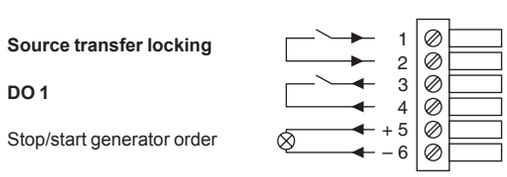
*Digital Input connection ("J2" or "J10" terminal block)*

DE56806




*Interface with the generating set*

DE59173




*Lock connection ("J1" terminal block on the 4-ways interface or "J9" on the 2-ways interface)*

## Paralleling upon Auto return

A software-configurable option allows the automatic transfer system to disable or enable paralleling of the channels upon automatic return to the main channel (in "Auto" mode).
Enabling of paralleling must be confirmed by the activation of a dedicated digital input.

**Paralleling disabled:** Auto return to the priority channel involves opening the backup channel and, when it is open, closing the priority channel.

**Paralleling enabled:** Auto return to the priority channel involves first closing the priority channel and, when it is closed, opening the backup channel.

## Changeover conditions

Changeover takes place if the following conditions are met:
- Automatic transfer system in operation
- SW1 open and SW2 closed or SW1 closed and SW2 open
- Absence of fault current on the two channels (only if locking by fault detection option activated)
- "Transfer locking" absent
- "Earthing switch" absent on the two channels
- MV voltage absent on the active channel
- MV voltage present on the other channel.

Return to the main channel for the "Auto" modes occurs if:
- The priority channel is open
- The MV voltage on the priority channel is present during time delay T2.

## Generating set connections

Relays are installed in factory in the T200 enclosure to provide interfacing with the generating set (Generator ATS version only). Connection should be performed as follows (see diagram opposite):
- **Voltage:** contact closed if Generator started, to be wired on the two available terminals (do not wire if detection of power on is performed by a relay VD23)
- **Start-up:** Generator start-up order, to be wired on terminals **C** and **B**
- **Stop:** Generator stoppage order, to be wired on terminals **D** and **B**.

## Detection of voltage presence

Voltage presence on a channel managing the Generator can be executed by two processes:
- Either by a dedicated "Voltage" digital input
- Or by voltage relay VD23 (via cubicle cable).

## Override setting on generator (Generator ATS only)

For routine test or reduced pricing requirements, it is possible to perform override setting of operation on the generator manually, remotely (from the supervisor) or locally (activation by a dedicated digital input).
When the override setting is terminated, the automatic transfer system places itself back in the initial mode, i.e. in the mode that was active before the override setting (ON or OFF). During override setting, the automatic transfer system is set to "ON" for channels 1 and 2.

## Source transfer locking

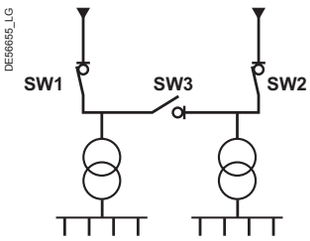
A dedicated digital input allows changeover to be locked if a problem occurs on one of the devices related to the changeover. This input is generally connected to the downstream circuit breaker. Local and remote controls are no longer possible in this case.

## Specific Generator-related management

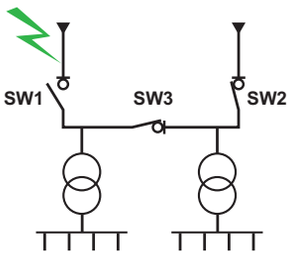
- Upon transfer to the Generator, if the latter doesn't start, the automatic transfer system waits for a period of 60 s at most before stopping changeover, then:
  - in SW –> SWG mode: the automatic transfer system is locked and must be reset (on the Control panel) to restart the device.
  - in SW <–> SWG mode or in Auto mode: the automatic transfer system remains operational.
    If voltage returns to the network channel, the automatic transfer system requests return to the network channel.
- When the automatic transfer system is configured with auto return on the network channel, Generator stoppage is requested 6 s after the changeover sequence is completed.

# MV electrical network management

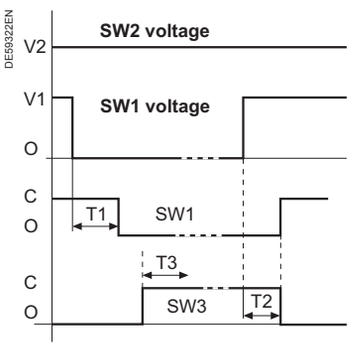
## Automation systems




*"Normal" position*




*Active coupling*




**Configurable parameters:**

- Operating mode:

Standard/locking upon voltage loss

- Automatic return: SW1/SW2
- Automation system: on/off
- Delay before switching

T1: 100 ms to 60 s in 100 ms steps

- Delay before return
- T2: 5 s to 300 s in 1 s steps
- Interlock delay on voltage loss

T3: 100 ms to 3 s in 100 ms steps

- Motorisation type: command time
- Manual control: enabled/disabled in local and remote modes if automation system in operation
- Paralleling: enabled/disabled in auto and (or) manual modes
- Transfer locking upon fault detection.

## Bus tie coupling (BTA) with T200 I

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 VD23 type voltage presence detectors and the fault current detection function on the busbar incoming lines.

### Operating mode

**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 dedicated digital input allows changeover to be locked if a problem occurs on one of the devices related to the changeover. This input is generally connected to the downstream circuit breaker. Local and remote controls are no longer possible in this case.

**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.

### Paralleling upon Auto return

A software-configurable option allows the automation system to disable or enable paralleling of the channels upon automatic return to the main channel (in "Auto" mode). Enabling of paralleling must be confirmed by the activation of a dedicated digital input.

**If paralleling is disabled:** Auto return to the normal channel involves opening the coupling channel (SW3) and, when it is open, closing the normal channel.

**If paralleling is enabled:** Auto return to the normal channel involves first closing the normal channel and, when it is closed, opening the coupling channel (SW3).

# Fault passage indicators

## Flair 21D, 22D and 23DM

Flair 21D, 22D, 23DM is a family of DIN format fault passage indicators. They are small in size, self-powered and adapt automatically to the network.

These devices use cutting-edge technology to detect earth faults on underground MV networks with isolated, resistor-earthed or directly earthed neutral and overcurrents on all networks.

- Self-powered, the fault current passage detection and indication system operates continuously
- Adjustment-free, they are immediately operational (numerous manual adjustments are however possible)
- Compact, their DIN format easily fits in MV cubicles
- Smart, they offer an ammeter/ digital maximeter function
- Comprehensive, the Flair 23DM version incorporates a highly sophisticated voltage presence/ absence relay function with RJ45 Modbus communication

PE57783

PE57784

EMS58355

## Applications and main features

The Flair range increases your power availability by providing indicators suitable for fault locating and MV network load management.

- Indication of phase-phase and phase-earth faults
- Display of settings
- Indication of the faulty phase
- Display of the load current including peak demand and frequency
- Fault passage indication and voltage detection combination (Flair 23DM)
- RJ45 communication (Flair 23DM only).

These fault passage indicators are reliable and easy to use.

- Automatic setting on the site
- Fault indication with LED or outdoor lamp
- 15-year battery life for Flair 22D
- More accurate fault detection if Flair 22D or 23DM is connected to voltage
- presence indication system (VPIS) voltage output
- Can be factory-mounted in Premset cubicles or added on the site
- Easy on-site addition without removing MV cables using split-type current sensor.

## Fault detection functions

### Overcurrent detection

- Automatic mode for adjustment-free calibration of detection thresholds
- Manual mode for special override settings:
- Flair 21D: 4 detection thresholds from 200 A to 800 A, in 200 A increments,
- selectable via microswitches
- Flair 22D and Flair 23DM: 8 detection thresholds from 100 A to 800 A, in 50 A
- increments, configurable via the front panel keypad.
- Fault acknowledge time:
- Flair 21D: 40 ms
- Flair 22D and Flair 23DM (configurable via the front panel keypad):
  Type A from 40 to 100 ms in 20 ms increments
  Type B from 100 to 300 ms in 50 ms increments.

### Earth fault detection

The detector checks the 3 phases for current variations (di/dt).
A time delay of 70 s is applied for fault confirmation by the upstream protective device.

- Automatic mode for adjustment-free calibration of detection thresholds
- Manual mode for special override settings:
- Flair 21D: 6 detection thresholds from 40 to 160 A, via microswitches
- Flair 22D and Flair 23DM (configurable via the front panel keypad):
  Type A from 20 to 200 A, in 10 A increments
  Type B from 5 to 30 A in 5 A increments and 30 to 200 A in 10 A.
- Inrush function: prevents unnecessary detection in the event of load switch-on.

Incorporates a 3 s time delay for fault filtering at network power up.
The Inrush function can be disabled via configuration on Flair 22D and 23DM.

## Fault indication function

### Signalling

As soon as a fault is confirmed, the indication device is activated.

- Fault indication via a red LED on the front panel
- Indication of the faulty phase (earth fault) on LCD display
- Optional remoting of indication to external flashing lamp
- Activation of a contact for retransmission to the SCADA system.

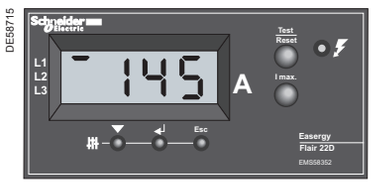
### Indication reset

- Automatic reset upon load current recovery (configurable time delay on Flair 22D and Flair 23DM)
- Manual reset via front panel button
- Reset via external Reset input
- Reset by time delay: fixed (4 hr) for Flair 21D and adjustable using front panel keypad (2 hr to 16 hr) for Flair 22D and Flair 23DM.

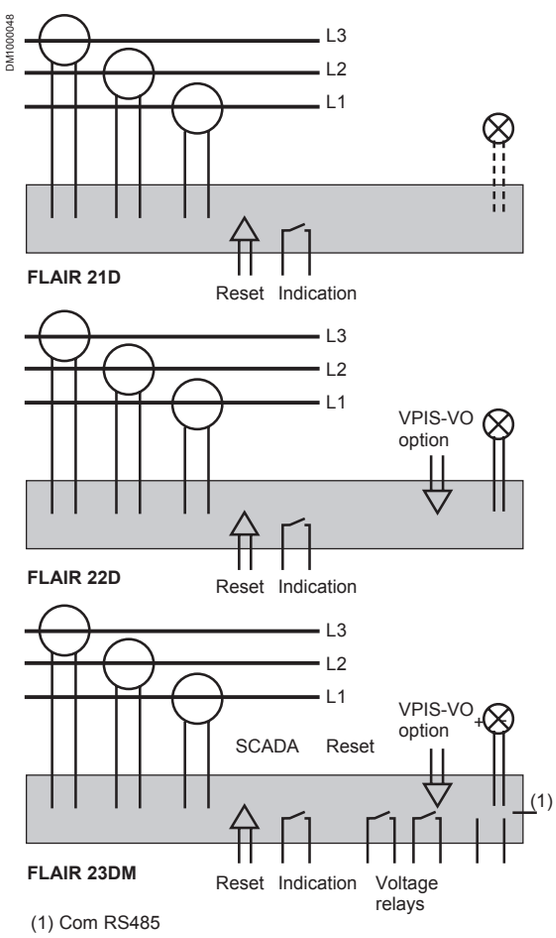
# Fault passage indicators

## Flair 21D, 22D and 23DM

The Flair 21D, 22D, 23DM range uses an integrated detection system composed of indicators and dedicated CTs. Integrated sensors are normally placed around the bushings. Split CTs can be placed around cables for retrofit purposes.




### Connection diagrams




(1) Com RS485

## Display principle

- The load current is displayed continuously
- When a fault is detected, the faulty phase is indicated
- Use the buttons on the front panel to scroll through settings and measurements.

## Selection table

| | | Flair | | |
|---|---|---|---|---|
| | | Flair 21D | Flair 22D | Flair 23DM |
| **Power supply** | Self-powered | ■ | ■ | ■ |
| | Dual-powered | | ■ (1) | ■ |
| **Detection** | Overcurrent | | ■ | ■ |
| | Earth-fault | | ■ | ■ |
| **Display (4 digit LCD)** | Ammeter | | ■ | ■ |
| | Maximeter | | ■ | ■ |
| | SCADA interface (relay) | | ■ | ■ |
| | External lamp | | ■ | ■ |
| | External reset | | ■ | ■ |
| | Extended setting (keypad) | | ■ | ■ |
| **Communication** | 2-voltage output relays | | | ■ |
| | Serial communication port | | | ■ |

*(1) By lithium battery*

## Characteristics per product

| Model | Description |
|---|---|
| **Fault passage indicator with single power supply (self-powered)** | |
| Flair 21D | Detector with autonomous power supply |
| | External indicator lamp output powered by battery (BVP) |
| **Fault passage indicator with dual power supply** | |
| Flair 22D | Detector with autonomous power supply and lithium battery |
| | External indicator lamp output powered by the Flair (BVE) |
| | Zero sequence CT option (type B setup) |
| | Interface with VPIS-VO possible to confirm the fault by voltage absence |
| **Fault passage indicator with dual power supply and voltage presence/absence** | |
| Flair 23DM | Detector with 24-48 Vdc external and autonomous power supply |
| | External indicator lamp output powered by the Flair (BVE) |
| | Zero sequence CT option (type B or C setup) |
| | Voltage presence and absence detector (same as for VD23) |
| | Interface with VPIS-VO needed for the voltage presence |

## Standard applications

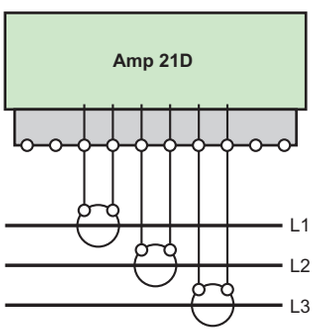
| | |
|---|---|
| Flair 21D | Maintenance-free, adjustment-free fault detector |
| Flair 22D | Fault detector for networks with very low load current (< 2 A) with possibility of manual adjustments |
| Flair 23DM | Adapted to Feeder Automation. Forwarding of current measurement, fault passage indication and voltage outage information to the SCADA via a serial communication port.<br>Combination fault passage indicator and voltage detector, ideal for use with an Automatic Transfer System |

# Ammeter

- 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

PE57786


DE58404_LG




PE57233_LG

*The SM6 can integrate ammeter Amp 21D on all incoming cubicles and the fuse-switch cubicles*

## Functions

- Display of 3 phase current: I1 , I2 , I3. Range: 3 A to 630 A
- Display of 3 phase current maximeter: I1 , I2 , I3. Range: 3 to 630 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.

## Connections, assembly

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

**Current sensors**
- Split core CT for mounting on MV cables.

## Technical data

| | | |
|---|---|---|
| **Application** | | |
| Frequency | | 50 Hz and 60 Hz |
| Load current | Minimum current | ≥ 3 A |
| **Measurement** | | |
| Range | Phase current | 3 to 630 A (resolution 1 A) |
| | Accuracy (I < 630 A) | ± (2% + 2 digit) |
| Reset of maximeter | Manual from device | Yes |
| **Power supply** | | |
| Self power | From the current sensors | I load ≥ 3 A |
| Battery | | No |
| Auxiliary supply | | No |
| **Display** | | |
| | Display | 4 digits LCD |
| | Current per phase | Yes (resolution 1 A) |
| | Maximeter per phase | Yes |
| **Sensors** | | |
| | Phase CTs | 3 split core CT |
| **Miscellaneous** | | |
| | Test | Yes |

# Protection & control monitoring

## Sepam selection guide for all applications

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 five families: Sepam series 10, 20, 40, 60 and 80.

### 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**

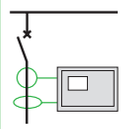
- Intuitive User Machine Interface, with direct data access.
- Local operating data in the user's language.

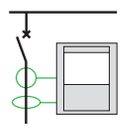
### Accurate measurement and detailed diagnosis

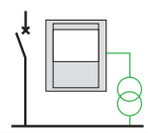
- Measuring all necessary electrical values.
- Monitoring switchgear status: sensors and trip circuit, mechanical switchgear status.
- Disturbance recording.
- Sepam self-diagnosis and watchdog.

### 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.





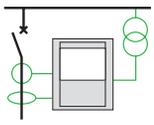
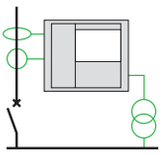


| | Series 10 | Series 20 | | | |
|---|---|---|---|---|---|
| **Protections** | | | | | |
| Current | ■ | ■ | ■ | | |
| Voltage | | | | ■ | ■ |
| Frequency | | | | ■ | ■ |
| Specifics | Phase and earth fault overcurrent | | Breaker failure | | Disconnection by rate of change of frequency |
| **Applications** | | | | | |
| **Substation** | **10A, 10B** | **S20** | **S24** | | |
| **Busbar** | | | | **B21** | **B22** |
| **Transformer** | **10A, 10B** | **T20** | **T24** | | |
| **Motor** | | **M20** | | | |
| **Generator** | | | | | |
| **Capacitor** | | | | | |
| **Characteristics** | | | | | |
| Logic inputs | 4 | 0 to 10 | | 0 to 10 | |
| Logic outputs | 7 | 4 to 8 | | 4 to 8 | |
| Temperature sensors | | 0 to 8 | | 0 to 8 | |
| Channel | | | | | |
| Current | 3 I + Io | 3 I + Io | | | |
| Voltage | | | | 3V + Vo | |
| LPCT (1) | | ■ | | | |
| Communication ports | 1 | 1 to 2 | | 1 to 2 | |
| IEC61850 Protocol | | ■ | | ■ | |
| Control | | | | | |
| Matrix (2) | | ■ | | ■ | |
| Logic equation editor | | | | | |
| Logipam (3) | | | | | |
| Other | | | | | |
| Backup battery | Lithium battery (4) | | | | |
| Front memory cartridge with settings | | | | | |

*(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.*
*(4) Standard lithium battery 1/2 AA format, 3.6 V, front face exchangeable.*

# Protection & control monitoring

## Sepam selection guide for all applications

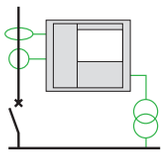
| | Series 40 | | | Series 60 | | |
|---|---|---|---|---|---|---|
| |  | | |  | | |
| |  | | |  | | |
| **Protections** | | | | | | |
| Current | ■ | ■ | ■ | ■ | ■ | ■ |
| Voltage | ■ | ■ | ■ | ■ | ■ | ■ |
| Frequency | ■ | ■ | ■ | ■ | ■ | ■ |
| Specifics | | Directional earth fault | Directional earth fault and phase overcurrent | | Directional earth fault | Directional earth fault and phase overcurrent |
| **Applications** | | | | | | |
| **Substation** | **S40** | **S41, S43** | **S42** | **S60** | | **S62** |
| **Busbar** | | | | | | |
| **Transformer** | **T40** | | **T42** | **T60** | | **T62** |
| **Motor** | | **M41** | | | **M61** | |
| **Generator** | **G40** | | | **G60** | | **G62** |
| **Capacitor** | | | | **C60** | | |
| **Characteristics** | | | | | | |
| Logic inputs | 0 to 10 | | | 0 to 28 | | |
| Logic outputs | 4 to 8 | | | 4 to 16 | | |
| Temperature sensors | 0 to 16 | | | 0 to 16 | | |
| Channel | | | | | | |
| Current | 3 I + Io | | | 3 I + Io | | |
| Voltage | 3V, 2U + Vo | | | 3V, 2U + Vo or Vnt | | |
| LPCT (1) | ■ | | | ■ | | |
| Communication ports | 1 to 2 | | | 1 to 2 | | |
| IEC61850 Protocol | ■ | | | ■ | | |
| Control | | | | | | |
| Matrix (2) | ■ | | | ■ | | |
| Logic equation editor | ■ | | | ■ | | |
| Logipam (3) | | | | | | |
| Other | | | | | | |
| Backup battery | 48 hours | | | Lithium battery (4) | | |
| Front memory cartridge with settings | | | | ■ | | |

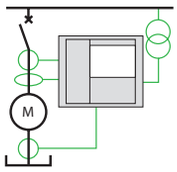
*(1) LPCT: low-power current transformer complying with standard IEC 60044-8.*
*(2) Control matrix for simple assignment of information from the protection, control and monitoring functions.*
*(3) Logipam ladder language (PC programming environment) to make full use of Sepam series 80 functions.*
*(4) Standard lithium battery 1/2 AA format, 3.6 V, front face exchangeable.*

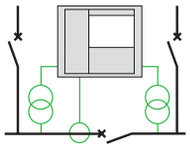
# Protection & control monitoring

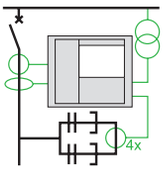
## Sepam selection guide for all applications

### Series 80








| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Protections** | | | | | | | | |
| Current | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Voltage | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Frequency | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Specifics | | 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 |
| **Applications** | | | | | | | | |
| **Substation** | **S80** | **S81** | **S82** | **S84** | | | | |
| **Busbar** | **B80** | | | | | | **B83** | |
| **Transformer** | | **T81** | **T82** | | **T87** | | | |
| **Motor** | | **M81** | | | **M88** | **M87** | | |
| **Generator** | | | **G82** | | **G88** | **G87** | | |
| **Capacitor** | | | | | | | | **C86** |
| **Characteristics** | | | | | | | | |
| Logic inputs | 0 to 42 | | | | 0 to 42 | | 0 to 42 | 0 to 42 |
| Logic outputs | 5 to 23 | | | | 5 to 23 | | 5 to 23 | 5 to 23 |
| Temperature sensors | 0 to 16 | | | | 0 to 16 | | 0 to 16 | 0 to 16 |
| Channel | | | | | | | | |
| Current | 3 I + 2 x Io | | | | 2 x 3 I + 2 x Io | | 3 I + Io | 2 x 3 I + 2 x Io |
| Voltage | 3V + Vo | | | | 3V + Vo | | 2 x 3V + 2 x Vo | 3V + Vo |
| LPCT (1) | ■ | | | | ■ | | ■ | ■ |
| Communication ports | 2 to 4 | | | | 2 to 4 | | 2 to 4 | 2 to 4 |
| IEC61850 Protocol | ■ | | | | ■ | | ■ | ■ |
| Control | | | | | | | | |
| Matrix (2) | ■ | | | | ■ | | ■ | ■ |
| Logic equation editor | ■ | | | | ■ | | ■ | ■ |
| Logipam (3) | ■ | | | | ■ | | ■ | ■ |
| Other | | | | | | | | |
| Backup battery | Lithium battery (4) | | | | Lithium battery (4) | | Lithium battery (4) | Lithium battery (4) |
| Front memory cartridge with settings | ■ | | | | ■ | | ■ | ■ |

*(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.*
*(4) Standard lithium battery 1/2 AA format, 3.6 V, front face exchangeable.*

# Protection & control monitoring

## Easergy P5

Easergy protection relays provide top-level protection for all types of installations, new smartgrid features, a lower total cost of ownership, fast delivery and multi-vendor inter-operability.

Easergy P5 is a family of digital protection relays for medium voltage distribution networks dedicated to:

- Buildings and Industry:
- Retails
- Hotels
- Healthcare
- Education and research
- Transportation,
- Industrial buildings
- Utilities: energy distribution
- Large sites:
- Oil and Gas
- Mining
- Mineral and Metals
- Water

The Easergy P5 family includes a variety of models. Each contains specific functionality designed to address application-specific needs.

### Easergy P5 protection relays are withdrawal and compact devices:

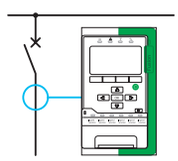
- The Easergy P5 (20TE) is a current-based or voltage-based protection relay in a 20TE* width format.

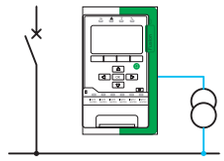
*(*) 1TE = 5.08 mm.*

### All Easergy protection relays are built according to the IEC 61850 standard and include the latest cybersecurity features:

- A complete set of protection functions, related to the application
- Control of the circuit-breaker
- Measurements
- Both serial and Ethernet communication, including redundancy
- A comprehensive HMI
- Powerful Easergy Pro configuration tool for an easy customization of the functions.

### Current or voltage





| | | | |
|---|---|---|---|
| **Feeder** | | P5F20 | |
| **Voltage** | | | P5V20 |
| **Motor** | | P5M20 | |
| **Characteristics** | | | |
| Measuring input | Phase current | 1/5 A CT (Qty 3) | |
| | Residual current | 1/5 A CT (Qty 2) or CSH (Qty 1) | |
| | Voltage | | VT or direct LV connection (Qty 4) |
| Digital inputs/outputs | Inputs | 4 or 10 | |
| | Outputs | 4 or 8 | |
| Temperature sensors | | 0 or 8 | |
| Communication Protocols | | ■ IEC 61850<br>■ Modbus | |
| Redundancy Protocols | | ■ RSTP (standard 802.1d 2004) | |
| Front ports | | USB device / USB host | |
| Rear ports | | ■ Extension port (option)<br>■ Serial port (option)<br>■ Ethernet port (option) | |
| Control | | 1 CB | |
| Configuration (customisation) | | Matrix | |
| Other | Withdrawability | Yes | |

# Protection & control monitoring

## VIP 35 protection relay

## VIP 300 LL protection relay

PE57159

*VIP 35*

## VIP 35 relay for transformer protection

**Integrated in the DM1-S and DMV-S cubicles for SM6-24**
The VIP 35 is an independent relay without an auxiliary power supply, powered by the current sensors, and actuating a Mitop release unit.
VIP 35 provides protection against phase-to-phase faults and against earthing faults.

**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**

| Operating voltage (kV) | Transformer rating (kVA) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 75 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 | 3150 | 4000 | 5000 | 6300 |
| 3 | 10 | 15 | 20 | 25 | 36 | 45 | 55 | 68 | 80 | 115 | 140 | 170 | 200 | | | | | | | | |
| 3.3 | 10 | 15 | 18 | 22 | 28 | 36 | 45 | 56 | 70 | 90 | 115 | 140 | 200 | | | | | | | | |
| 4.2 | 8 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 55 | 70 | 90 | 115 | 140 | 200 | | | | | | | |
| 5.5 | 8* | 8 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 55 | 68 | 90 | 115 | 140 | 170 | | | | | | |
| 6 | 8* | 8* | 10 | 12 | 18 | 20 | 25 | 36 | 45 | 55 | 68 | 80 | 115 | 140 | 170 | 200 | | | | | |
| 6.6 | 8* | 8* | 10 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 56 | 70 | 90 | 115 | 140 | 200 | | | | | |
| 10 | 8* | 8* | 8* | 8 | 10 | 12 | 15 | 20 | 25 | 30 | 37 | 55 | 68 | 80 | 115 | 140 | 170 | 200 | | | |
| 11 | 8* | 8* | 8* | 8* | 10 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 55 | 68 | 90 | 115 | 140 | 170 | | | |
| 13.8 | 8* | 8* | 8* | 8* | 8 | 10 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 55 | 68 | 90 | 115 | 140 | 170 | | |
| 15 | 8* | 8* | 8* | 8* | 8* | 8 | 10 | 15 | 18 | 20 | 25 | 36 | 45 | 55 | 68 | 80 | 115 | 140 | 170 | 200 | |
| 20 | 8* | 8* | 8* | 8* | 8* | 8* | 8 | 10 | 12 | 15 | 20 | 25 | 30 | 37 | 55 | 68 | 80 | 115 | 140 | 170 | 200 |
| 22 | 8* | 8* | 8* | 8* | 8* | 8* | 8 | 10 | 12 | 15 | 18 | 22 | 28 | 36 | 45 | 55 | 68 | 90 | 115 | 140 | 170 |

** Short-circuit protection, no over-load protection*

PE57160

*VIP 300 LL*

## VIP 300 LL protection relay

**Integrated in the DM1-S and DMV-S cubicles for SM6-24**
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.

# Protection & control monitoring

## Sepam series 10 with CRa/CRb sensors

PE57170


*Sepam series 10*

## Sepam series 10 with CRa/CRb sensors for transformer protection

**Integrated in the DM1-S cubicle for SM6-24 with CRa and CRb sensors and DM1-A cubicle for SM6-36 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

# Protection & control monitoring

## Protection and sensor selection table

## General common selection of protection units

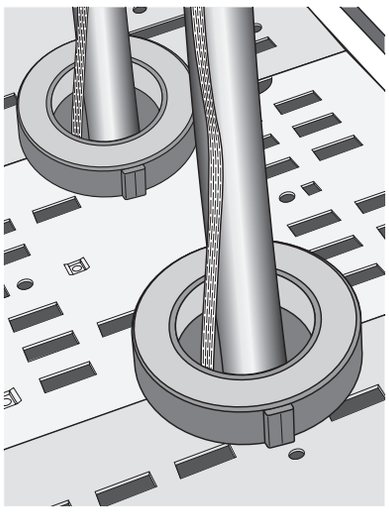
| Protection type | Code | Protection units | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Sepam | | | | | VIP | |
| | | series 10 | series 20 | series 40 | series 60 | series 80 | 35 | 300 |
| Three-phase overcurrent | 50 - 51 | ■ | ■ | ■ | ■ | ■ | ■ (2) | ■ (1) |
| Zero-sequence overcurrent | 50N - 51N | ■ | ■ | ■ | ■ | ■ | ■ (3) | ■ (1) |
| Directional zero-sequence current | 67N | | | ■ | ■ | ■ | | |
| Undervoltage | 27 | | | ■ | ■ | ■ | | |
| Overvoltage | 59 | | | ■ | ■ | ■ | | |
| Thermal image | 49 | ■ | ■ | ■ | ■ | ■ | | |
| Zero-sequence overvoltage | 59N | | | ■ | ■ | ■ | | |
| Negative sequence overcurrent | 46 | | ■ | ■ | ■ | ■ | | |
| Long start-up and rotor blocking | 51LR | | ■ | ■ | ■ | ■ | | |
| Maximum number of start-ups | 66 | | ■ | ■ | ■ | ■ | | |
| Single-phase undercurrent | 37 | | ■ | ■ | ■ | ■ | | |
| Communication | | ■ | ■ | ■ | ■ | ■ | | |

***(1)** DT, EI, SI, VI and RI trip curves.*
***(2)** Inverse curve suited to transformer protection.*
***(3)** DT trip curve.*

## Current sensor for VIP 35 and VIP 300LL and Sepam series 10 for SM6-24

| Type | Dimensions (mm) | | | Weight (kg) | Ratio of transformation | Class of precision | | VIP 35 | VIP 300LL | Sepam 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | External Ø | Internal Ø | Thickness (without fastening) | | | | | | | |
| **CRa** | 143.5 | 81 | 37.5 | 2.18 | 1/200 | ± 2% from 10 A to 100 A<br>± 1% from 100 A to 1600 A | On load 5.7 Ω (cal. x 1) | | ■ | ■ |
| | | | | | | ± 1% from 10 A to 10 kA | On load 0.67 Ω (cal. x 4) | | | |
| **CRb** | 143.5 | 81 | 37.5 | 1.26 | 1/1250 | ± 1% from 10 A to 11 kA | On load 5.7 Ω (cal. x 1) | | ■ | ■ |
| | | | | | | ± 1 % from 10 A to 25 kA | On load 0.67 Ω (cal. x 4) | | | |
| **CRc** | 143.5 | 81 | 37.5 | 2 | S1-S2: 1/200<br>S1-S3: 1/500 | S1-S2:<br>± 5% from 10 A to 80 A<br>± 2.5 % from 80 A to 600 A<br>S1-S3:<br>± 2% from 20 A to 2200 A | On load 0.6 Ω | ■ | | |

DE58412



# Protection & control monitoring

## LPCT protection chain

**Standard applications**

PE88012

**Sepam series 20**

**Demanding applications**

PE88011

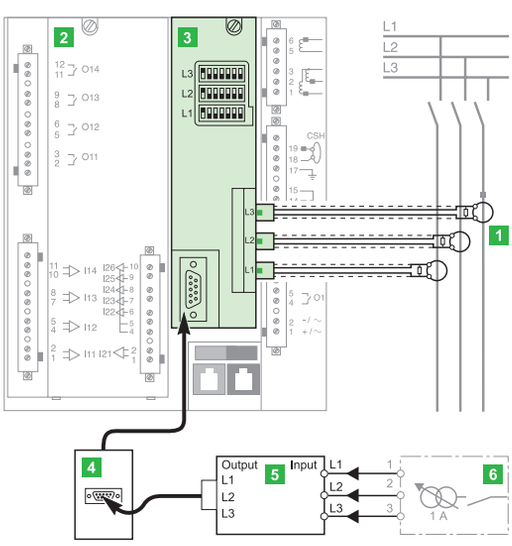
**Sepam series 40**

**Custom applications**

PE88010

**Sepam series 60 and 80**

MT11325_LG




## TLP130, TLP190, CLP2 sensors for Sepam series 20, 40, 60, 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.

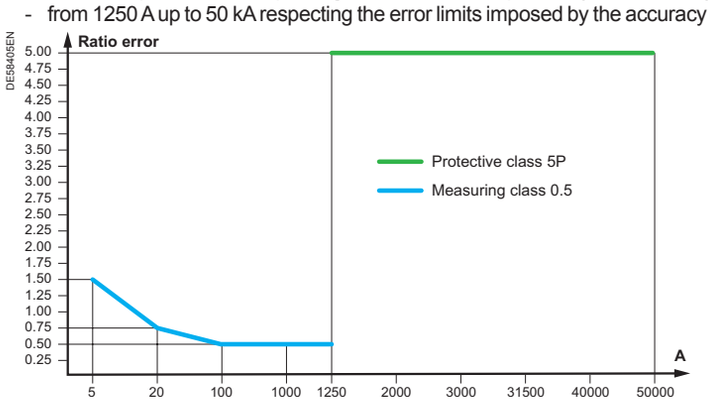
**Sepam series 20, 40, 60 and 80 protection units are at the heart of the LPCT protection chain.**
Sepam series 20, 40, 60 and 80 performs the following functions:
- acquisition of phase currents measured by the LPCT sensors
- utilization of measurements by the protection functions
- tripping of the 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 and TLP190 are installed around MV cable
    CLP2 is installed on the MV circuit
  - LPCT connected directly to Sepam series 20, 40, 60 and 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.

