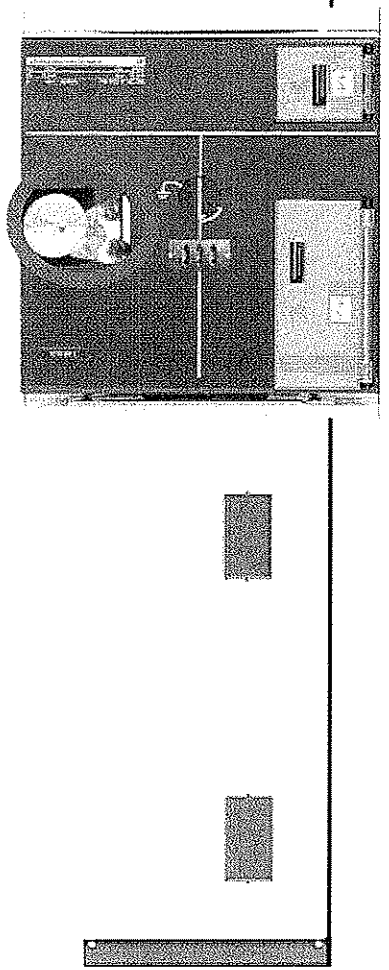
Manometer

- What is it?
  - An analog pressure indicator that shows the SF6 tank pressure.
  - Temperature compensated on analog screen
  - Operating temperature: -5°C to +40°C
- Application can be done on site as "quick connection ®" (plug & play) for all without any leakage test repetition.
- 2 versions available
  - No-visibility of main contact
  - Visibility of main contact



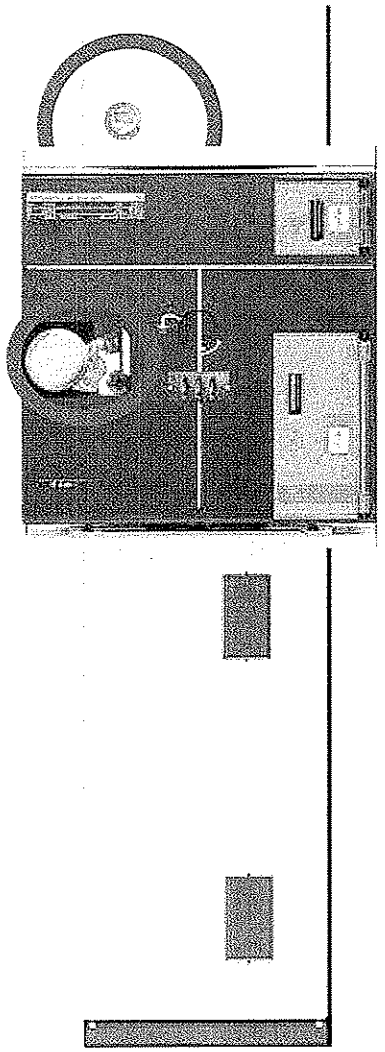
Manometer

- If indication on green
  - SM6-24 unit is completely in normal conditions.
- If indication is just on border between green and red
  - SM6-24 unit OK
  - Unit may remain energised
  - Unit can be operated (open or close) while energized
- If indication is on **red**
  - SM6-24 unit must be replaced, immediately
  - Unit may remain energized until replacement
  - Unit can be operated (open) for once while energized
  - For replacement, the unit has to be switched off through the adjacent units.

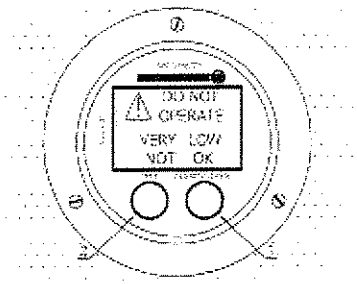
DANGER

Pressure switch

- What is it?
  - A density switch to monitor SF6 tank pressure with auxiliary contact for remote indication or local electrical interlocking,
  - Local indication of pressure (LCD display)
  - No need of auxiliary supply
  - Temperature compensated
  - Operating temperature: -5°C to +40°C
- Application can be done on site as "quick connection®" (plug & play) for all without any leakage test repetition.
- 2 versions available
  - No-visibility of main contact
  - Visibility of main contact



Pressure switch

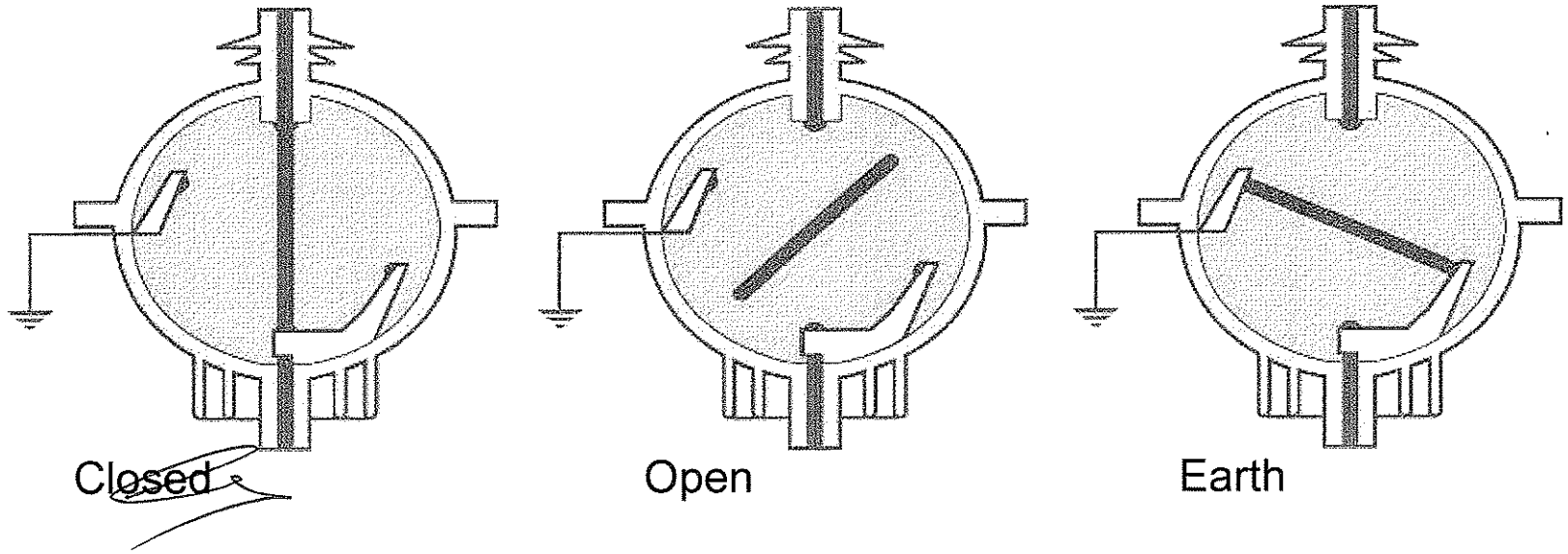


- If SF6 density control result is “OK”
  - SM6-24 unit is completely in normal conditions.
- If SF6 density control result is “LOW/ OK”
  - SM6-24 unit OK
  - Unit may remain energized
  - Unit can be operated (open or close) while energized
- If SF6 density control result is “VERY LOW/ NOT OK” :
  - SM6-24 unit shall be replaced immediately
  - Unit may remain energized until replacement
  - Unit can be operated (open) for ones while energized
  - For replacement, the unit has to be switched off through the adjacent units.

DANGER

Operating safely

- Load Break Switch (LBS)
  - 3 positions
  - Making capacity at earthing
  - Optimised breaking at rated current

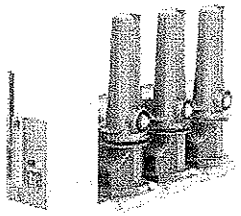


People's safety: a major commitment

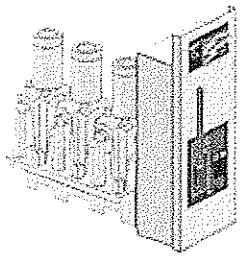
- Safe and easy operation (total confidence)
  - 3 positioned Load Break Switch (LBS) / Disconnector
  - Natural interlocking mechanism
  - Clear symbols and animated mimic diagram
  - Anti-reflex lever
  - Making capacity at earthing switch
  - Compartmented function
  - Internal arc (safety membrane on the LBS/Disconnector)

The best technologies for hi-protection

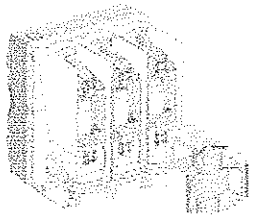
- You can choose the best technologies for your protection chains
  - SF6 CB range (lateral disconnectable / withdrawable)
    630A & 1250A, 25kA/1s, 24kV



  - Vacuum CB range (lateral disconnectable)
    630A, 25kA/1s, 24kV



  - Vacuum CB range (frontal fix)
    630A & 1250A, 25kA/1s, 17.5kV



Summary of performances

Electrical characteristics (1)

Rated voltage	**Ur**	kV		7.2	12	17.5	24
Insulation level							
Insulation	**Ud**	50/60 Hz, 1 min (kV rms)		20	28	38	50
Isolation	**Ud**	50/60 Hz, 1 min (kV rms)		23	32	45	60
Insulation	**Up**	1.2/50 µs (kV peak)		60	75 [1]	95	125
Isolation	**Up**	1.2/50 µs (kV peak)		70	85	110	145
Breaking capacity							
Transformer off load		A		16			
Cables off load		A		31.5			
Rated current	Ir	A		400 - 630 - 1250			
Short-time withstand current	Ik/tk [2]	kA/1 s	25	630 - 1250			
			20	630 - 1250			
			16	630 - 1250			
			12.5	400 - 630 - 1250			
Making capacity	Ima	kA	62.5	630		NA	
			50	630			
			40	630			
			31.25	400 - 630			

Summary of performances

- Electrical characteristics (2)

Rated voltage	**Ur**	kV	7.2	12	17.5	24
Insulation level						
Insulation	**Ud**	50/60 Hz, 1 min (kV rms)	20	28	38	50
Isolation	**Ud**	50/60 Hz, 1 min (kV rms)	23	32	45	60
Insulation	**Up**	1.2/50 µs (kV peak)	60	75 [1]	95	125
Isolation	**Up**	1.2/50 µs (kV peak)	70	85	110	145
Maximum breaking capacity (Isc)						
Units IM, IMC, IMB, NSM-cables, NSM-busbars		A	630 - 800 [2]			
QM, QMC, QMB		kA	25		20	
FM		kA	25			
CRM		kA	10	8	NA	
CRM with fuses		kA	25		NA	
CVM		kA	6.3	NA		
CVM with fuses		kA	25	NA		
SF6 circuit breaker range						
DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2		kA	25			
Vacuum circuit breaker range						
DMV-A, DMV-D, DMV-S		kA	25			NA [3]
DMV-I		kA	20			

Monitoring and protecting your network

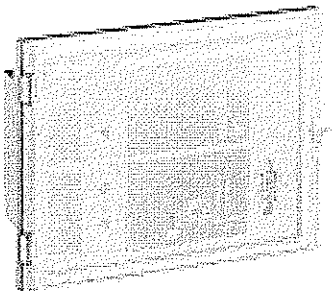
Protection Type

Protection Type	Code	Relays		
		VIP 300	Sepam 10	Sepam 20
Three-phase overcurrent	50 - 51	☑	☑	☑
Zero-sequence overcurrent	50N - 51N	☑	☑	☑
Very sensitive Zero-sequence overcurrent	50N - 51N		☑	☑
Thermal image	49		☑	☑
Communication			☑	☑
Negative seq. overcurrent	46			☑
Single-phase undercurrent	37			☑
Long start-up	51LR			☑
Self powered		☑	☑	☑

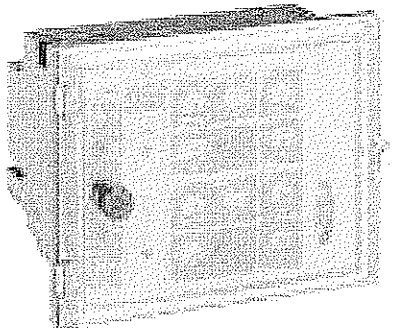
Protecting your network Self powered relay

- VIP range, a cost-effective solution

  - Transformer protection
    VIP35 : Overcurrent & Earth fault



  - Network protection
    - VIP300 : Overcurrent & Earth fault



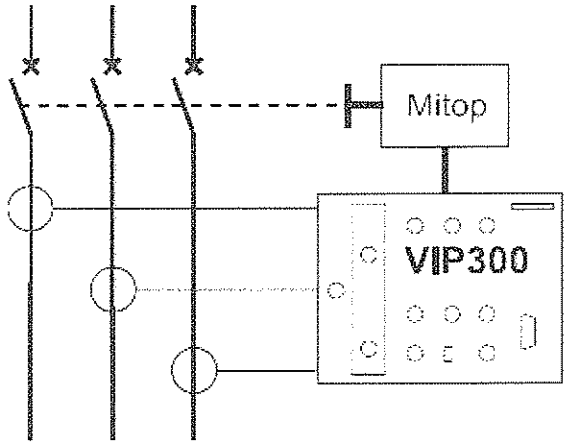
VIP application

- Self-powered protection relay
  - Designed for use in power distribution systems that may be used to protect MV/LV transformer, incoming points of industrial installations or branch feeders.

- Type of Sensor

Sensor's type	Current operating range
CRa/CRb/CRc	10A – 1250A

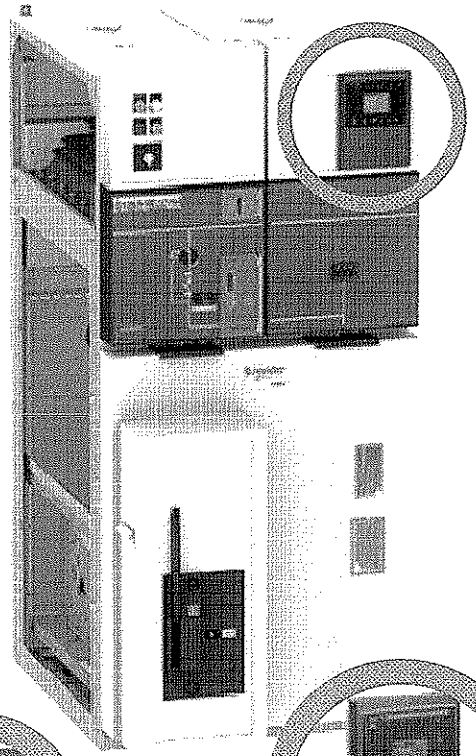
- Reducing your acquisition & operation costs
  - Simplified solution
  - No auxiliary power supply necessary

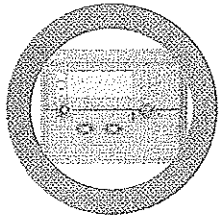


Simplified wiring diagram

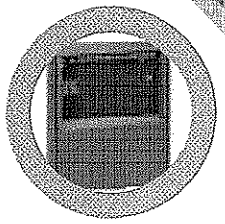
Monitoring and protecting your network: Auxiliary powered relay

- Sepam range
  - Protection
  - Monitoring
  - Control

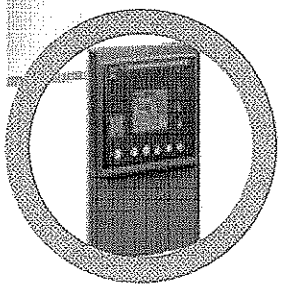




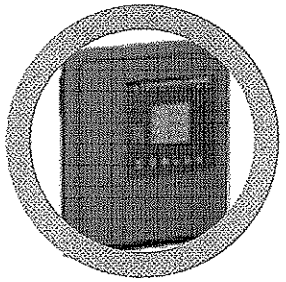
Sepam 10
The "just enough" protection



Sepam 20
For basic loads



Sepam 40
For important source and loads

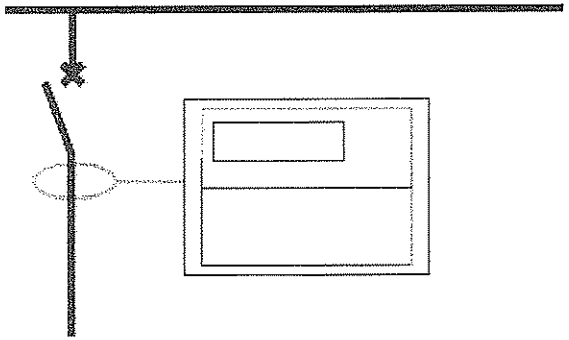


Sepam 80
For critical source and loads

Sepam 10 application

- Sepam range offers you especially cost-effective & just enough, essential protection relay reliability.

  Designed for use in power distribution systems that may be used to protect MV/MV branch feeders, MV/LV transformer, incoming points of industrial installations.



- Type of Sensor

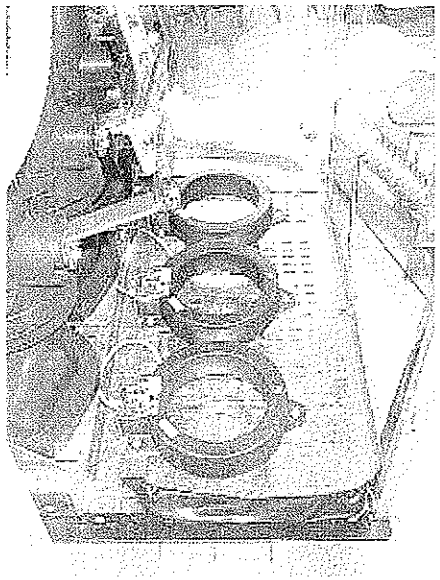
Sensor's type	Current operating range
CRa/CRb	20A – 1250A

- Reducing your acquisition & operation costs
  - Simplified solution with communication
  - No need computer assistance

Sepam 20/40/80 with LPCT application

- LPCT is a Low Power Current Transformer
- Type of Sensor

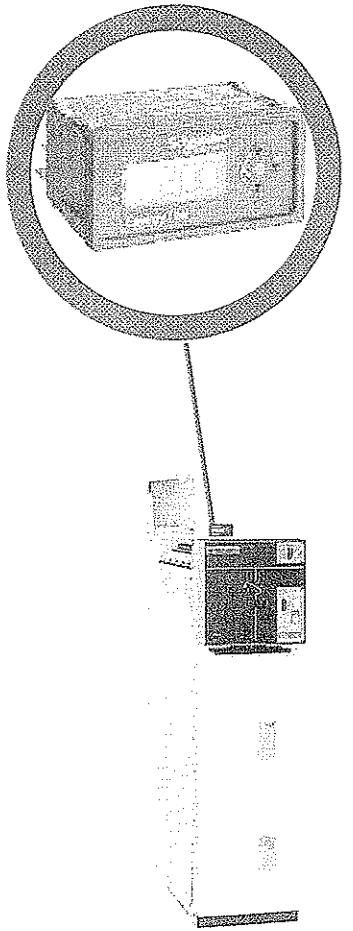
Sensor's type	Current operating range
TLP130	5A – 1250A



- Reducing your acquisition & operation costs
  - Cost effective even though as sensitive as traditional CTs
  - Simplified solution with advantage of Sepam 20/40/80
- Innovative and unique

Fault Passage Indicators: Embedded

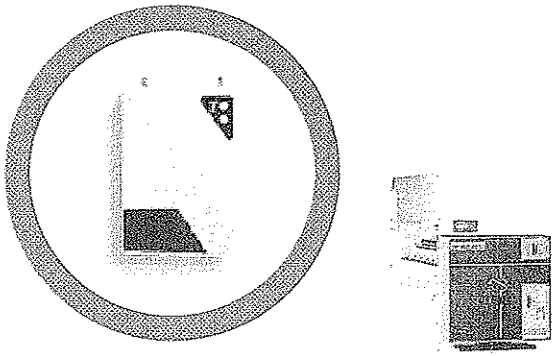
- Increase the reliability of your network and application thanks to the self-powered and hi-performance indicator
  - Fault current passage indicators are adapted product to all neutral earthing system: insulation, impedant and direct earthing.