DE58405EN




- **Optimized integration of functions:**
  - measurement of phase rated currents as of 25 A that is set by micro-switch
  - monitoring of LPCT sensor by Sepam series 20, 40, 60 and 80 (detection of phase loss).

### 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, 40, 60 and 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 60 and 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.**

# PS100 high-availability power supply

Backup solution for MV switchgear power needs in the event of micro outages and power interruptions.

- Easy maintenance with only one battery
- Remote battery monitoring
- High level of insulation to protect the electronic devices in harsh MV environments
- End-of-life alarm possible via Modbus communication
- Compliant with standards IEC 60255-5 (10 kV level).

PM100592


*PS100*

## PS100 backup power supply for MV substations

### Applications

The power supply unit supplies backup operating power for:
- MV switchgear motor mechanisms and circuit breaker coils
- Transmission equipment (e.g. radio)
- Control units such as RTU or Automatic Transfer System
- Protection relays, Fault Passage Indicators and others electronic devices.

### High availabilty power supply

A battery ensures uninterrupted operation of the whole substation in the event of loss of the main supply. The backup power supply unit:
- Includes a regulated and temperature-compensated charger
- Stops the battery before deep discharge
- Carries out a battery check every 12 hours
- Measures battery ageing
- Forwards monitoring information via a Modbus communication port and output relays.

### Benefits

#### Only one battery

Traditional backup power supplies require a set of 2 or 4 batteries to produce 24 V or 48 V, with complicated replacement and adjustment of the battery pack.

The PS100 needs only one battery, simplifying replacement.

The battery is a standard sealed lead-acid 12 V battery with a 10-year service. It can be purchased easily, anywhere in the world.

#### Improved availability of MV/LV substations

The PS100 is designed to ride through power network interruptions of up to 48 hours. It is associated with a battery selected to meet the required backup time.

The PS100 protects and optimises the battery with state-of-the-art monitoring. A Modbus communication port forwards monitoring data to allow optimised maintenance operations. Perfect integration with the Easergy range to control and monitor your distribution network.

#### Additional energy backup

The PS100 stops supplying power and reserves an "additional energy backup" to restart the installation after an extended power interruption.

The "additional energy backup" can be enabled with a local pushbutton to provide energy for restarting the protection relays and operating the MV switchgear.

#### Withstands severe substation environments

The PS100 includes 10 kV insulation, electronic protection against overvoltage and overloads, and automatic restart after a fault.

### Main features

- DIN rail mounting for easy integration in any LV cabinet or MV/LV substation
- 2 power supply outputs:
- 12 Vdc - 18 W continuous - 100 W 20 s (for modem, radio, RTU, etc.)
- 48 Vdc or 24 Vdc - 300 W /1 minute (for switchgear operating mechanism motors) and 90 W / continuous for protection relays, electronic devices, etc.
- RJ45 Modbus communication port
- 2 output relays (AC supply ON, Battery ON)
- Diagnosis with LEDs
- 1 sealed lead-acid 12 V battery with a 10-year service life (from 7 Ah to 40 Ah)
- Power supply paralleling available with a 2nd PS100
- -40°C to +70°C operating temperature.

### Range

- PS100-48V 48 Vdc power supply and battery charger
- PS100-24V 24 Vdc power supply and battery charger
- Bat24AH 24 Ah long life battery
- Bat38AH 38 Ah long life battery.

# Notes

# Characteristics of the functional units

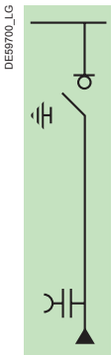
# General characteristics

## Contents

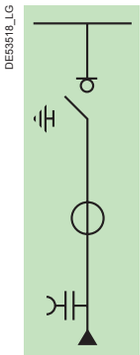
# Functional units selection

## Switching

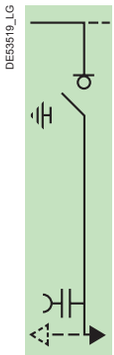
**IM**
Switch unit



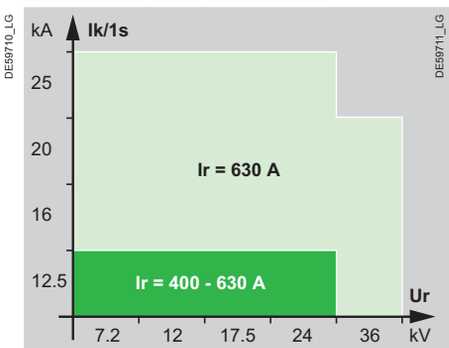

**IMC**
Switch unit

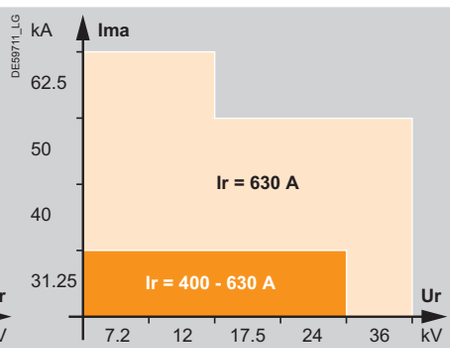



**IMB**
Switch unit **with** earthing switch
Right or left outgoing




### Electrical characteristics




### Basic equipment:

- switch and earthing switch
- three-phase busbars
- CIT operating mechanism
- voltage presence indicator
- 150 W heating element for SM6-36
- LSC2A

- connection pads for dry-type cables

- three-phase bottom busbars for outgoing lines (right or left)

- one to three CTs for SM6-24
- three CTs for SM6-36

### Versions:

- CI2 operating mechanism

- CI1 operating mechanism

- CI1 operating mechanism for SM6-36

- CI1 operating mechanism

- in 800 A version for SM6-24, 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 SM6-24
- visibility of main contacts
- pressure indicator device
- enlarged low-voltage control cabinet for SM6-24
- 50 W heating element for SM6-24
- 630 A cable connection by the top (no internal arc withstand if selected)

- earth fault indicators
- connection pads for two dry-type single-core cables for 36 kV

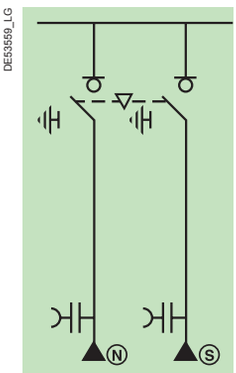
- digital ammeter
- surge arresters (for SM6-36 and for SM6-24 in 500 mm width cubicle)
- 630 A busbars earthing switch cabinet for SM6-24 (not available for internal arc IEC62271-200)

# Functional units selection

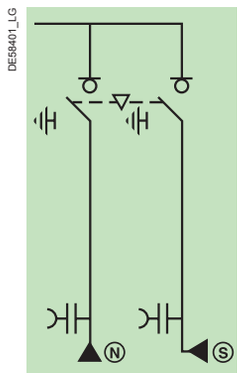
## Switching

### Automatic Transfer System for SM6-24

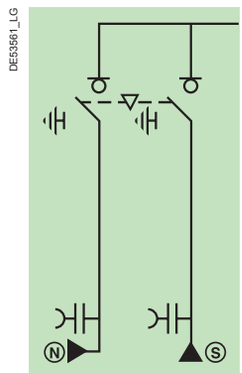
**NSM-cables**
**Cables** power supply for
main incoming line (N)
and standby line (S)



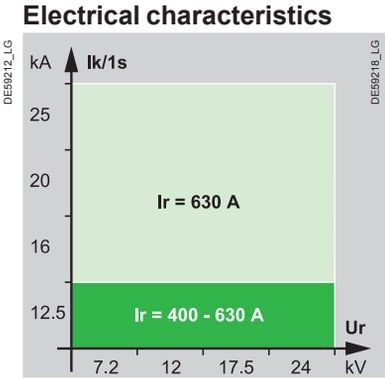

**NSM-busbars**
**Cables** power supply for
main incoming line on left (N) and
**busbars** for standby line (S) on right

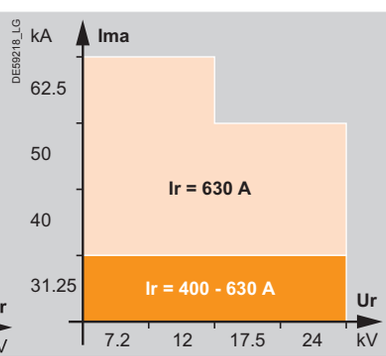



**NSM-busbars**
**Busbars** power supply for
main incoming line on left (N) and
**cables** for standby line (S) on right




### 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)
- LSC2A

### Optional accessories:

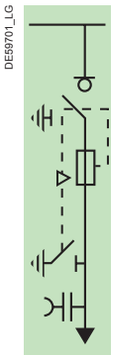
- auxiliary contacts
- key-type interlocks
- 50 W heating element
- control and monitoring
- visibility of main contacts
- pressure indicator device
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions

# Functional units selection

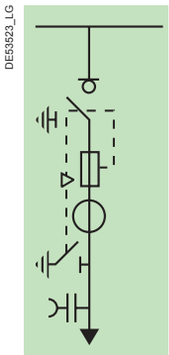
## Protection

## Fuse-switch

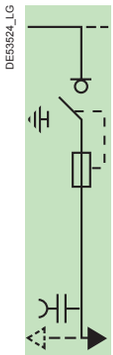
**QM**
Fuse-switch combination unit



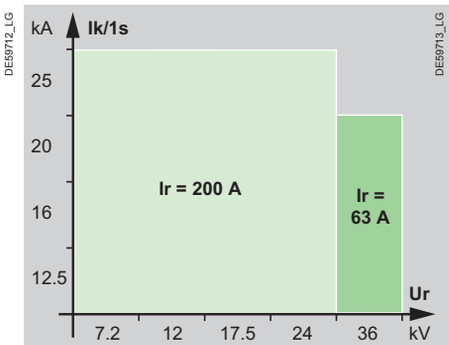

**QMC**
Fuse-switch combination unit

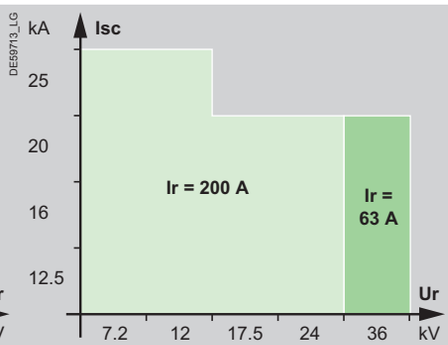



**QMB**
Fuse-switch combination unit
Outgoing line right or left




### 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 SM6-36
- LSC2A

- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity

- three-phase bottom busbars for outgoing lines (right or left)

- one to three CTs for SM6-24
- three CTs for SM6-36

### Version:

- equipment for three UTE striker fuses for SM6-24

- CI2 operating mechanism

- CI2 operating mechanism for SM6-36

### Optional accessories:

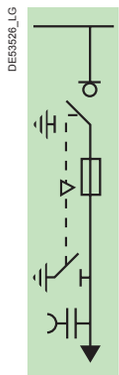
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- auxiliary contact for blown fuses
- DIN striker fuses
- release units (coil)
- digital ammeter
- 1250 A three-phase upper busbars
- 630 A cable connection by the top (no internal arc withstand if selected)
- visibility of main contacts
- pressure indicator device
- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- enlarged low-voltage control cabinet for SM6-24
- 50 W heating element for SM6-24

# Functional units selection

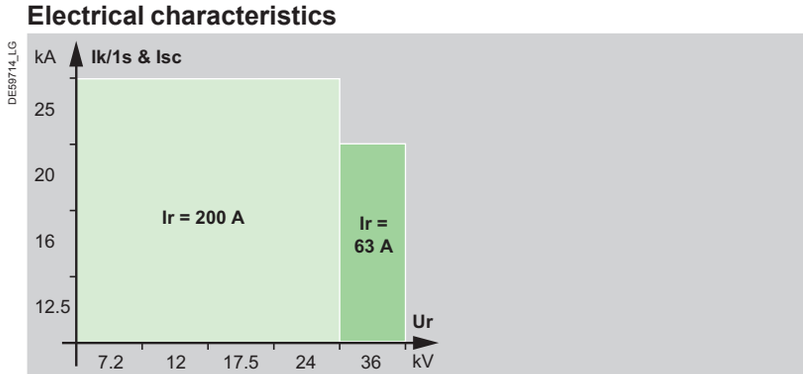
## Protection

### Fuse-switch

**PM**
Fused-switch unit




### Electrical characteristics




### Basic equipment:

- switch and earthing switch
- three-phase busbars
- CIT operating mechanism
- voltage presence indicator
- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity
- equipment for three UTE (for SM6-24) or DIN striker fuses
- 150 W heating element for SM6-36
- LSC2A

### Version:

- CI1 operating mechanism
- CI2 operating mechanism for SM6-36

### 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
- 630 A cable connection by the top (no internal arc withstand if selected)
- UTE (for SM6-24) or DIN striker fuses
- visibility of main contacts
- pressure indicator device
- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- enlarged low-voltage control cabinet for SM6-24
- 50 W heating element for SM6-24
- Release units for SM6-36

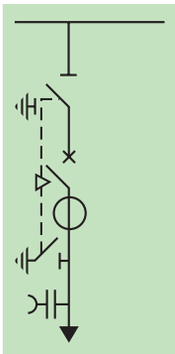
# Functional units selection

## Protection

### SF6 type circuit breaker

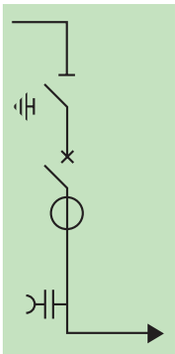
**DM1-A**
Single-isolation
disconnectable CB unit

DE53531_LG



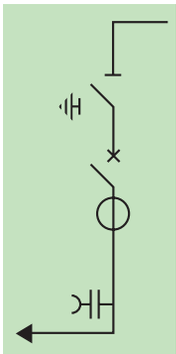
**DM1-D**
Single-isolation
disconnectable CB unit
Outgoing line on right

DE53532_LG



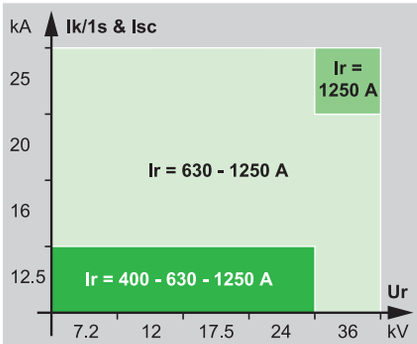
**DM1-D**
Single-isolation
disconnectable CB unit
Outgoing line on left

DE53533_LG



## Electrical characteristics

DE59715_LG




## 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 SM6-36
- LSC2A

- 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

- three-phase bottom busbars

## Version:

- LPCT (only with Sepam series 20, 40, 60, 80)

- SFset circuit breaker disconnectable (only for 400-630 A performances and SM6-24)

## 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
- 630 A cable connection by the top (no internal arc withstand if selected)

- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- enlarged low-voltage control cabinet for SM6-24
- 50 W heating element for SM6-24
- connection pads for two dry-type single-core cables for SM6-36

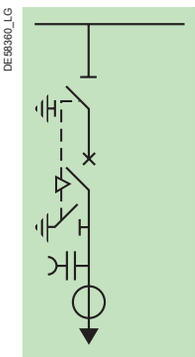
- surge arresters
- 630 A busbars earthing switch cabinet for SM6-24 (not available for internal arc IEC62271-200)

# Functional units selection

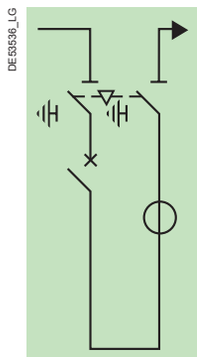
## Protection

### SF6 type circuit breaker

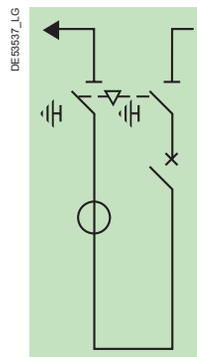
**DM1-S**
Single-isolation
disconnectable CB unit
with independent protection



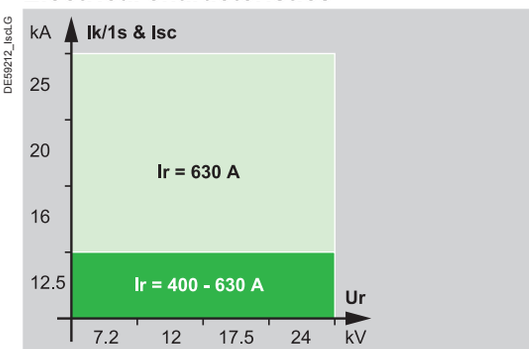

**DM2**
Double-isolation
disconnectable CB unit
Outgoing line on right

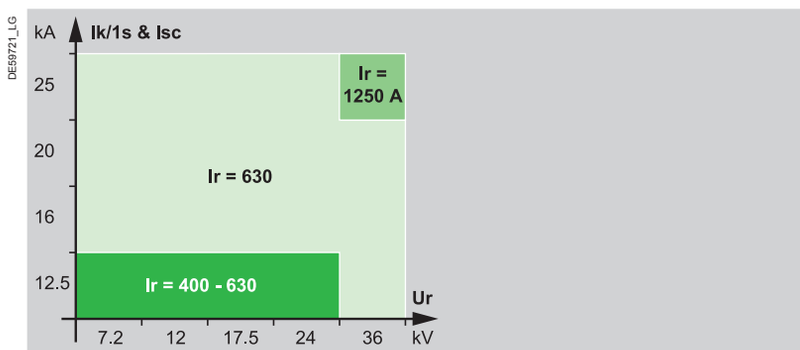



**DM2**
Double-isolation
disconnectable CB unit
Outgoing line on left




### Electrical characteristics




### Basic equipment:

- SF1 disconnectable circuit breaker
- disconnector and earthing switch
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- auxiliary contacts on circuit breaker
- mechanical interlocking between circuit breaker and disconnector
- LSC2A

- 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

- three CTs
- 150 W heating element for SM6-36

### Version:

- Sepam series 10 with auxiliary supply and three CR sensors

### Optional accessories:

- **cubicle:**
  - key-type interlocks

- **cubicle:**
  - protection using Sepam programmable electronic unit
  - auxiliary contacts on disconnectors
  - 2 voltage transformers phase-to-phase or 3 voltage transformers phase-to-earth

- 1250 A three-phase upper busbars at Ir 630 A
- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- enlarged low-voltage control cabinet for SM6-24

- 630 A cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for SM6-24

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

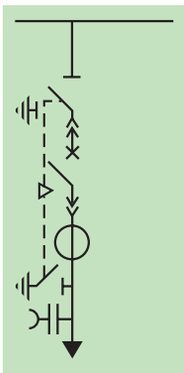
# Functional units selection

## Protection

### SF6 type circuit breaker

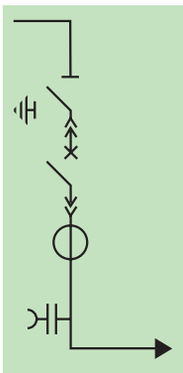
**DM1-W**
Withdrawable single-isolation
circuit breaker unit

DE53538_LG



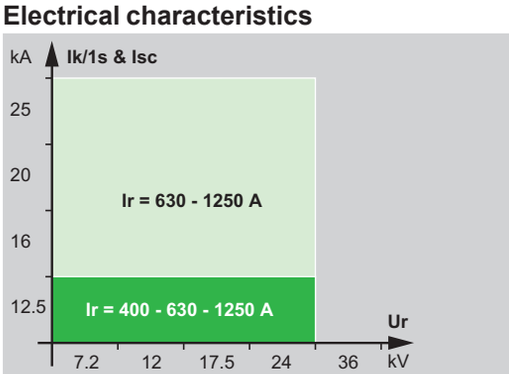
**DM1-Z**
Withdrawable single-isolation CB unit
Outgoing line on right

DE53539_LG

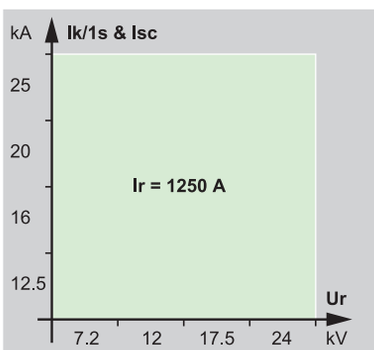


## Electrical characteristics

DE59715_2-LG




DE59228_LG




## 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
- LSC2A

- 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

- three-phase busbars

## Version:

- LPCT (only with Sepam series 20, 40, 60 and 80)

## Optional accessories:

- **cubicle:**
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - key-type interlocks
  - three voltage transformers for SM6-24
  - connection enclosure for cabling from above for SM6-24
  - 50 W heating element for SM6-24
  - enlarged low-voltage control cabinet for SM6-24
- **circuit breaker:**
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

- 1250 A three-phase upper busbars at Ir 630 A
- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- surge arresters (only for 630 A and SM6-24)

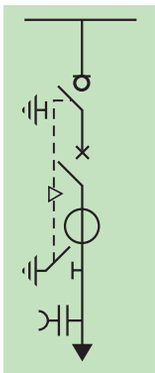
# Functional units selection

## Protection

### Vacuum type circuit breaker

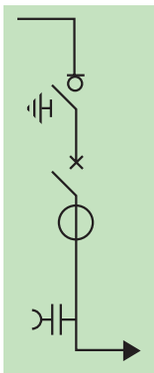
**DMV-A**
Single-isolation
circuit breaker unit

DE53541_LG



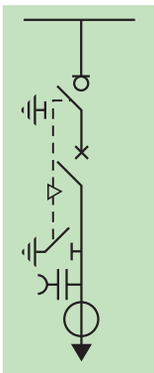
**DMV-D**
Single-isolation circuit breaker unit
Outgoing line on right

DE53542_LG



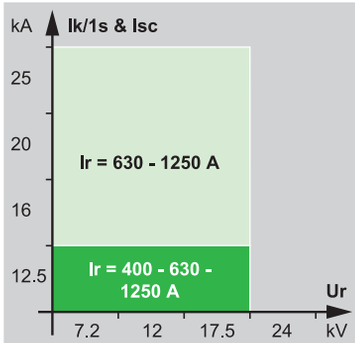
**DMV-S**
Single-isolation circuit breaker unit
with independent protection

DE53543_LG



## Electrical characteristics

DE59227_LG




## 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
- LSC2A

- three CTs
- Sepam series 20 programmable electronic unit

- connection pads for dry-type cables
- downstream earthing switch 25 kA rms making capacity

- 3 CR sensors for VIP relay
- VIP protection relay
- 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
  - 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

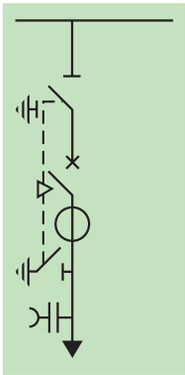
# Functional units selection

## Protection

### Vacuum type circuit breaker

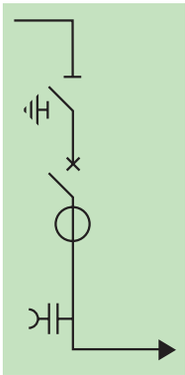
**DMVL-A**
Single-isolation disconnectable circuit breaker unit

DE53535_LG



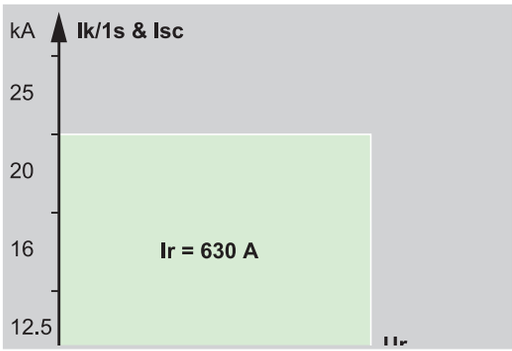
**DMVL-D**
Single-isolation disconnectable circuit breaker unit
Outgoing line on right

DE59703_LG

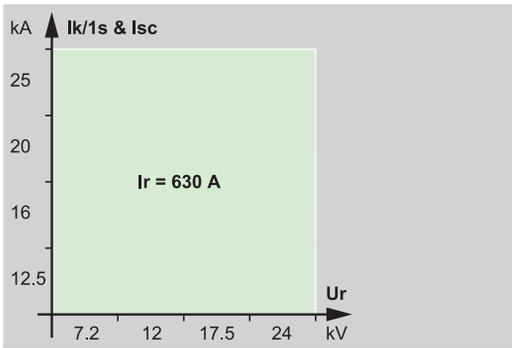


### Electrical characteristics

DE59228_LG




DE59717_LG




### 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 breakerr
- 3 CTs
- connection pads for dry-type cables
- LSC2A

- downstream earthing switch 2 kA rms making capacity

### Optional accessories:

- **cubicle:**
  - auxiliary contacts on the disconnector
  - three voltage transformers
  - key-type interlocks
  - 50 W heating element
- **circuit breaker:**
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

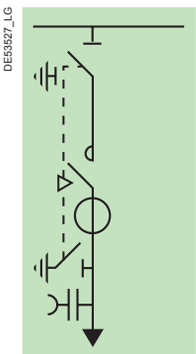
- 1250 A three-phase upper busbars at Ir 630 A
- 630 A three-phase upper busbars for severe operating conditions
- enlarged low-voltage control cabinet
- Sepam relay protection
- surge arresters