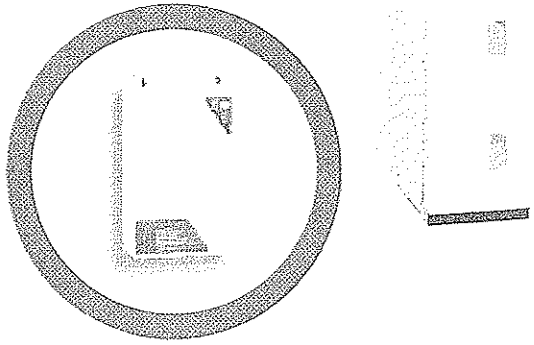
- Self-powered with a liquid crystal display
  - Clear and comprehensive display
  - Maintenance free

Fault Passage Indicators: Stand alone

- Communicating fault passage indicator for underground applications

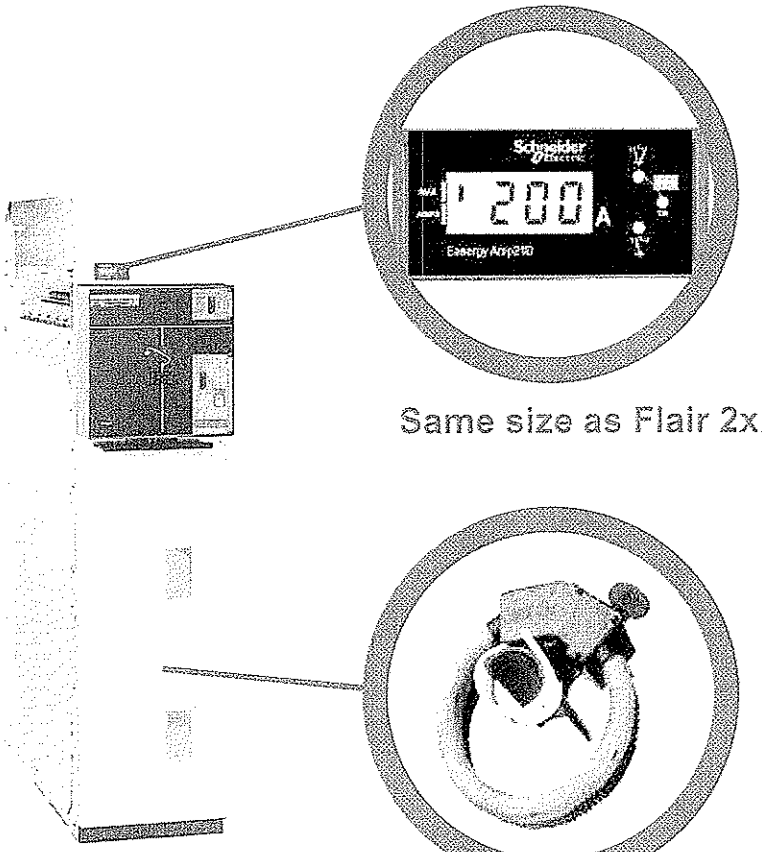


- Local fault indicator for underground applications



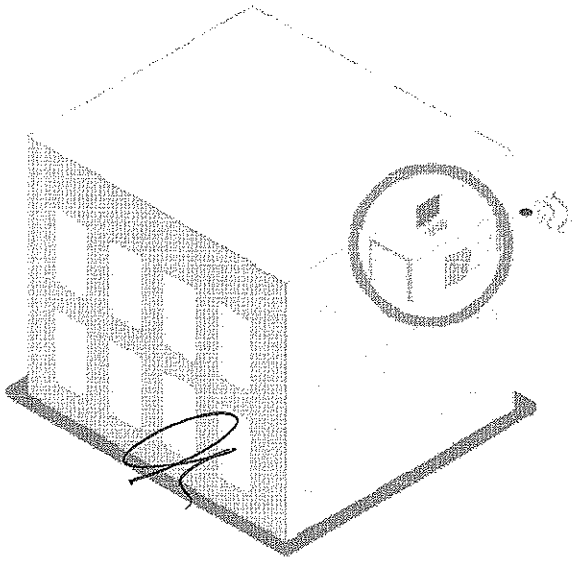
Ammeter

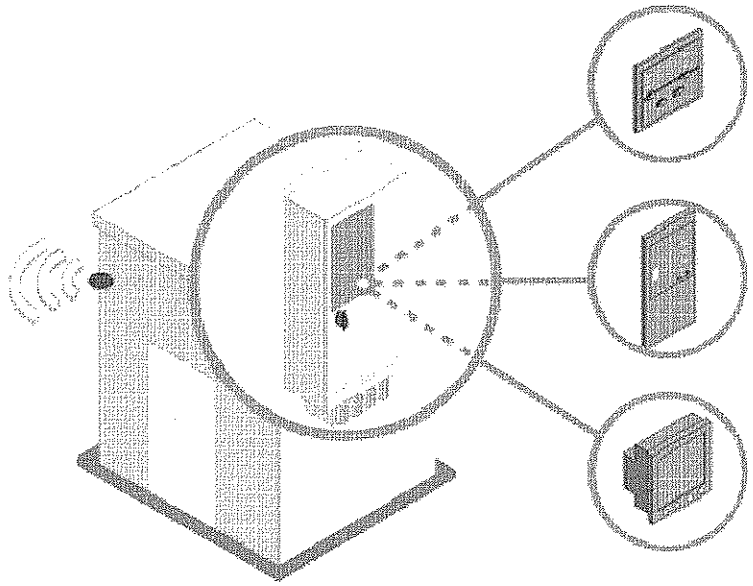
- No power supply
- Digital display
- 3 phase current indication
- Maximeter
- Accuracy : ~5%
- 1A resolution



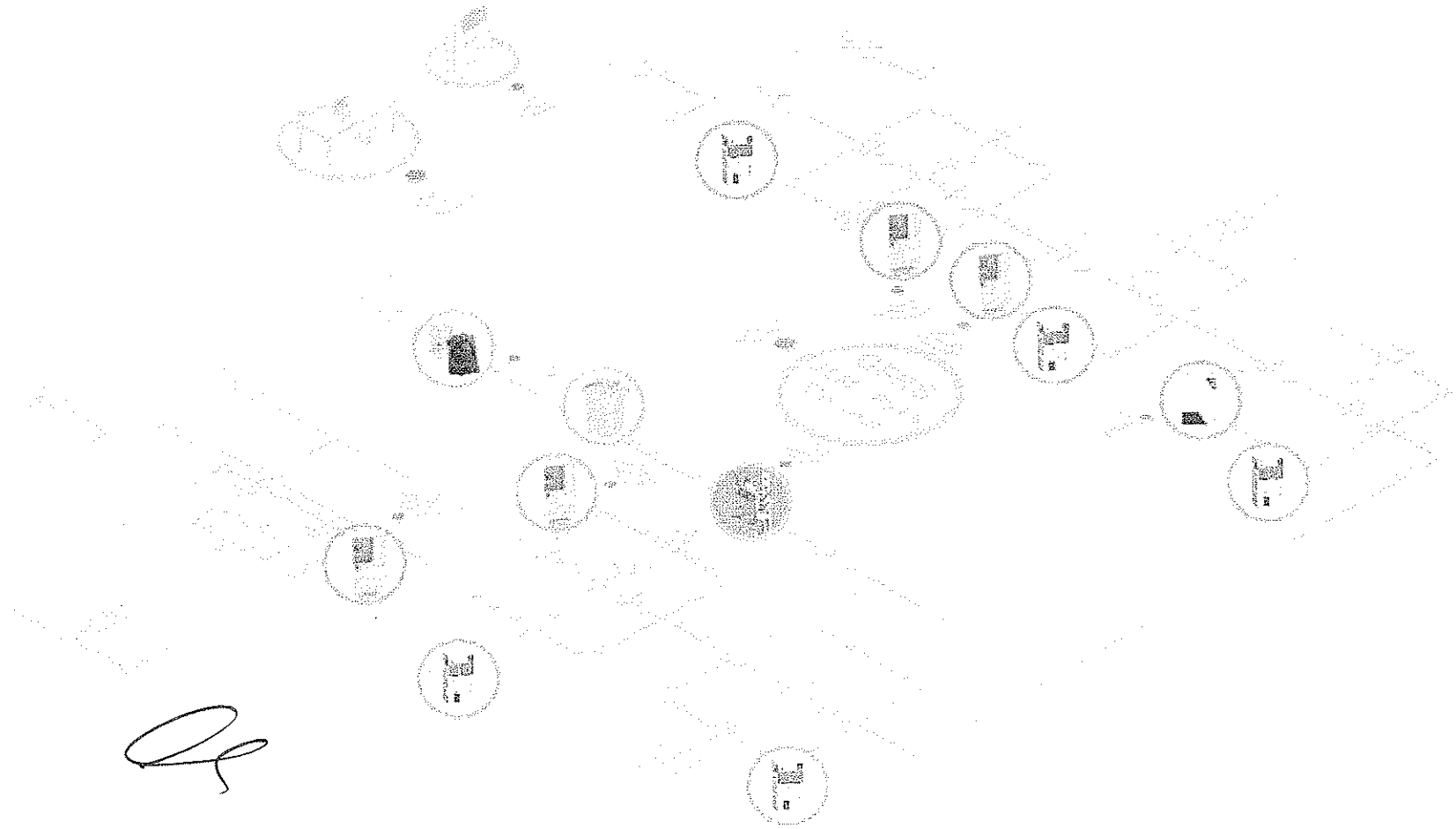
Hi-reliability: guaranteeing continuity of service

- T200 is a simplified MV substation control unit for secondary distribution network enabling remote control of one or two substation switches.
  - Multifunctional "plug & play" interface which integrates all functions required for remote monitoring and control.
  - Compatible with all SCADA remote control system.

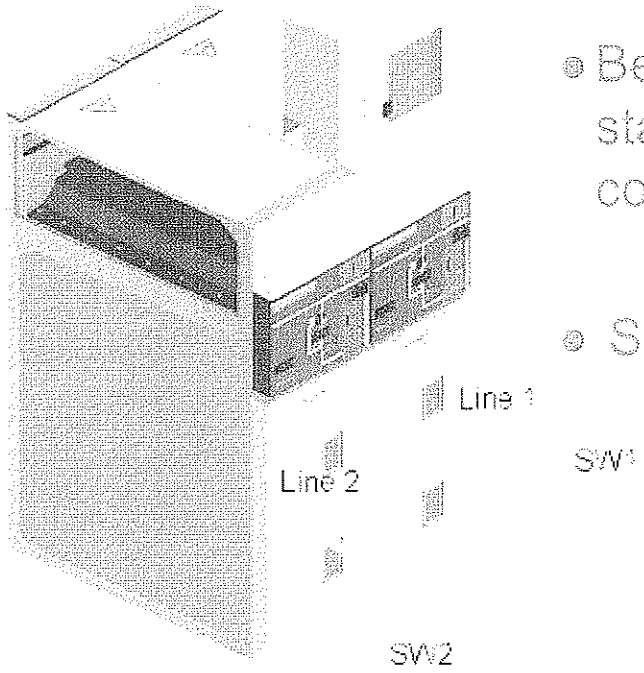




Guaranteeing continuity of service with control and monitoring



Guaranteeing continuity of service through hi-reliability



- Because continuity of service is one major stake, the change-over function gives automatic control and let you free from cut-off.
- Switching time : Less than 0.4'

ВЯРНО С
ОРИГИНАЛА

Making the most of our energy

Continuity of service

Easy upgradeability

Monitoring and protection of your network

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ПРИЛОЖЕНИЕ 2

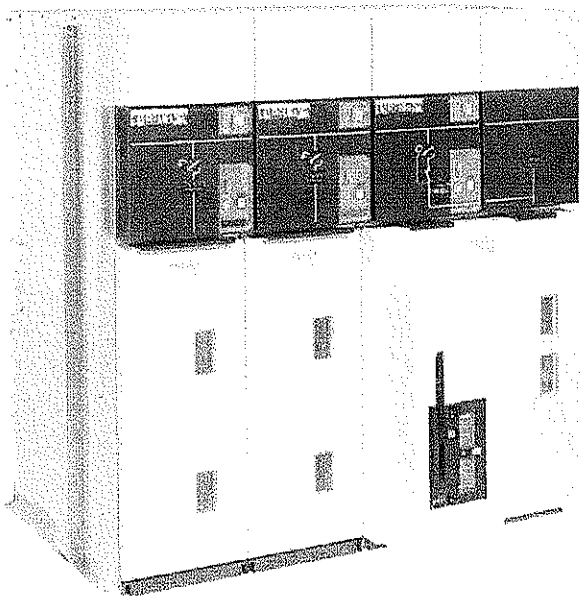
Medium Voltage Distribution

Catalogue | 2012

SM6

Modular units

Air insulated switchgear up to 36 kV



ВЯРНО С ОРИГИНАЛА

Make the most of your energy

Schneider Electric

ВЯРНО С ОРИГИНАЛА

Medium Voltage Distribution
SM6
Air insulated switchgear
7.2 to 36 kV

Your requirements...

Continuity of Service & Complete Safety

Safety

- Operating safety through protection against electrical, mechanical and thermal effects of a fault (insulation of each compartment)
- All operations carried out from the front, door closed
- Voltage Presence Indicator System located on the front panel
- Position indicator linked to the devices [illegible]
- Protection in the event of internal arcing
- Interlocking devices
- "Anti-reflex" handles

Reliability

- Type-tested switchboard, complies with the IEC 62271-200 standard
- Design by the most advanced three-dimensional computer techniques
- Manufacturing & testing according to ISO 9001: 2000 quality standard

Simplicity

- Easy installation - All cubicles with the same engineering dimensions
- On site information [illegible]
- Possibility of remote management
- Maintenance with innovation [illegible] very simple
- Compartmentalization of MV parts (insulated partitions)

Reliability + Simplicity = Cost optimization!

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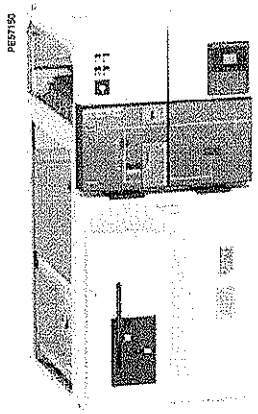
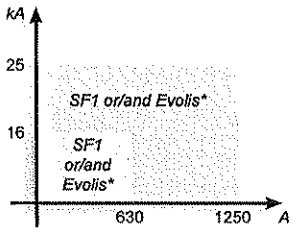
Our solutions

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.





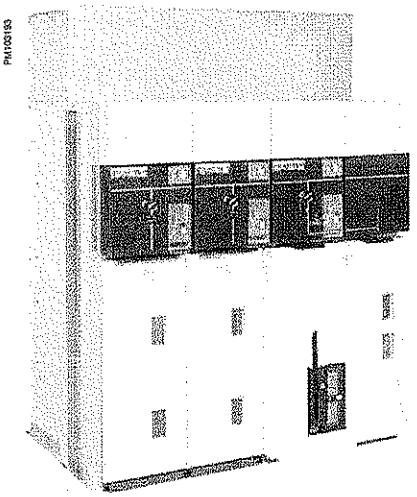
(*) Not available at 36 kV.

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.

SM6, a truly professional solution! More than 1,100,000 cubicles installed world-wide.

Internal Arc Classification: A-FL and A-FLR.
- 3-sides internal arc protection IAC: A-FL,
  12,5 kA 1 s and 16 kA 1 s for 24 kV and 16 kA 1 s for 36 kV.
- 4-sides internal arc protection IAC: A-FLR,
  16 kA 1 s and 20 kA 1 s for 24 kV.
- Choice of exhaust:
  - downwards exhaust
  - upwards exhaust for 24 kV.



General contents

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ВЯРНО С ОРИГИНАЛА

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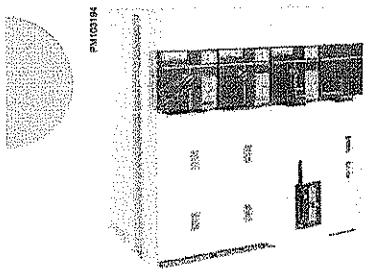
The experience of a world leader



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.

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.

2012: a leading position
With over 1,100,000 SM6 cubicles installed around the world, Schneider Electric consolidates its position as uncontested leader in the Medium Voltage field.

ВЯРНО С ОРИГИНАЛА

The range's advantages

Upgradability

SM6, a comprehensive range

- A comprehensive offer covering your present and future requirements
- A design adapted to the extension of your installations
- A catalogue of functions for all your applications
- A product designed to be in compliance with standards constraints
- Options to anticipate the control and monitoring of your installations.

Compactness

SM6, an optimised range

- Compact units, with low increment cubicles
- Rationalised space requirement for switchboard installation
- Reduction of civil works costs
- Easy integration in factory-built outdoor substations for which the SM6 is particularly well designed.

Maintenance

SM6, a range with reduced maintenance

- The active parts (breaking and earthing) are integrated in an SF6-filled, "sealed for life" unit
- The control mechanisms, are intented to function with reduced maintenance under normal operating conditions
- Enhanced electrical endurance when breaking.

Ease of installation

SM6, a simple range to incorporate

- Reduced dimensions and weights
- Only one civil works layout
- A solution adapted to cable connection
- Simplified switchboard busbar design.

Ease and safe to operate

SM6, a proven range

- A three position switch to block incorrect switching
- The earthing disconnector has full closing capacity
- Positive breaking of position indicators
- Internal arc withstand in the cable and switchgear compartments
- Clear and animated display diagrams
- Switching lever with an "anti-reflex" function
- Compartmented cubicles.

SM6: a range designed with 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.

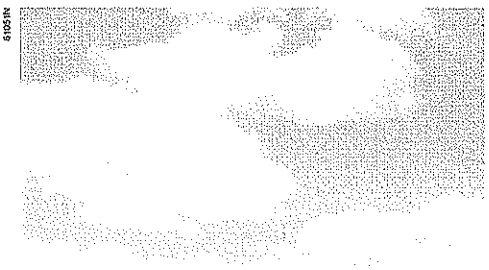
SM6: a range with adapted protection devices

With the SM6, Schneider Electric proposes solutions for network management; the Sepam and VIP or relay ranges protect installations, providing continuity of electrical supply and reducing downtime.

Protecting the environment

Product environmental profile & recycling service

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

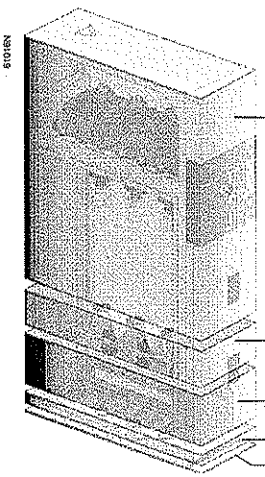


Schneider Electric is committed to a long term environmental approach.
As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product's recycleability.

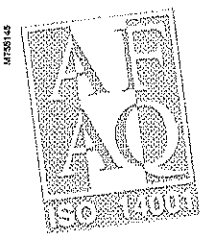
The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable.
It was performed in conformity with ISO 14040 "Environmental management: life cycle assessment - principle and framework".

At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular withoutany gas being released to the atmosphere nor any polluting fluids being discharged.

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



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



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

A full range of services

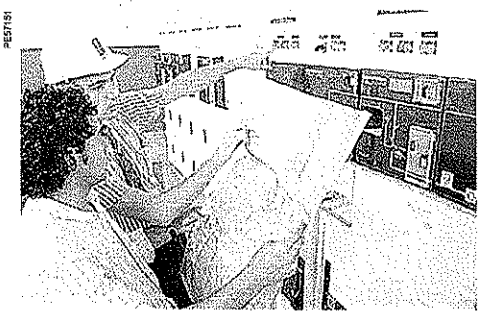
Schneider Electric is capable of offering a full range of services either associated or not with the supply of the SM6 unit.

To improve the quality of your electrical power:
- Network study, harmonics study, etc.
- Reactive energy compensation
- Consumption monitoring
- Optimisation of your electrical power supply contracts.

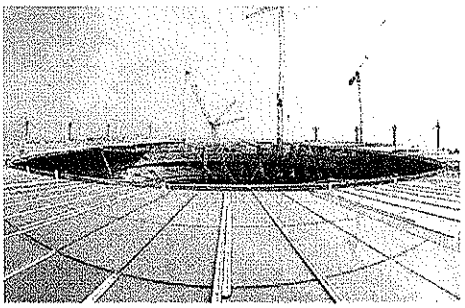
To accompany the purchase and installation of your SM6 equipment:
- Adaptation of our equipment to provide a better response to your requirements
- On site assembly, testing and commissioning of your equipment
- Customised financing solutions
- Warranty extension
- Operator training.

To accompany your installation throughout its life and upgrading your equipment:
- Upgrading your existing equipment: functional adaptation, control motorisation, renovation of protections units, etc.
- On site work
- Supply of replacement parts
- Maintenance contracts
- End of life recycling.

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



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

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 French Quality Assurance Association (**FQAA**).

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

MT56054

MT56055

61002N

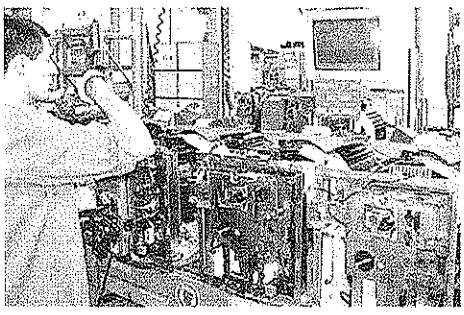
Meticulous and systematic controls

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.

61003N



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 24 kV *
- MTTF (cumulative) = 6259 years for 36 kV *.

(*) Year 2010.

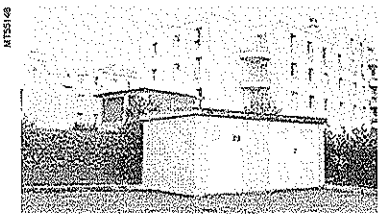
Contents

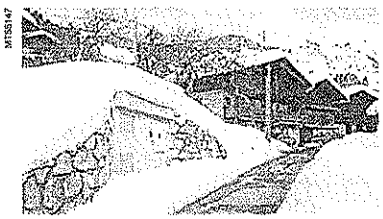
Field of application

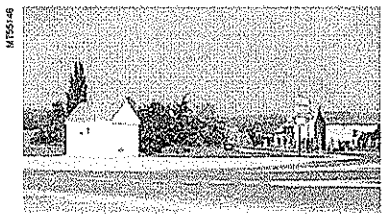
The SM6 is made up of modular units containing fixed, disconnectable or withdrawable metal-enclosed switchgear, using sulphur hexafluoride (SF6) or vacuum:

- Switch-disconnector
- SF1, SFset or Evolis circuit breaker
- Rollarc 400 or 400 D contactor, or vacuum contactor
- Disconnector.

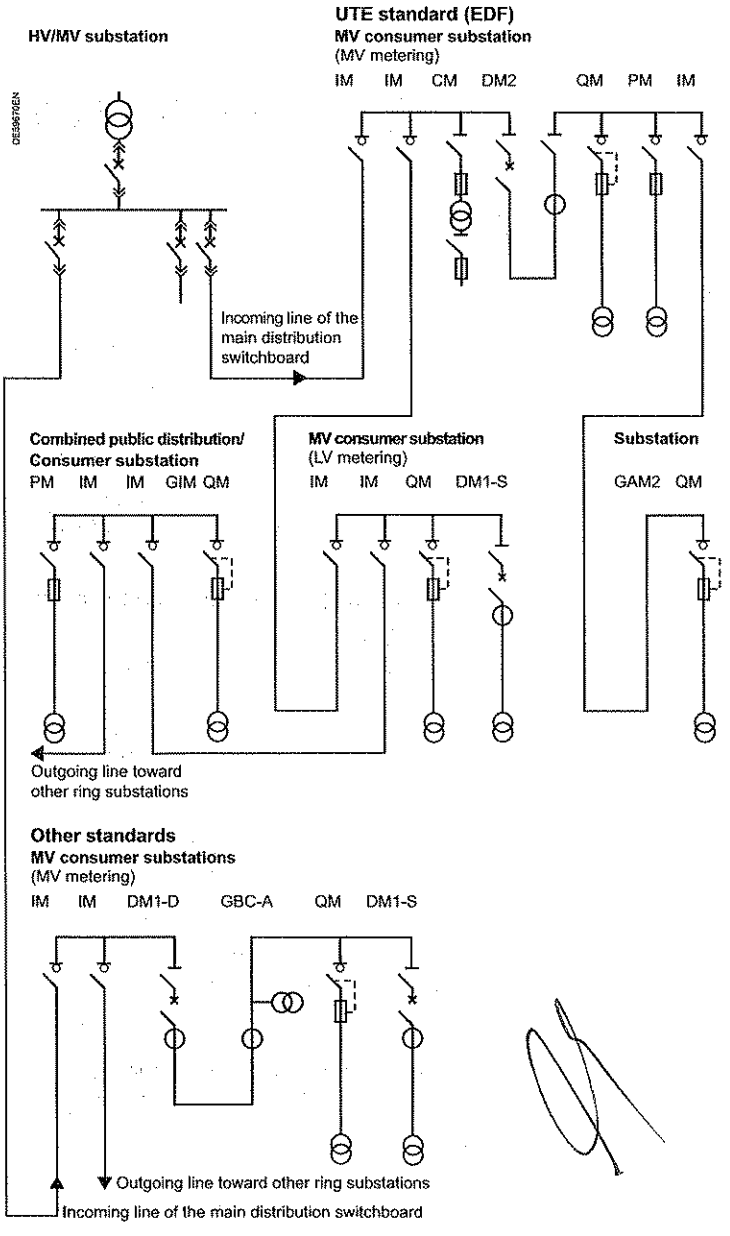
SM6 units are used for the MV section in MV/LV transformer substations in public distribution systems and MV consumer or distribution substations up to 36 kV.





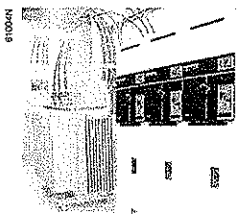


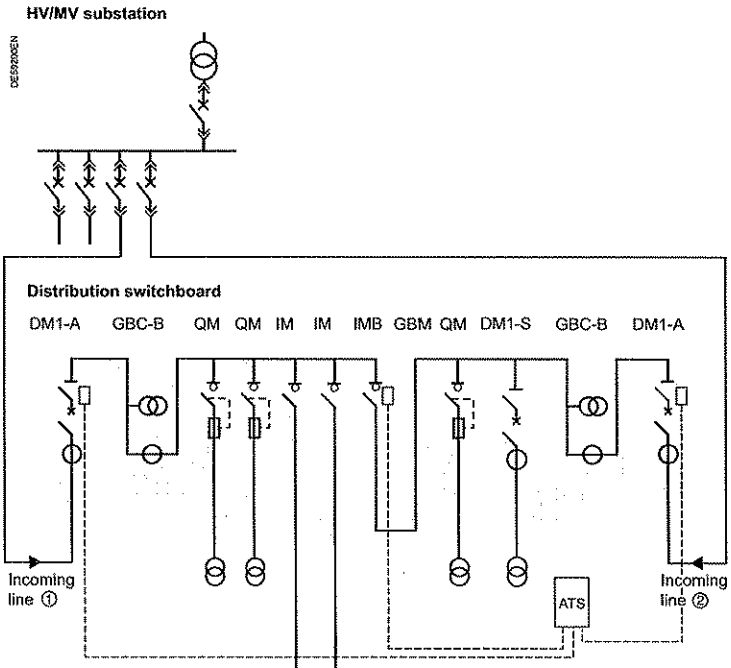
MV/LV transformer substations



Field of application

Industrial distribution substations

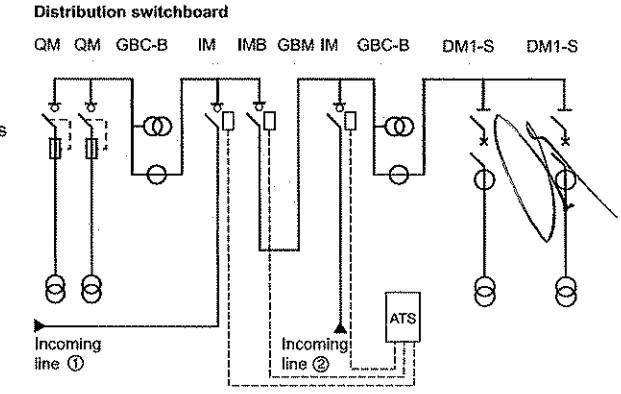




Unit definitions

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

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

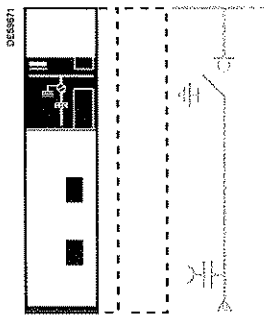


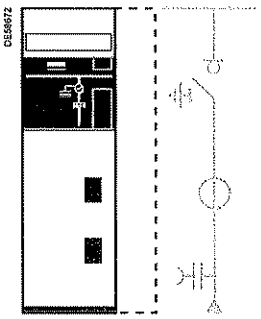
ATS: Automatic Transfer System

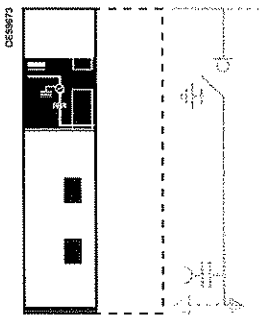
Units for switching function

Switching

page







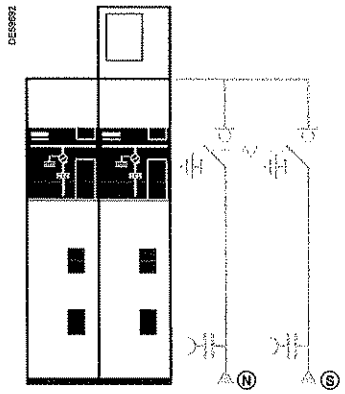
48

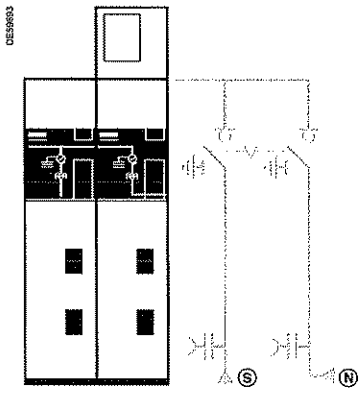
IM
Switch unit
24 kV: 375 or 500 mm
36 kV: 750 mm

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

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

Automatic transfer system

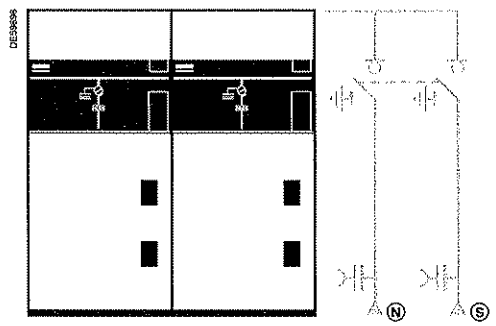


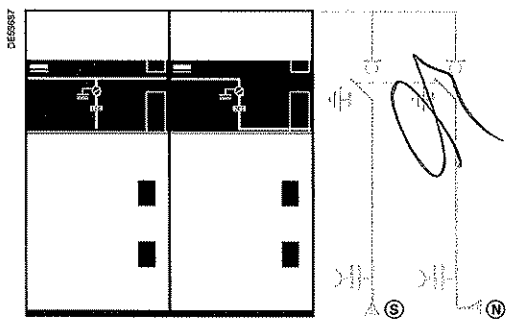


49

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

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





50

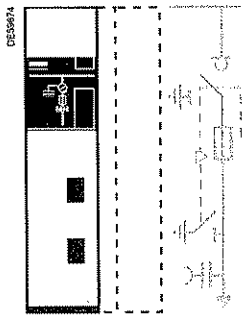
NSM-cables
Cables power supply
for main incoming line
and standby line
36 kV: 1500 mm

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

Units for protection function

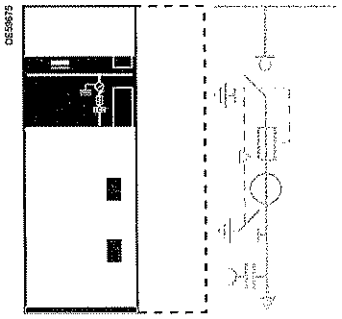
Fuse-switch

page

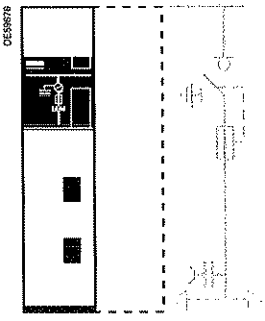


51

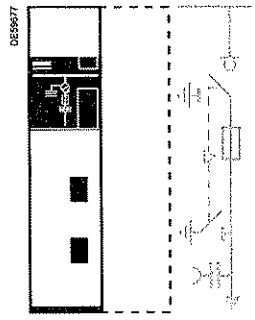
QM
Fuse-switch combination unit
24 kV: 375 or 500 mm
36 kV: 750 mm



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



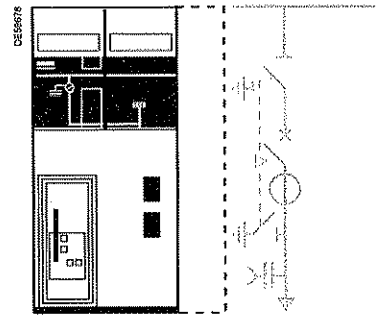
QMB
Fuse-switch combination unit
right or left outgoing line
24 kV: 375 mm
36 kV: 750 mm



52

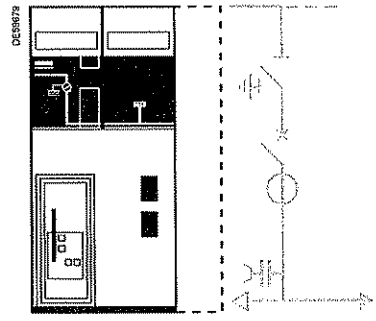
PM
Fuse-switch unit
24 kV: 375 mm
36 kV: 750 mm

SF6 circuit-breaker



53

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

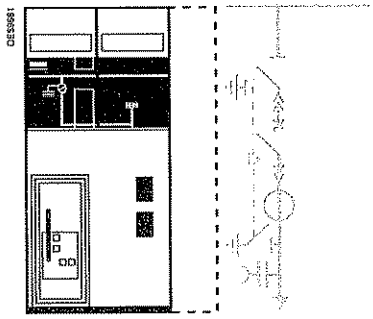


DM1-D
Single-isolation, disconnectable circuit breaker unit
right or left outgoing line
24 kV: 750 mm
36 kV: 1000 mm