# Functional units selection

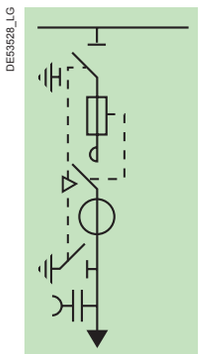
## Protection

### Contactor (Direct Motor Starter) for SM6-24

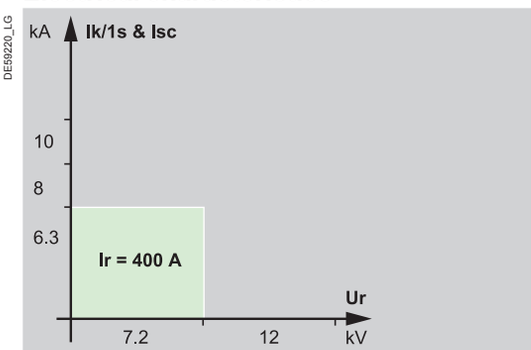
**CVM**
Disconnectable contactor unit

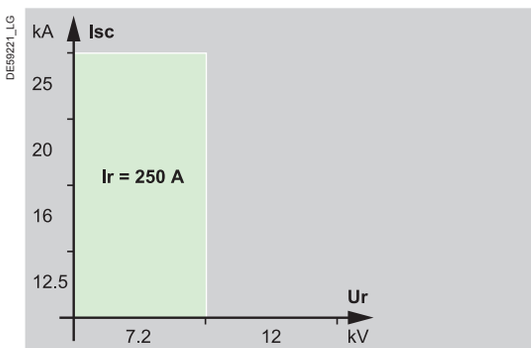



**CVM**
Disconnectable contactor unit with fuses




### Electrical characteristics




### 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
- LSC2A

- equipment for three DIN striker fuses
- mechanical indication system for blown fuses
- auxiliary contact for blown fuses

### Version:

- LPCT (only with Sepam series 20, 40, 60, 80)

### Optional accessories:

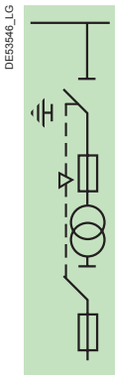
- **cubicle:**
- auxiliary contacts on the disconnector
- protection using Sepam programmable electronic unit
- one to three voltage transformers
- key-type interlocks
- 50 W heating element
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions
- **contactor:**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

- DIN striker fuses

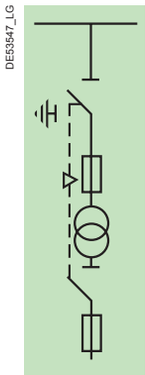
# Functional units selection

## Metering

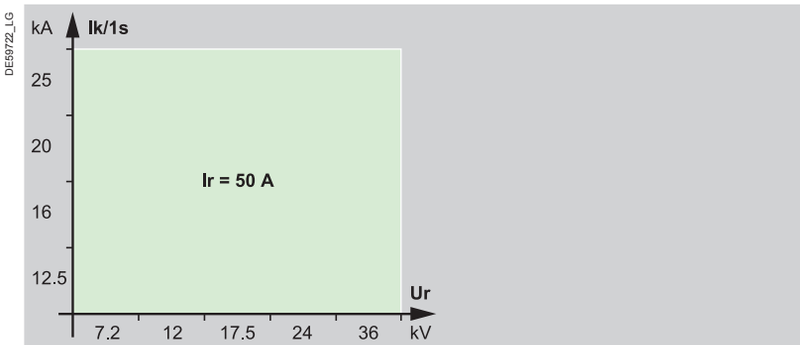
**CM**
Voltage transformers unit for network with earthed neutral system




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




### Electrical characteristics




### 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 SM6-36
- LSC2A

- three-voltage transformers (phase-to-earth)

- two voltage transformers (phase-to-phase)

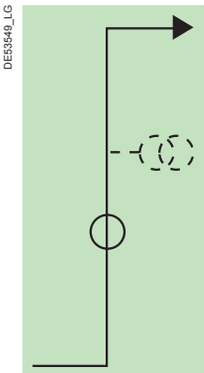
### Optional accessories:

- auxiliary contacts
- mechanical signalling for blown fuses
- auxiliary contact for blown fuses for SM6-24
- 1250 A three-phase upper busbars
- 630 A cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for SM6-24
- 630 A three-phase upper busbars for severe operating conditions for SM6-24
- enlarged low-voltage control cabinet for SM6-24

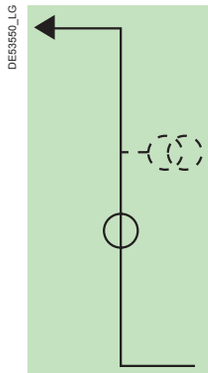
# Functional units selection

## Metering

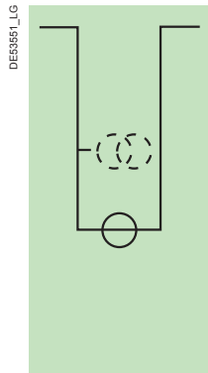
**GBC-A**
Current and/or voltage measurements unit
Outgoing line on right



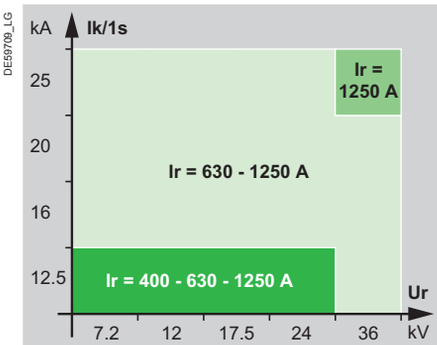

**GBC-A**
Current and/or voltage measurements unit
Outgoing line on left




**GBC-B**
Current and/or voltage measurements unit




### Electrical characteristics




### Basic equipment:

- one to three CTs for SM6-24
- three CTs for SM6-36
- connection bars
- three-phase busbars
- 150 W heating element for SM6-36
- LSC1

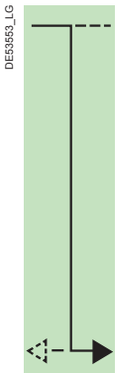
### Optional accessories:

- 1250 A three-phase upper busbars at Ir 630 A for SM6-24
- enlarged low-voltage control cabinet for SM6-24
- three voltage transformers (phase-to-earth) or two voltage transformers (phase-to-phase) for SM6-24
- 50 W heating element for SM6-24
- 630 A cable connection by the top for SM6-36 (no internal arc withstand if selected)

# Functional units selection

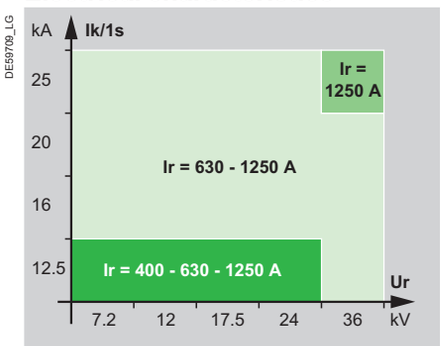
## Other functions

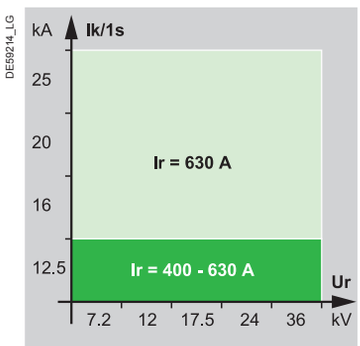
**GBM**
Connection unit
Outgoing line right or left




**GIM**
Intermediate bus unit


### Electrical characteristics




### Basic equipment:

- connection bars
- three-phase busbars for outgoing lines right or left
- 150 W heating element for SM6-36
- LSC1

- metallic envelop

### Optional accessories:

- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for SM6-24
- 630 A cable connection by the top for SM6-36 (no internal arc withstand if selected)

# Functional units selection

## Other functions (extension unit)

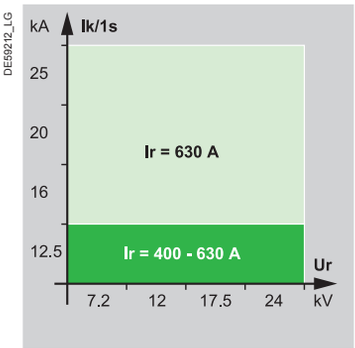
**GEM**
Extension unit
VM6/SM6

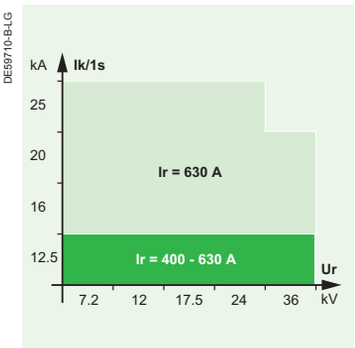

**GFM**
Extension unit
Fluokit SM6

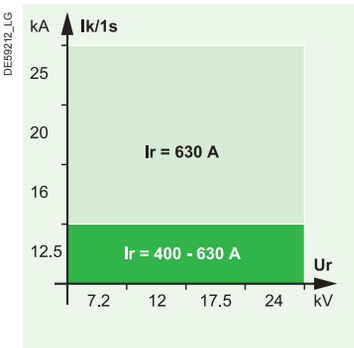

**GUM**
Extension unit
Unifluorc/SM6

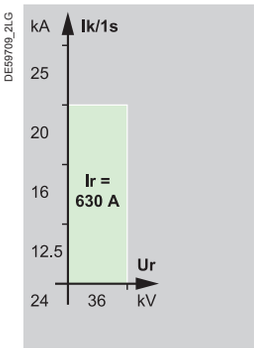

**GMM**
Extension unit
Modularc/SM6


### Electrical characteristics




### Basic equipment:

- metallic envelop
- three-phase busbars

- metallic envelop
- three-phase busbars

- metallic envelop
- three-phase busbars

- metallic envelop
- three-phase busbars

### Optional accessories:

- LV-continuity

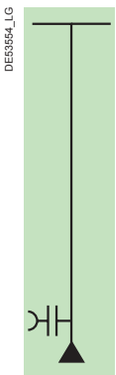
- LV-continuity

- LV-continuity

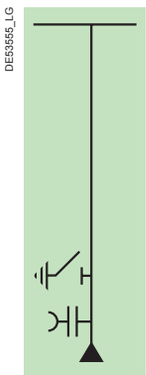
# Functional units selection

## Other functions

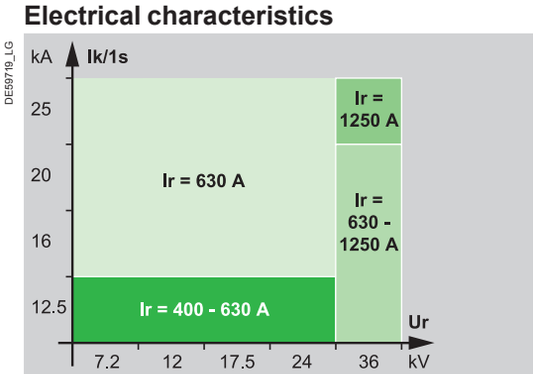
**GAM2**
Incoming-cable-connection unit

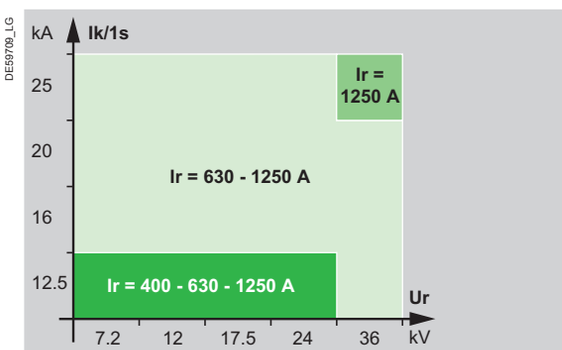



**GAM**
Incoming-cable-connection unit




### Electrical characteristics




### Basic equipment:

- three-phase busbars
- voltage presence indicator
- connection pads for dry-type cables
- connection bars
- 150 W heating element for SM6-36
- LSC1

- downstream earthing switch 25 kA rms making capacity
- operating mechanism CC for SM6-24
- operating mechanism CS for SM6-36

### Optional accessories:

- earth fault indicator
- digital ammeter
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for SM6-24
- 630A cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for SM6-24

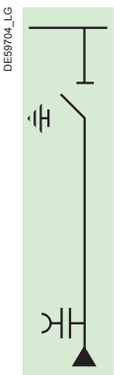
- surge arresters for SM6-36

- auxiliary contacts
- key-type interlocks
- surge arresters for SM6-24

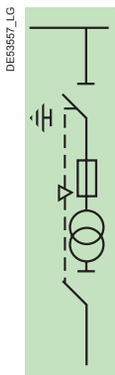
# Functional units selection

## Other functions

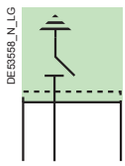
**SM**
Disconnector unit



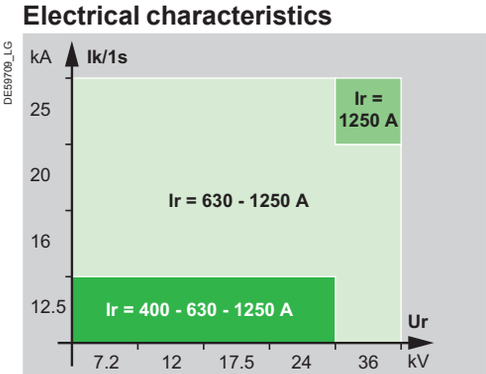

**TM**
MV/LV transformer unit
for auxiliaries

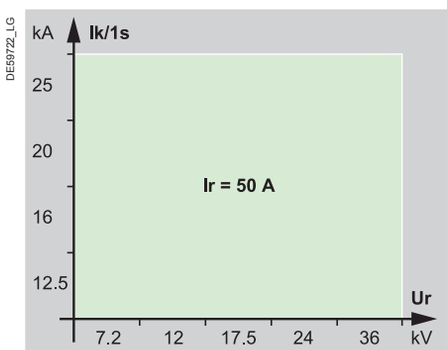


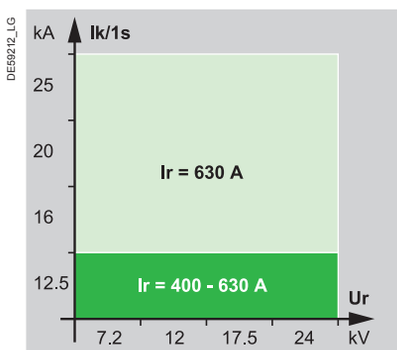

**EMB**
Busbars earthing switch
enclosure




### Electrical characteristics




### Basic equipment:

- disconnector and earthing switch
- three-phase busbars
- operating mechanism CS
- 150 W heating element for SM6-36
- LSC2A

- connection pads for dry-type cables
- voltage presence indicator

- two 6.3 A fuses, UTE (for SM6-24) or DIN type
- LV circuit isolating switch
- one voltage transformer (phase-to-phase)

- earthing switch
- connection bars three phase
- operating mechanism CIT
- installation on 630 A IM 375 mm or DM1-A units (not available for internal arc IEC 62271-200)
- require a key-type interlocks adapted to the switchboard network

### Optional accessories:

- auxiliary contacts
- key-type interlocks
- 1250 A three-phase upper busbars at Ir 630 A
- 630A cable connection by the top (no internal arc withstand if selected)
- enlarged low-voltage control cabinet for SM6-24
- 50 W heating element for SM6-24
- 630 A three-phase upper busbars for severe operating conditions for SM6-24

- digital ammeter for SM6-24
- surge arrester for SM6-36

- mechanical signalling for blown fuses
- auxiliary contact for blown fuses for SM6-24

- auxiliary contacts

# Operating mechanisms

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.

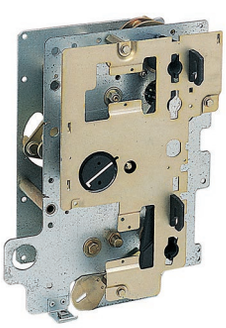
Operating speeds do not depend on the operator, except for the CS.

| Units | Type of operating mechanism | | | | | | |
|---|---|---|---|---|---|---|---|
| | Switch/disconnector / downstream earthing switch | | | | | Circuit breaker | |
| | CIT | CI1 | CI2 | CS | CC | RI | P2 |
| IM, IMB | ■ | □ | □ | | | | |
| IMC | ■ | □ | □ | | | | |
| PM | ■ | □ | □ (1) | | | | |
| QM | | ■ | □ | | | | |
| QMC, QMB | | ■ | □ | | | | |
| CM, CM2, CVM | | | | ■ | | | |
| DM1-A, DM1-D, DM1-S, DM1-Z, DM2, DMVL-A, DMVL-D | | | | ■ | | ■ | |
| DM1-A (2), DM1-W | | | | ■ | ■ | ■ | |
| DMV-A, DMV-D, DMV-S | ■ | | | | | | ■ |
| NSM-cables, NSM-busbars | | | ■ | | | | |
| GAM 24 kV | | | | | ■ | | |
| SM, TM, GAM 36 kV | | | | ■ | | | |
| EMB | ■ | | | | | | |

■ *Provided as standard*
□ *Other possibility*
*(1) Only SM6-36*
*(2) 1250 A version*

| Operating mechanism types | CIT | | CI1 | | CI2 | | | CS | |
|---|---|---|---|---|---|---|---|---|---|
| **Unit applications** | Load-break switch<br>Fused switch | | Load-break switch<br>Fuse switch combination | | Load-break switch<br>Fuse switch combination | | | Disconnector | |
| **Main circuit switch** | Closing | Opening | Closing | Opening | Mechanism charging | Closing | Opening | Closing | Opening |
| **Manual operating mode** | Hand lever | Hand lever | Hand lever | Push button | Hand lever | Push button | Push button | Hand lever | Hand lever |
| **Electrical operating mode (option)** | Motor | Motor | Motor | Coil | Motor | Coil | Coil | N/A | N/A |
| **Speed of operation** | 1 to 2 s | 1 to 2 s | 4 to 7 s | 35 ms | 4 to 7 s | 55 ms | 35 ms | N/A | N/A |
| **Network applications** | Remote control<br>network management | | Remote control<br>transformer protection | | Remote control<br>network management, need of quick reconfiguration (generator source, loop) | | | N/A | |
| **Earthing switch** | Closing | Opening | Closing | Opening | N/A | Closing | Opening | Closing | Opening |
| **Manual operating mode** | Hand lever | Hand lever | Hand lever | Hand lever | Hand lever | Hand lever | Hand lever | Hand lever | Hand lever |

61029N



## 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)*,
- 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.

- **Mechanical indications**

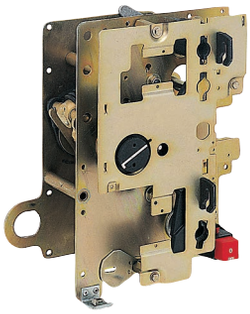
Fuses blown in unit PM.

- **Motor option**

*(*) Included with the motor option*

# Operating mechanisms

61030N



## Double-function operating mechanism CI1

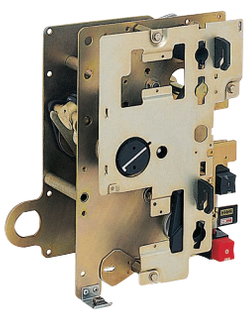
- **Switch function**
- independent-operation closing by lever or motor.

Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
- independent-operation opening by push-button (O) or trip units.
- **Earthing-switch function**

Independent-operation closing and opening 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)*,
- 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.
- **Motor option**

61031N



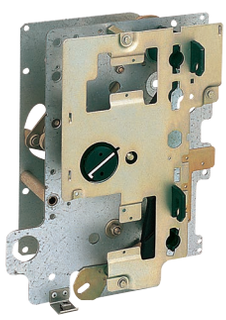
## Double-function operating mechanism CI2

- **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.
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)*,
- 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**
- **Closing release shunt trip**
- **Motor option**

61032N



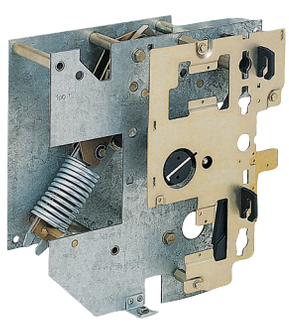
## Double-function operating mechanism CS

- **Disconnector 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,
- 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,
- disconnector (1 O + 2 C) for units CM, CM2, TM, DM1-A, DM1-D, DM2, DMVL-A, DMVL-D, CVM.
- **Mechanical indications**

Fuses blown in units CM, CM2 and TM.

61033N



## Single-function operating mechanism CC

- **Earthing switch function**

Independent-operation opening and closing by lever.
Operating energy is provided by a compressed spring which, when released, provokes opening or closing of the contacts.
- **Auxiliary contacts**

Earthing switch (1 O + 1 C).

*(*) Included with the motor option.*

# Operating mechanisms

PE57163

## 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.

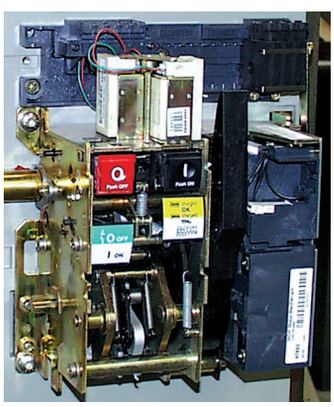
- **Closing release**
- shunt trip

- **Motor option** (option and installation at a later date possible).

**Possible combinations between opening releases**

| | SF1 | | | | | | SFset | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Release type** | **Combinations** | | | | | | **Combinations** | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 |
| Mitop (low energy) | ■ | ■ | ■ | | | | ■ | ■ | ■ | |
| Shunt trip | | ■ | | ■ | ■ | | | ■ | | |
| Undervoltage | | | ■ | | ■ | ■ | | | | ■ |

61035N



## 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**

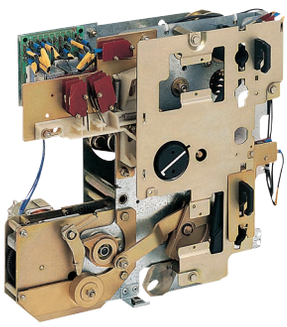
Operation counter.
- **Opening releases**
- Mitop (low energy),
- shunt trip.

- **Closing release**
- shunt trip

- **Motor option** (option and installation at a later date possible).

# Auxiliaries

61036N



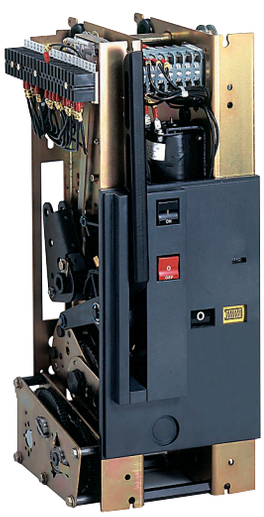
## Motor option and releases for switch-units

The operating mechanisms CIT, CI1 and CI2 may be motorised.

| Un | | DC | | | | | AC (50 Hz)* | |
|---|---|---|---|---|---|---|---|---|
| Power supply | (V) | 24 | 48 | 110 | 125 | 220 | 120 | 230 |
| **Motor option** | | | | | | | | |
| | (W) | 200 | | | | | | |
| | (VA) | | | | | | 200 | |
| Operating time for CIT | | 1 to 2 (s) | | | | | 1 to 2 (s) | |
| Charging time for CI1, CI2 | | 4 to 7 (s) | | | | | 4 to 7 (s) | |
| **Opening releases** | | | | | | | | |
| Shunt trip | (W) | 200 | 250 | 300 | 300 | 300 | | |
| | (VA) | | | | | | 400 | 750 |
| Response time | (ms) | 35 | | | | | 35 | |
| Undervoltage | | | | | | | | |
| Pick-up | (W) | 160 | | | | | | |
| | (VA) | | | | | | 280 | 550 |
| Hold | (W) | 4 | | | | | | |
| | (VA) | | | | | | 50 | 40 |
| Response time | (ms) | 45 | | | | | 45 | |
| **Closing release** | | | | | | | | |
| Shunt trip | (W) | 200 | 250 | 300 | 300 | 300 | | |
| | (VA) | | | | | | 400 | 750 |
| Response time | (ms) | 55 | | | | | 55 | |

** Please consult us for other frequencies.*

PE57164



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

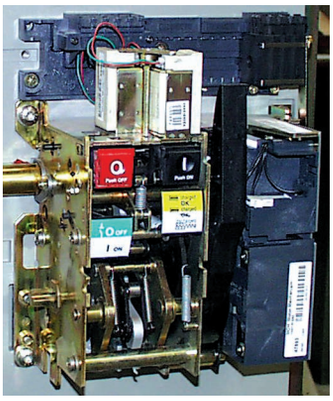
Operating mechanism RI may be equipped with the motor option for the recharging function.

| Un | | DC | | | | | AC (50 Hz)* | |
|---|---|---|---|---|---|---|---|---|
| Power supply | (V) | 24 | 48 | 110 | 125 | 220 | 120 | 230 |
| **Motor option** | | | | | | | | |
| | (W) | 300 | | | | | | |
| | (VA) | | | | | | | 380 |
| Charging time | (s) | 15 | | | | | 15 | |
| **Opening releases** | | | | | | | | |
| Mitop (low energy) | (W) | 3 | | | | | | |
| Response time | (ms) | 30 | | | | | 30 | |
| Shunt trip | (W) | 85 | | | | | | |
| | (VA) | | | | | | | 180 |
| Response time | (ms) | 45 | | | | | 45 | |
| Undervoltage | | | | | | | | |
| Pick-up | (W) | 160 | | | | | | |
| | (VA) | | | | | | 280 | 550 |
| Hold | (W) | 10 | | | | | | |
| | (VA) | | | | | | 50 | 40 |
| Response time | (ms) | 55 | | | | | 55 | |
| **Closing release** | | | | | | | | |
| Shunt trip | (W) | 85 | | | | | | |
| | (VA) | | | | | | | 180 |
| Response time | (ms) | 65 | | | | | 65 | |

** Please consult us for other frequencies.*

# Auxiliaries

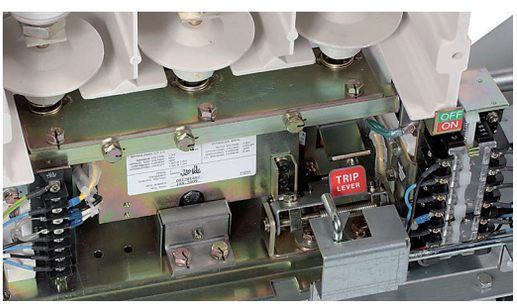
61035N



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

| Charging motor and associated mechanism (P2) | | | | | |
|---|---|---|---|---|---|
| Power supply | (Vac 50/60 Hz) | | 48/60 | 100/130 | 200/240 |
| | (Vdc) | 24/30 | 48/60 | 100/125 | 200/250 |
| Threshold | | 0.85 to 1.1 Ur | | | |
| Consumption | (VA or W) | 180 | | | |
| Motor overcurrent | | 2 to 3 Ir during 0.1 s | | | |
| Charging time | | 6 s max. | | | |
| Switching rate | | 3 cycles per minute max. | | | |
| CH contact | | 10 A 240 V | | | |
| **Opening release (MITOP low energy)** | | | | | |
| Power supply | | Direct current | | | |
| Threshold | | 0.6 A < I < 3 A | | | |
| Response time to the circuit breaker at Ur | | 50 ms (protection relay setting) | | | |
| **Opening release (MX)** | | | | | |
| Power supply | (Vac 50/60 Hz) | 24 | 48 | 100/130 | 200/250 |
| | (Vdc) | 24/30 | 48/60 | 100/130 | 200/250 |
| Threshold | | 0.7 to 1.1 Ur | | | |
| Consumption | (VA or W) | Pick-up: 200 (during 200 ms) | | | |
| | | Hold: 4.5 | | | |
| Response time to the circuit breaker at Ur | | 50 ms ± 10 | | | |
| **Closing release (XF)** | | | | | |
| Power supply | (Vac 50/60 Hz) | 24 | 48 | 100/130 | 200/250 |
| | (Vdc) | 24/30 | 48/60 | 100/130 | 200/250 |
| Threshold | | 0.85 to 1.1 Ur | | | |
| Consumption | (VA or W) | Pick-up: 200 (during 200 ms) | | | |
| | | Hold: 4.5 | | | |

PE57842




## Auxiliary 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 |

# Current transformers for SM6-24

## Synthesis table by unit

| Units | QMC | CVM | DM1-A | DM1-D DMVL-D | DM1-W | DM2 | GBC-A GBC-B | DMVL-A | DMV-A DMV-D | IMC | DM1-A DM1-D | DM1-W DM1-Z | GBC-A GBC-B | DMV-A DMV-D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 630 A | | | | | | | | 1250 A | | | |
| **TC** | | | | | | | | | | | | | | |
| ARJP1 | ■ | ■ | | | | | | | | | | | | |
| ARM3 | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| ARJP2 | | | | | | | | | ■ | ■ | | | | |
| ARJP3 | | | | | | | | | | | ■ | ■ | ■ | ■ |
| CLP2 | | | | ■ | | | | | | | | | | |
| TLP130 | | ■ | ■ | | ■ | | | | | | | | | |
| ARM4 | | | (*) | | | | (*) | | | | | | | |

PE60539

*ARJP1*

**Transformer ARJP1/N2F**
- characteristics according to IEC standard 61869-2
- single primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I1n (A) | | 10 | 20 | 30 | 50 | 75 | 100 | 150 | 200 |
| Ith (kA) | | 1.2 | 2.4 | 3.6 | 6 | 10 | 10 | 10 | 10 |
| t (s) | | 1 | | | | | | | |
| Measurement and protection | 5 A | 15 VA - class 0.5 | | | | | | | |
| | 5 A | 2.5 VA - 5P20 | | | | | | | |

PE60539

*ARJP1*

**Transformer ARJP1/N2F**
- characteristics according to IEC standard 61869-2
- single primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| | | | | | |
|---|---|---|---|---|---|
| I1n (A) | | 50 | 100 | 150 | 200 |
| Ith (kA) | | 6 | 10 | | |
| t (s) | | 1 | | | |
| Measurement and protection | 5 A | 15 VA - class 0.5 | | | |
| | 5 A | 2.5 VA - 5P20 | | | |

***Note:** please consult us for other characteristics.*

PE60536

*ARM3*

**Transformer ARM3/N2F**
- characteristics according to IEC standard 61869-2
- double primary winding
- single secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| I1n (A) | | 10/20 | 20/40 | 50/100 | 100/200 | 200/400 | 300/600 |
| Ith (kA) | | 5 | 12.5 | 12.5/21* | 12.5/25* | 12.5/25* | 25 |
| t (s) | | 1 | 0.8 | 1 | | | |
| Measurement and protection | 5 A | 7.5 VA - class 0.5 | | | | | |
| | 1 A | 1 VA - 10P30 | | | | | |
| | 5 A | 5 VA - 5P10 | | 5 VA - 5P15 | | | |

** For 5 A protection*

PE60535

*ARM4*

- characteristics according to IEC standard 61869-2
- double primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| | | | | | |
|---|---|---|---|---|---|
| I1n (A) | | 50/100 | 100/200 | 200/400 | 300/600 |
| Ith (kA) | | 14.5 | 25 | 25 | 25 |
| t (s) | | 1 | | | |
| Measurement and protection | 5 A | 30 VA - class 0.5 | | | |
| | 5 A | 5 VA - 5P15 | 7.5 VA - 5P15 | | |
| | 5 A | 7.5 VA - 5P10 | 15 VA - 5P10 | | |

**Transformer ARM4**
- characteristics according to IEC standard 61869-2
- single or double primary winding
- up to 3 secondary windings (for measure and/or for protection)
- rated highest voltage 7,2 - 12 - 17,5 - 24kV
- rated primary current up to 630A (for SM6 cubicles)
- secondary currents 5A or 1A
- version with one secondary winding: ARM4/N1F
- version with two secondary windings: ARM4/N2F
- version with three secondary windings: ARM4/N3F (*)

*(*) Consult us*

# Current transformers for SM6-24

PE60538

*ARJP2*

## Transformer ARJP2/N2F

- characteristics according to IEC standard 61869-2
- single primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| I1n (A) | | 50 | 100 | 200 | 400 | 600 |
|---|---|---|---|---|---|---|
| Ith (kA) | | 25 | | | | |
| t (s) | | 1 | | | | |
| Measurement and protection | 5 A | 10 VA class 0.5 | 15 VA class 0.5 | 15 VA class 0.5 | 15 VA class 0.5 | 20 VA class 0.5 |
| | 5 A | 2.5 VA 5P20 | 2.5 VA 5P20 | 5 VA 5P20 | 5 VA 5P20 | 7.5 VA 5P20 |

PE60537

*ARJP3*

## Transformer ARJP3/N2F

- characteristics according to IEC standard 61869-2
- single primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| I1n (A) | | 1000 | 1250 |
|---|---|---|---|
| Ith (kA) | | 25 | |
| t (s) | | 1 | |
| 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 | |

PE55661

## 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 |

PE57162

## 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 |

# Current transformers for SM6-36

PE57222

*Current transformer ARM6T*

## For units DM1-A, DM1-D, SM6-36, DM2, IMC, GBC-A, GBC-B

**Transformer ARM6T/N1 or N2**

- characteristics according to IEC standard 61869-2
- double primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| I1n (A) | | 50-100 | 75-150 | 100-200 | 150-300 | 200-400 | 300/600 | 1000/1250 |
|---|---|---|---|---|---|---|---|---|
| Ith (kA) | | 16 - 20 | | | | | | 25 |
| t (s) | | 1 | | | | | | 1 |
| Measurement and protection | 5 A | 7.5 VA - 15 VA - class 0.5 | | | | | | 30 VA - class 0.5 |
| | 5 A | 2.5 VA - 5 VA - 5P20 | | | | | | 10 VA - 5P20 |

PE58391

*Current transformer ARM9T*

## For units DM1-A, DM1-D, DM2

**Transformer ARM9T**

- characteristics according to IEC standard 61869-2
- double primary winding
- double secondary winding for measurement and protection.