Units for protection function

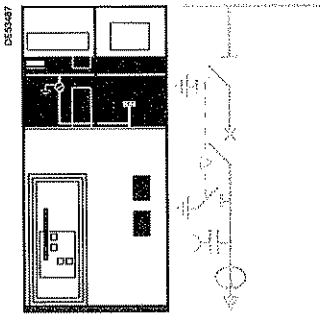
SF6 circuit-breaker

page

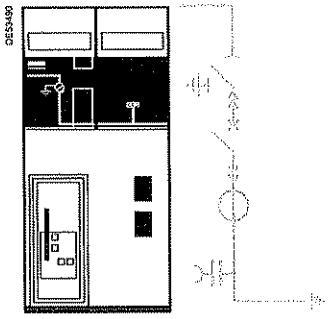


54
55

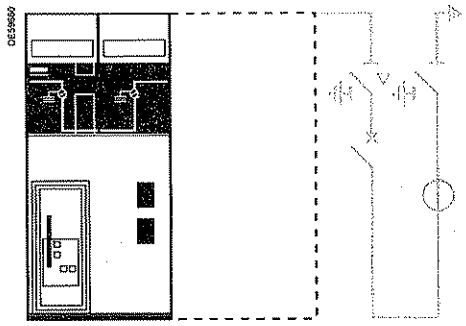
DM1-W
Withdrawable single-isolation circuit breaker unit
24 kV: 750 mm
36 kV: 1000 mm



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



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



54
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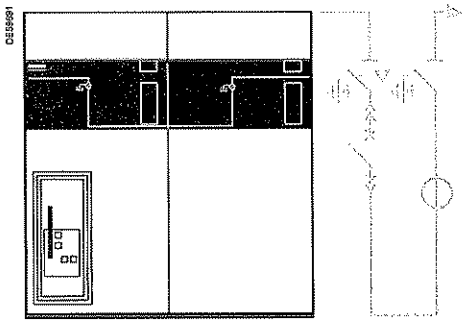
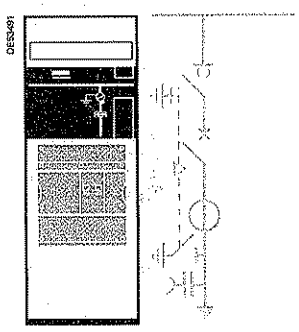
DM2
Double-isolation, disconnectable circuit breaker unit right or left outgoing line
24 kV: 750 mm
36 kV: 1500 mm



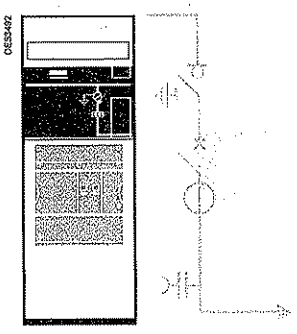
DM2-W
Withdrawable double-isolation circuit breaker unit right outgoing line
36 kV: 1500 mm

Vacuum circuit-breaker

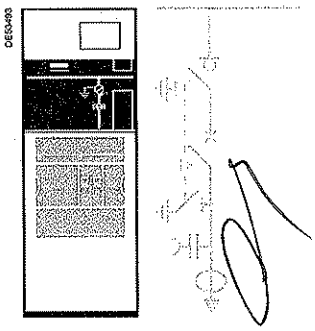


56

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



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



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

Units for protection function

Vacuum circuit-breaker

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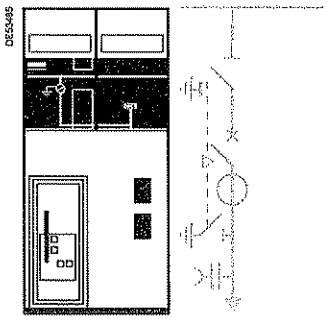
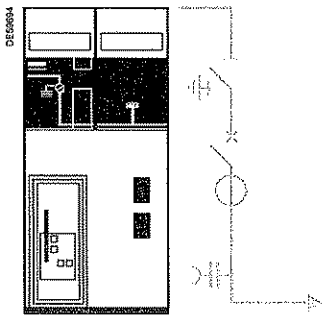


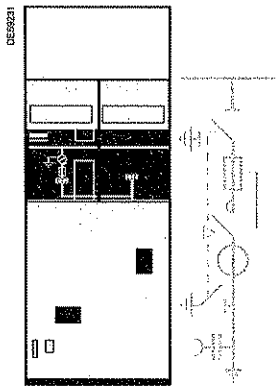
57

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



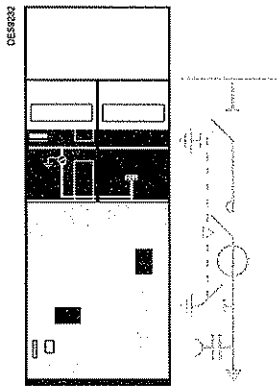
DMVL-D
Single-isolation, disconnectable circuit breaker unit right outgoing line
24 kV: 750 mm

Vacuum contactor (Direct Motor Starter)



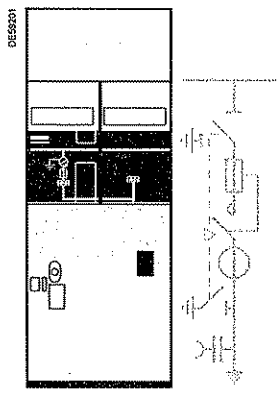
58

CVM
Fuse-contactor unit
24 kV: 750 mm



CVM
Contactor unit
24 kV: 750 mm

SF6 contactor (Direct Motor Starter)



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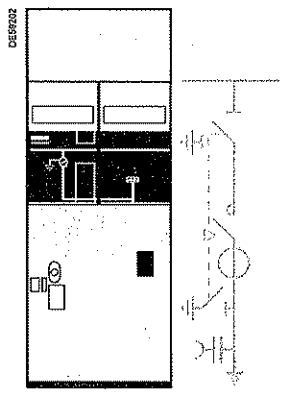
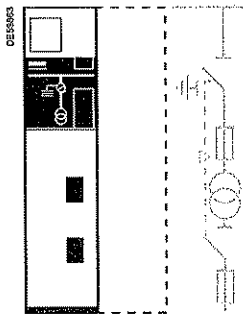
CRM
Fuse-contactor unit
24 kV: 750 mm



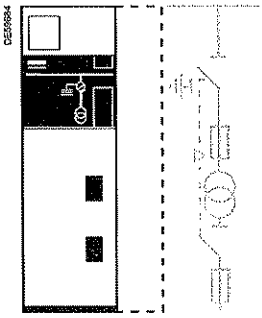
CRM
Contactor unit
24 kV: 750 mm

Units for metering function

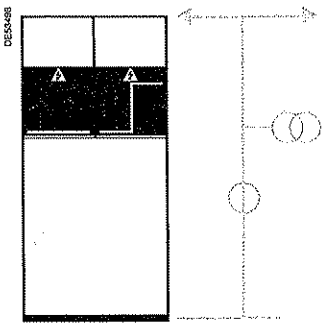
page



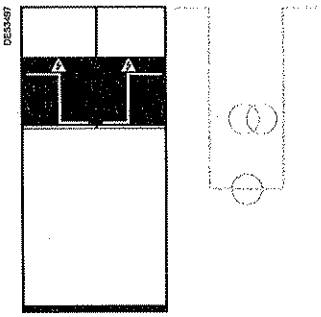
60 **CM**
Voltage transformers for mains with earthed neutral system
24 kV: 375 mm
36 kV: 750 mm



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



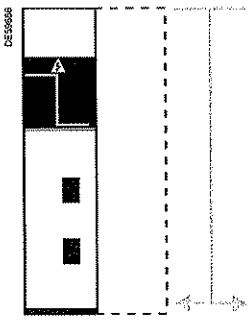
61 **GBC-A**
Current and/or voltage measurement unit right or left outgoing line
24 and 36 kV: 750 mm



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

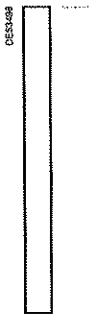
Units for other functions

page

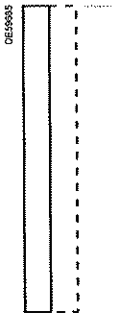


62

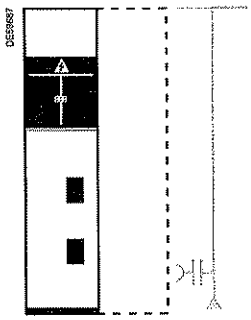
GBM
Connection unit
right or left outgoing line
24 kV: 375 mm
36 kV: 750 mm



GEM
Extension unit VM6/SM6
24 kV: 125 mm

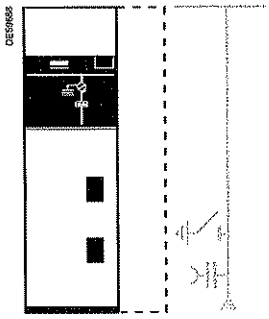


GIM
Intermediate bus unit
24 kV: 125 mm
36 kV: 250 mm

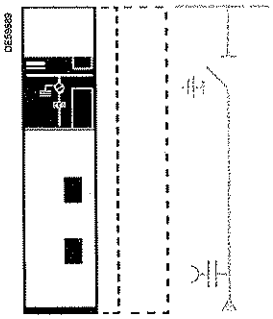


63

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

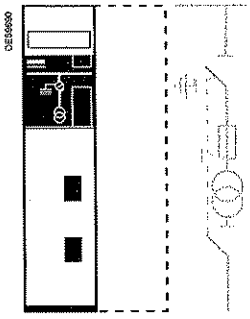


GAM
Incoming cable-connection unit
with earthing
24 kV: 500 mm
36 kV: 750 mm

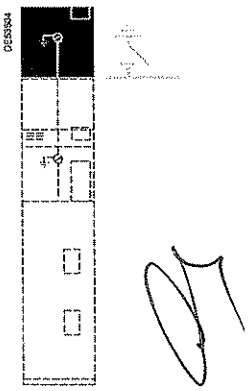


64

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



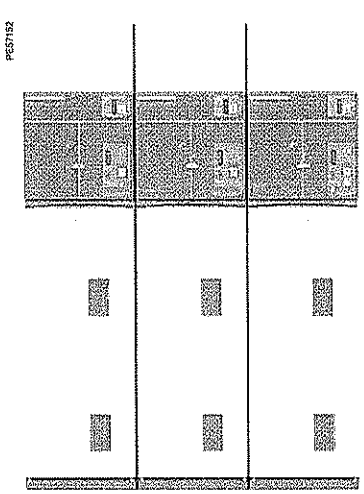
TM
MV/LV transformer unit
for auxiliaries
24 kV: 375 mm
36 kV: 750 mm



EMB
Busbar earthing compartment
24 kV: 375 mm

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.



SM6 units are designed for indoor installations.
Their compact dimensions are:
- 375 to 1500 mm width
- 1600 to 2250 mm height
- 840 to 1400 mm depth...

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

Normal operating conditions

- **Ambient air temperature:**

1) less than or equal to 40°C
2) less than or equal to 35°C on average over 24 hours
3) greater or equal to –5°C.

- **Altitude**

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

- **Solar radiation**

1) no solar radiation influence is permitted.

- **Ambient air pollution**

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

- **Humidity**

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

For these conditions, condensation may occasionally occur. Condensation can be expected where sudden temperature changes occur in periods of high humidity.

To withstand the effects of high humidity and condensation, such as breakdown of insulation, please pay attention on Civil Engineering recommendations for design of the building or housing, by suitable ventilation and installation.

Severe operating conditions (please consult us).

Standards

SM6 units meet all the following standards and specifications:

- IEC standards
- UTE standards for 24 kV
- EDF specifications 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.
60044-1	Instrument transformers - Part 1: Current transformers.
60044-2	Instrument transformers - Part 2: Voltage transformers.
60044-8	Instrument transformers - Part 8: Low Power Current Transducers.
61958	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems.
62271-206	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems.

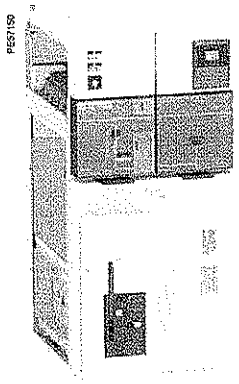
■ UTE standards for 24 kV

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

EDF specifications for 24 kV

HN 64-S-41	A.C. metal-enclosed 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



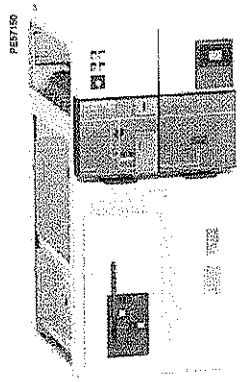
The hereunder values are for working temperatures from -5°C up to +40°C and for a setting up at an altitude below 1000 m.

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 (1)	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** (2)	kA/1 s	25	630 - 1250				1250
			20 (3)	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, NSM-cables, NSM-busbars		A		630 - 800 (4)				630
QM, QMC, QMB		kA		25		20		20
PM		kA		25				20
CRM		kA		10	NA			
CRM with fuses		kA		25	NA			
CVM		kA		6.3	NA			
CVM with Fuses		kA		25	NA			
SF6 circuit breaker range								
DM1-A, DM1-D, DM1-W		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
DM2-W		kA	25	NA				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) 60 kV peak for the CRM unit
(2) 3 phases
(3) In 20 kA/3 s, consult us
(4) In 800 A, consult us.

Main characteristics



Endurance

Units		Mechanical endurance	Electrical endurance
Units IM, IMC, IMB, PM, QM [5], QMC [5], QMB [5], NSM-cables, NSM-busbars		IEC 62271-103 1 000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
CRM	Disconnector	IEC 62271-102 1 000 operations	
	Rollarc 400	IEC 60470 300 000 operations	IEC 60470 100 000 breaks at 320 A 300 000 breaks at 250 A
	Rollarc 400D	100 000 operations	100 000 breaks at 200 A
CVM	Disconnector	IEC 62271-102 1 000 operations	
	Vacuum contactor	IEC 60470 2 500 000 operations 250 000 with mechanical latching	IEC 60470 250 000 breaks at Ir
SF6 circuit breaker range			
DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 DM2-W	Disconnector	IEC 62271-102 1 000 operations	
	SF circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 30 breaks at 12.5 kA for 24 kV 25 breaks at 25 kA for 24 kV 40 breaks at 16 kA for 36 kV 15 breaks at 25 kA for 36 kV 10 000 breaks at Ir, p.f. = 0.7, class E2
Vacuum circuit breaker range			
DMV-A, DMV-D, DMV-S	Switch	IEC 62271-103 1 000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
	Evolis circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 10 000 breaks at Ir, p.f. = 0.7, class E2
DMVL-A DMVL-D	Disconnector	IEC 62271-102 1 000 operations	
	Evolis circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 10 000 breaks at Ir, p.f. = 0.7, class E2

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

Internal arc withstand (in accordance with IEC 62271-200):
- ■ SM6 24 kV:
- □ 12.5 kA 1 s, 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 kV:
- □ 16 kA 1 s, IAC: A-FL.

Protection index:
- ■ Classes: PI (insulating partition)
- ■ Loss of service continuity classes: LSC2A
- ■ Units in switchboard: IP3X
- ■ Between compartments: IP2X for 24 kV, IP2XC for 36 kV
- ■ Cubicle: IK08 for 24 kV, IK07 for 36 kV.

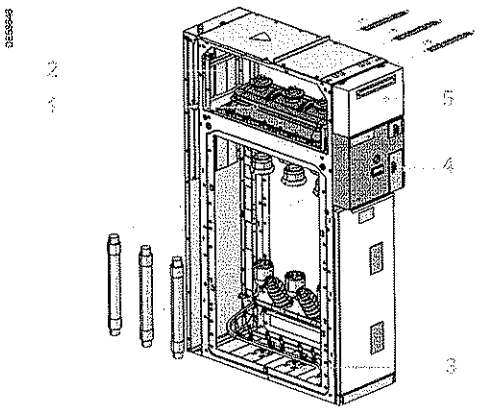
Electro-magnetic compatibility:
- ■ Relays: 4 kV withstand capacity, as per recommendation IEC 60801.4
- ■ Compartments:
- □ electrical field:
  - 40 dB attenuation at 100 MHz
  - 20 dB attenuation at 200 MHz
- □ magnetic field: 20 dB attenuation below 30 MHz.

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

Factory-built cubicles description

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

Switch and fuse protection cubicles



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

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

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

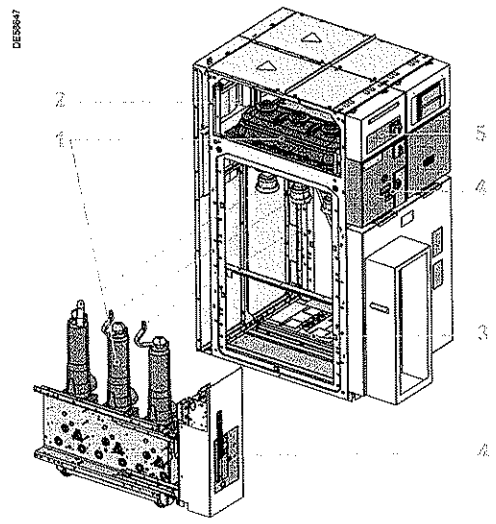
4 **operating mechanism**: contains the elements used to operate the switch-disconnector and earthing switch and actuate the corresponding indications (positive break).

5 **low voltage**: installation of a terminal block (if motor option installed), LV fuses and compact relay devices.
If more space is required, an additional enclosure may be added on top of the cubicle.

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

(*) 2 compartments for 36 kV

SF6 circuit breaker cubicles



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

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

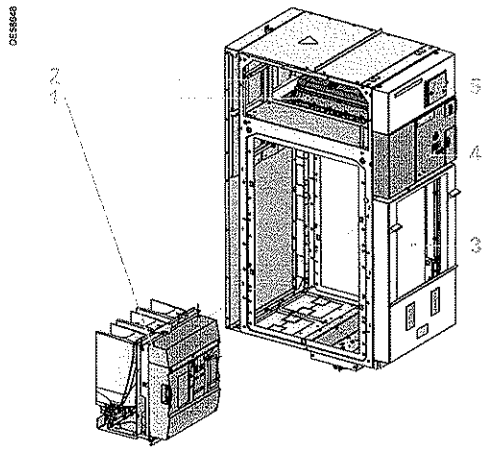
3 **connection and switchgear**: accessible through front, connection to the downstream terminals of the circuit breaker.
Two circuit breaker offers are possible:
- SF1: combined with an electronic relay and standard sensors (with or without an auxiliary power supply
- SFset: autonomous set equipped with an electronic protection system and special sensors (requiring no auxiliary power supply).

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

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

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

Factory-built cubicles description



Frontal vacuum type circuit breaker cubicles

1 **switchgear**: load break switch and earthing switch(es), in enclosure filled with SF6 and satisfying and one vacuum circuit breaker, "sealed pressure system" requirements.

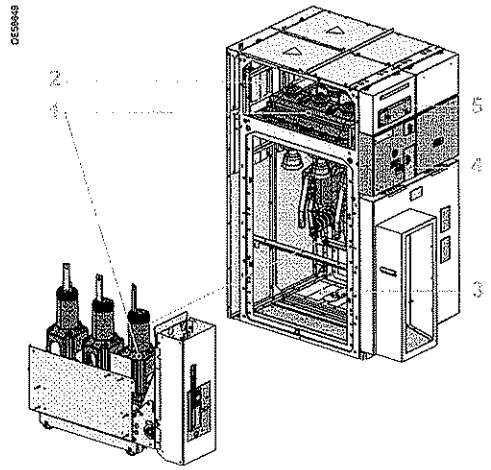
2 **busbars**: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

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



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.

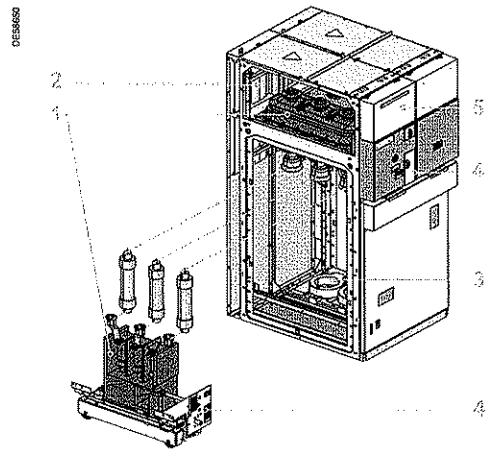
2 **busbars**: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

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".



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.

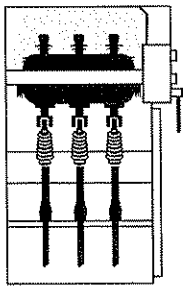
3 **connection and switchgear**: accessible through front.
This compartment is also equipped with an earthing switch downstream.
The contactor may be equipped with fuses.
4 types may be used:
- R400 with magnetic holding
- R400D with mechanical latching
- Vacuum with magnetic holding
- Vacuum with mechanical latching.

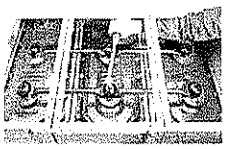
4 **operating mechanism**: contains the elements used to operate the disconnector(s), the contactor and the earthing switch and actuate the corresponding indications.

5 **low voltage**: installation of compact relay devices and test terminal boxes. With basic equipment, an additional enclosure is added on top of the cubicle.

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

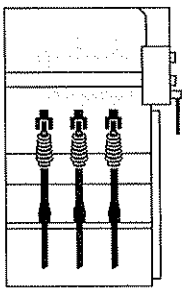
Compartments description

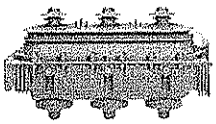




Busbar compartment

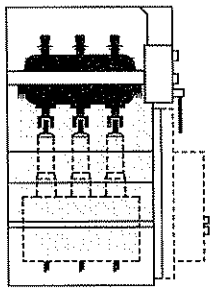
The three insulated busbars are parallel-mounted. Connection is made to the upper pads of the enclosure using a field distributor with integrated captive screws.
Ratings 400 (for 24 kV only) - 630 - 1250 A.



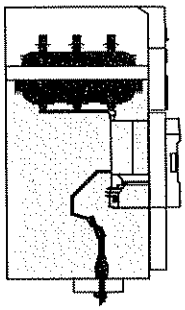


Switch compartment

This compartment 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 and switch compartment

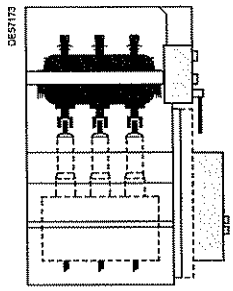
The network cables are connected:
- To the terminals of the switch
- To the lower fuse holders
- Or to the connection pads of the circuit breaker.

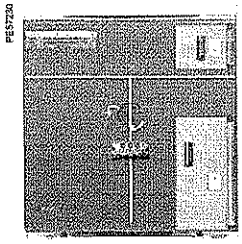
Cables may have either:
- Cold fitted cable end for dry-type

With basic equipment, the maximum allowable cross-section for cable is:
- 630 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 fonctional units characteristics chapter for each unit allowable section.
The earthing switch must be closed before the cubicle may be accessed.
The reduced depth of the cubicle makes for easy connection of all phases.
A stud incorporated in the field distributor makes it possible to position and secure the cable-end lug with a single hand.

Compartments description

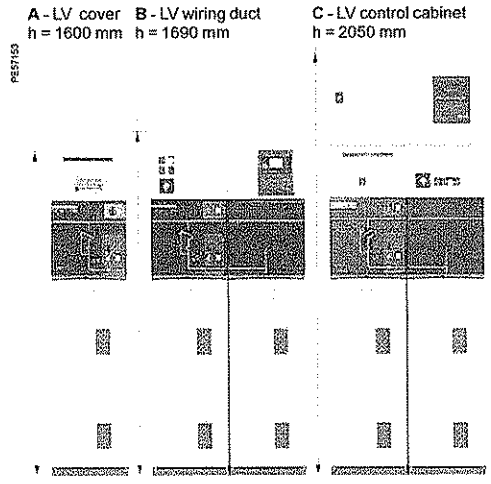




Operating-mechanism cover

These covers contain the various operating functions for the:
- switch and earthing switch
- disconnector(s)
- circuit breaker
- contactor

and the voltage presence indicator.
The operating-mechanism cover may be accessed with the cables and busbars energised and without isolating the substation.
It also enables easy installation of padlocks, locks and standard LV accessories (auxiliary contacts, trip units, motors, etc.).



Low-voltage monitoring control cabinet for 24 kV

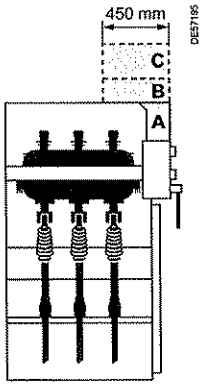
It enables the cubicle to be equipped with low voltage switchgear providing protection, control, status indication and data transmission.
According to the volume, it is available in 3 versions: cover, wiring duct and cabinet.

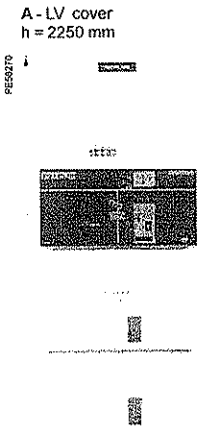
A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 1600 mm.

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

C - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 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.



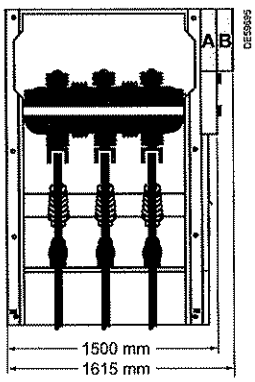


Low-voltage monitoring control cabinet for 36 kV

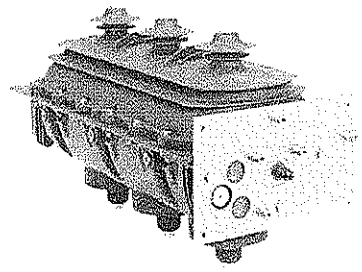
A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 2250 mm.

B - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 60 or series 80, converters, control and monitoring units, regulating transformers or dual secondary transformers.

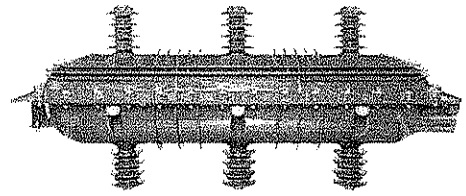
In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.



Switch or disconnector and earthing switch



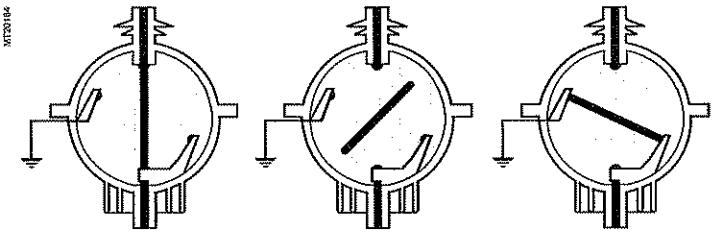
Switch-disconnector for 24 kV



Switch-disconnector for 36 kV

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

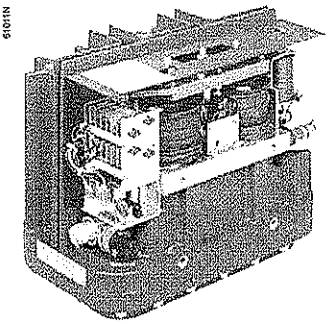
■ **Operating safety**
□ the switch may be in one of three positions: "closed", "open", or "earthed", representing a natural interlocking system that prevents incorrect operation. Moving-contact rotation is driven by a fast-acting mechanism that is independent of the action of the operator.
□ the device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



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.

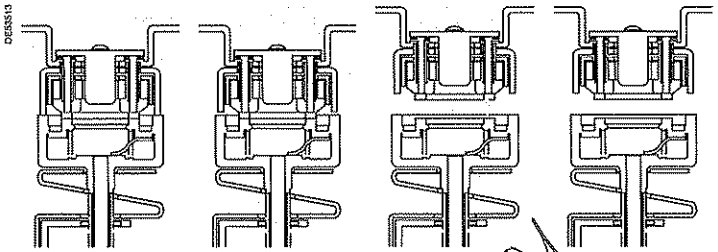
Rollarc 400 and 400D contactor



Rollarc contactor

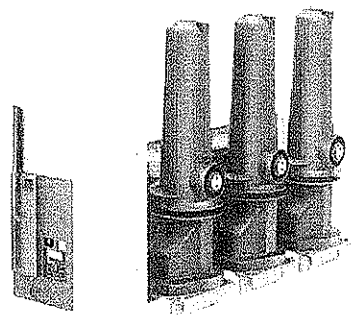
■ **Gas tightness**
The three phases are placed in an enclosure filled with SF6 gas to a relative pressure of 2.5 bars (2500 hPa). It satisfies "sealed pressure system" requirements and seal tightness is always checked in the factory.

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

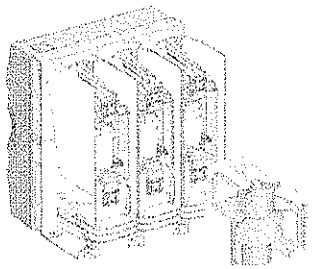


Contacts closed *Main contacts separated* *Arcing period* *Contacts open*

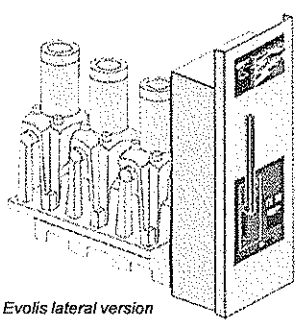
Safety of people
By switchgear



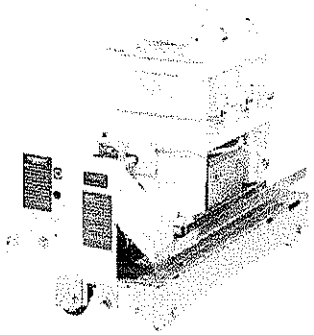
SF1 circuit breaker



Evolis circuit breaker



Evolis lateral version

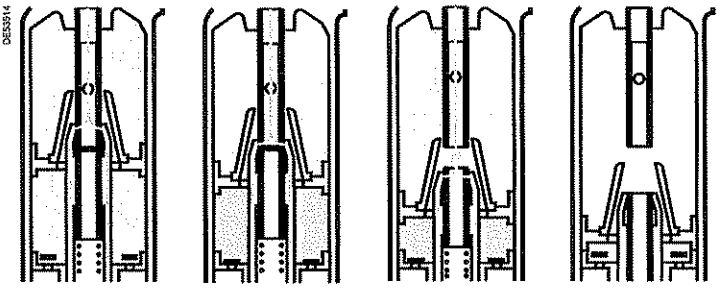


Vacuum type contactor

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.



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

Vacuum type circuit breaker: Evolis

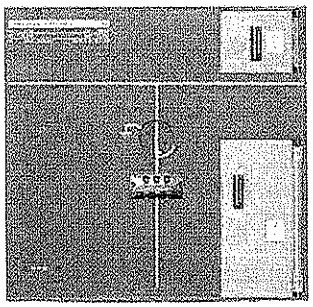
■ **Vacuum tightness**
The Evolis circuit breaker comprises three separate pole units fixed on a structure supporting the control mechanism. Each pole encloses all of the active parts in an insulating enclosure, under vacuum, and its vacuum tightness is systematically checked in the factory.

■ **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

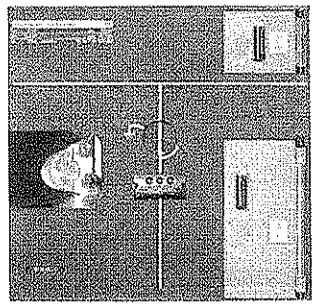


Reliable operating mechanism

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

Simple and effortless switching

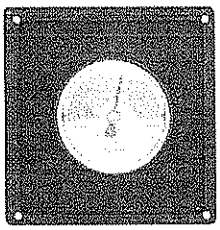
Mechanical and electrical controls are side by side on the front fascia, on a panel including the schematic diagram indicating the device's status (closed, open, earthed):
■ **Closed:** the drive shaft is operated via a quick acting mechanism, independent of the operator. No energy is stored in the switch,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



Visibility of main contacts

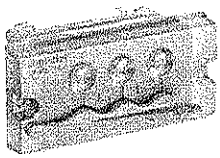
Visibility of main contacts (option)

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



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.



Voltage Presence Indicating System

VPIS complies with IEC 61958 and 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 susbstations worldwide.
Exits in Voltage Output version to provide voltage presence information to VD23 voltage presence relay.

Safety of people
By internal arc protection

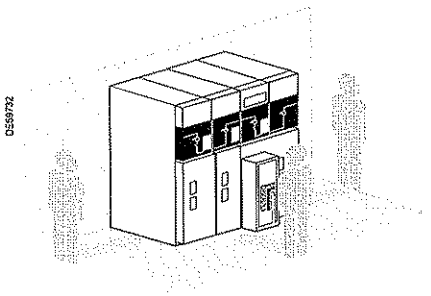
Standard IEC 62271-200 appendix A indicates a method for testing switchgear in metal enclosures under internal arc conditions. The aim of this test is to show that an operator situated in front of a switchboard would be protected against the effects of an internal fault.

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

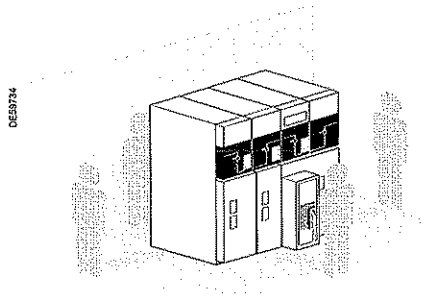
- **Control of the architecture:**
  - compartment type enclosure.
- **Technological control:**
  - electrotechnical: modelling of electrical fields,
  - mechanical: parts produced using CAD systems.
- **Use of reliable components:**
  - choice of materials,
  - earthing switch with closing capacity.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



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

Internal arc withstand (in conformity with IEC 62271-200)

- **3 versions are available for SM6 24 kV:**
  - 12.5 kA 1 s, 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 kV:**
  - 16 kA 1 s, IAC: A-FL.



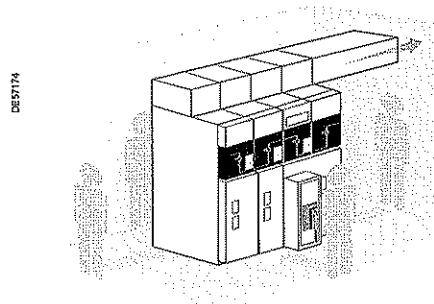
Example of installation of an SM6 24 kV switchboard installed in the middle of a room downwards exhaust 16 kA 1 s, IAC: A-FLR: 4-sides internal arc protection

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.

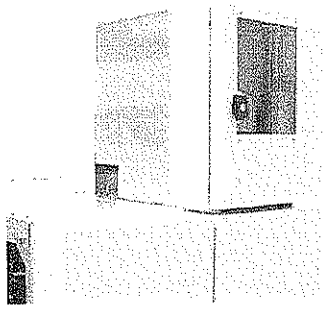
SM6 proposes several options to install a standard internal arc withstand switchboard

- **3-sides internal arc protection IAC: A-FL,**
  12,5 kA 1 s and 16 kA 1 s for 24 kV and 16 kA 1 s for 36 kV.
  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,**
  16 kA 1 s and 20 kA 1 s for 24 kV.
  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 24 kV**
    A ceiling height greater or equal than 2 150 mm is necessary, duct at the right or left side of the cubicle (not supplied).



Example of installation of an SM6 24 kV 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

MV electrical network management
Easergy T200 S for 24 kV



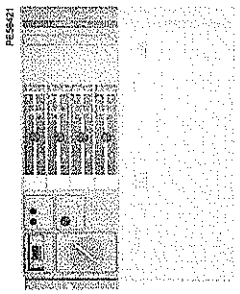
Easergy T200 S for 24 kV: remote control interface in LV control cabinet

Easergy T200 S for NSM cubicle

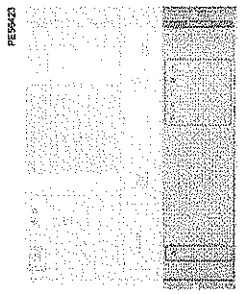
Easergy T200 S is a simplified MV substation control unit for secondary distribution networks enabling remote control of one or two MV substation switches.
T200 S, a version of the T200 unit, is integrated in the SM6 cubicle LV control cabinet.
It is limited to control 2 switches. It is intended for 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.

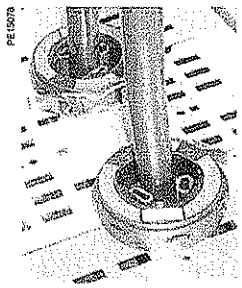
Particularly used during network incidents, Easergy T200 S has proven its reliability and availability to be able to operate the switchgear at all times. It is easy to implement and operate.



Control command



Back up power supply



Split core CTs

Functional unit dedicated to Medium Voltage applications

Easergy T200 S is installed in the low voltage control cabinet of NSM cubicles for remote control of one or two switches.
Easergy notably enables source transfer switching between two switches.
It has a simple panel for local operation to manage electrical controls (local/remote switch) and to display switchgear status information.
It integrates a fault current detector (overcurrent and zero sequence current) with detection thresholds configurable channel by channel (threshold and fault duration).