**Short-time withstand current Ith (kA)**

| I1n (A) | | 1000/1250 |
|---|---|---|
| Ith (kA) | | 40 |
| t (s) | | 1 |
| Measurement and protection | 5 A | 30 VA - class 0.5 - Fs < 10 |
| | 5 A | 10 VA - 5P20 |

PE57162

*LPCT*

## Low Power Current Transformer (LPCT) for units DM1-A, SM6-36

**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.

| | **TLP 130** | **TLP 190** |
|---|---|---|
| Minimum rated primary current | 5 A | 5 A |
| Rated extended primary current | 1250 A | 2500 A |
| Secondary output | 22.5 mV - 100 A | 22.5 mV - 100 A |
| Accuracy class for measurement | 0.5 | 0.5 |
| Accuracy class for protection | 5P | 5P |
| Accuracy limit factor | 250 | 400 |
| Rated short time thermal current | 25 kA 1 s | 40 kA 1 s |
| Highest voltage (Um) | 0.72 kV | 0.72 kV |
| Rated power-frequency withstand | 3 kV | 3 kV |

# Voltage transformers for SM6-24

## Synthesis table by unit

| Units / VTs | CM | CVM | DM1-A | DM1-D DMVL-D | DM1-W | DM2 | GBC-A | GBC-B | DMVL-A | DMV-A | DMV-D | CM2 | TM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VRQ2-n/S1 | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| VRFR-n/S1 | | ■ | | | | | | | | ■ | ■ | | |
| VRC2/S1 | | | | | | | ■ | ■ | | | | ■ | |
| VRM3-n/S2 | | | | | | | ■ | ■ | | | | | |
| VCT24 | | | | | | | | | | | | | ■ |
| VRC1/S1 | | ■ | | | | | | | | | | | |

PE60526

*VRQ2*

## Transformer VRQ2n/S1 (phase-to-earth) 50 or 60 Hz

- characteristics according to IEC standard 61869-3.

| | | | | |
|---|---|---|---|---|
| Rated voltage (kV) | 24 | | | |
| Primary voltage (kV) | $10/\sqrt{3}$ | $15/\sqrt{3}$ | $15\text{-}20/\sqrt{3}$ | $20/\sqrt{3}$ |
| Secondary voltage (V) | $100/\sqrt{3}$ | | | |
| Thermal power (VA) | 250 | | | |
| Accuracy class | 0.5 | | | |
| Rated output for single primary winding (VA) | 30 | 30 | | 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 61869-3.

| | | |
|---|---|---|
| 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 | |

PE60527

*VRC2*

## Transformer VRC2/S1 (phase-to-phase) 50 or 60 Hz

- characteristics according to IEC standard 61869-3.

| | | | |
|---|---|---|---|
| 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 | | |

# Voltage transformers for SM6-24

PE55648

## Transformer VRM3-n/S2 (phase-to-earth and protected by fuses 0.3 A) 50 or 60 Hz

- characteristics according to IEC standard 61869-3.

| | | | | |
|---|---|---|---|---|
| | 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 | | |

PE60528

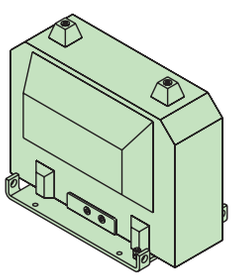
*VRC1*

## Transformer VRC1/S1 (phase-to-phase) 50 or 60 Hz

- characteristics according to IEC standard 61869-3.

| | | | | | |
|---|---|---|---|---|---|
| Rated voltage (kV) | 7.2 | | | | |
| Primary voltage (kV) | 3.3 | 5 | 5.5 | 6 | 6.6 |
| Secondary voltage (V) | 110 | 100 | 110 | 100 | 110 |
| Thermal power (VA) | 300 | | | | |
| Accuracy class | 0.5 | | | | |
| Rated output for single primary winding (VA) | 100 | | | | |

DE53562_LG

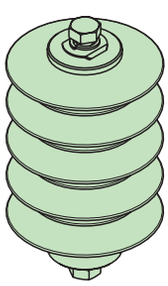


## Transformer VCT24 (phase-to-phase) 50 or 60 Hz

| | | | |
|---|---|---|---|
| Rated voltage (kV) | 24 | | |
| Primary voltage (kV) | 10 | 15 | 20 |
| Secondary voltage (V) | 220 | | |
| Output (VA) | 2500 | 2500 | 2500 |
| | | 4000 | 4000 |

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

DE58408_LG



## Surge arresters

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

| | | | | | |
|---|---|---|---|---|---|
| In (A) | 400/630 | | | | |
| Un (kV) | 7.2 | 10 | 12 | 17.5 | 24 |

***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.*

# Voltage transformers for SM6-36

PE57223

*Voltage transformer VRF3*

## For units CM, GBC-A, GBC-B

**Transformer VRF3n/S2** (phase-to-earth)
- single primary winding
- single secondary
- characteristics according to IEC standard 61869-3

| | | |
|---|---|---|
| Rated voltage (kV) | 36 | |
| Primary voltage (kV) | $30\sqrt{3}$ | $33\sqrt{3}$ |
| Secondary voltage (V) | $100\sqrt{3}$ | $100\sqrt{3}$ or $110\sqrt{3}$ |
| Thermal power (VA) | 450 | |
| Accuracy class | 0.5 | 3P |
| Rated output for single primary winding (VA) | 30-50 | 30 |

PE57224

*Voltage transformer VRC3*

## For units CM2

**Transformer VRC3/S1** (phase-to-phase)
- single primary winding
- single secondary
- characteristics according to IEC standard 61869-3

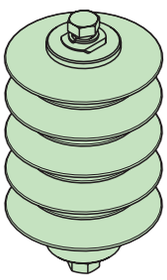
| | | |
|---|---|---|
| Rated voltage (kV) | 36 | |
| Primary voltage (kV) | 30 | 33 |
| Secondary voltage (V) | 100 | 100 or 110 |
| Thermal power (VA) | 700 | |
| Accuracy class | 0.5 | |
| Rated output for single primary winding (VA) | 50-100 | |

## For units TM

**Transformer VRC3/S1** (phase-to-phase)
- single primary winding
- single secondary
- characteristics according to IEC standard 61869-3

| | |
|---|---|
| Rated voltage (kV) | 36 |
| Primary voltage (kV) | 30 |
| Secondary voltage (V) | 220 |
| Thermal power (VA) | 1000 |

DE58408_LG



## Surge arresters

### For units IM, DM1-A, SM, GAM2

| | |
|---|---|
| In (A) | 630 |
| Un (kV) | 36 |

# Motors protection units

The current rating of fuses installed in units depends on:
- motor current rating In
- starting current Id
- 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
- Id/In ≤ 6
- pf = 0.8 (P ≤ 500 kW) or 0.9 (P > 500 kW)
- η = 0.9 (P ≤ 500 kW) or 0.94 (P > 500 kW).

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

**Example:**
Consider a 950 kW motor at 5 kV.

$$In = \frac{P}{\sqrt{3} \cdot U \cdot \eta \cdot pf} = 130\ A$$

Id = 6 x In = 780 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 CVM units

| Service voltage (kV) | Starting current (A) | Rated operational current (continous duty) (A) | Starting time (s) 5 | | 10 | | 30 | |
|---|---|---|---|---|---|---|---|---|
| | | | Number of starts per hour | | | | | |
| | **Id = 6 x Ie** | **Ie** | **3** | **6** | **3** | **6** | **3** | **6** |
| **3.3** | 1100 | 183 | 250 | 250 | 250 | | | |
| | 942 | 157 | 250 | 250 | 250 | 250 | 250 | 250 |
| | 785 | 131 | 200 | 200 | 200 | 200 | 200 | 250 |
| **6.6** | 628 | 105 | 160 | 160 | 160 | 200 | 200 | 200 |
| | 565 | 94 | 160 | 160 | 160 | 160 | 160 | 160 |
| | 502 | 84 | 125 | 160 | 160 | 160 | 160 | 160 |
| | 439 | 73 | 125 | 125 | 125 | 160 | 160 | 160 |
| | 377 | 63 | 100 | 125 | 100 | 125 | 125 | 160 |
| | 314 | 52 | 100 | 100 | 100 | 100 | 100 | 125 |
| | 251 | 42 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 188 | 31 | 80 | 100 | 100 | 100 | 100 | 100 |
| | 126 | 21 | 50 | 50 | 63 | 80 | 80 | 80 |

**Fuse selection method:**
- if Id ≥ 6 x Ie, use Id to select the fuses
- if Id < 6 x Ie, use Ie 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

PE57161

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, ≤1000 m altitude.

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

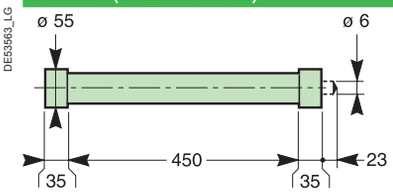
| Type of fuse | Service voltage (kV) | Transformer rating (kVA) 25 | 50 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 | Rated voltage (kV) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Solefuse (UTE NFC standards 13.100. 64.210)** | | | | | | | | | | | | | | | | | | | |
| | 5.5 | 6.3 | 16 | 31.5 | 31.5 | 63 | 63 | 63 | 63 | 63 | | | | | | | | | **7.2** |
| | 10 | 6.3 | 6.3 | 16 | 16 | 31.5 | 31.5 | 31.5 | 63 | 63 | 63 | 63 | | | | | | | |
| | 15 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 16 | 43 | 43 | 43 | 43 | 43 | 63 | | | | | |
| | 20 | 6.3 | 6.3 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 43 | 43 | 43 | 43 | 43 | 63 | | | | **24** |
| **Solefuse (general case, UTE NFC standard 13.200)** | | | | | | | | | | | | | | | | | | | |
| | 3.3 | 16 | 16 | 31.5 | 31.5 | 31.5 | 63 | 63 | 100 | 100 | | | | | | | | | **7.2** |
| | 5.5 | 6.3 | 16 | 16 | 31.5 | 31.5 | 63 | 63 | 63 | 80 | 80 | 100 | 125 | | | | | | |
| | 6.6 | 6.3 | 16 | 16 | 16 | 31.5 | 31.5 | 43 | 43 | 63 | 80 | 100 | 125 | 125 | | | | | |
| | 10 | 6.3 | 6.3 | 16 | 16 | 16 | 31.5 | 31.5 | 31.5 | 43 | 43 | 63 | 80 | 80 | 100 | | | | **12** |
| | 13.8 | 6.3 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 31.5 | 31.5 | 31.5 | 43 | 63 | 63 | 80 | | | | **17.5** |
| | 15 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 16 | 31.5 | 31.5 | 31.5 | 43 | 43 | 63 | 80 | | | | |
| | 20 | 6.3 | 6.3 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 31.5 | 31.5 | 31.5 | 43 | 43 | 63 | | | | **24** |
| | 22 | 6.3 | 6.3 | 6.3 | 6.3 | 16 | 16 | 16 | 16 | 16 | 31.5 | 31.5 | 31.5 | 43 | 43 | 63 | | | |
| **Fusarc CF and SIBA (1) (general case for QM, QMB and QMC cubicle according to IEC 62271-105)** | | | | | | | | | | | | | | | | | | | |
| | 3.3 | 16 | 25 | 40 | 50 | 50 | 80 | 80 | 100 | 125 | 125 | 160(1) | 200(1) | | | | | | **7.2** |
| | 5 | 10 | 16 | 31.5 | 40 | 40 | 50 | 63 | 80 | 80 | 125 | 125 | 160(1) | | | | | | |
| | 5.5 | 10 | 16 | 31.5 | 31.5 | 40 | 50 | 50 | 63 | 80 | 100 | 125 | 125 | 160(1) | 160(1) | | | | |
| | 6 | 10 | 16 | 25 | 31.5 | 40 | 50 | 50 | 63 | 80 | 80 | 125 | 125 | 160(1) | 160(1) | | | | |
| | 6.6 | 10 | 16 | 25 | 31.5 | 40 | 50 | 50 | 63 | 80 | 80 | 100 | 125 | 125 | 160(1) | | | | |
| | 10 | 6.3 | 10 | 16 | 20 | 25 | 31.5 | 40 | 50 | 50 | 63 | 80 | 80 | 100 | 100 | 125(1) | 200(1) | | **12** |
| | 11 | 6.3 | 10 | 16 | 20 | 25 | 25 | 31.5 | 40 | 50 | 50 | 63 | 80 | 100 | 100 | 125(1) | 160(1) | | |
| | 13.8 | 6.3 | 10 | 16 | 16 | 20 | 25 | 31.5 | 31.5 | 40 | 50 | 50 | 63 | 80 | 80 | 100(1) | 125(1) | 125(1) | **17.5** |
| | 15 | 6.3 | 10 | 10 | 16 | 16 | 20 | 25 | 31.5 | 40 | 50 | 50 | 63 | 80 | 80 | 100(1) | 125(1) | 125(1) | |
| | 20 | 6.3 | 6.3 | 10 | 10 | 16 | 16 | 25 | 25 | 31.5 | 40 | 40 | 50 | 50 | 63 | 80 | 100(1) | 125(1) | **24** |
| | 22 | 6.3 | 6.3 | 10 | 10 | 10 | 16 | 20 | 25 | 25 | 31.5 | 40 | 40 | 50 | 50 | 80 | 80 | 100(1) | |
| **Fusarc CF for dry type transformers (2)** | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | 10 | | 10 | 16 | 20 | 25 | 31.5 | 31.5 | 50 | 50 | 63 | 63 | | **36** |
| | 31.5 | | | | | 10 | | 10 | 16 | 20 | 25 | 25 | 31.5 | 50 | 50 | 63 | 63 | | |
| | 33 | | | | | 6.3 | | 10 | 16 | 20 | 25 | 25 | 31.5 | 40 | 50 | 50 | 63 | | |
| | 34.5 | | | | | 6.3 | | 10 | 16 | 20 | 25 | 25 | 31.5 | 40 | 50 | 50 | 63 | | |
| **Fusarc CF oil immersed type transformers (2)** | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | 10 | | 10 | 16 | 20 | 25 | 31.5 | 31.5 | 40 | 40 | 50 | 63 | | **36** |
| | 31.5 | | | | | 10 | | 10 | 16 | 20 | 25 | 31.5 | 31.5 | 40 | 40 | 50 | 63 | | |
| | 33 | | | | | 10 | | 10 | 16 | 20 | 25 | 25 | 31.5 | 31.5 | 40 | 40 | 50 | | |
| | 34.5 | | | | | 10 | | 10 | 16 | 20 | 25 | 25 | 31.5 | 31.5 | 40 | 40 | 50 | | |

*(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 manufactures and standards.*

# Protection of transformers

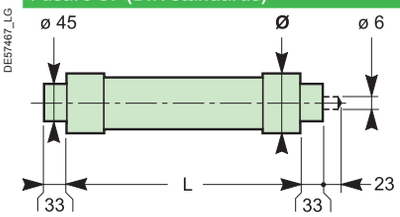
## Fuses dimensions

### Solefuse (UTE standards)



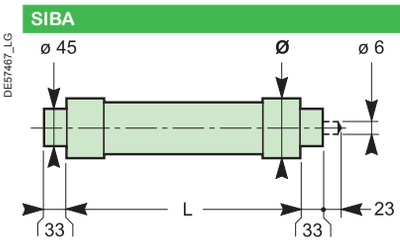

| Ur (kV) | Ir (A) | L (mm) | Ø (mm) | Weight (kg) |
|---|---|---|---|---|
| **7.2** | 6.3 to 125 | 450 | 55 | 2 |
| **12** | 100 | 450 | 55 | 2 |
| **17.5** | 80 | 450 | 55 | 2 |
| **24** | 6.3 to 63 | 450 | 55 | 2 |

### Fusarc CF (DIN standards)




| Ur (kV) | Ir (A) | L (mm) | Ø (mm) | Weight (kg) |
|---|---|---|---|---|
| **7.2** | 125 | 292 | 86 | 3.3 |
| **12** | 6.3 | 292 | 50.5 | 1.2 |
| | 10 | 292 | 50.5 | 1.2 |
| | 16 | 292 | 50.5 | 1.2 |
| | 20 | 292 | 50.5 | 1.2 |
| | 25 | 292 | 57 | 1.5 |
| | 31.5 | 292 | 57 | 1.5 |
| | 40 | 292 | 57 | 1.5 |
| | 50 | 292 | 78.5 | 2.8 |
| | 63 | 292 | 78.5 | 2.8 |
| | 80 | 292 | 78.5 | 2.8 |
| | 100 | 292 | 78.5 | 2.8 |
| **24** | 6.3 | 442 | 50.5 | 1.6 |
| | 10 | 442 | 50.5 | 1.6 |
| | 16 | 442 | 50.5 | 1.6 |
| | 20 | 442 | 50.5 | 1.6 |
| | 25 | 442 | 57 | 2.2 |
| | 31.5 | 442 | 57 | 2.2 |
| | 40 | 442 | 57 | 2.2 |
| | 50 | 442 | 78.5 | 4.1 |
| | 63 | 442 | 78.5 | 4.1 |
| | 80 | 442 | 86 | 5.3 |
| **36** | 10 | 537 | 50.5 | 1.8 |
| | 16 | 537 | 50.5 | 1.8 |
| | 25 | 537 | 57 | 2.6 |
| | 31.5 | 537 | 78.5 | 4.7 |
| | 40 | 537 | 78.5 | 4.7 |
| | 50 | 537 | 86 | 6.4 |
| | 63 | 537 | 86 | 6.4 |

### SIBA




| Ur (kV) | Ir (A) | L (mm) | Ø (mm) | Weight (kg) |
|---|---|---|---|---|
| **7.2** | 160 | 292 | 85 | 3.8 |
| | 200 | 292 | 85 | 5.4 |
| **12** | 125 | 292 | 67 | 2 |
| | 160 | 292 | 85 | 3.8 |
| | 200 | 292 | 85 | 3.8 |
| **17.5** | 125 | 442 | 85 | 5.4 |
| **24** | 100 | 442 | 85 | 5.4 |
| | 125 | 442 | 85 | 5.4 |

# 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 earthing 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 earth 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 earth 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:

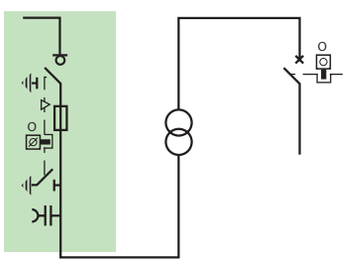
- **built-in padlocking** capacities (padlocks not supplied)
- **four knock-outs** that may be used for keylocks (supplied on request) for mechanism locking functions.

**Unit interlock**

| Units | Interlock | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | C1 | C4 | A3 | A4 | A5 | 50 | 52 | P1 | P2 | P3 | P5 |
| IM, IMB, IMC | | | | ■ | ■ | | | | ■ | | | |
| PM, QM, QMB, QMC, | ■ | ■ | ■ | | | | | | | | | |
| DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DMV-A, DMV-D, DMV-S, DMVL-A, DMVL-D | ■ | ■ | ■ | | | | ■ | | | | | |
| CVM | | ■ | | | | | | ■ | | | | |
| NSM | | | | ■ | | | | | ■ | | | |
| GAM | | | | ■ | | ■ | | | | | | ■ |
| SM | | | | | | | | | | ■ | ■ | |
| DM2 | | | | | | | ■ | | | | | |

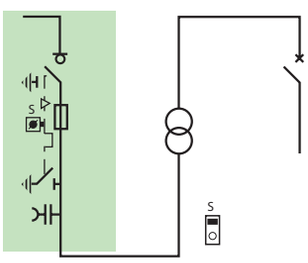
DE53565_LG

**A1 type**



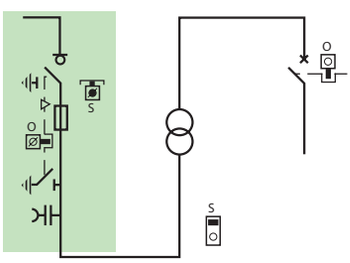

DE53566_LG

**C1 type**




DE53567_LG

**C4 type**




## 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.

MT20240EN

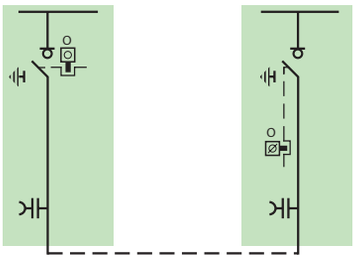
**Legend for key-type interlocks:**

no key — free key — captive key — panel or door

# Interlocks

## Ring units

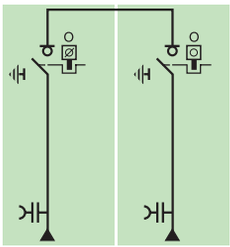
DE53568_LG **A3 type**



**Aim:**

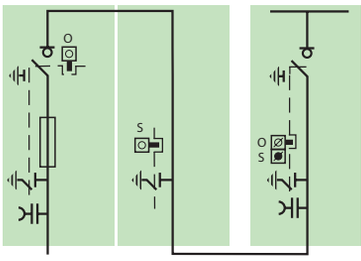
- to prevent the closing of the earthing switch of a load-side cubicle unless the line-side switch is locked "open".

DE53569_LG **A4 type**



- to prevent the simultaneous closing of two switches.

DE53570_LG **A5 type**



- 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.

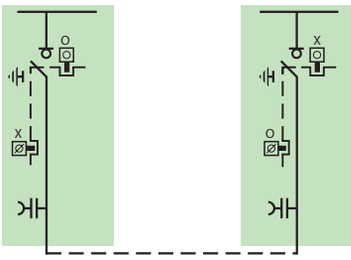
MT20240EN **Legend for key-type interlocks:**

no key | free key | captive key | panel or door

# Interlocks

DE53572_LG

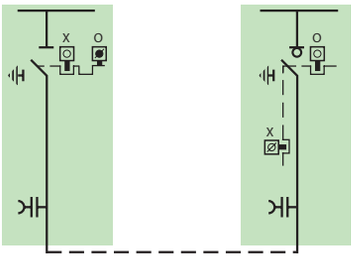
**P1 type**




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

DE53573_LG

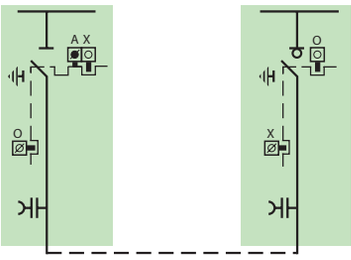
**P2 type**




- 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".

DE53574_LG

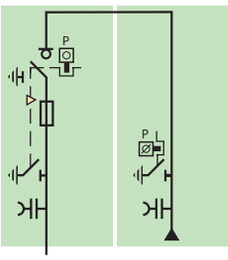
**P3 type**




- 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.