"Plug and play" and secure

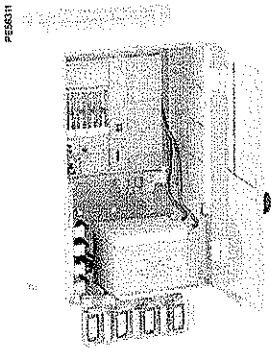
Integrated in the low voltage control cabinet of an MV-equipped cubicle, it is ready to connect to the data transmission system.
Easergy T200 S has been subject to severe tests on its resistance to MV electrical constraints. A back-up power supply guarantees several hours continuity of service for the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

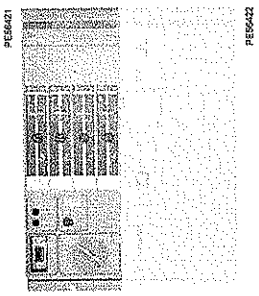
Compatible with all SCADA remote control systems

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

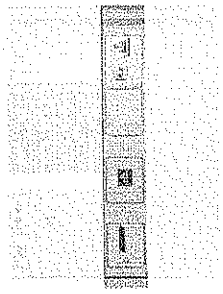
Data transmission system standards are: RS232, RS485, PSTN, FSK, FFSK, GSM/GPRS.
Other systems are available on request, the radio frequency emitter/receiver is not supplied.

MV electrical network management
Easergy T200 I

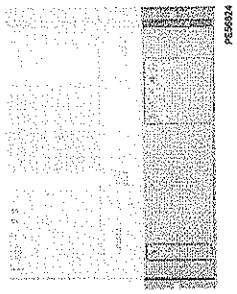




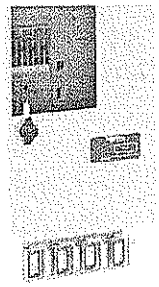
Local information and control



Monitoring and control



Back up power supply



Polarized connectors

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).

Medium Voltage switchgear operating guarantee

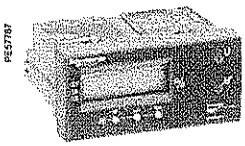
- Easergy T200 I has undergone severe MV electrical stress withstand tests.
- It is a backed up power supply which guarantees continuity of service for several hours in case of loss of the auxiliary source, and supplies power to the Easergy T200 I and the MV switchgear motor mechanisms.
- **Ready to 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.

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.



VD23

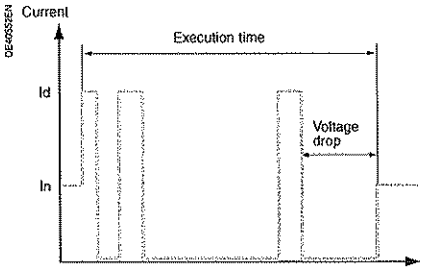
Voltage detection relay

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.

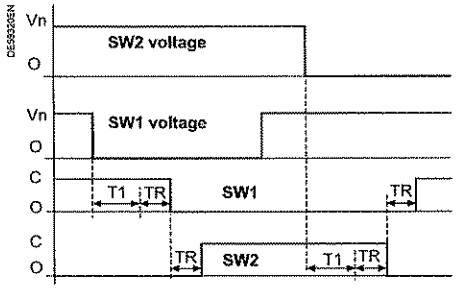
Various combinations of voltage detection are possible:
- 3 Ph-N and residual voltage: V1 + V2 + V3 + V0
- 3 Ph-N or Ph-Ph voltage: V1 + V2 + V3 or U12 + U13 + U23
- 1 Ph-N or Ph-Ph or residual voltage: V1, V2, V3, U12, U13, U23, V0.

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.
- Auxilary 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.**

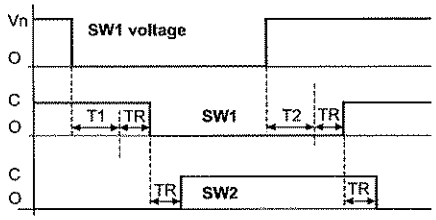
MV electrical network management
Automation systems



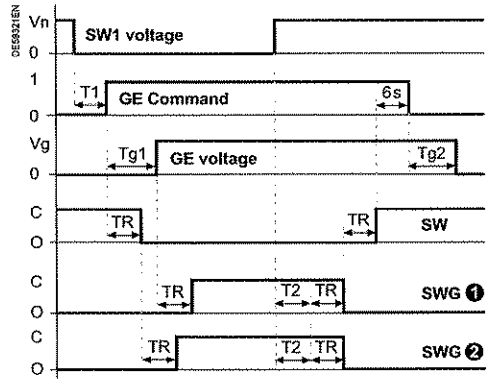
■ Configurable parameters:
□ Number of faults: from 1 to 4
□ Execution time: from 20 s to 4 mins configurable in 5 s steps
□ Automation system valid/invalid.



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.

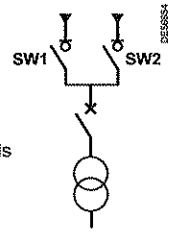
■ The automation system counts the number of times a fault current followed by a voltage loss is detected. It sends an open order if:
□ the switch is closed
□ the fault has disappeared
□ the MV supply is absent.

■ 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:

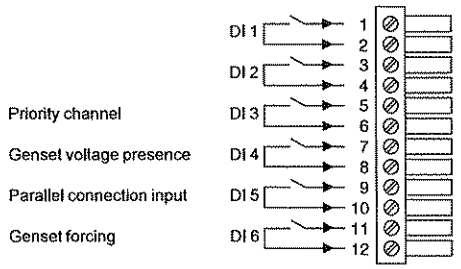
Network ATS: in the event of voltage loss on the normal channel, changeover involves opening the normal channel after time delay T1 and then closing the backup channel.
Note: in "Auto" mode, the sequence of return to the normal channel depends on configuration of the "Paralleling upon auto return" option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

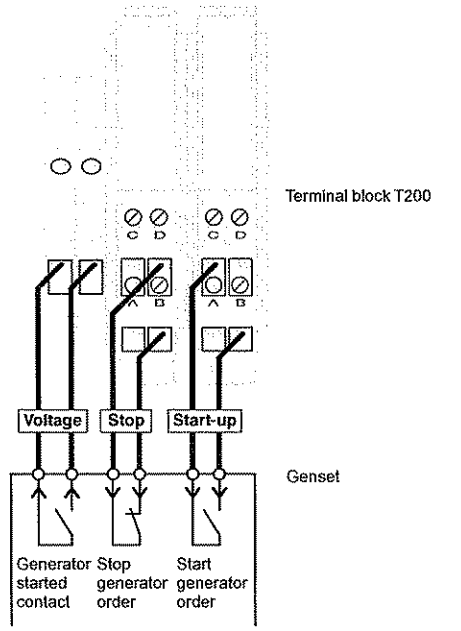
DE59175



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

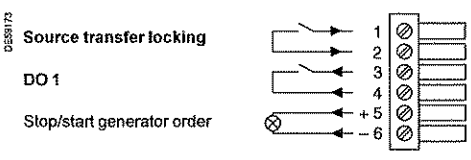
Digital Input connection ("J2" or "J10" terminal block)

DE56666



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**.

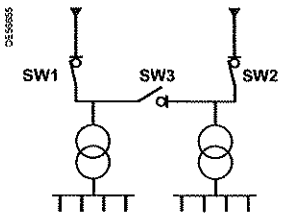
Detection of voltage presence
Voltage presence on a channel managing the Generator can be executed by two processes:
- Either by a dedicated "Voltage" digital input
- Or by voltage relay VD23 (via cubicle cable).

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.

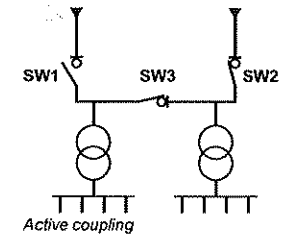
Source transfer locking
A dedicated digital input allows changeover to be locked if a problem occurs on one of the devices related to the changeover. This input is generally connected to the downstream circuit breaker. Local and remote controls are no longer possible in this case.

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.

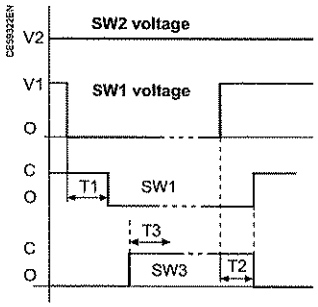
  If voltage returns to the network channel, the automatic transfer system requests return to the network channel.
- When the automatic transfer system is configured with auto-return on the network channel, Generator stoppage is requested 6 s after the changeover sequence is completed.



"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 i s 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.

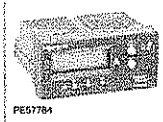
If paralleling is enabled: Auto return to the normal channel involves first closing the normal channel and, when it is closed, opening the coupling channel (SW3).

Fault indicators

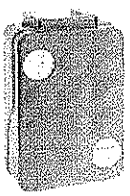
Easergy Flair is a comprehensive range of underground network fault current indicators

Easergy MV underground network fault current passage indicators are a range of products adapted to all neutral earthing systems: insulated, impedant and direct earthing.

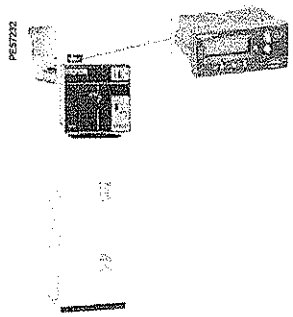
- Easergy Flair 21D-22D-23DV, are self-powered with a liquid crystal display, with DIN dimensions for MV cubicle installation.
- Easergy Flair 279 and 219, have a wall-mounted case for the MV cubicles substation or LV compartment and an external power supply which can be backed up (Li battery or LV supply + Li battery in LV compartment).
- Easergy Flair 200C is a communicating Fault passage Indicator with advanced measurement functions and Modbus master port for data concentration.


PE57784


PE57922


PE57921

Easergy Flair	21D - 22D - 23DV	279 - 219	200C
Application	Underground MV networks, isolated, impedant and solidly earthed		+ compensated
Installation	Flush mounted	Wall-mounted	Wall-mounted
Power supply	Self-powered or dual power	230 Vac and/or Li battery	230 Vac and rechargeable battery
Fault detection	Phase-phase and phase-earth for all 3 ranges		
Indication	Led and LCD display + optional external light indicator	External light indicator	External light indicator (option)
Measurement	Current, frequency		Current, voltage, power
Communication	Dry output contact	Dry output contact	Modbus, DNP3, IEC101&104, GMS, GPRS and others


PE57232

Easergy Flair 21D - 22D - 23DV

SM6 can integrate Flair 21D, Flair 22D and Flair 23DV on every incoming cubicles.

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

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

■ Maintenance free.

Display of settings	Flair 21D	Flair 22D	Flair 23DV
Automatic fault detection calibration mode	■	■	■
Short-circuit fault thresholds	■	■	■
Earth fault thresholds	■	■	■
Fault acknowledge time	■	■	■
Type of CT (CT1 or CT2)	■	■	■
Time delay for resetting upon current return (or voltage return on Flair 22D and Flair 23DV)		■	■
Time delay for fault resetting		■	■
Time delay for fault confirmation		■	■
Inrush time delay		■	■
Phase at fault and measurements			
Phase at fault	L1-L2-L3	L1-L2-L3	L1-L2-L3
Load current	■	■	■
MV network frequency	50/60 Hz	50/60 Hz	50/60 Hz
Current maximeter	■	■	■
Residual current	■	■	■

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.

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 curents 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.

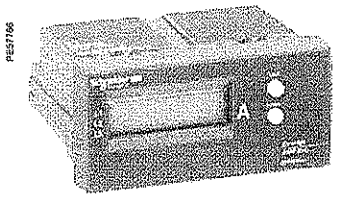
Connections, assembly

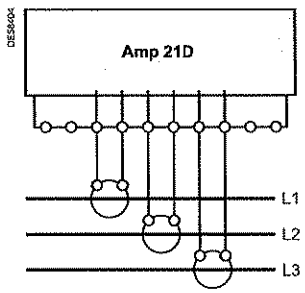
Small size enclosure

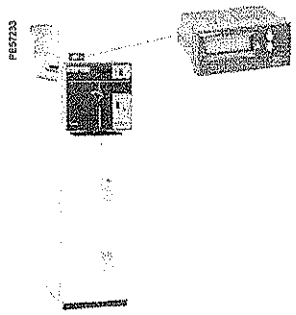
- DIN format: 93 x 45 mm
- Secured, extraction-proff mounting
- Terminal connections.

Current sensors

- Split core CT for mounting on MV cables.







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

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 and 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.

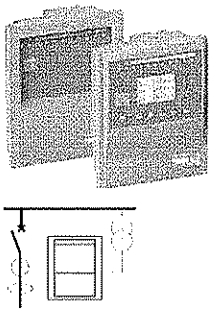
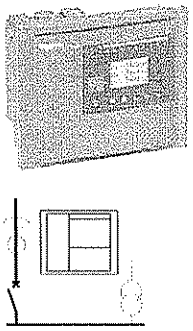
Flexibility and evolutivity

- 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	3I + Io	3I + 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.

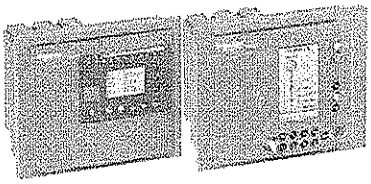
Protection and control monitoring
Sepam selection guide for all applications

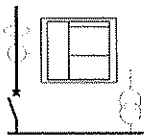
	Series 40			Series 60		
						
Protections						
Current	■	■	■	■	■	■
Voltage	■	■	■	■	■	■
Frequency	■	■	■	■	■	■
Specifics		Directional earth fault	Directional earth fault and phase overcurrent		Directional earth fault	Directional earth fault and phase overcurrent
Applications						
Substation	**S40**	**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				■		

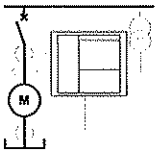
(1) LPCT: low-power current transformer complying with standard IEC 60044-8.
(2) Control matrix for simple assignment of information from the protection, control and monitoring functions.
(3) Logipam ladder language (PC programming environment) to make full use of Sepam series 80 functions.
(4) Standard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

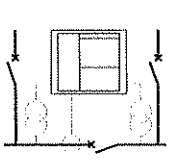
Protection and control monitoring
Sepam selection guide for all applications

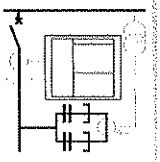
Series 80







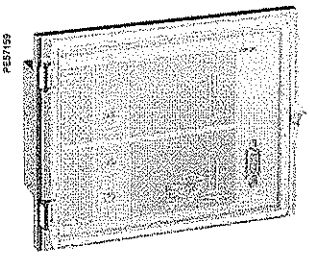




Protections								
Current	■	■	■	■	■	■	■	■
Voltage	■	■	■	■	■	■	■	■
Frequency	■	■	■	■	■	■	■	■
Specifics		Directional earth fault	Directional earth fault and phase overcurrent	Disconnection by rate of change of frequency	Transformer & transformer-machine unit differential	Machine differential	Voltage 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	3I + 2 x Io				2 x 3I + 2 x Io		3I + Io	2 x 3I + 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 and control monitoring
VIP 35 protection relay
VIP 300 LL protection relay



VIP 35

VIP 35 relay for transformer protection

Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
The VIP 35 is an independent relay without an auxiliary power supply, powered by the current sensors, and actuating a Mitop release unit.
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).

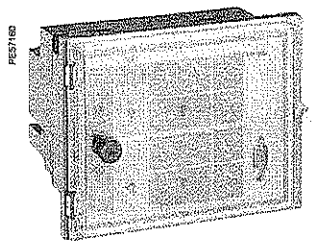
Earthing protection
■ earthing fault protection functions with the residual current measurement taken from the sum of the secondary currents in the sensors. This is taken via a CRc, 8 A to 80 A gauge.
■ earthing protection is inverse definite time: its threshold and time delay can be set.

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*



VIP 300 LL

VIP 300 LL protection relay

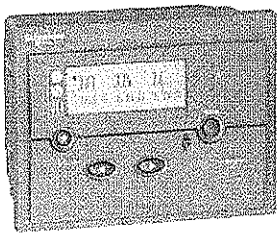
Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
VIP 300 provides protection against phase-to-phase and phase-to-earth faults.
A choice of trip curves and the large number of possible settings mean that it can be used in a large variety of selectivity layouts.
VIP 300 is an independent relay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

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

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

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

Protection and control monitoring
Sepam series 10 with CRa/CRb sensors



Sepam series 10

Sepam series 10 with CRa/CRb sensors for transformer protection

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

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						
3.3				22	28	35	44	55	70	87	110	140	175						
4.2					22	27	34	43	55	69	87	110	137	172					
5.5						21	26	33	42	52	66	84	105	131	168				
6						19	24	30	38	48	61	77	96	120	154	192			
6.6							22	28	35	44	55	70	87	109	140	175			
10									23	29	36	46	58	72	92	115	144	173	
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 and control monitoring
Protection and sensor selection table

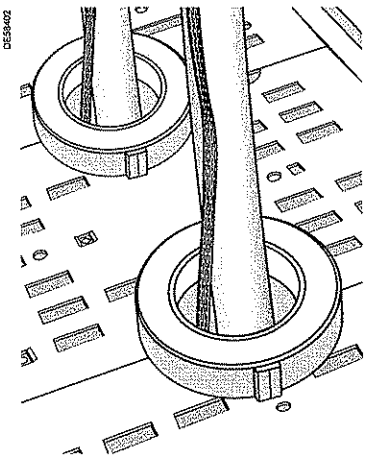
General common selection of protection units

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.

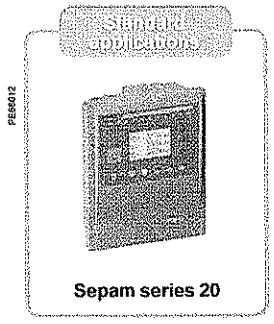
Current sensor for VIP 35 and VIP 300LL and Sepam series 10 for 24 kV

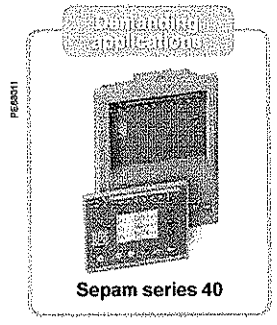
Type	Dimensions (mm) External Ø	Internal Ø	Thickness (without fastening)	Weight (kg)	Ratio of transformation	Class of precision		VIP 35	VIP 300LL	Sepam 10
CRa	143.5	81	37.5	2.18	1/200	± 2% from 10 A to 100 A ± 1% from 100 A to 1600 A	On load 5.7 Ω (cal. x 1)		■	■
						± 1% from 10 A to 10 kA	On load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

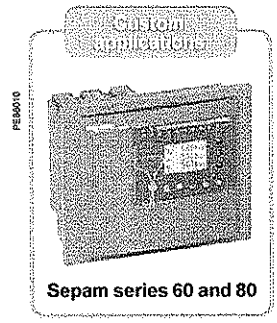


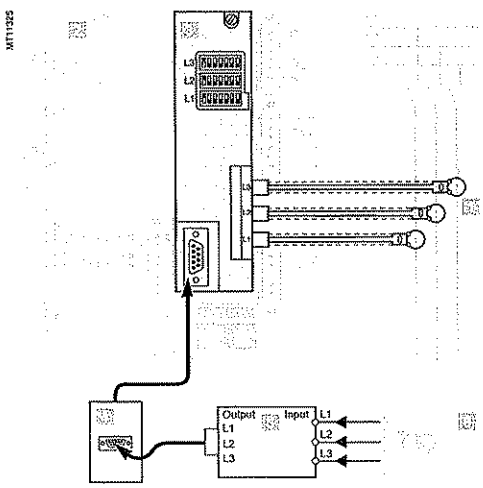
CRa, CRb, CRc current sensor

Protection and control monitoring
LPCT protection chain









TLP130, TLP160, TLP190, CLP2 sensors for Sepam series 20, 40, 60, 80 protection units

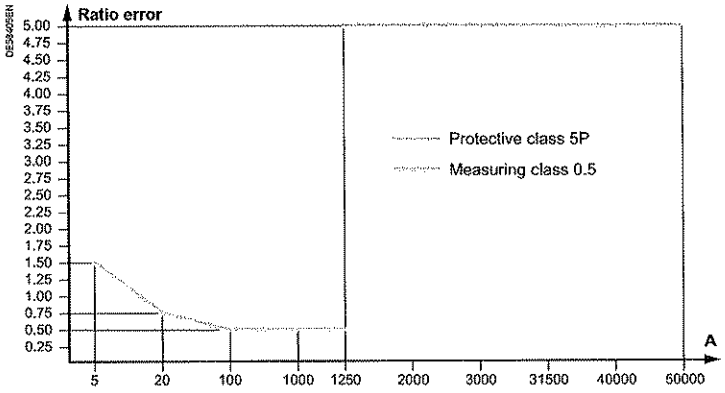
LPCT sensors are voltage-output current sensors (Low Power Current Transformer) compliant with the IEC 60044-8 standard.
These sensors are designed to measure rated current between 5 A and 630 A, with a ratio of 100 A / 22.5 mV.

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, TLP160 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.



- **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

LPCT sensor, equipped with a shielded cable fitted with an RJ45 connector to be connected directly to the card

Sepam series 20, 40, 60 and 80 protection unit

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

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)

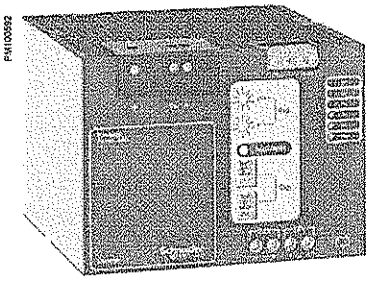
ACE917 injection interface, used to test the LPCT protection chain with a standard injection box

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 60 255-5 (10 kV level).



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.

PS100 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.

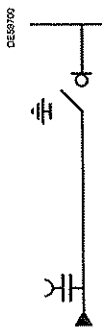
Range

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.

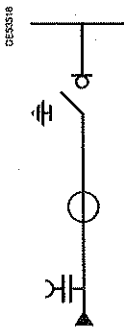
Contents

Functional units selection
Switching

IM
Switch unit

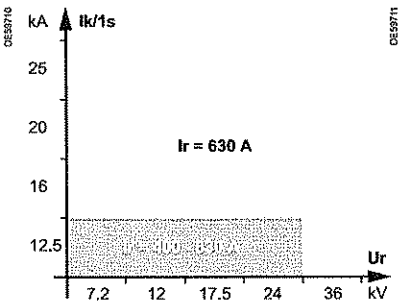


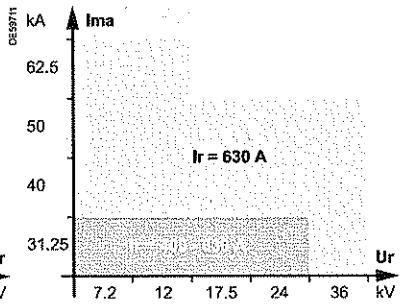
IMC
Switch unit



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 36 kV
- connection pads for dry-type cables
- three-phase bottom busbars for outgoing lines (right or left)
- one to three CTs for 24 kV
- three CTs for 36 kV

Versions:

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

Optional accessories:

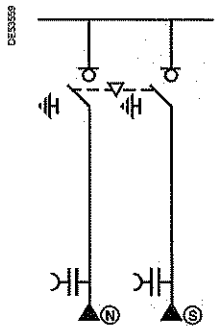
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- release units (coil)
- operation counter
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- visibility of main contacts
- pressure indicator device
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- cable connection by the top (no internal arc withstand if selected)
- fault indicators
- Connection pads for two dry-type single-core cables for 36 kV
- digital ammeter
- surge arresters (for 36 kV and for 24 kV in 500 mm width cubicle)
- 630 A busbars earthing switch cabinet for 24 kV (not available for internal arc IEC62271-200)

Functional units selection

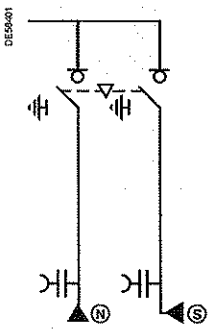
Switching

Automatic Transfer System for 24 kV

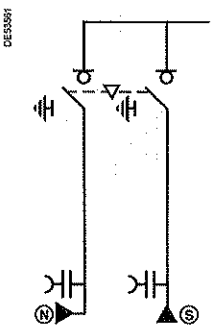
NSM-cables
Cables power supply for
main incoming line (N)
and standby line (S)



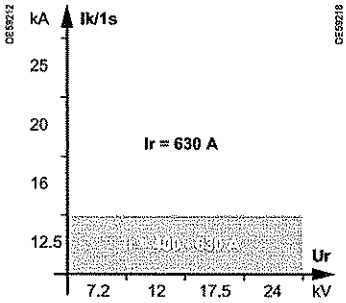
NSM-busbars
Cables power supply for
main incoming line on left (N) and
busbars for standby line (S) on right

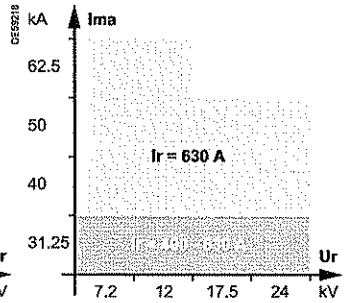


NSM-busbars
Busbars power supply for
main incoming line on left (N) and
cables for standby line (S) on right



Electrical characteristics





Basic equipment:

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

Optional accessories:

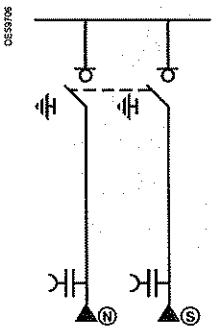
- auxiliary contacts
- key-type interlocks
- 50 W heating element
- control and monitoring
- visibility of main contacts
- pressure indicator device
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions

Functional units selection

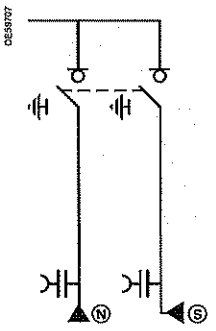
Switching

Automatic Transfer System for 36 kV

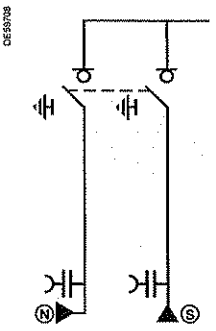
NSM-cables
Cables power supply for
main incoming line (N)
and standby line (S)



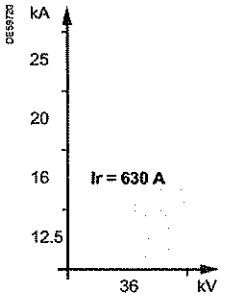
NSM-busbars
Cables power supply for
main incoming line on left (N) and
busbars for standby line (S) on right



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 630 A
- connection pads for dry-type cables
- voltage presence indicator
- motorised operating mechanism CI2 with shunt trips
- additional enclosure
- automatic-control equipment
- 150 W heating element

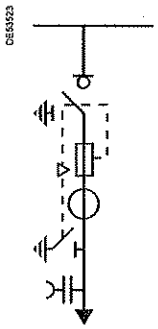
Optional accessories:

- auxiliary contacts
- key-type interlocks
- control and monitoring

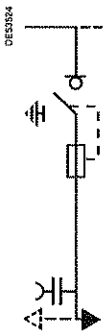
Functional units selection
Protection
Fuse-switch

QM
Fuse-switch combination unit

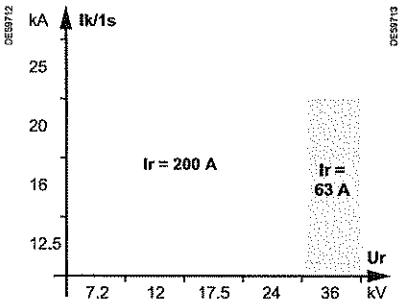
QMC
Fuse-switch combination unit

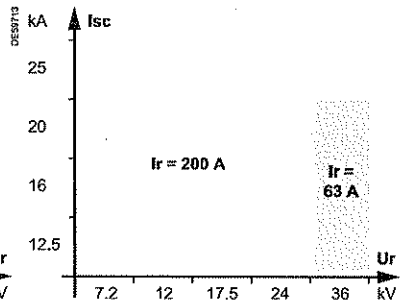


QMB
Fuse-switch combination unit
Outgoing line right or left



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 36 kV
- 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 24 kV
- three CTs for 36 kV

Version:

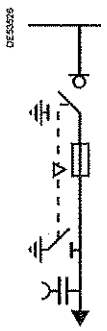
- equipment for three UTE striker fuses for 24 kV
- CI2 operating mechanism
- CI2 operating mechanism for 36 kV

Optional accessories:

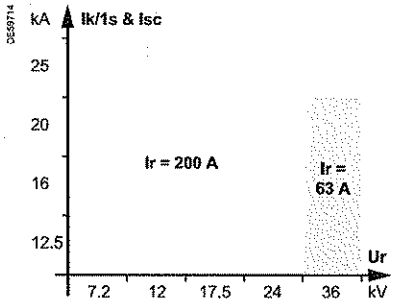
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- auxiliary contact for blown fuses
- DIN striker fuses
- release units (coil)
- digital ammeter
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- visibility of main contacts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

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 24 kV) or DIN striker fuses
- 150 W heating element for 36 kV

Version:

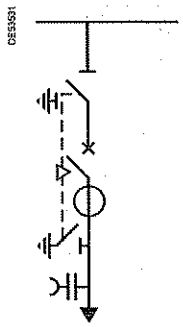
- CI1 operating mechanism
- CI2 operating mechanism for 36 kV

Optional accessories:

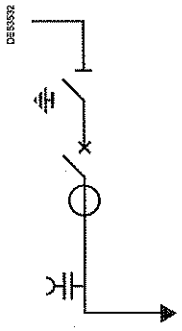
- motor for operating mechanism
- auxiliary contacts
- digital ammeter
- key-type interlocks
- mechanical indication system for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- UTE (for 24 kV) or DIN striker fuses
- visibility of main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

Functional units selection
Protection
SF6 type circuit breaker

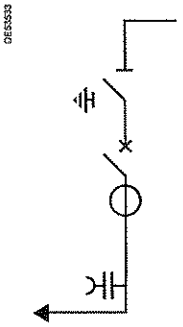
DM1-A
Single-isolation
disconnectable CB unit



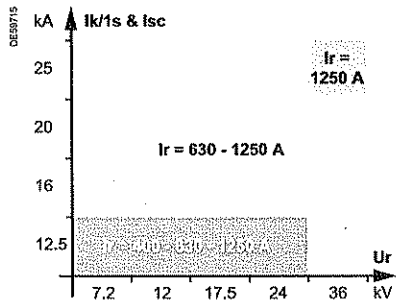
DM1-D
Single-isolation
disconnectable CB unit
Outgoing line on right



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



Electrical characteristics



Basic equipment:

- SF1 disconnectable circuit breaker
- disconnector and earthing switch
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- voltage presence indicator
- three CTs
- auxiliary contacts on circuit breaker
- mechanical interlocking between circuit breaker and disconnector
- 150 W heating element for 36 kV
- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity at 630 A and 25 kA rms making capacity at 1250 A
- three-phase bottom busbars

Version:

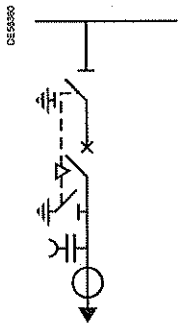
- LPCT (only with Sepam series 20, 40, 60, 80)
- SFset circuit breaker disconnectable (only for 400-630 A performances and 24 kV)

Optional accessories:

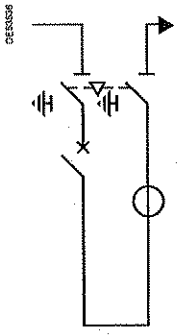
- **cubicle:**
- ☐ auxiliary contacts on the disconnector
- ☐ protection using Sepam programmable electronic unit
- ☐ three voltage transformers
- ☐ key-type interlocks
- ☐ 1250 A three-phase upper busbars at Ir 630 A
- ☐ cable connection by the top (no internal arc withstand if selected)
- ☐ surge arresters
- ☐ 630 A busbars earthing switch cabinet for 24 kV (not available for internal arc IEC62271-200)
- ☐ 630 A three-phase upper busbars for severe operating conditions for 24 kV
- ☐ enlarged low-voltage control cabinet for 24 kV
- ☐ 50 W heating element for 24 kV
- ☐ connection pads for two dry-type single-core cables for 36 kV

Functional units selection
Protection
SF6 type circuit breaker

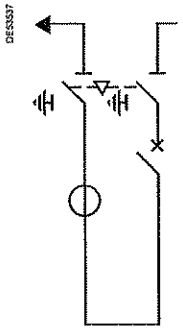
DM1-S
Single-isolation
disconnectable CB unit
with independent protection



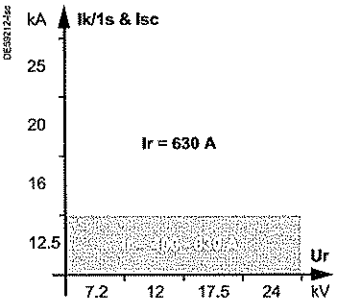
DM2
Double-isolation
disconnectable CB unit
Outgoing line on right

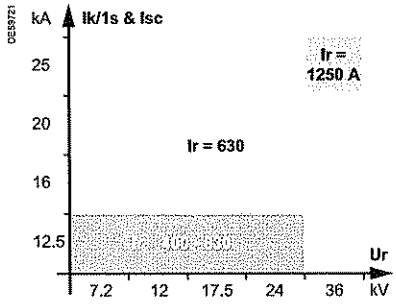


DM2
Double-isolation
disconnectable CB unit
Outgoing line on left



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
- 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 36 kV

Version:

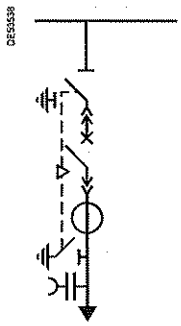
- Sepam series 10 with auxiliary supply and three CR sensors

Optional accessories:

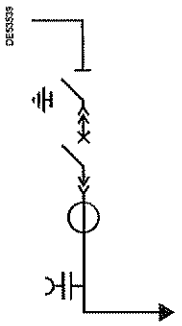
- **cubicle:**
  - ☐ three voltage transformers
  - ☐ key-type interlocks
  - ☐ 1250 A three-phase upper busbars at Ir 630 A
  - ☐ 630 A three-phase upper busbars for severe operating conditions for 24 kV
  - ☐ enlarged low-voltage control cabinet for 24 kV
- **circuit breaker:**
  - ☐ motor for operating mechanism
  - ☐ release units (coil)
  - ☐ operation counter on manual operating mechanism
- **cubicle:**
  - ☐ protection using Sepam programmable electronic unit
  - ☐ auxiliary contacts on disconnectors
  - ☐ 2 voltage transformers phase-to-phase or 3 voltage transformers phase-to-earth
  - ☐ cable connection by the top
  - ☐ 50 W heating element for 24 kV

Functional units selection
Protection
SF6 type circuit breaker

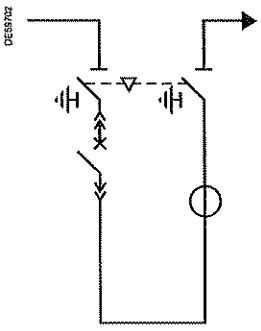
DM1-W
Withdrawable single-isolation circuit breaker unit



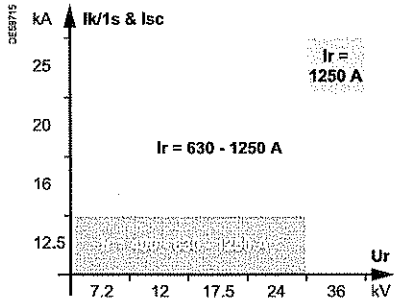
DM1-Z
Withdrawable single-isolation CB unit
Outgoing line on right

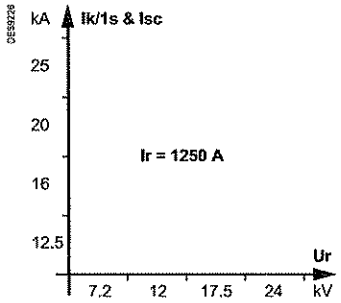


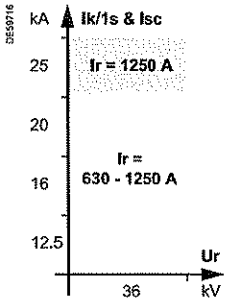
DM2-W
Withdrawable double-isolation CB unit
Outgoing line on right