DE53575_LG

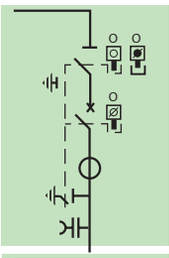
**P5 type**




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

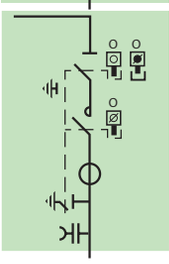
DE53571_LG

**50 type**




DE59203_LG

**Type 52**




## Functional interlocks

**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).

MT20240EN

**Legend for key-type interlocks:**

no key | free key | captive key | panel or door

# Notes

# Connections

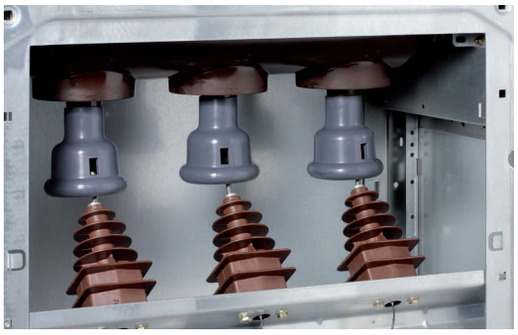
# Connections

## Contents

# Connections with dry-type cables for SM6-24

## Selection table

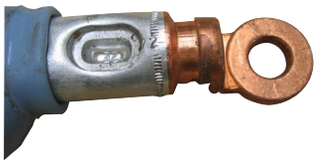
PE57840



### 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.

PE50775



*Round connector*

PE50776

*Square connector*

**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 mm$^2$
- square connection round shank for cables > 240 mm$^2$ 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 mm$^2$ for 1250 A incomer and feeder cubicles
- 240 mm$^2$ for 400-630 A incomer and feeder cubicles
- 120 mm$^2$ for contactor cubicles
- 95 mm$^2$ 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

| Performance | Cable end terminal type | X-section mm2 | Supplier | Number of cables | Comments |
|---|---|---|---|---|---|
| 3 to 24 kV<br>400 A - 630 A | Round connector | 50 to 240 mm$^2$ | All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc. | 1 or 2 per phase | For larger x-sections, more cables and other types of cable end terminals, please consult us |
| 3 to 24 kV<br>1250 A | Round connector | 50 to 630 mm$^2$ | All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc. | 1 or 2 per phase<br>⩽ 400 mm$^2$ | For larger x-sections, more cables and other types of cable end terminals, please consult us |
| | Square connector | > 300 mm$^2$ admissible | | 400 < 1 ⩽ 630 mm$^2$ per phase | |

## Three core, dry cable

### Short inner end, cold fitted

| Performance | Cable end terminal type | X-section mm2 | Supplier | Number of cables | Comments |
|---|---|---|---|---|---|
| 3 to 24 kV<br>400 A - 630 A | Round connector | 50 to 240 mm$^2$ | All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc. | 1 per phase | For larger x-sections, more cables and other types of cable end terminals, please consult us |
| 3 to 24 kV<br>1250 A | Round connector | 50 to 630 mm$^2$ | All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc. | 1 per phase | For larger x-sections, more cables and other types of cable end terminals, please consult us |

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

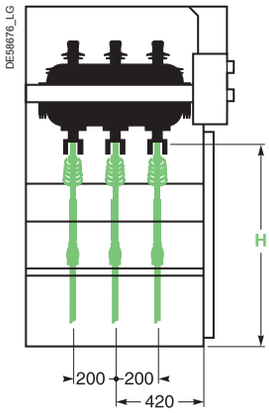
# Cable-connection from below for SM6-24

## Cable positions

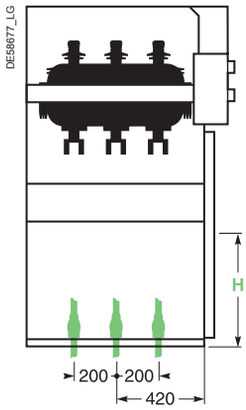
### Cable-connection height H measured from floor (mm)

| | 630 A | 1250 A |
|---|---|---|
| IM, NSM-cables, NSM-busbars | 945 | |
| SM | 945 | 945 |
| IMC | 400 | |
| PM, QM | 400 | |
| QMC | 400 | |
| CVM | 430 | |
| DM1-A | 430 | 320 |
| DMVL-A | 430 | |
| DMV-S | 320 | |
| DM1-W | 370 | 320 |
| GAM2 | 760 | |
| GAM | 470 | 620 |
| DMV-A | 320 | 313 |
| DM1-S | 543 | |

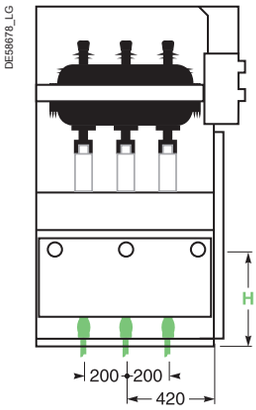
**IM, NSM-cables, NSM-busbars, SM**



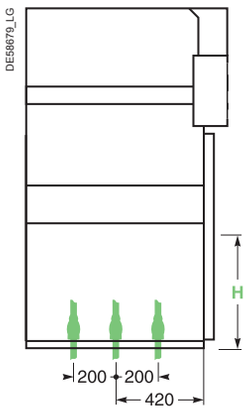

**IMC, PM, QM, QMC**



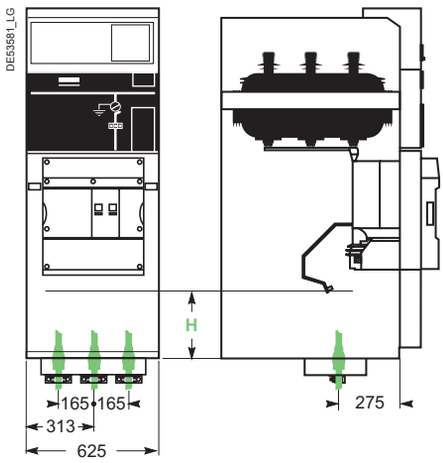

**CVM**



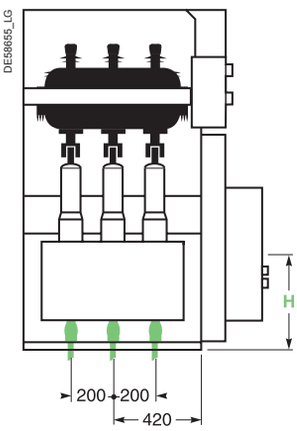

**GAM, GAM2**



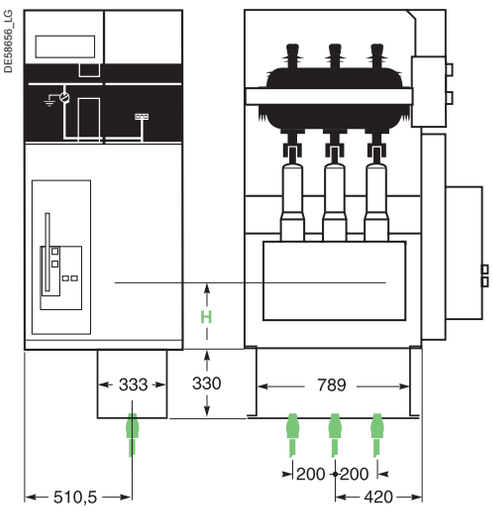

**DMV-A, DMV-S (630 A)**



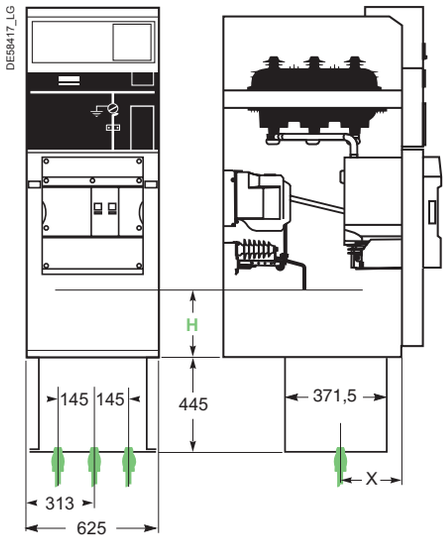

**DM1-A, DM1-S, DMVL-A DM1-W (630 A)**




**DM1-A, DM1-W (1250 A)**



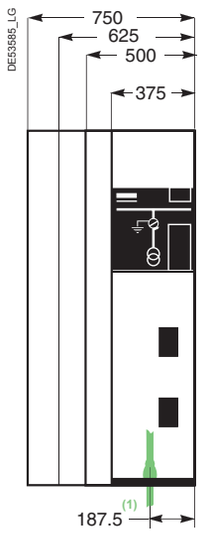

**DMV-A (1250 A)**




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

# Cable-connection from below for SM6-24

## Trenches depth




## For internal arc 12.5 kA 1s, IAC: A-FL

### Cabling from below

- **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 | | Units until 630 A | | | | | 1250 A units | | |
|---|---|---|---|---|---|---|---|---|---|
| Cable x-section ($mm^2$) | Bending radius (mm) | IM, SM, NSM-cables, NSM-busbars | IMC, DM1-A, DM1-W, DM1-S, DMVL-A, GAM | CRM CVM | DMV-A, DMV-S | PM, QM, QMC (1) | SM, GAM | DM1-A (2) DM1-W (2) | DMV-A (3) |
| | | Depth P (mm) all orientations | | | | | | | |
| | | P1 | P2 | P2 | P2 | P3 | P4 | P5 | P6 |
| 50 | 370 | 140 | 400 | 400 | 500 | 350 | | | |
| 70 | 400 | 150 | 430 | 430 | 530 | 350 | | | |
| 95 | 440 | 160 | 470 | 470 | 570 | 350 | | | |
| 120 | 470 | 200 | 500 | 500 | 600 | | | | |
| 150 | 500 | 220 | 550 | | 650 | | | | |
| 185 | 540 | 270 | 670 | | 770 | | | | |
| 240 | 590 | 330 | 730 | | 830 | | | | |
| 400 | 800 | | | | | | 1000 | 1350 | 1450 |
| 630 | 940 | | | | | | 1000 | 1350 | 1450 |

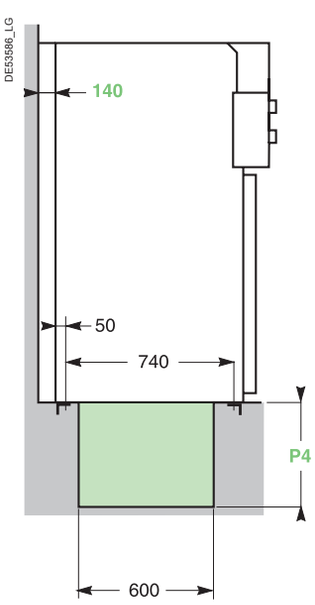
*(1) Must be installed with a 100 mm depth metal pan.*
*(2) Must be installed with a 350 mm depth metal pan, in a floor void.*
*(3) Mounting with a 445 mm depth metal pan compulsory in a floor void.*

***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.*

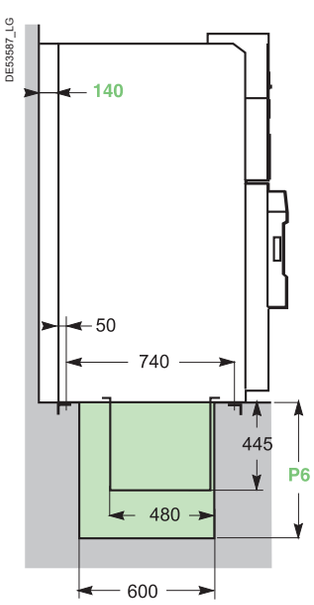
### Cable trench drawings

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

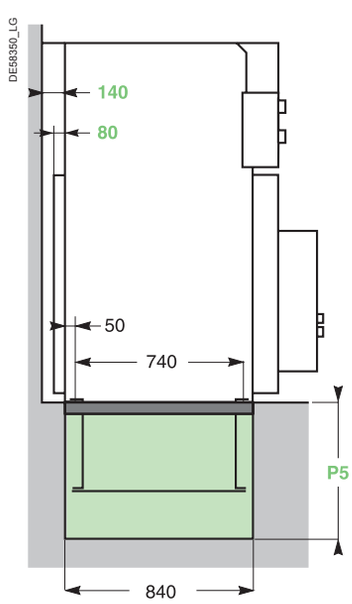
**SM, GAM**
For single and tri-core cables




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

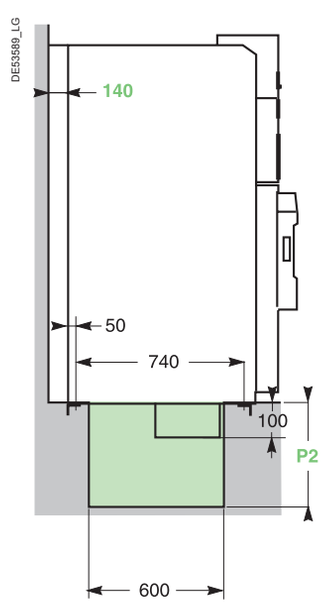



**DM1-A, DM1-W**
For single-core cables



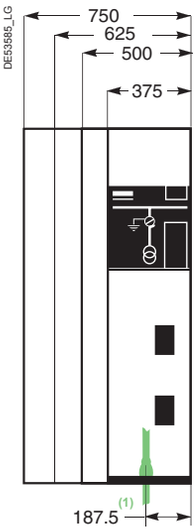

**630 A units**

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



# Cable-connection from below for SM6-24

## Trenches depth




*(1) Except DMV-A and DMV-S*

## For internal arc 12.5 kA 1s, IAC: A-FLR
## 16 and 20 kA 1s, IAC: A-FL/A-FLR

### Cabling from below

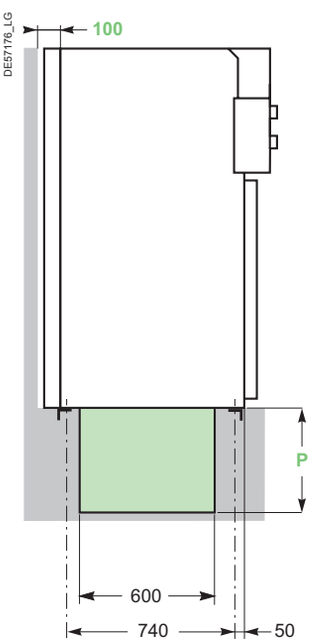
- **Through trenches:** the trench depth **P** is given in the following table for usual dry single-core cables type (for tri-core cables consult us).
- **With stands:** to reduce depth **P** or avoid trenches, by placing the units on 400 mm concrete footings.
- **With floor void:** the trench depth is given in the following table for usual types of cables.

| | 630 A | | | | | | | 1250 A | |
|---|---|---|---|---|---|---|---|---|---|
| | All cubicles except: | | Other cubicles | | | | | | |
| | | | DMVA | CVM | | DM1A, DM1S, DM1W, DMVLA | | SM, GAM | DM1A, DMV-A, DM1-W |
| **IAC** | 12.5 kA/1s | 16 kA/1s | 12-16 kA/1s | 12.5 kA/1s | 16 kA/1s | 12.5 kA/1s | 16 kA/1s | 12-16 kA/1s | 12-16 kA/1s |
| **Cable section ($mm^2$)** | **Depth P (mm)** | | | | | | | | |
| **S < 120** | 330 | 550 | 550 | 330 | 550 | 330 | 550 | – | – |
| **120 < S < 240** | 330 | 550 | 800 | – | – | 330; cables coming other side of the circuit breaker | 450; cables coming under the circuit breaker | 550 | – | – |
| **S > 400** | – | – | – | – | – | – | – | – | 1000 | 1400 |

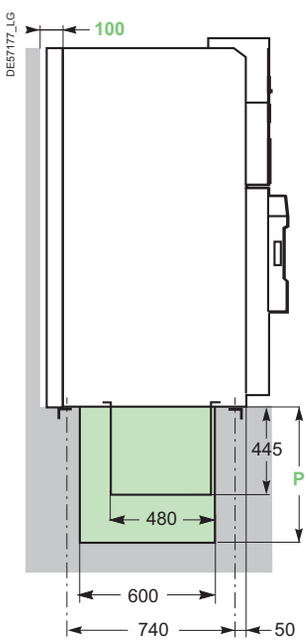
### Cable trench drawings

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

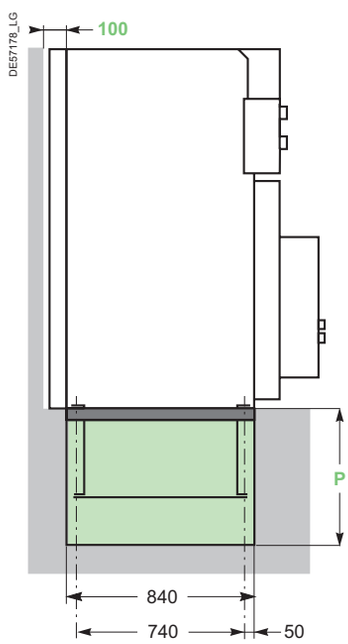
**SM, GAM**
For single and tri-core cables




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

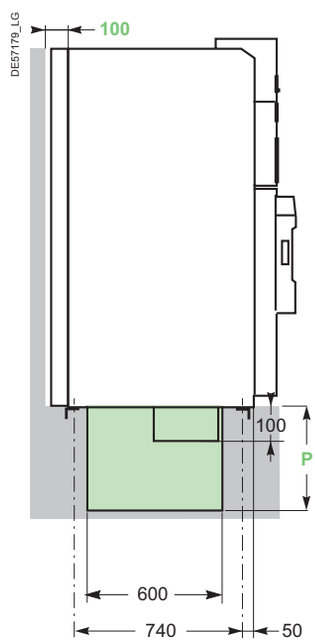



**DM1-A, DM1-W**
For single-core cables




**630 A units**

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



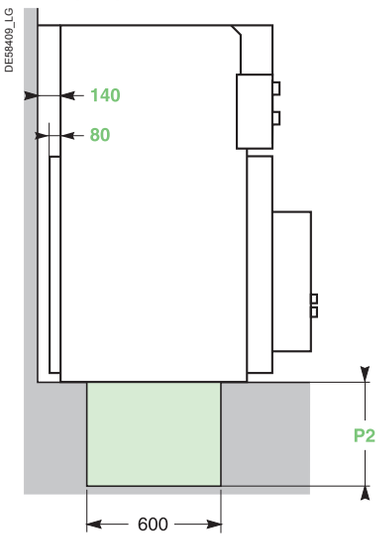
# Cable-connection from below for SM6-24

## Trench diagrams example

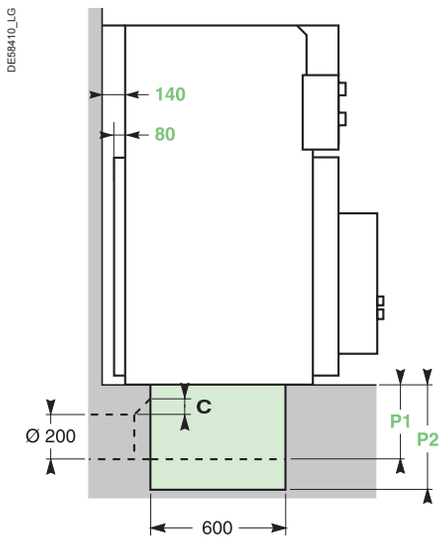
## For internal arc 12.5 kA 1s, IAC: A-FL

**Units represented without switchboard side panels**

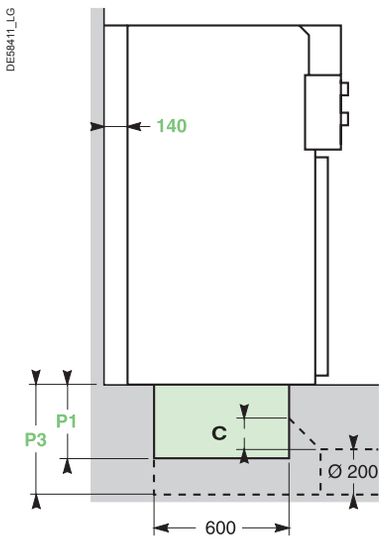
**630 A units**
Cable entry or exit
through right or left side

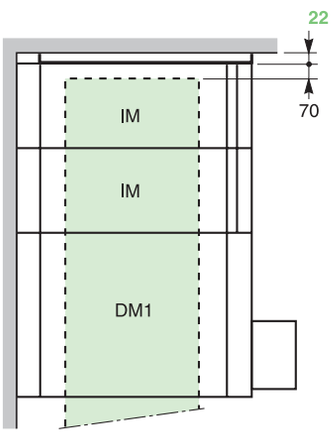


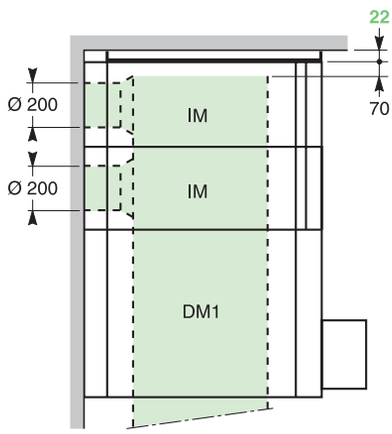

**630 A units**
Rear entry or exit
with conduits

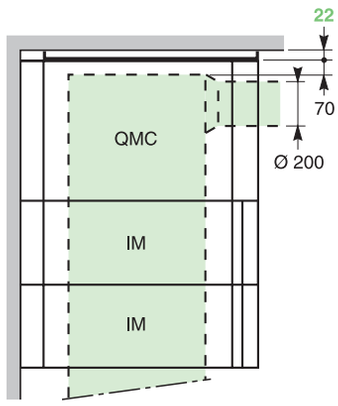



**630 A units**
Front entry or exit
with conduits



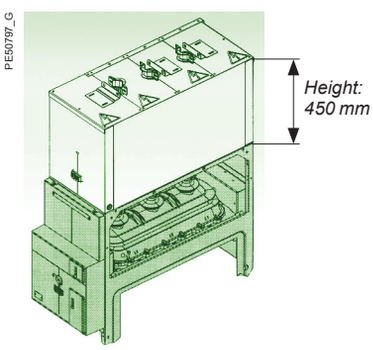




**Required dimensions (mm)**

***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 enclosure, the connection is made with dry-type and single-core cables.

***Remarks:***
- *Not available for internal arc IEC 62271-200.*
- *Not available in 1250 A.*

# Cable-connection from below for SM6-24

## Trench diagrams example

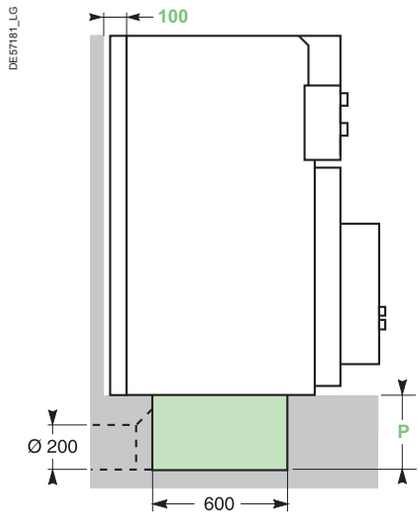
### For internal arc 12.5 kA 1s, IAC: A-FLR
### 16 and 20 kA 1s, IAC: A-FL/ A-FLR

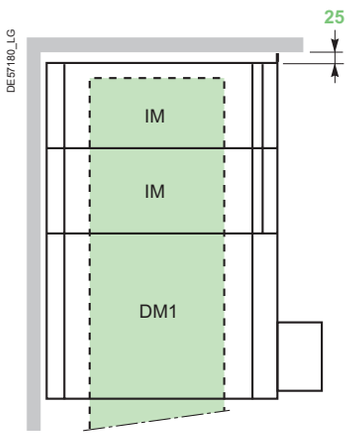
**Units represented without switchboard side panels**

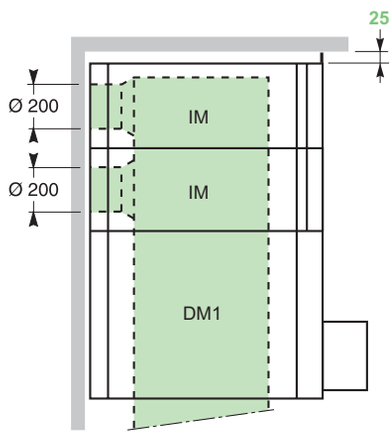
**630 A units**
Cable entry or exit
through right or left side

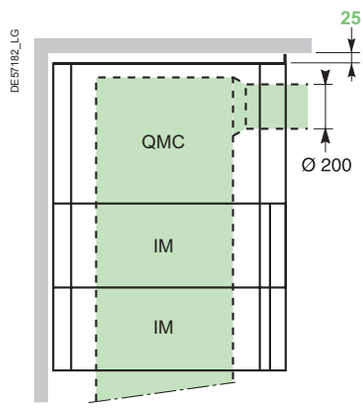
**630 A units**
Rear entry or exit
with conduits

**630 A units**
Front entry or exit
with conduits

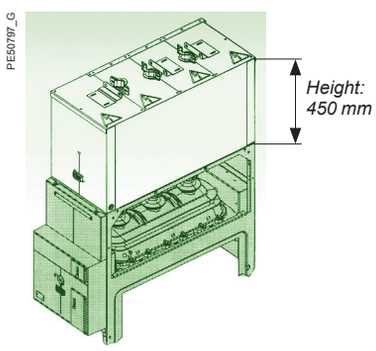



**Required dimensions (mm)**




## Cabling from above

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

***Remarks:***
- *Not available for internal arc IEC 62271-200.*
- *Not available in 1250 A.*

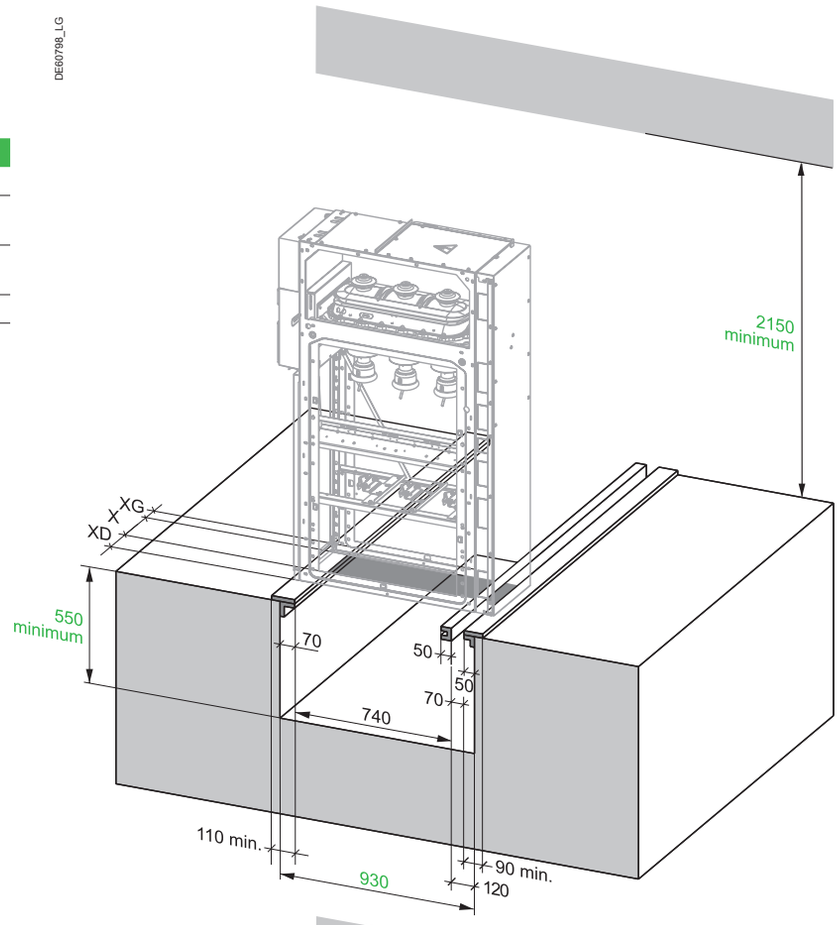
# Cable-connection from below for SM6-24

## Trench diagrams and floor void drawings example

### Installation with floor void for 16 kA 1 s downwards exhaust

- Area free of obstructions:

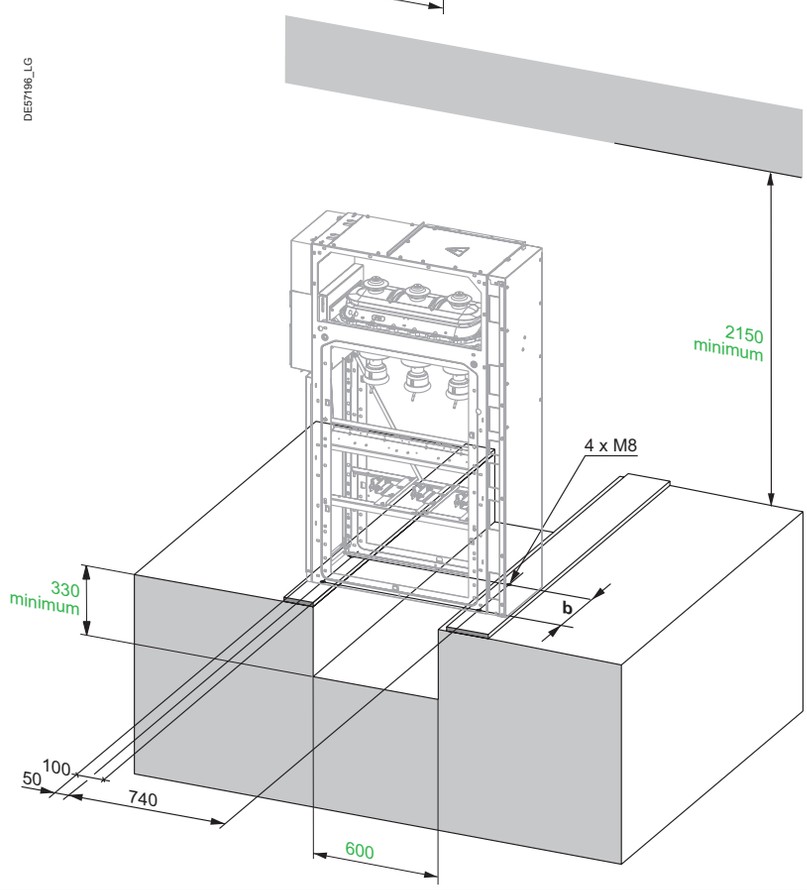
| Width | Cubicles | XG (mm) | X (mm) | XD (mm) |
|---|---|---|---|---|
| 375 | All | 57.5 | 260 | 57.5 |
| 500 | GAM<br>Other | 57.5<br>182.5 | 260<br>260 | 182.5<br>57.5 |
| 625 | QMC<br>Other | 307.5<br>57.5 | 260<br>510 | 57.5<br>57.5 |
| 750 | All | 432.5 | 260 | 57.5 |




### Installation with cable trench for 12.5 kA 1 s downwards exhaust for 16 kA 1 s and 20 kA 1 s upwards exhaust

- Position of fixing holes **b** depends on the width of the unit:

| Cubicle width (mm) | b (mm) |
|---|---|
| 125 | 95 |
| 375 | 345 |
| 500 | 470 |
| 625 | 595 |
| 750 | 720 |



# Connections with dry-type cables for SM6-36

## Selection table

| Single-core cables | | Units 630 A | |
|---|---|---|---|
| Cable-section ($mm^2$) | Bending radius (mm) | IM, IMC, QM, CM, CM2, PM, DM1-A, GAM, GAM2, SM, TM | |
| | | Depth **P** (mm) | |
| | | **P1** | **P2** |
| 1 x 35 | 525 | 350 | 550 |
| 1 x 50 | 555 | 380 | 580 |
| 1 x 70 | 585 | 410 | 610 |
| 1 x 95 | 600 | 425 | 625 |
| 1 x 120 | 630 | 455 | 655 |
| 1 x 150 | 645 | 470 | 670 |
| 1 x 185 | 675 | 500 | 700 |
| 1 x 240 | 705 | 530 | 730 |

***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.*

### 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 $mm^2$.

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 x (1 x 240 $mm^2$ per phase) for 1250 A incomer and feeder cubicles
- 240 $mm^2$ for 630 A incomer and feeder cubicles
- 95 $mm^2$ for transformer protection cubicles with fuses.

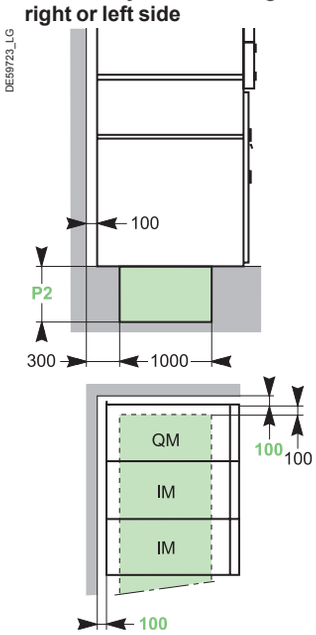
Access to the compartment is interlocked with the closing of the earthing disconnector.
The reduced cubicle depth makes it easier to connect all phases.
A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.
*(*) Consult us for alu cable cross sections*

## Cabling from below

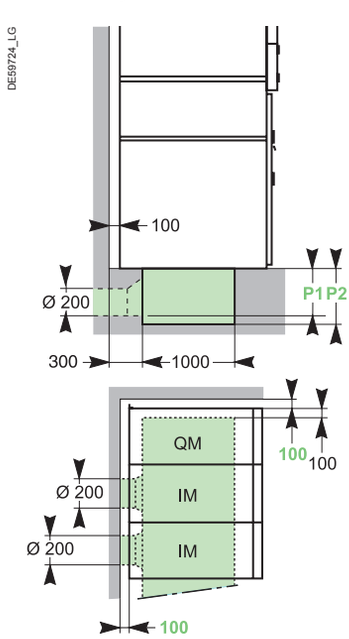
All units through trenches
- the trench depth P is given in the table opposite for commonly used types of cables.

## Trench diagrams

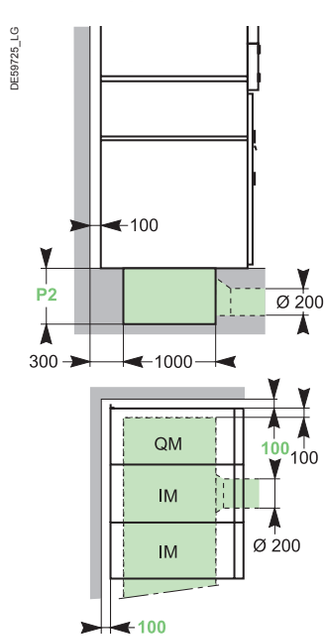
**Cable entry or exit through right or left side**




**Rear entry or exit with conduits**




**Front entry or exit with conduits**

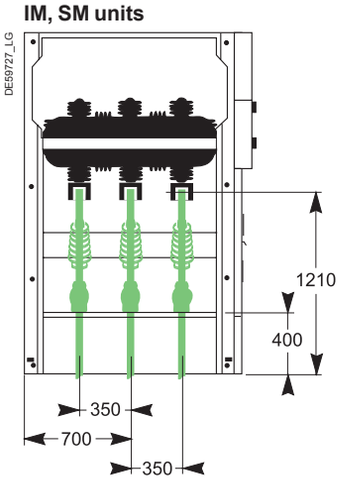


# Cable-connection from below for SM6-36

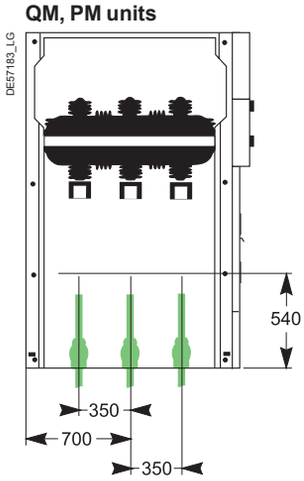
## Cable positions

### Side view

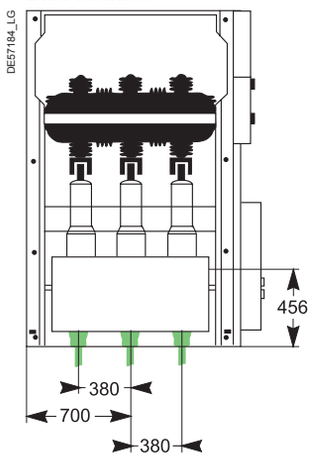
**IM, SM units**



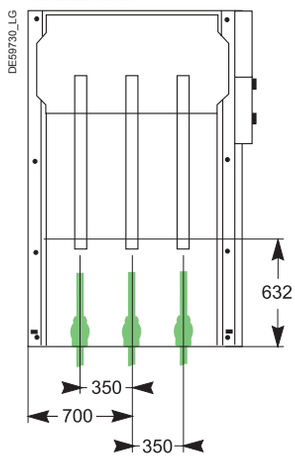

**QM, PM units**




**DM1-A units**

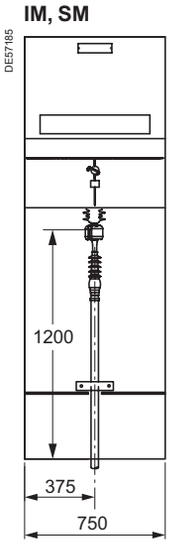



**GAM2 unit**

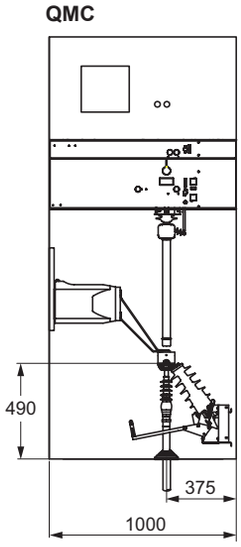



### Front view

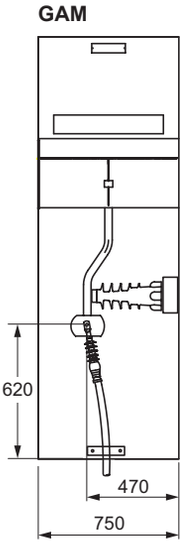
**IM, SM**



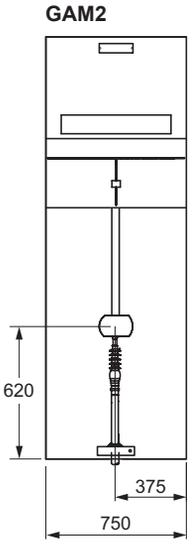

**QMC**



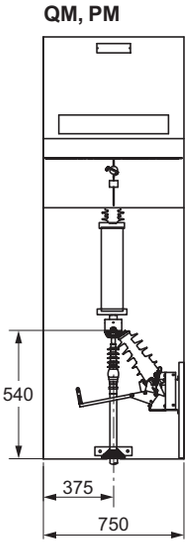

**GAM**



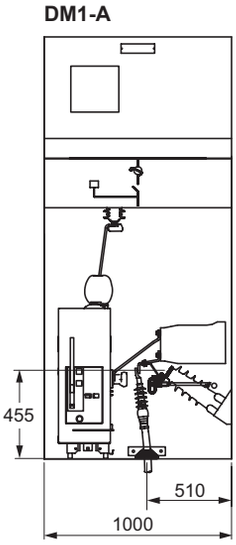

**GAM2**




**QM, PM**




**DM1-A**



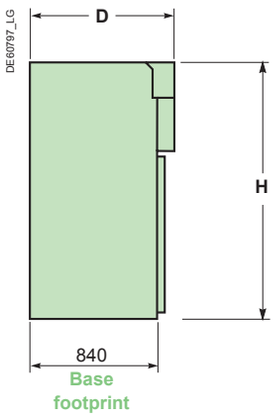
# Notes

# Installation

# Installation

## Contents

# Dimensions and weights for SM6-24

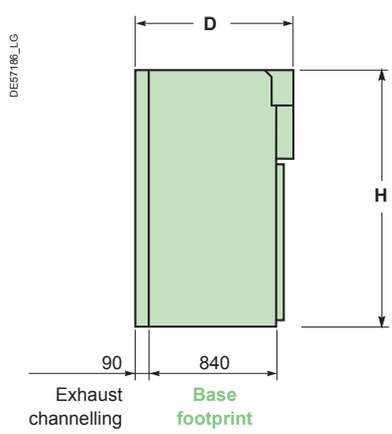



## For internal arc 12.5 kA 1s, IAC: A-FL

### Dimensions and weights

| Unit type | Height | Width | Depth | Weight |
|---|---|---|---|---|
| | H (mm) | (mm) | D (mm) | (kg) |
| IM,IMB | 1600 (1) | 375/500 | 940 | 120/130 |
| IMC | 1600 (1) | 500 | 940 | 200 |
| PM, QM, QMB | 1600 (1) | 375/500 | 940 | 130/150 |
| QMC | 1600 (1) | 625 | 940 | 180 |
| CRM, CVM | 2050 | 750 | 940 | 390 |
| DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D | 1600 (1) | 750 | 1220 | 400 |
| DM1-S | 1600 (1) | 750 | 1220 | 340 |
| DMV-A, DMV-D | 1695 (1) | 625 | 940 | 340 |
| DMV-S | 1600 (1) | 625 | 940 | 260 |
| CM | 1600 (1) | 375 | 940 | 190 |
| CM2 | 1600 (1) | 500 | 940 | 210 |
| GBC-A, GBC-B | 1600 | 750 | 1020 | 290 |
| NSM-cables, NSM-busbars | 2050 | 750 | 940 | 260 |
| GIM | 1600 | 125 | 840 | 30 |
| GEM (2) | 1600 | 125 | 920/1060 (2) | 30/35 (2) |
| GBM | 1600 | 375 | 940 | 120 |
| GAM2 | 1600 | 375 | 940 | 120 |
| GAM | 1600 | 500 | 1020 | 160 |
| SM | 1600 (1) | 375/500 (3) | 940 | 120/150 (3) |
| TM | 1600 | 375 | 940 | 200 |
| DM1-A, DM1-D, DM1-W, DM1-Z (1250 A) | 1600 | 750 | 1220 | 420 |

**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.*




## For internal arc 12.5 kA 1s, IAC: A-FLR 16 and 20 kA 1s, IAC: A-FL/ A-FLR

### Dimensions and weights

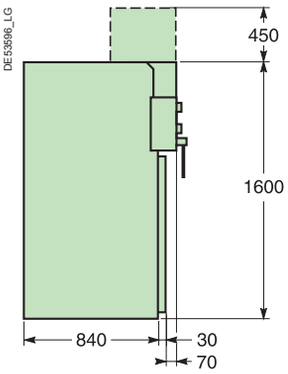
| Unit type | Height | Width | Depth | Weight |
|---|---|---|---|---|
| | H (mm) | (mm) | D (mm) | (kg) |
| IM,IMB | 1600 (1) | 375/500 | 1030 | 130/140 |
| IMC | 1600 (1) | 500 | 1030 | 210 |
| PM, QM, QMB | 1600 (1) | 375/500 | 1030 | 140/160 |
| QMC | 1600 (1) | 625 | 1030 | 190 |
| CVM | 2050 | 750 | 1030 | 400 |
| DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D | 1600 (1) | 750 | 1230 | 410 |
| DM1-S | 1600 (1) | 750 | 1230 | 350 |
| DMV-A, DMV-D | 1695 (1) | 625 | 1115 | 350 |
| DMV-S | 1600 (1) | 625 | 1115 | 270 |
| CM | 1600 (1) | 375 | 1030 | 200 |
| CM2 | 1600 (1) | 500 | 1030 | 220 |
| GBC-A, GBC-B | 1600 (1) | 750 | 1030 | 300 |
| NSM-cables, NSM-busbars | 2050 | 750 | 1030 | 270 |
| GIM | 1600 | 125 | 930 | 40 |
| GEM (2) | 1600 | 125 | 930/1060 (2) | 40/45 |
| GBM | 1600 | 375 | 1030 | 130 |
| GAM2 | 1600 | 375 | 1030 | 130 |
| GAM | 1600 | 500 | 1030 | 170 |
| SM | 1600 (1) | 375/500 (3) | 1030 | 130/160 |
| TM | 1600 | 375 | 1030 | 210 |
| DM1-A, DM1-D, DM1-W, DM1-Z (1250 A) | 1600 (1) | 750 | 1230 | 430 |

*(1) Add to height 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 930 mm is required.*
*(3) For the 1250 A unit.*

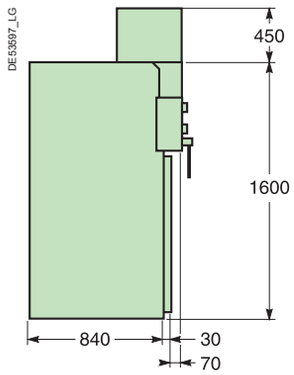
# Units dimensions for SM6-24

## For internal arc 12.5 kA 1s, IAC: A-FL

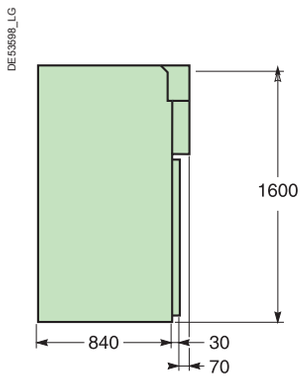
**IM, IMB, PM, QM, QMB, SM, IMC, QMC, CM, CM2**



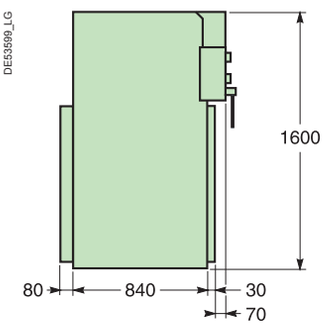

**NSM-cables, NSM-busbars, CRM, CVM**



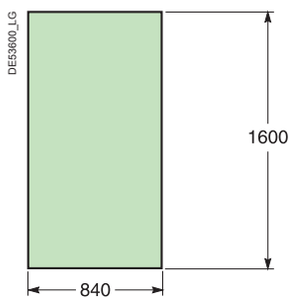

**GBM, GAM2**



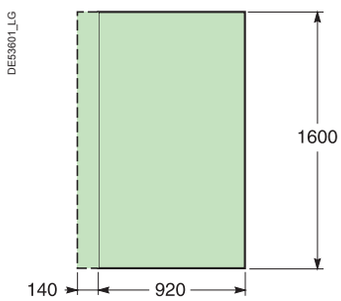

**GAM**



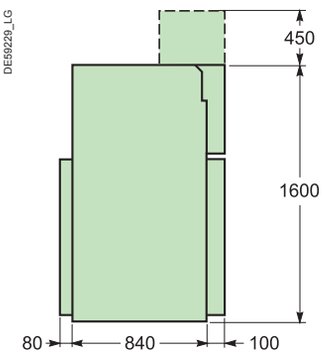

**GIM**



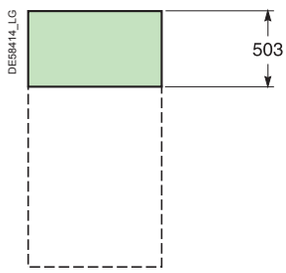

**GEM**




**GBC-A, GBC-B**



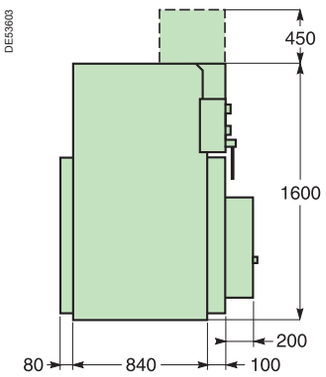

**EMB**



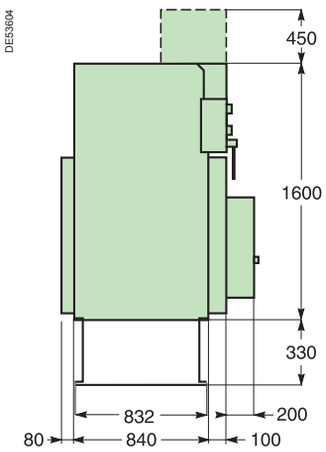
# Units dimensions for SM6-24

## For internal arc 12.5 kA 1s, IAC: A-FL

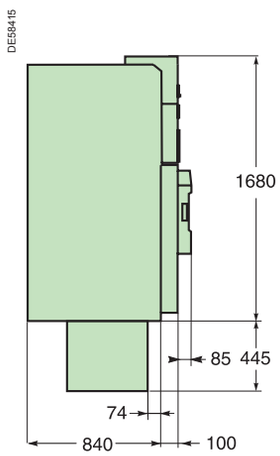
**DMVL-A, DMVL-D, DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 630 A**



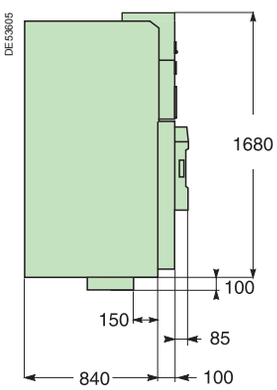

**DM1-A, DM1-W 1250 A**



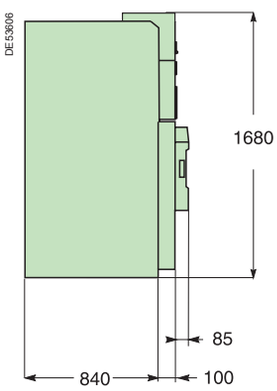

**DMV-A 1250 A**



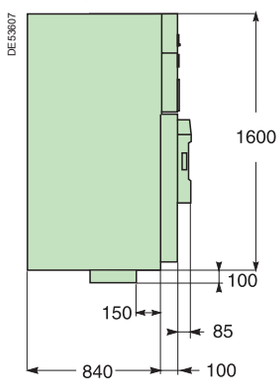

**DMV-A 630 A**




**DMV-D**



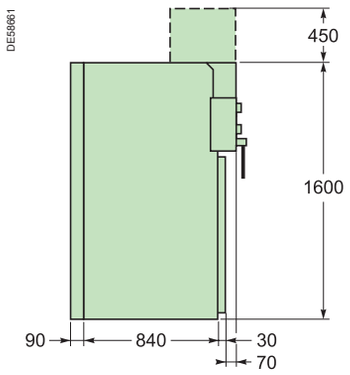

**DMV-S**



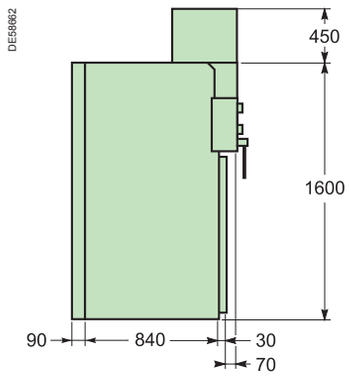
# Units dimensions for SM6-24

## For internal arc 12.5 kA 1s, IAC: A-FLR 16 and 20 kA 1s, IAC: A-FL/A-FLR

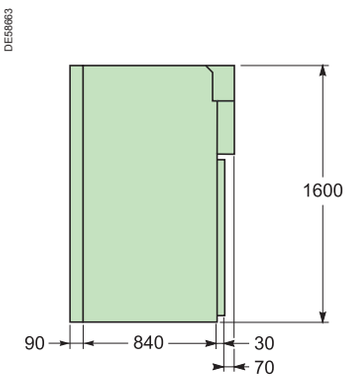
**IM, IMB, PM, QM, QMB, SM, IMC, QMC, CM, CM2**



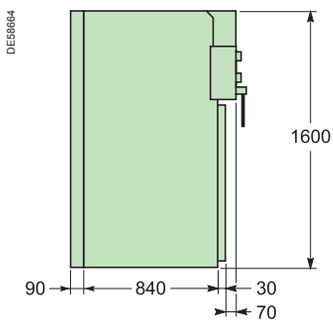

**NSM-cables, NSM-busbars, CVM**



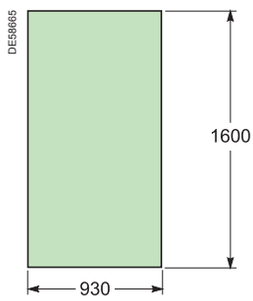

**GBM, GAM2**



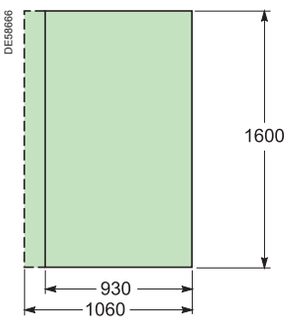

**GAM**



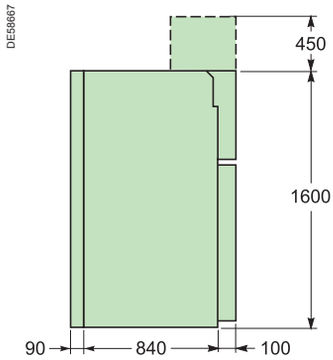

**GIM**



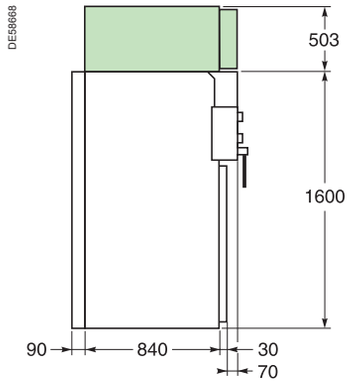

**GEM**




**GBC-A, GBC-B**



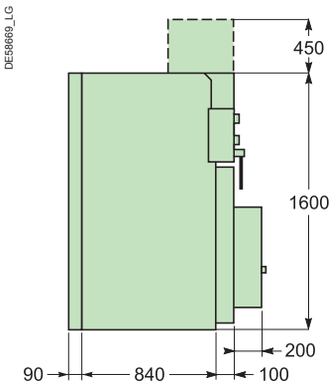

**IM with EMB option**



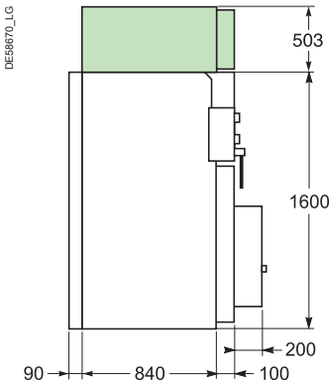
# Units dimensions for SM6-24

## For internal arc 12.5 kA 1s, IAC: A-FLR
## 16 and 20 kA 1s, IAC: A-FL/ A-FLR

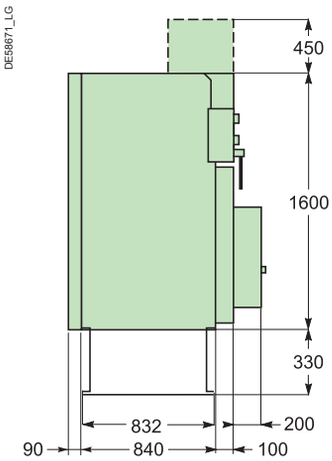
**DMVL-A, DMVL-D, DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 630 A**



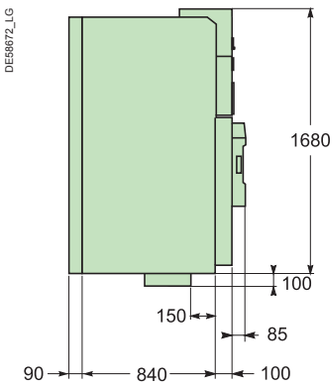

**DM1-A 630 A with EMB option**



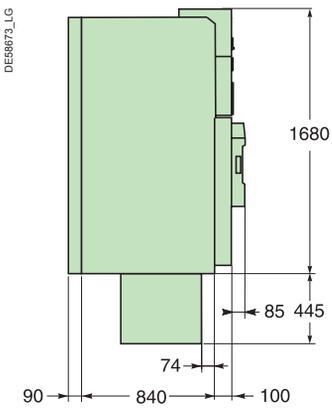

**DM1-A, DM1-W 1250 A**



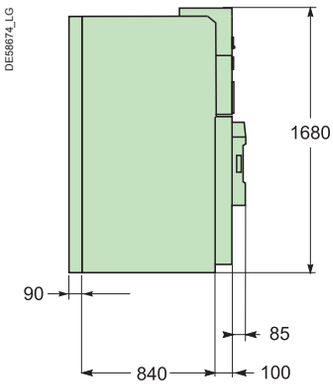

**DMV-A 630 A**



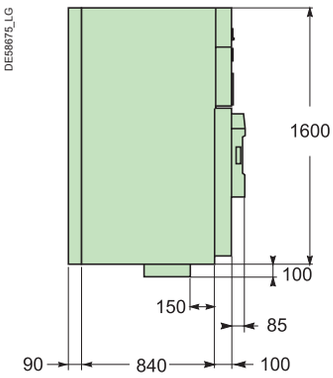

**DMV-A 1250 A**




**DMV-D**




**DMV-S**

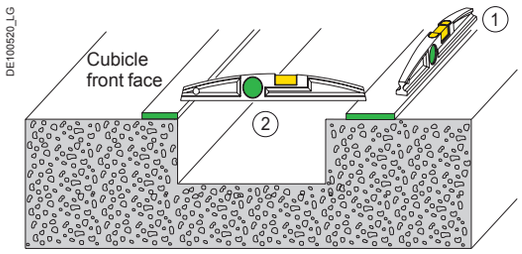


# Civil engineering for SM6-24

## Ground preparation

To obtain the internal arc performance, ground implementation must comply with the following requirements:
- Straightness: 2 mm / 3 m (Rep.1)
- Flatness: 3 mm maximum (Rep.2)

All the elements allowing the evacuation of the gas (duct, casing, etc.) must be able to bear a load of 250 kg/m$^2$.




## 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 to the ground
- In circuit-breaker or contactor units, fixing devices are installed on the opposite side of the switchgear.

# Layout examples for SM6-24

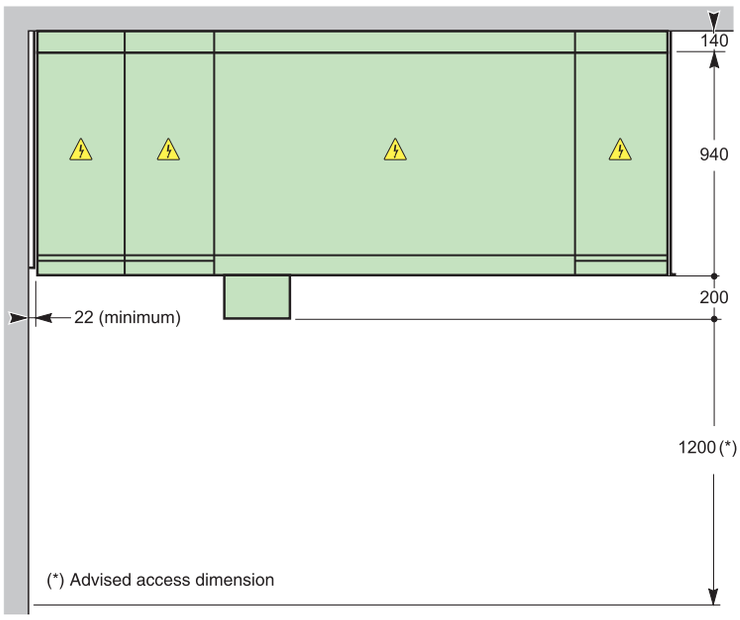
## Prefabricated substation (Kiosk)

PE57168

## Position of cubicles in a substation

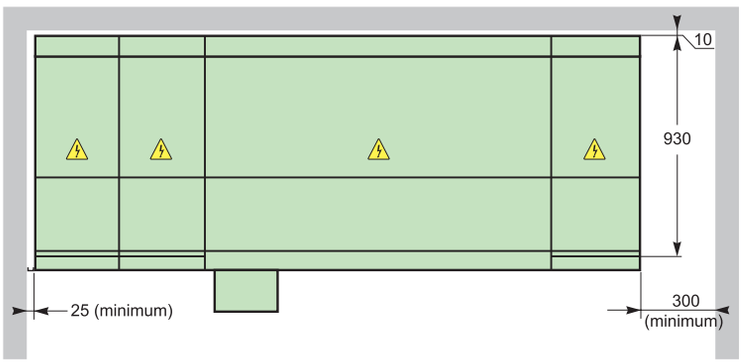
### Installation of a switchboard classified IAC 12.5 kA 1s: A-FL Conventional substation (Masonery)

DE58416EN_LG



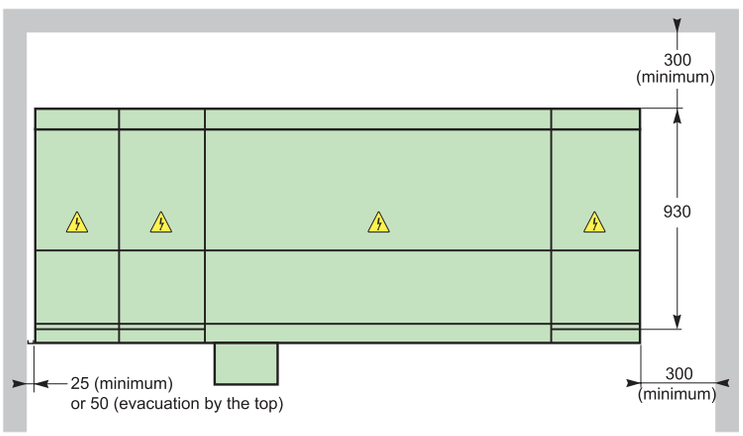

### Installation of a switchboard classified IAC 16/20 kA 1s: A-FL with downwards exhaust

DE58657_LG




### Installation of a switchboard classified IAC: A-FLR with downwards exhaust

DE58658EN_LG



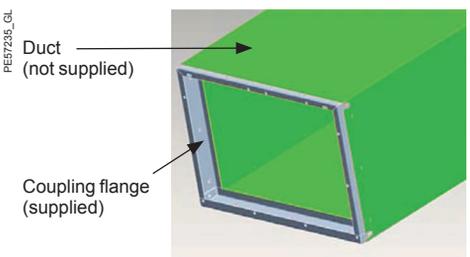
# Layout examples for SM6-24

## Evacuation duct

To enable the evacuation of gases by the top, users must install a conduit fixed to the coupling flange at right or left of the switchboard. For IP3X protection performance, a flap must be installed with this coupling flange on the lateral side of the cubicle duct. The end of the duct must block water, dust, moisture, animals, etc. from entering and at the same time enable the evacuation of gases into a dedicated area through a device situated at the outer end of the duct (not supplied).

**Evacuation duct example**

The evacuation duct must be made of metal sheet of sufficient thickness to withstand pressure and hot gases.




## Installation of a switchboard classified IAC: A-FL & A-FLR with upwards exhaust left side (ceiling height ⩾ 2150 mm)

# Dimensions and weights for SM6-36

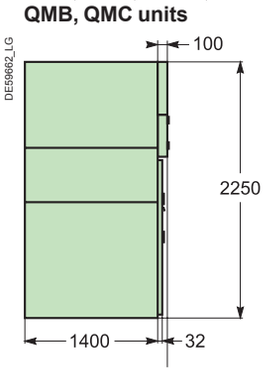
## Dimensions and weights

| Unit type | Height | Width | Depth (1) | Weight |
|---|---|---|---|---|
| | (mm) | (mm) | (mm) | (kg) |
| IM, SM | 2250 | 750 | 1400 (3) | 310 |
| IMC, IMB | 2250 | 750 | 1400 (2) | 420 |
| QM, PM, QMB | 2250 | 750 | 1400 (3) | 330 |
| QMC | 2250 | 1000 | 1400 (3) | 420 |
| DM1-A | 2250 | 1000 | 1400 (2) | 600 |
| DM1-D | 2250 | 1000 | 1400 (2) | 560 |
| GIM | 2250 | 250 | 1400 | 90 |
| DM2 | 2250 | 1500 | 1400 (2) | 900 |
| CM, CM2 | 2250 | 750 | 1400 (2) | 460 |
| GBC-A, GBC-B | 2250 | 750 | 1400 (3) | 420 |
| GBM | 2250 | 750 | 1400 (3) | 260 |
| GAM2 | 2250 | 750 | 1400 (3) | 250 |
| GAM | 2250 | 750 | 1400 (3) | 295 |
| GFM | 2250 | 250 | 1400 | 100 |

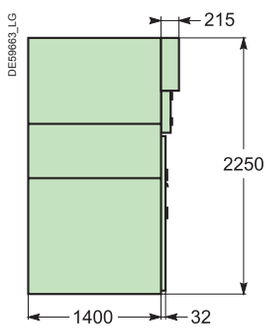
*(1) The depth measures are given for the floor surface.*
*(2) The depth in these units are 1615 mm with the enlarged low voltage compartment.*
*(3) The depth in these units are 1500 mm with the standard low voltage compartment.*

## Dimensions

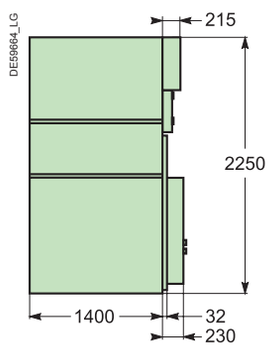
**IM, SM, IMC, QM, PM, IMB, GBM, GAM, GAM2, GBC-A,GBC-B QMB, QMC units**




**CM, CM2 units**



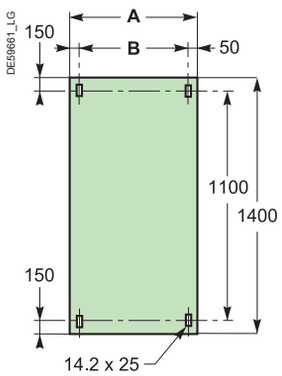

**DM1-A, DM1-D, DM2 units**



# Civil engineering for SM6-36

## 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.

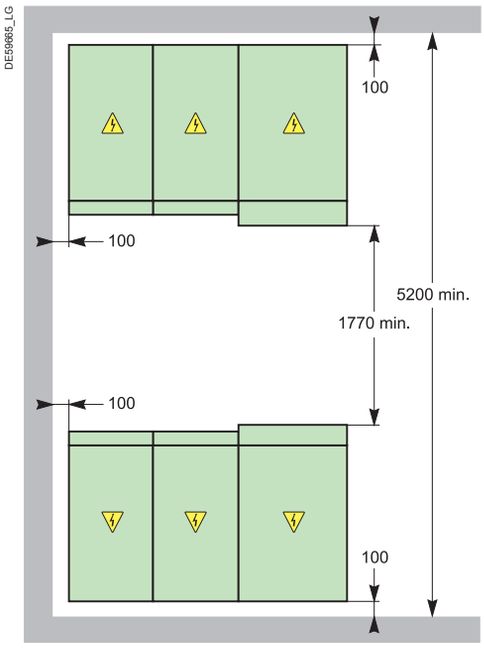
**On the ground**
- for switchboards comprising up to three units, the four corners of the switchboard must be secured to the ground using:
  - bolts (not supplied) screwed into nuts set into the ground using a sealing pistol
  - screw rods grouted into the ground
- for switchboards comprising more than 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.

| Unit type | A (mm) | B (mm) |
|---|---|---|
| IM, IMC, IMB, QM, PM, SM, CM, CM2, TM<br>GBC-A, GBC-B, GBM, GAM2, IMB, GAM, QMB | 750 | 650 |
| DM1-A, DM1-D, QMC | 1000 | 900 |
| DM2 | 1500 | 1400 |
| GIM | 250 | 150 |

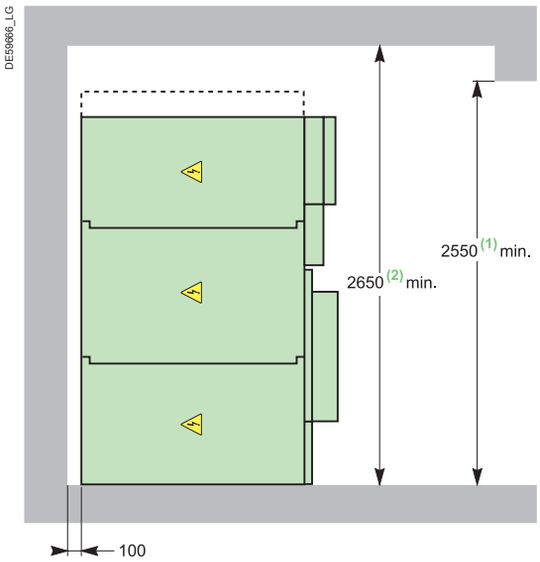
# Layout examples for SM6-36

## Conventional substation (Masonery)

**Top view**

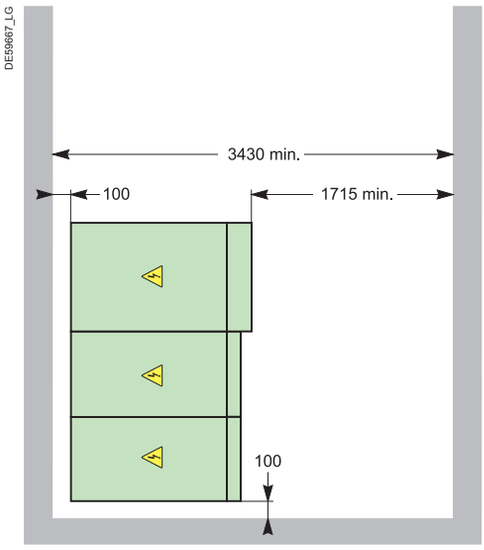



**Side view**




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

**Top view**



# Notes

# Schneider Electric services

# Schneider Electric services

## Contents

# ProDiag Breaker

## Diagnosis of MV and LV Circuit Breakers

PE60531

## What is ProDiag Breaker?

ProDiag Breaker is a Schneider Electric diagnosis tool.
ProDiag Breaker compares the mechanical and electrical parameters measured during the full operation of circuit breakers with the data collected from our production facilities. This allows detecting possible failure in advance. It measures, records and displays on a screen the key electrical parameters in MV and LV circuit breakers, relating to opening, closing and springloading operations.
All this data is automatically compared with the criteria for the circuit breaker designated in the software, which indicates which values are within the acceptable range, which are on the limit and which are outside it.
Two tests are always performed on each circuit breakers, one at minimum voltage and one at nominal voltage. A written report is generated and provided by Schneider Electric so that the customer can use it as a tool to define the necessary corrective action (maintenance, repair or replacement).

### ProDiag Breaker is part is part of ProDiag preventive maintenance plan

Evaluation of circuit breakers using ProDiag Breaker includes:
- Evaluation of the operating mechanism.
- Measurement and comparison of the actual contact resistance with that specified by the manufacturer.
- Measurement and comparison of the insulation resistance.
- Evaluation of the general circuit breaker conditions based on the captured data.

Moreover, analysis of the ProDiag Breaker time/ travel curve combined with the current curve of the coil and phase contact detects possible faults, such as:
- Worn out latches and operating mechanisms.
- Faulty coils.
- Mechanical wear and tear and hardening of lubricating grease.
- Defective shock absorbers.
- Defective simultaneous contact operation (opening/closing).

Some maintenance programmes involve dismantling the circuit breaker mechanism to check its condition. ProDiag Breaker using signals captured from the circuit breaker operation, reduces maintenance costs compared with programs which check the circuit breakers manually.

### ProDiag Breaker Objectives

Your priority is to enhance the reliability of your installation:
- to ensure its continuity of service,
- to minimize the time for maintenance & repair
- to perform maintenance

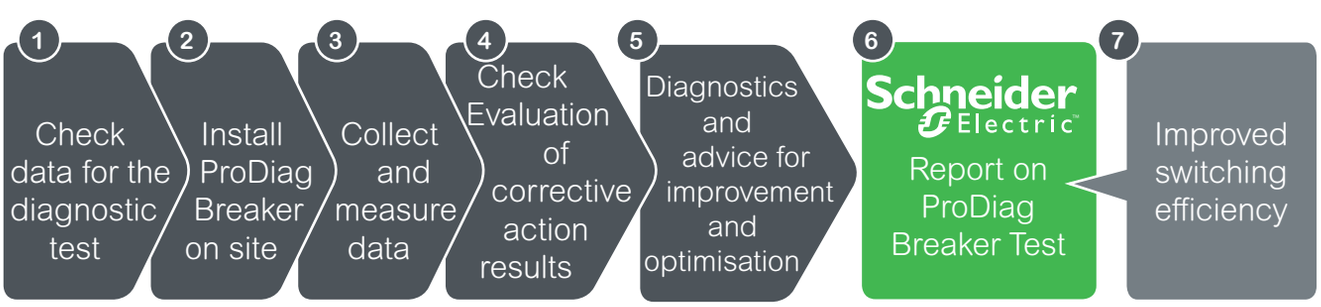
Only on the equipment requiring it and only when necessary(conditional preventive maintenance)

### Where can ProDiag Breaker reduce costs?

- ProDiag Breaker significantly reduces the time taken to identify potential faults in a circuit breaker, using operational analysis rather than inspection and mechanical re-sets.
- The software analyses the captured data and identifies the specific problem area.
- A device's normal operating life is increased by timely diagnostics of when and what repairs are necessary.
- The tool comprises both hardware and software, resulting in a highly efficient predictive maintenance program.

### Results

**ProDiag Breaker** provides a report of the complete nature of the circuit breaker, detailing: closing / opening time, contact simultaneity, bounce and resistance, mechanical closing and opening forces.
This report enables any required maintenance to be targeted and time in order to optimize the customer's maintenance plan.

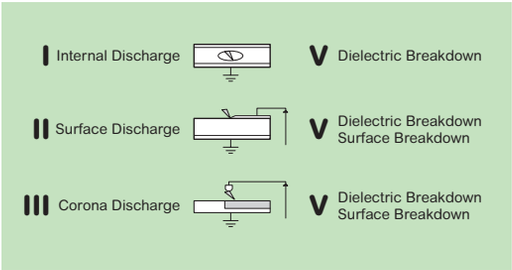


# ProDiag Corona

## Diagnostics of partial discharges

PE60530

DE60799




### ProDiag Corona objectives

Your priority is to have fast Electrical equipment inspection without shutdown

**Safety (Human Life and asset)**
- Enhance the reliability of your installation
- Optimisation of installation life duration & costs

**Risks prevention from:**
- Partial discharges and internal arc
- Dielectric degradation
- Electrical Fire

## What is ProDiag Corona?

**ProDiag Corona** is a Schneider Electric diagnosis tool.
**ProDiag Corona** detects partial discharges in Medium Voltage cubicles.
- Partial Discharge occurs across part of the insulation between two conducting electrodes, without completely bridging the gap.
- Partial discharge can happen under normal working conditions as a result of insulation breakdown due to premature aging caused by thermal or electrical over-stressing of the high voltage system.

ProDiag Corona analyses the primary electrical signal through VIS (Voltage Indicator System) fixed on the switchboards. Measurements are taken by an electronic sensor and the data is transmitted to the ProDiag Corona software in order to evaluate the level of criticality of the controlled equipment.
A written report is generated, which will be handed over by Schneider Electric so that the customer can use it as a tool to define the necessary corrective action, whether maintenance, repair or replacement.
**ProDiag Corona** is not a certification tool.
**ProDiag Corona** executes the assessment of the energized equipment, without any shutdown and then without disruption for the users.
This system allows you to control all types of the most common partial discharges:
- Internal partial discharges
- Surface partial discharge
- Corona effect

**ProDiag Corona** diagnostic can be realized on most Medium Voltage equipment on the market equipped with VIS.

### Where can ProDiag Corona reduce costs?

**ProDiag Corona** significantly reduces the time taken to identify potential faults in a switch, without electrical shutdown.
A device's normal operating life is increased by timely diagnostics of when and what repairs are necessary. **ProDiag Corona** is a trouble shooting anticipation tool which can avoid internal arc risks and untimely tripping.
- The tool comprises both hardware and software, resulting in a highly efficient preventive maintenance program.

### Results

**ProDiag Corona** provides a report of the complete electrical room, detailing: ventilation, air filtration, due point calculation, level of criticability of each set of equipment, constructor recommendations on any potential maintenance, repair & rehabilitation.
This report enables any required maintenance to be targeted and timed to optimize the customer's maintenance plan.
**ProDiag Corona** is performed thanks to XDP2 testing equipment from NDB technology.

# ProDiag Fuse

## Proprietary and standards diagnostics tools

PE60532

PE60533

## Customer needs

Electrical power installations protected by MV switchgear with fuse protection should be regularly checked (for correct assembly, electrical parameters, etc.) to confirm that their characteristics correspond to the original specification. Regular diagnosis of fuse performance (electrical parameters, resistance) according to the manufacturer's recommendations is necessary to secure
the ED installation and its service continuity, which are important for customers.
The ProDiag Fuse diagnostic solution can be used on MV switchgear protected by fuses that have not received any maintenance intervention
in the last four years (under normal operating conditions, and less if operating in severe environments or depending on their criticality in the installation).

The purpose of ProDiag Fuse (a proprietary hardware-software solution)
is to mitigate the risks on MV switchgear and equipment by fuses of faults or drifts causing unwanted effects. The result of fuse ageing is the destruction of filaments that can lead to thermal runaway, partial damage, complete destruction of MV switchgear and equipment, or even destruction
of the electrical room.

## Customer benefits

ProDiag Fuse helps customers visualise, discover, and understand MV switchgear fuse ageing and wear and tear as compared to the original fuse manufacturers' technical specification.

ProDiag Fuse monitors the performance of MV switchgear fuses.
Thanks to ProDiag Fuse, maintenance managers can implement, manage, and enrich their maintenance plans. Schneider Electric FSRs conclude
their on-site interventions with an exhaustive report on the MV switchgear fuses conformity/non-conformity. If a MV fuse is declared non-conforming, Schneider Electric suggests a corrective plan that includes fuse replacement to regain original performance in safety and service continuity.

Customers can augment their preventive maintenance plans with this corrective action at the most convenient time for each ED device.

## "Unique value for customer vs standard market tools"

Electrical parameter measurements (resistance, etc.) on MV switchgear fuses at customer sites are taken by a test tool and transmitted to the Schneider Electric FSRs' ProDiag Fuse software. Data are compared to those of a fuse manufacturers' technical database.

The aim is to determine whether recorded measurements are within the acceptable range, at the limit, or fall outside it, as criteria for MV switchgear fuse conformity.

As an ED equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific tests tools, proprietary software, and testing methodology to collect reliable measurements from MV switchgears fuses.

ProDiag Fuse measures a larger number of parameters than standard market tools.
It delivers best-in-class MV switchgear fuse diagnostics.

**Schneider Electric scope:** Schneider Electric fuses and main market fuses players.

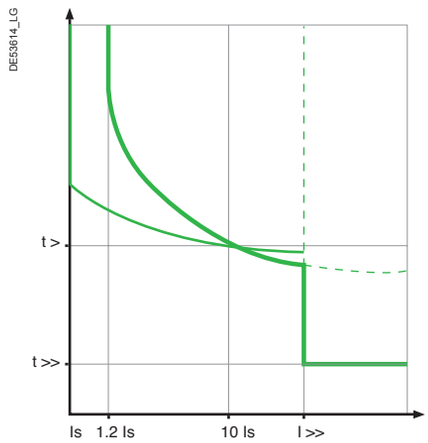
# Notes

# Appendices & Order Form

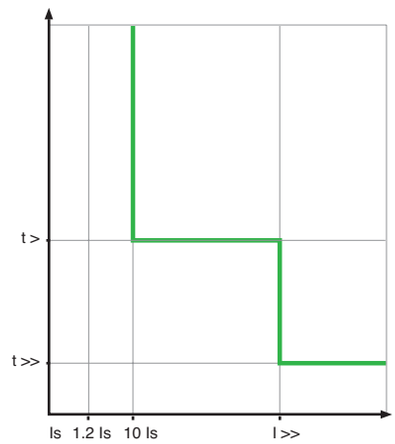
# Appendices & Order form

## Contents

# Trip curves for VIP 300 LL or LH relays



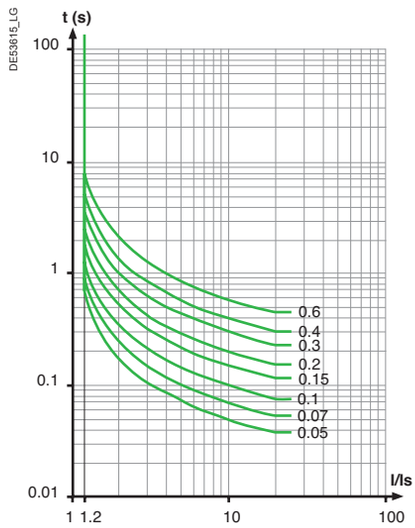

With lower definite time threshold



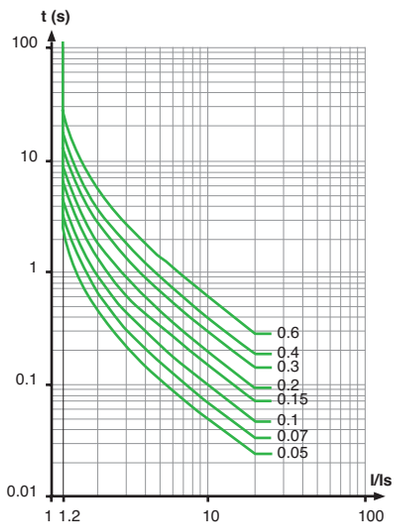

With lower inverse definite time threshold

## Definite time tripping curves

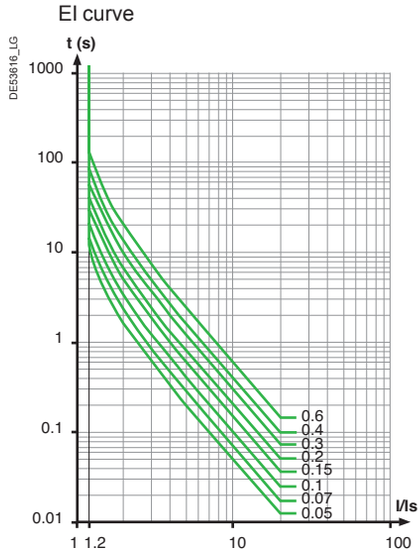
SI curve



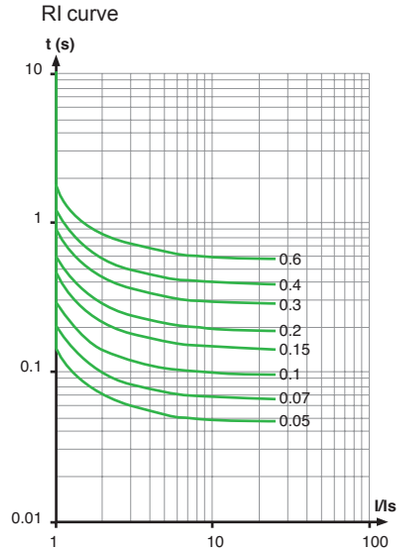

VI curve




EI curve

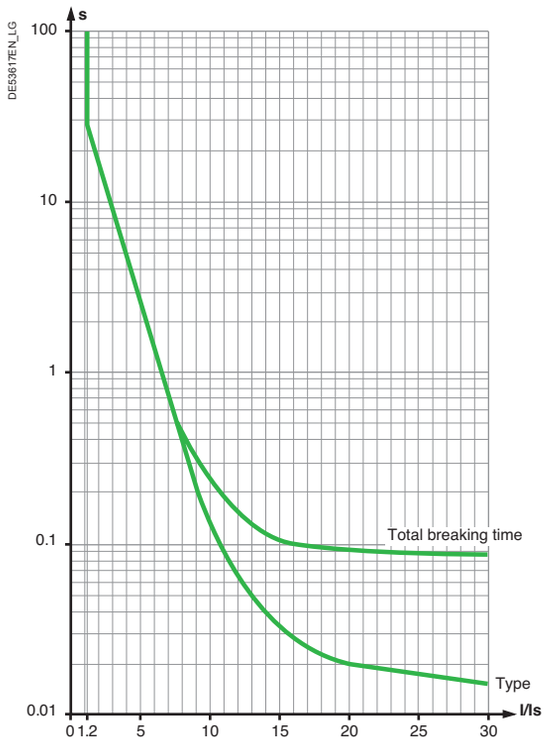



RI curve



# Trip curves for VIP 35 relays

## Phase protection curve

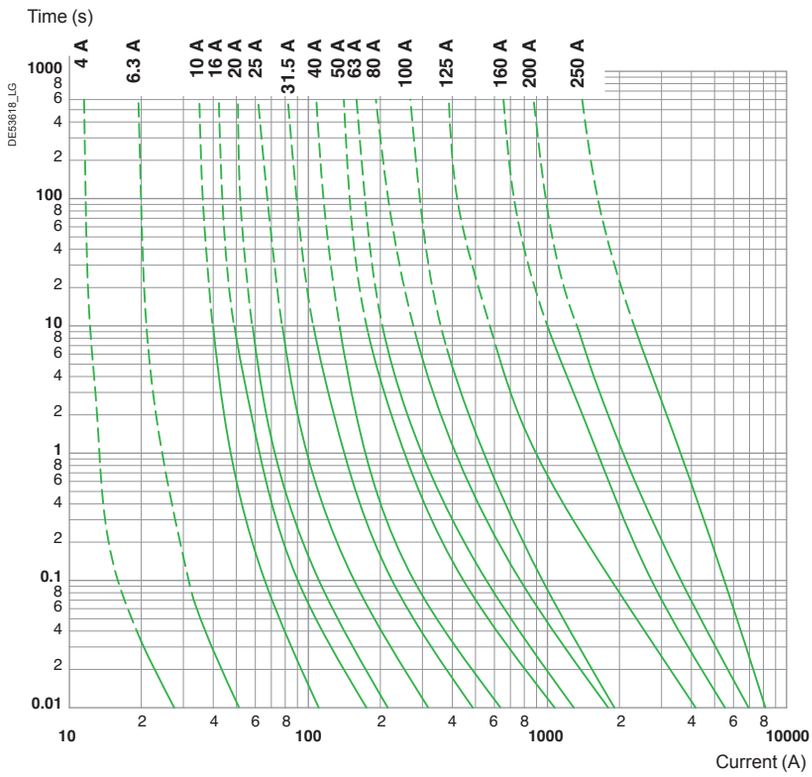



*The trip curve shows the time before the relay acts, to which must be added 70 ms to obtain the breaking time.*

# Fusarc CF fuses

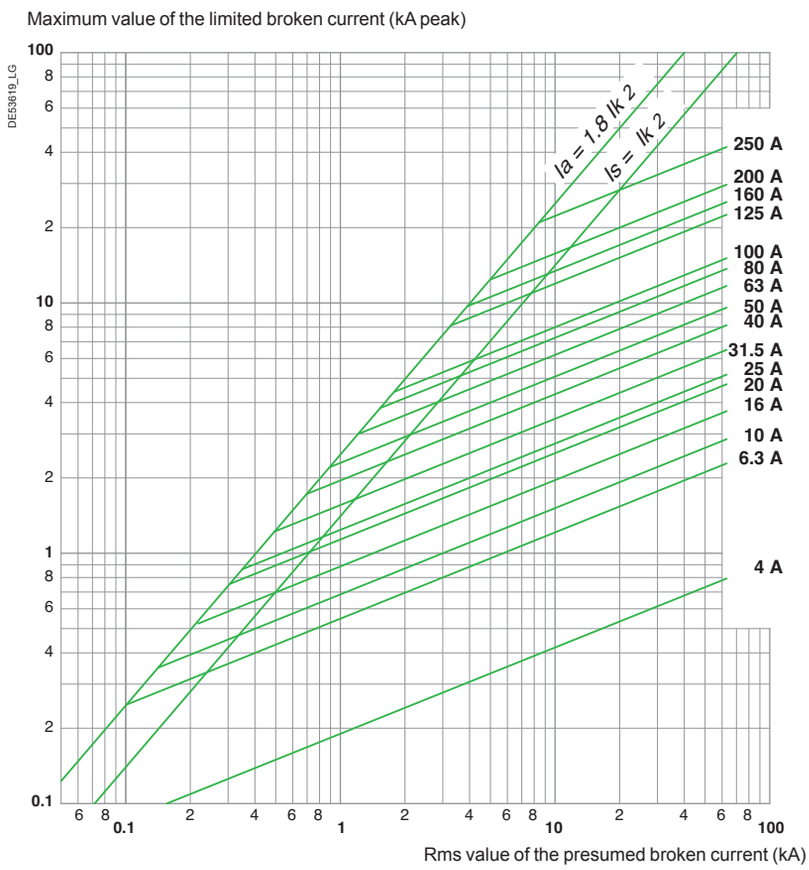
## Fuse and limitation curves

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




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

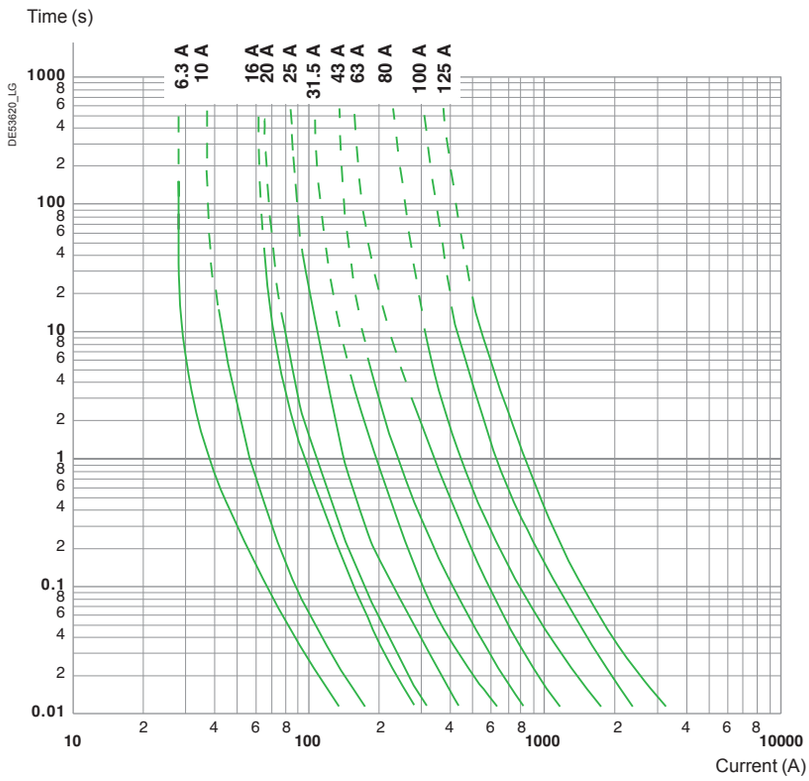
*The diagram shows the maximum limited broken current value as a function of the rms current value which could have occured in the absence of a fuse.*



# Solefuse fuses

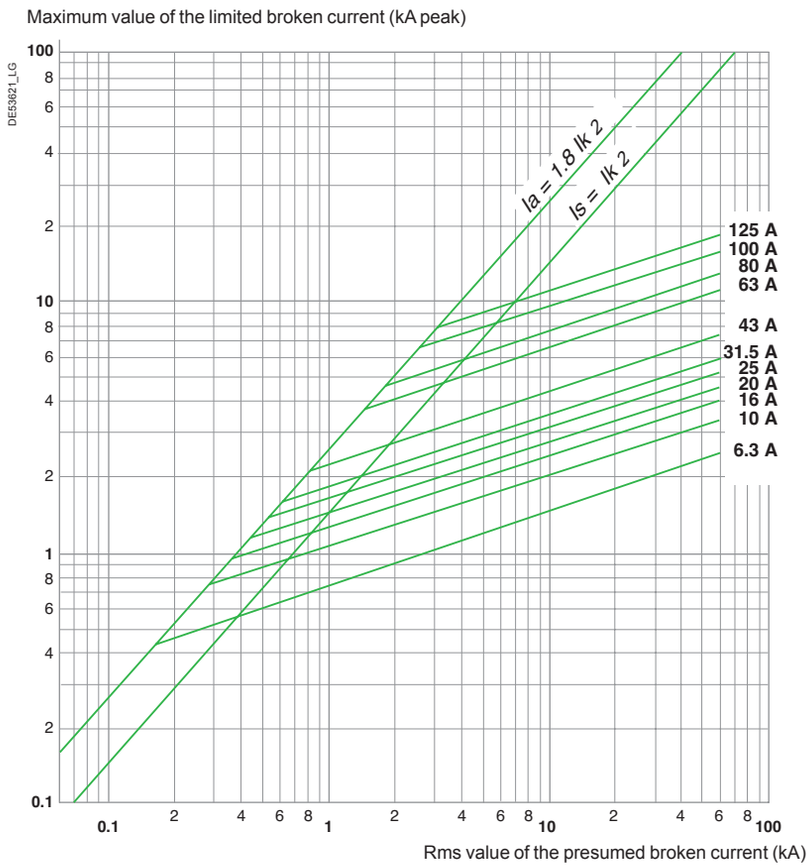
## Fuse and limitation curves

### Fuse curve 7.2 - 12 - 17.5 - 24 kV




### Limitation 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 occured in the absence of a fuse.*



# SM6
## Switching

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

| | | | | |
|---|---|---|---|---|
| **Rated voltage Ur** | | | | (kV) |
| **Service voltage** | | | | (kV) |
| **Short-circuit current Isc** | | | | (kA) |
| **Rated current Ir** | | | | (A) |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 | | 16 kA 1s for SM6-36 | |
| **Internal arc classification** | | | | A-FL |
| **Gaz exhaust direction** | | | | Downwards |
| **Type of cubicle** | | | | |
| **24 kV** | SM 375 | IM 375 | IMC 500 | IMB 375 |
| | SM 500 (for 1250 A) | IM 500 | | |
| **36 kV** | SM 750 | IM 750 | IMC 750 | IMB 750 |
| **Position in the switchboard** | First on left | Middle | Last on right | |
| **Direction of lower busbars for IMB** | | | | |
| | Left (impossible as first cubicle of switchboard) | | Right | |
| **Cable connection by the bottom** (1x single core, cable maxi 240 mm$^2$) | | | 36 kV | |

## Options

### Common options

| | | | |
|---|---|---|---|
| **Replacement of CIT by** | | CI1 | CI2 |
| **Electrical driving motorization** and/or coil voltage (not applicable on SM cubicle) | 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) |
| **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** | | Tubular key type | Flat key type |
| | For all cubicle (except SM) A4 | A3 SM6-SM6 | P1 SM6-SM6 |
| | Localisation of 2nd lock for A3 | On switch | On earthing switch |
| | Localisation of 2nd lock for A4 | | Cubicle no. |
| | SM cubicle only | P2 SM6-SM6 | P3 SM6-SM6 |
| **Replacement of 630 A upper busbar by 1250 A** (not possible for IMB) | | | |
| **Digital ammeter or fault current indicator** | AMP 21D | | Flair 23DV zero sequence |
| | Flair 21D | Flair 22D | Flair 23DM |
| **Visibility of main contacts** | | | |
| **Pressure indicator device** | Analogic manometer **without** visibility of main contacts | | |
| | Pressure switch | Analogic manometer **with** visibility of main contacts | |

### SM6-36 options

| | |
|---|---|
| **Cable connection by the top** (single core cable maxi 240 mm$^2$ with VPIS) | |
| **Cable connection by the bottom** (2 x single core, cable maxi 240 mm$^2$, not applicable on IMC) | |
| **Surge arresters** (not applicable on IMB, IMC cubicles) | 36 kV |

### SM6-24 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, B or C only one choice possible) | | | |
| | **A - Cable connection by the top** (cable maxi 240 mm$^2$ with VPIS) | | |
| | | Single core | 2 x single core |
| | **B - Low voltage control cabinet** (h = 450 mm) | | With unpunched door |
| | **C - Wiring duct** | | |
| **Cable connection by the bottom** (not applicable on IMB, cable maxi 240 mm$^2$) | | | |
| | Three core | Single core | 2 x single core |
| **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 |
| **Busbar field distributors for severe conditions** (only for 630 A) | | | |
| **Internal arc version** (not possible with "top incomer" option) | 16 kA 1 s | 20 kA 1 s | |
| **Internal arc classification** | | | A-FLR |
| **Gaz exhaust direction** | | | Upwards |

# SM6

## Switching

## 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 — Quantity [ ]

| | | | |
|---|---|---|---|
| **Rated voltage Ur** | | | (kV) [ ] |
| **Service voltage** | | | (kV) [ ] |
| **Short-circuit current Isc** | | | (kA) [ ] |
| **Rated current Ir** | | | (A) [ ] |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 [ ] | | 16 kA 1s for SM6-36 [ ] |
| **Internal arc classification** | | | A-FL |
| **Gaz exhaust direction** | | | Downwards |
| **Type of cubicle/upper busbar for 24 kV** | | | |
| Ir = 630 A, Ir busbar = 400 A | NSM busbar [ ] | | NSM cable [ ] |
| Ir = 630 A, Ir busbar = 630 A | NSM busbar [ ] | | NSM cable [ ] |
| Ir = 630 A, Ir busbar = 1250 A | | | NSM cable [ ] |
| **Position in the switchboard** | First on left [ ] | Middle [ ] | Last on right [ ] |
| **Incoming bottom busbar for NSM busbar** | | Left [ ] | Right [ ] |
| **Cable connection by the bottom** (cable maxi 240 mm$^2$) **for NSM cable** | | | |
| Three core on both [ ] | Single core on both [ ] | | 2 x single core on both [ ] |
| **Stand by source** | | | Generator without paralleling [ ] |
| | Utility with paralleling [ ] | | Utility without paralleling [ ] |
| **Control unit HMI language** | | | |
| French [ ] | English [ ] | Spanish [ ] | Portuguese [ ] | Chinese [ ] |

### Options

#### Common options

| | | | |
|---|---|---|---|
| **Signalling contact** | | | 1 C on SW and 1 O & 1C on ES [ ] |
| **Operation counter** | | | [ ] |
| **Interlocking SM6-SM6** | | Tubular key type [ ] | Flat key type [ ] |
| | 1 x P1 | Right cubicle [ ] | Left cubicle [ ] |
| | 2 x P1 | | Right and left cubicle [ ] |
| | 1 x A3 | Right cubicle [ ] | Left cubicle [ ] |
| | | On switch [ ] | On earthing switch [ ] |
| | 2 x A3 Right cubicle | On switch [ ] | On earthing switch [ ] |
| | Left cubicle | On switch [ ] | On earthing switch [ ] |
| **Control and monitoring** | | | [ ] |
| **Protocol type** | DNP3 [ ] | IEC 101/204 [ ] | Modbus (by default) [ ] |
| **Modem type** | FFSK [ ] | RS485 [ ] | RS232 (by default) [ ] |
| | PSTN [ ] | GSM [ ] | FSK [ ] |

#### SM6-24 options

| | | |
|---|---|---|
| **2 heating elements** | | [ ] |
| **Busbar field distributors for severe conditions** (only for 630 A) | | [ ] |
| **Internal arc version** (not possible with "top incomer" option) | 16 kA 1 s [ ] | 20 kA 1 s [ ] |
| **Internal arc classification** | | A-FLR [ ] |
| **Gaz exhaust direction** | | Upwards [ ] |

# SM6

## Protection

## Circuit breaker

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**

| | | | | |
|---|---|---|---|---|
| **Rated voltage Ur** | | | | **(kV)** [ ] |
| **Service voltage** | | | | **(kV)** [ ] |
| **Short-circuit current Isc** | | | | **(kA)** [ ] |
| **Rated current Ir** | | | | **(A)** [ ] |
| **Internal arc withstand** | | 12.5 kA 1s for SM6-24 [ ] | | 16 kA 1s for SM6-36 [ ] |
| **Internal arc classification** | | | | A-FL |
| **Gaz exhaust direction** | | | | Downwards |
| **24 kV** | For **SF1** circuit breaker | DM1-A 750 [ ] | DM1-D left 750 [ ] | DM1-D right 750 [ ] |
| | | DM1-S 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-D right 1000 [ ] |
| | | | DM2 left 1500 [ ] | DM2 right 1500 [ ] |
| **Position in the switchboard** | | First on left [ ] | Middle [ ] | Last on right [ ] |
| **Circuit breaker** | | | | See specific order form |
| **Current transformers (CT) and LPCTs** | | | | See specific order form |
| **Cable connection by the bottom** (1x single core, cable maxi 240 mm$^2$) | | | | 36 kV [ ] |

**Basic SM6-24**

| | | | |
|---|---|---|---|
| **Busbar** (Ir ⩾ Ir cubicle) | | | |
| For DM1-A, DM1-S, DM1-W, DMVL-A, DMVL-D ,DM1-D, DM2 | 400 A [ ] | 630 A [ ] | 1250 A [ ] |
| For DM1-A, DM1-D, DM1-W, DM1-Z | | | 1250 A [ ] |
| For DMV-A, DMV-D | | 630 A [ ] | 1250 A [ ] |
| For DMV-S | | 630 A [ ] | |
| **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 [ ] |
| **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) | | | [ ] |
| Voltage of the auxiliaries | 48/60 Vdc [ ] | | 110/125 or 220/250 Vdc [ ] |
| | | | 110/130 or 220/240 Vac (50 Hz) [ ] |
| Voltage of signalling | 48/60 Vdc [ ] | 110/125 Vdc [ ] | 220/250 Vdc [ ] |
| | 110/130 Vac (50 Hz) [ ] | | 220/240 Vac (50 Hz) [ ] |
| **Cable connection by the bottom** | | | |
| For DM1-A, DM1-W, DMVL-A | | | |
| | 3 x single core cable maxi 240 mm$^2$ [ ] | | 6 x single core cable maxi 240 mm$^2$ [ ] |
| **Current sensors** | CT [ ] | | LPCT ring type for DM1-A 630 A [ ] |
| | | | LPCT MV type for DM1-D [ ] |

**Basic SM6-36**

| | | |
|---|---|---|
| **Current sensors** | CT [ ] | LPCT ring type for DM1-A 630 A [ ] |

### Options — See following page

# SM6

## Protection

## Circuit breaker

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

| | | | | | |
|---|---|---|---|---|---|
| **Interlocking** | Tubular key type | | | Flat key type | |
| Not applicable on DM2 | A1 | | C1 | C4 | |
| **Signalling contact** | 2 O & 2 C on SW (not applicable with VTs) | | | | |
| | 2 O & 3 C on SW and 1 O & 1 C on ES (not applicable with VTs) | | | | |
| | 1 O & 2 C on SW (available only on cubicle with VTs) | | | | |
| **VTs** (not applicable for DM1-S, DMV-S) | See specific order form | | | | |

### SM6-24 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 mm$^2$ 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** | | | | | |
| **Busbar field distributors for severe conditions** (only for 630 A) | | | | | |
| **Internal arc version** (not possible with "top incomer" option) | | 16 kA 1 s | | 20 kA 1 s | |
| **Internal arc classification** | | | | A-FLR | |
| **Gaz exhaust direction** | | | | Upwards | |

### SM6-36 options

| | | |
|---|---|---|
| **Cable connection by the top** (single core cable maxi 240 mm$^2$ with VPIS) | | |
| **Cable connection by the bottom** (for DM1-A only) | | |
| | 3 x 2 x single core cable maxi 240 mm$^2$ | |
| **Surge arrester** | 36 kV | |
| **Sepam relay protection** | See specific order form | |

# SM6

## Protection

### Fuse switch

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 [ ]

| | | | | |
|---|---|---|---|---|
| **Rated voltage Ur** | | | | **(kV)** [ ] |
| **Service voltage** | | | | **(kV)** [ ] |
| **Short-circuit current Isc** | | | | **(kA)** [ ] |
| **Rated current Ir** | | | | **(A)** [ ] |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 [ ] | | 16 kA 1s for SM6-36 [ ] | |
| **Internal arc classification** | | | | A-FL |
| **Gaz exhaust direction** | | | | Downwards |
| **Type of cubicle** | | | | |
| **SM6-24** | QM 375 [ ] | QMB 375 [ ] | QMC 625 [ ] | PM 375 [ ] |
| | QM 500 [ ] | | | |
| **SM6-36** | QM 750 [ ] | QMB 750 [ ] | QMC 1000 [ ] | PM 750 [ ] |
| **Position in the switchboard** | First on left [ ] | | Middle [ ] | Last on right [ ] |
| **Current transformers for QMC 24 kV** (to see price structure) | | | | |
| Quantity of CTs | 1 [ ] | | 2 [ ] | 3 [ ] |
| **Direction of lower busbars for QMB** | | | Left [ ] | Right [ ] |
| **Cable connection by the bottom** (1x single core, cable maxi 240 mm$^2$) | | | | 36 kV [ ] |

## 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) [ ] |
| | | | 380 Vac (50/60 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 [ ] | Tubular key type [ ] | Flat key type [ ] |
| Replacement of 630 A upper busbar by 1250 A (not possible for QMB) | | | [ ] |
| **Blown fuse signalling contact** (for QM, QMB, QMC) | | | [ ] |
| **Visibility of main contacts** | | | [ ] |
| **Pressure indicator device** | | | Analogic manometer **without** visibility of main contacts [ ] |
| | Pressure switch [ ] | | Analogic manometer **with** visibility of main contacts [ ] |

### SM6-24 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) | | | [ ] |
| **Roof configuration** (A, B or C only one choice possible) | | | |
| | **A - Cable connection by the top** (cable maxi 240 mm$^2$ 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** | | | [ ] |
| **Operation counter** | | | [ ] |
| **Digital ammeter** (not applicable for QMB) | | | AMP21D [ ] |
| **Busbar field distributors for severe conditions** (only for 630 A) | | | [ ] |
| **Internal arc version** (not possible with "top incomer" option) | | 16 kA 1 s [ ] | 20 kA 1 s [ ] |
| **Internal arc classification** | | | A-FLR [ ] |
| **Gaz exhaust direction** | | | Upwards [ ] |

### SM6-36 options

| | |
|---|---|
| **Replacement of mechanism**<br>CIT by CI2 (only for PM) | [ ] |
| **Cable connection by the top**<br>(single core cable maxi 240 mm$^2$ with VPIS) | [ ] |

# SM6

## Protection

### Vacuum contactor (Direct Motor Starter) for SM6-24

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 |
|---|---|---|---|---|
| **Rated voltage Ur** | | | | (kV) 7.2 |
| **Service voltage** | | | | (kV) |
| **Short-circuit current Isc** (6.3 kA without fuse) | | | | (kA) |
| **Rated current Ir** (max. 400 A without fuse) | | | | (A) |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 ☐ | | 16 kA 1s for SM6-36 ☐ | |
| **Internal arc classification** | | | A-FL | |
| **Gaz exhaust direction** | | | Downwards | |
| **Position in the switchboard** | First on left ☐ | Middle ☐ | Last on right ☐ | |
| **Busbar Ir** | 400 A ☐ | 630 A ☐ | 1250 A ☐ | |
| **Phase current sensors** | 1 CT ☐ | 2 CT ☐ | 3 CT ☐ | |
| | | | 3 LPCT ring type ☐ | |
| **Key interlockings for 52 type** | Tubular key type ☐ | | Flat key type ☐ | |

**Options**

| | | | | | |
|---|---|---|---|---|---|
| **MV fuses** | 25 A ☐ | 31.5 A ☐ | 40 A ☐ | 50 A ☐ | 63 A ☐ |
| | 80 A ☐ | 100 A ☐ | 125 A ☐ | 160 A ☐ | 200 A ☐ | 250 A ☐ |
| **Busbar field distributors for severe conditions** (only for 630 A) | | | | | ☐ |
| **Key interlockings for C1 type** | Tubular key type ☐ | | | Flat key type ☐ | |
| **Voltage transformer** (quantity) | 1 ☐ | | 2 ☐ | 3 ☐ | |
| **Internal arc version** (not possible with "top incomer" option) | | | 16 kA 1 s ☐ | 20 kA 1 s ☐ | |
| **Internal arc classification** | | | | A-FLR ☐ | |
| **Gaz exhaust direction** | | | | Upwards ☐ | |

| Contactor | | | |
|---|---|---|---|
| **Vacuum contactor** | Magnetic hold ☐ | | Mechanical latching ☐ |
| **Open release** | 48 Vdc ☐ | 125 Vdc ☐ | 250 Vdc ☐ |
| **Closing coil** | 110 Vac/dc ☐ | 120 Vac/dc ☐ | 125 Vac/dc ☐ |
| | 220 Vac/dc ☐ | 240 Vac/dc ☐ | 250 Vac/dc ☐ |

# SM6
## Metering

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 SM6-24/SM6-36

| | | | | | |
|---|---|---|---|---|---|
| **Rated voltage Ur** | | | | | **(kV)** [ ] |
| **Service voltage** | | | | | **(kV)** [ ] |
| **Short-circuit current Isc** | | | | | **(kA)** [ ] |
| **Rated current Ir** | | | | | **(A)** [ ] |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 [ ] | | | 16 kA 1s for SM6-36 [ ] | |
| **Internal arc classification** | | | | | A-FL |
| **Gaz exhaust direction** | | | | | Downwards |
| **Type of cubicle/upper busbar for SM6-24** | | | | | |
| Ir = 630 A, Ir busbar = 400 A | CM [ ] | CM2 [ ] | TM [ ] | GBC-A [ ] | GBC-B [ ] |
| Ir = 630 A, Ir busbar = 630 A | CM [ ] | CM2 [ ] | TM [ ] | GBC-A [ ] | GBC-B [ ] |
| Ir = 630 A, Ir busbar = 1250 A | CM [ ] | CM2 [ ] | TM [ ] | GBC-A [ ] | GBC-B [ ] |
| Ir = 1250 A, Ir busbar = 1250 A | | | | GBC-A [ ] | GBC-B [ ] |
| **Type of cubicle for SM6-36** | CM 750 [ ] | CM2 750 [ ] | | GBC-A 750 [ ] | |
| | | TM 750 [ ] | | GBC-B 750 [ ] | |
| **Position in the switchboard** | First on left [ ] | Middle [ ] | | Last on right [ ] | |
| **Direction of lower busbars for GBC-A** | | Left [ ] | | Right [ ] | |
| **Signalling contact** (for CM, CM2 and TM only) | | | | | 1 O and 1 C on SW [ ] |
| **Fuses** (for CM, CM2 and TM only) | | | | | See fuse price structure |
| **Cable connection by the bottom** (1x single core, cable maxi 240 mm$^2$) | | | | | SM6-36 [ ] |

### Basic SM6-24

| | | | | |
|---|---|---|---|---|
| **VTs for GBC** (to see price structure) | Phase/phase [ ] | | Phase/earth [ ] | |
| **CTs for GBC** (to see price structure) | Quantity 1 [ ] | | 2 [ ] | 3 [ ] |
| **Ratio choice for GBC** | | | | |
| Protections | 1 secondary [ ] | | 1 high secondary [ ] | |
| | 2 secondaries [ ] | | 1 low secondary [ ] | |

### Basic SM6-36

| | |
|---|---|
| **Voltage transformers** | See specific order form |

## Options

### SM6-24 options

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

| | | |
|---|---|---|
| **A - Cable connection by the top** (cable maxi 240 mm$^2$ 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 for CM, CM2, TM** | | | [ ] |
| **Busbar field distributors for severe conditions** (only for 630 A and CM, CM2 and TM cubicles) | | | [ ] |
| **Blown fuse auxiliary contact** (for CM, CM2 and TM only) | | 1 O and 1 C | [ ] |
| **Internal arc version** (not possible with "top incomer" option) | 16 kA 1 s [ ] | 20 kA 1 s | [ ] |
| **Internal arc classification** | | A-FLR | [ ] |
| **Gaz exhaust direction** | | Upwards | [ ] |

### SM6-36 options

| | |
|---|---|
| **Current transformers and voltage transformers for GBC** | See specific order form |
| **Cable connection by the top** (single core cable maxi 240 mm$^2$ with VPIS) | [ ] |
| **Replacement of 630 A busbar by 1250 A** (for CM, CM2 and TM only) | [ ] |

# SM6
## Other functions

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 [ ]

| | | | |
|---|---|---|---|
| **Rated voltage Ur** | | | (kV) [ ] |
| **Service voltage** | | | (kV) [ ] |
| **Short-circuit current Isc** | | | (kA) [ ] |
| **Rated current Ir** | | | (A) [ ] |
| **Internal arc withstand** | 12.5 kA 1s for SM6-24 [ ] | | 16 kA 1s for SM6-36 [ ] |
| **Internal arc classification** | | | A-FL |
| **Gaz exhaust direction** | | | Downwards |
| **Type of cubicle/upper busbar for SM6-24** | | | |
| Ir = 630 A, Ir busbar = 400 A | GAM 500 [ ] | GAM2 375 [ ] | GBM 375 [ ] |
| Ir = 630 A, Ir busbar = 630 A | GAM 500 [ ] | GAM2 375 [ ] | GBM 375 [ ] |
| Ir = 1250 A, Ir busbar = 1250 A | GAM 500 [ ] | | GBM 375 [ ] |
| **Type of cubicle for SM6-36** | GAM 750 [ ] | GAM2 750 [ ] | GBM 750 [ ] |
| **Position in the switchboard** | First on left [ ] | Middle [ ] | Last on right [ ] |
| **Direction of lower busbars for GBM** | | | |
| Left (impossible on the first cubicle of the switchboard) | | | Right [ ] |
| **Cable connection by the bottom** (1x single core, cable maxi 240 mm$^2$) | | | SM6-36 [ ] |

### Options

#### SM6-24 options

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

| | | |
|---|---|---|
| **A - Cable connection by the top** (cable maxi 240 mm$^2$ 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 [ ] | SM6-24 [ ] |
| **Interlocking on GAM 500** | | Tubular key type [ ] | | Flat key type [ ] |
| | | A3 SM6-SM6 [ ] | | P5 SM6-SM6 [ ] |
| Localisation of 2nd lock for P5 | | | | Cubicle no. [ ] |
| **Heating element** (on GAM 500 630 A and on GAM2) | | | | [ ] |
| **Digital ammeter or Fault current indicator** | | AMP 21D (except GBM) [ ] | | Flair 23DV zero sequence [ ] |
| | | Flair 21D [ ] | Flair 22D [ ] | Flair 23DV [ ] |
| **Internal arc version** (not possible with "top incomer" option) | | | 16 kA 1 s [ ] | 20 kA 1 s [ ] |
| **Internal arc classification** | | | | A-FLR [ ] |
| **Gaz exhaust direction** | | | | Upwards [ ] |

#### SM6-36 options

| | |
|---|---|
| **Cable connection by the top** (single core cable maxi 240 mm$^2$ with VPIS) | [ ] |
| **Replacement of 630 A busbar by 1250 A** (for GAM2 only) | [ ] |
| **Surge arresters for GAM2** | [ ] |

# SF1

## Lateral disconnectable or withdrawable

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 circuit breaker — Quantity [ ]

| | | | | | |
|---|---|---|---|---|---|
| **Rated voltage Ur** | | | | **(kV)** | [ ] |
| **Service voltage** | | | | **(kV)** | [ ] |
| **Impulse voltage Up** | | | | **(kVbil)** | [ ] |
| **Short-circuit current Isc** | | | | **(kA)** | [ ] |
| **Rated current Ir** | | | | **(A)** | [ ] |
| **Frequency** | | 60 Hz | [ ] | 50 Hz | [ ] |
| **Mechanism position** | Disconnectable | A1 | [ ] | B1 | [ ] |
| | 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)

Shunt opening release **YO1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 Vdc | [ ] | 60 Vdc | [ ] | 220 Vdc | [ ] | 220 Vac (50 Hz) | [ ] |
| 30 Vdc | [ ] | 110 Vdc | [ ] | 48 Vac (50 Hz) | [ ] | 120 Vac (60 Hz) | [ ] |
| 48 Vdc | [ ] | 125 Vdc | [ ] | 110 Vac (50 Hz) | [ ] | 240 Vac (60 Hz) | [ ] |

Undervoltage release **YM**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 Vdc | [ ] | 60 Vdc | [ ] | 220 Vdc | [ ] | 220 Vac (50 Hz) | [ ] |
| 30 Vdc | [ ] | 110 Vdc | [ ] | 48 Vac (50 Hz) | [ ] | 120 Vac (60 Hz) | [ ] |
| 48 Vdc | [ ] | 125 Vdc | [ ] | 110 Vac (50 Hz) | [ ] | 240 Vac (60 Hz) | [ ] |

| | | | | | |
|---|---|---|---|---|---|
| Mitop | | Without contact | [ ] | With contact | [ ] |

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

Shunt opening release **YO2**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 Vdc | [ ] | 60 Vdc | [ ] | 220 Vdc | [ ] | 220 Vac (50 Hz) | [ ] |
| 30 Vdc | [ ] | 110 Vdc | [ ] | 48 Vac (50 Hz) | [ ] | 120 Vac (60 Hz) | [ ] |
| 48 Vdc | [ ] | 125 Vdc | [ ] | 110 Vac (50 Hz) | [ ] | 240 Vac (60 Hz) | [ ] |

Undervoltage release **YM**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 Vdc | [ ] | 60 Vdc | [ ] | 220 Vdc | [ ] | 220 Vac (50 Hz) | [ ] |
| 30 Vdc | [ ] | 110 Vdc | [ ] | 48 Vac (50 Hz) | [ ] | 120 Vac (60 Hz) | [ ] |
| 48 Vdc | [ ] | 125 Vdc | [ ] | 110 Vac (50 Hz) | [ ] | 240 Vac (60 Hz) | [ ] |

| | | | | | |
|---|---|---|---|---|---|
| Mitop | | Without contact | [ ] | With contact | [ ] |

### Remote control

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

Shunt closing release **YF**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 Vdc | [ ] | 60 Vdc | [ ] | 220 Vdc | [ ] | 220 Vac (50 Hz) | [ ] |
| 30 Vdc | [ ] | 110 Vdc | [ ] | 48 Vac (50 Hz) | [ ] | 120 Vac (60 Hz) | [ ] |
| 48 Vdc | [ ] | 125 Vdc | [ ] | 110 Vac (50 Hz) | [ ] | 240 Vac (60 Hz) | [ ] |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Leaflets language** | | French | [ ] | | | English | [ ] |

*Different releases combinations*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Shunt opening releases **YO1/YO2** | 1 | | | 2 | 1 | 1 | |
| Undervoltage release **YM** | | | 1 | | 1 | | 1 |
| Mitop | | 1 | | | | 1 | 1 |

# SFset

## Lateral disconnectable for SM6-24

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 circuit breaker | | | | Quantity |
|---|---|---|---|---|
| **Rated voltage Ur** | | | | **(kV)** |
| **Service voltage** | | | | **(kV)** |
| **Impulse voltage Up** | | | | **(kVbil)** |
| **Short-circuit current Isc** | | | | **(kA)** |
| **Rated current Ir** | | | | **630 A maximum** |
| **Frequency** | 60 Hz | | 50 Hz | |
| **Mechanism position** | A1 | | B1 | |

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

## Control unit and sensors

| | | | |
|---|---|---|---|
| **VIP 300P** (not available for all electrical characteristics) | CSa 200/1 | Is = 10 to 50 A | Is = 40 to 200 A |
| | CSb 1250/1 | Is = 63 to 312 A | Is = 250 to 1250 A |
| **VIP 300LL** | CSa 200/1 | Is = 10 to 50 A | Is = 40 to 200 A |
| | CSb 1250/1 | Is = 63 to 312 A | Is = 250 to 1250 A |

## Circuit breaker options

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

Shunt opening release **YO2**

| | | | |
|---|---|---|---|
| 24 Vdc | 60 Vdc | 220 Vdc | 220 Vac (50 Hz) |
| 30 Vdc | 110 Vdc | 48 Vac (50 Hz) | 120 Vac (60 Hz) |
| 48 Vdc | 125 Vdc | 110 Vac (50 Hz) | 240 Vac (60 Hz) |

Undervoltage release **YM**

| | | | |
|---|---|---|---|
| 24 Vdc | 60 Vdc | 220 Vdc | 220 Vac (50 Hz) |
| 30 Vdc | 110 Vdc | 48 Vac (50 Hz) | 120 Vac (60 Hz) |
| 48 Vdc | 125 Vdc | 110 Vac (50 Hz) | 240 Vac (60 Hz) |

### Remote control

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

Shunt closing release **YF**

| | | | |
|---|---|---|---|
| 24 Vdc | 60 Vdc | 220 Vdc | 220 Vac (50 Hz) |
| 30 Vdc | 110 Vdc | 48 Vac (50 Hz) | 120 Vac (60 Hz) |
| 48 Vdc | 125 Vdc | 110 Vac (50 Hz) | 240 Vac (60 Hz) |

| | | |
|---|---|---|
| **Test box** (VAP 6) | | |
| **Leaflets language** | French | English |

*Different releases combinations*

| | | | |
|---|---|---|---|
| Mitop | 1 | 1 | 1 |
| Shunt opening release **YO2** | | 1 | |
| Undervoltage release **YM** | | | 1 |

# Evolis

## Frontal fixed version for SM6-24 (up to 17.5 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.

### Basic fixed circuit breaker — Quantity [ ]

| | | |
|---|---|---|
| **Rated voltage Ur (kV)** | **12** [ ] | **17.5** [ ] |
| **Service voltage** | | **(kV)** [ ] |
| **Short-circuit current Isc** | | **25 kA** |
| **Rated normal current Ir (A)** | **630** [ ] | **1250** [ ] |
| **Phase distance** | | **185 mm** |

### Circuit breaker options

**Opening release** (see possible choices in combination table below)

Shunt opening release **MX**

| | | |
|---|---|---|
| 24 Vac [ ] | 24…30 Vdc [ ] | 100…130 Vdc/ac [ ] |
| 48 Vac [ ] | 48…60 Vdc [ ] | 200…250 Vdc/ac [ ] |

Low energy release **Mitop**

1 AC fault signalling SDE and reset 200...250 Vac are included [ ]

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

Electrical motor **MCH**

| | | |
|---|---|---|
| 24…30 Vdc [ ] | 100…125 Vdc [ ] | 200…250 Vdc [ ] |
| 48…60 Vdc/ac [ ] | 100…130 Vac [ ] | 200…240 Vac [ ] |

Shunt closing release **XF**

| | | |
|---|---|---|
| 24 Vac [ ] | 24…30 Vdc [ ] | 100…130 Vdc/ac [ ] |
| 48 Vac [ ] | 48…60 Vdc [ ] | 200…250 Vdc/ac [ ] |

| | | |
|---|---|---|
| **Operation counter CDM** | | [ ] |
| **Additional auxiliary contacts OF** (4 AC) | 1 [ ] | 2 [ ] |
| **Ready to close contact PF** (1 AC) | | [ ] |

**Locking of the circuit breaker in the open position**

By padlock [ ]

**or** by locks and keys — Tubular key type [ ] — Flat 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 |

# Evolis

## Lateral disconnectable version for SM6-24 (up to 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.

### Basic circuit breaker

Quantity [ ]

| | |
|---|---|
| **Rated voltage Ur** | **24 (kV)** |
| **Service voltage** | **(kV)** [ ] |
| **Impulse voltage Up** | **(kVbil)** [ ] |
| **Rated normal current Ir** | **630 A maximum** |
| **Phase distance** | **250 mm** |
| **Mechanism position** | **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)

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** (see possible choices combination table below)

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*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Shunt opening releases **YO1** | 1 | | 1 | 1 | 1 | | |
| Shunt opening releases **YO2** | | | 1 | | | | |
| Undervoltage release **YM** | | 1 | | 1 | | 1 | |
| Mitop | | | | | 1 | 1 | 1 |

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