Electrical characteristics







Basic equipment:

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

Version:

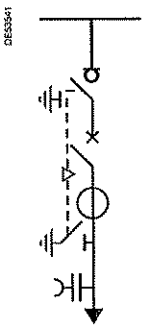
- LPCT (only with Sepam series 20, 40 and 80)

Optional accessories:

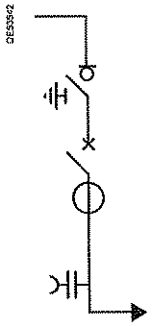
- **cubicle:**
  - ☐ auxiliary contacts on the disconnector
  - ☐ protection using Sepam programmable electronic unit
  - ☐ key-type interlocks
  - ☐ three voltage transformers for 24 kV
  - ☐ connection enclosure for cabling from above for 24 kV
  - ☐ 50 W heating element for 24 kV
  - ☐ enlarged low-voltage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

Functional units selection
Protection
Vacuum type circuit breaker

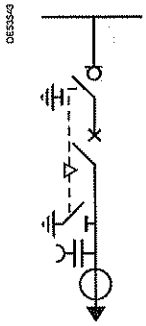
DMV-A
Single-isolation
circuit breaker unit



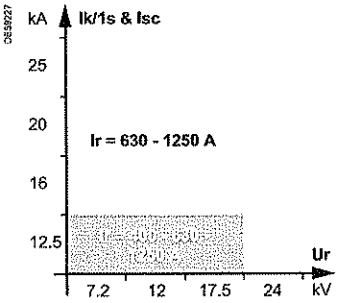
DMV-D
Single-isolation circuit breaker unit
Outgoing line on right



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



Electrical characteristics



Basic equipment:

- Evolis circuit breaker frontal
- switch and earthing switch for 400 - 630 A
- disconnector and earthing switch for 1250 A
- three-phase busbars
- circuit breaker operating mechanism P2
- disconnector and switch operating mechanism CIT
- voltage presence indicator
- auxiliary contacts on circuit breaker
- three CTs
- Sepam series 20 programmable electronic unit
- connection pads for dry-type cables
- downstream earthing switch 25 kA rms making capacity

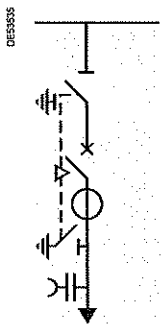
- 3 CR sensors for VIP relay
- VIP protection relay
- connection pads for dry-type cables
- downstream earthing switch
  25 kA rms making capacity

Optional accessories:

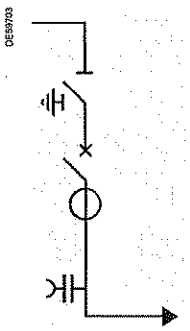
- **cubicle:**
  - ☐ auxiliary contacts on the disconnector
  - ☐ three voltage transformers
  - ☐ key-type interlocks
  - ☐ 50 W heating element
  - ☐ connection enclosure for cabling from above
  - ☐ 1250 A three-phase upper busbars at Ir 630 A
  - ☐ 630 A three-phase upper busbars for severe operating conditions
  - ☐ enlarged low-voltage control cabinet
- **circuit breaker:**
  - ☐ motor for operating mechanism
  - ☐ release units (coil)
  - ☐ operation counter on manual operating mechanism

Functional units selection
Protection
Vacuum type circuit breaker

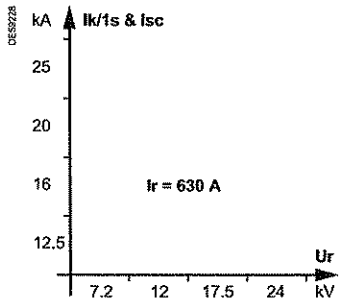
DMVL-A
Single-isolation disconnectable circuit breaker unit

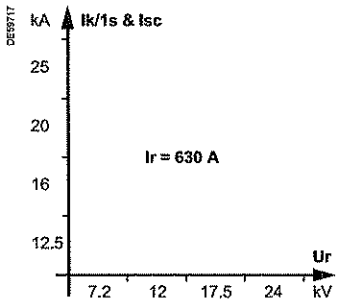


DMVL-D
Single-isolation disconnectable circuit breaker unit
Outgoing line on right



Electrical characteristics





Basic equipment:

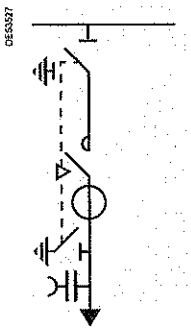
- Evolis circuit breaker lateral disconnectable
- disconnector and earthing switch
- mechanical interlocking between circuit breaker and disconnector
- three-phase busbars
- circuit breaker operating mechanism RI
- disconnector operating mechanism CS
- voltage presence indicator
- auxiliary contacts on circuit breaker
- 3 CTs
- connection pads for dry-type cables
- downstream earthing switch 2 kA rms making capacity

Optional accessories:

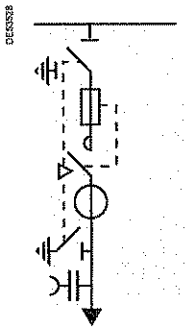
- **cubicle:**
  - auxiliary contacts on the disconnector
  - three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - connection enclosure for cabling from above
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions
  - enlarged low-voltage control cabinet
  - Sepam relay protection
  - surge arresters
- **circuit breaker:**
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

Functional units selection
Protection
Contactor (Direct Motor Starter) for 24 kV

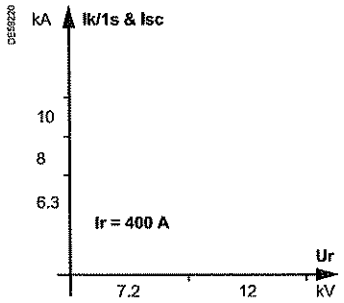
CVM
Disconnectable contactor unit

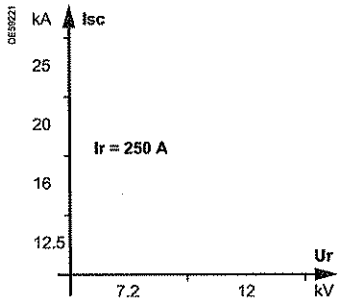


CVM
Disconnectable contactor unit with fuses



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

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

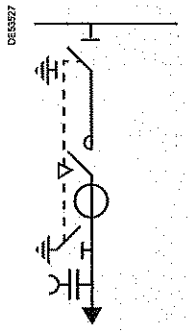
Version:
- LPCT (only with Sepam series 20, 40, 60, 80)

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

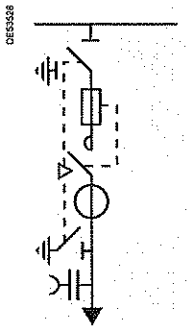
- DIN striker fuses

Functional units selection
Protection
Contactor (Direct Motor Starter) for 24 kV

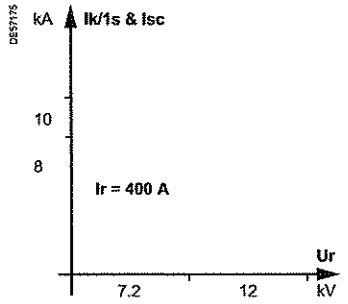
CRM
Contactor unit

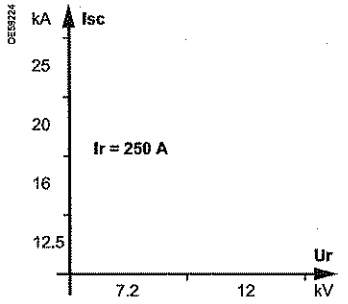


CRM
Contactor unit with fuses



Electrical characteristics





Basic equipment:

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

■ equipment for three DIN striker fuses

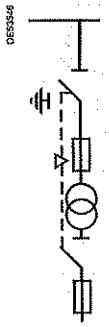
Optional accessories:

- **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

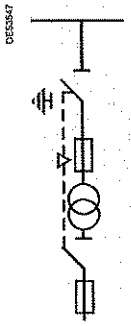
■ DIN striker fuses

Functional units selection
Metering

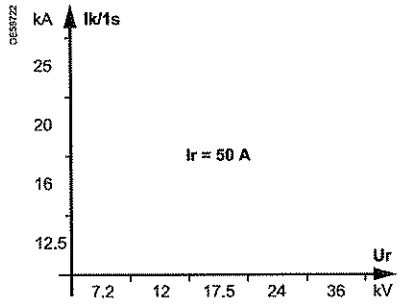
CM
Voltage transformers unit for network with earthed neutral system



CM2
Voltage transformers unit for network with insulated neutral system



Electrical characteristics



Basic equipment:

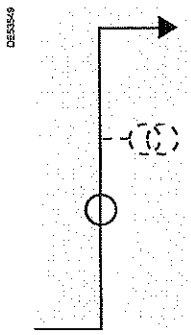
- disconnector and earthing switch
- three-phase busbars
- operating mechanism CS
- LV circuit isolation switch
- LV fuses
- three 6.3 A UTE or DIN type fuses
- 150 W heating element for 36 kV
- three-voltage transformers (phase-to-earth)
- two voltage transformers (phase-to-phase)

Optional accessories:

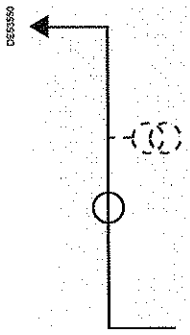
- auxiliary contacts
- mechanical signalling and auxiliary contact for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged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

Functional units selection
Metering

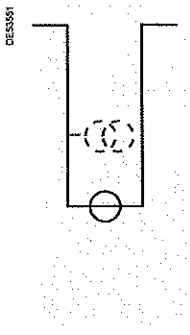
GBC-A
Current and/or voltage measurements unit
Outgoing line on right



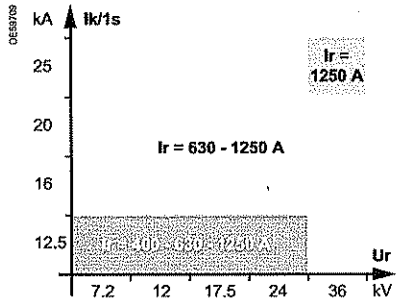
GBC-A
Current and/or voltage measurements unit
Outgoing line on left



GBC-B
Current and/or voltage measurements unit



Electrical characteristics



Basic equipment:

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

Optional accessories:

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

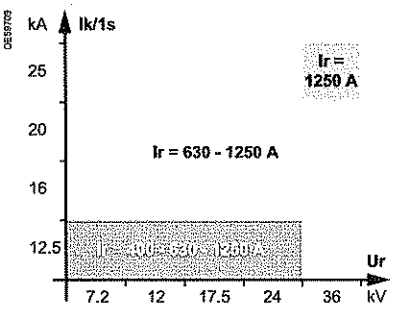
Functional units selection
Other functions

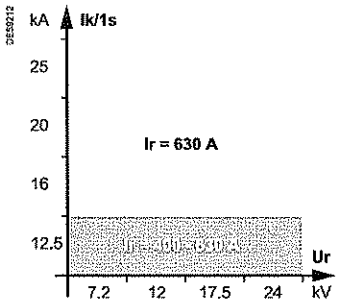
GBM
Connection unit
Outgoing line right or left

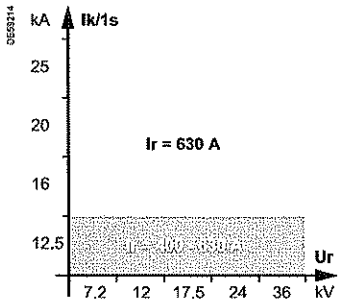
GEM
Extension unit VM6/SM6

GIM
Intermediate bus unit

Electrical characteristics







Basic equipment:

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

- metallic envelop
- three-phase busbars

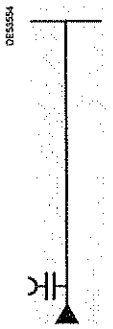
- metallic envelop

Optional accessories:

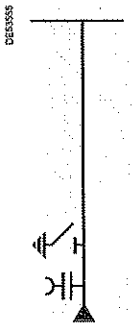
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top for 36 kV (no internal arc withstand if selected)

Functional units selection
Other functions

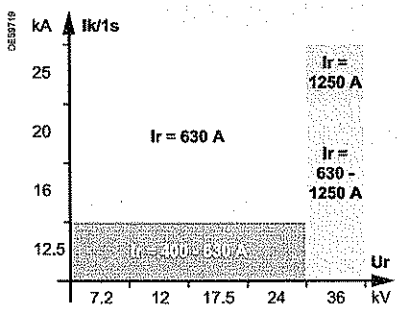
GAM2
Incoming-cable-connection unit

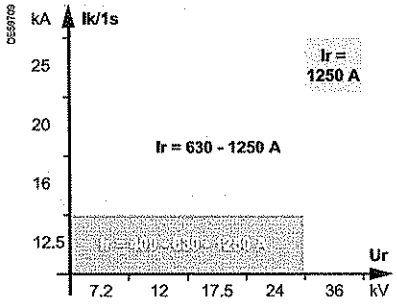


GAM
Incoming-cable-connection unit



Electrical characteristics





Basic equipment:

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

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

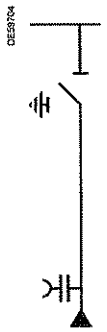
Optional accessories:

- fault indicator
- digital ammeter
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- surge arresters for 36 kV

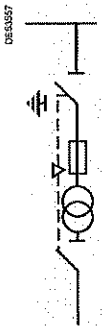
- auxiliary contacts
- key-type interlocks
- surge arresters for 24 kV

Functional units selection
Other functions

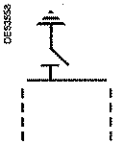
SM
Disconnector unit



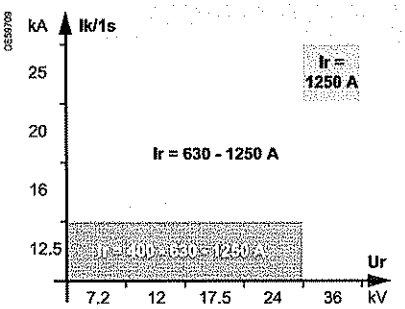
TM
MV/LV transformer unit
for auxiliaries

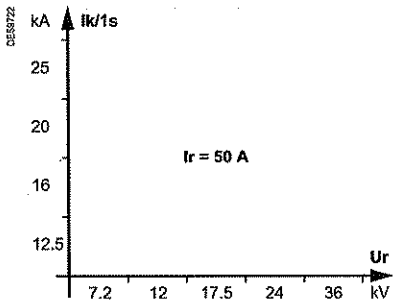


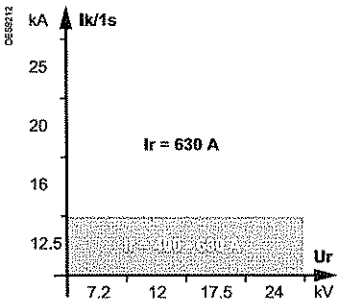
EMB
Busbars earthing switch
cabinet



Electrical characteristics







Basic equipment:

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

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

- 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
- cable connection by the top (no internal arc withstand if selected)
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- digital ammeter for 24 kV
- surge arrester for 36 kV

- mechanical indication system and auxiliary contacts for blown fuses

- auxiliary contacts

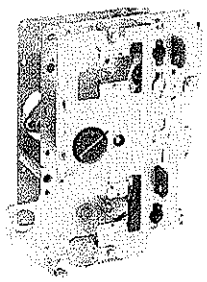
Operating mechanisms

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					Circuit breaker	
	CIT	CI1	CI2	CS	CC	RI	P2
IM, IMB	■	□	□				
IMC	■	□	□				
PM	■	□	□(1)				
QM		■	□				
QMC, QMB		■	□				
CM, CM2, CRM, CVM				■			
DM1-A, DM1-D, DM1-S, DM1-Z, DM2, DMVL-A, DMVL-D				■		■	
DM1-A (2), DM1-W, DM2-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 36 kV
(2) 1250 A version

Operating mechanism types	CIT		CI1		CI2			CS	
Unit applications	Load-break switch Fused switch		Load-break switch Fuse switch combination		Load-break switch 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 network management		Remote control transformer protection		Remote control 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

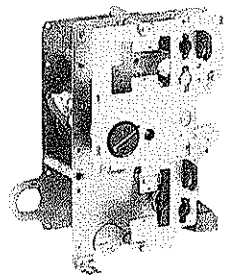


Double-function operating mechanism CIT

■ **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

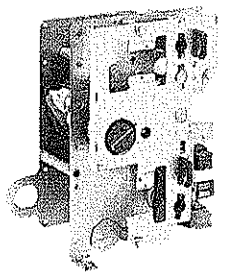
Operating mechanisms



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,
□ undervoltage for unit QM.
■ **Motor option**

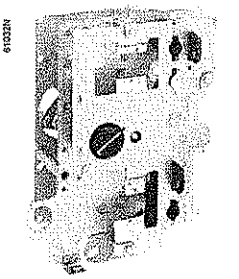
(*) Included with the motor option.



Double-function operating mechanism CI2

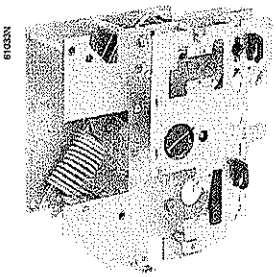
■ **Switch function**
□ independent-operation closing in two steps:
1 - operating mechanism recharging by lever or motor,
2 - stored energy released by push-button (I) or trip unit.
□ independent-operation opening by push-button (O) or trip unit.
■ **Earthing-switch function**
Independent-operation closing and opening by lever.
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**

(*) Included with the motor option.



Double-function operating mechanism CS

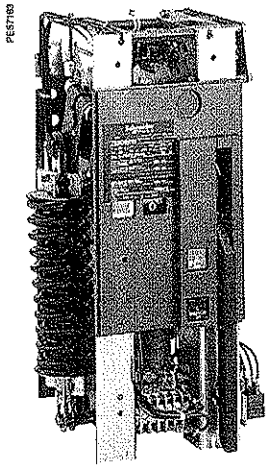
■ **Disconnector and earth switch functions**
Dependent-operation opening and closing by lever.
■ **Auxiliary contacts**
□ disconnector (2 O + 2 C) for units DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D, CVM and CRM without VT,
□ disconnector (2 O + 3 C) and earthing switch (1 O + 1 C) for units DM1-A, DM1-D,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



Single-function operating mechanism CC

■ **Earthing switch function**
Independent-operation opening and closing by lever.
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).

Operating mechanisms

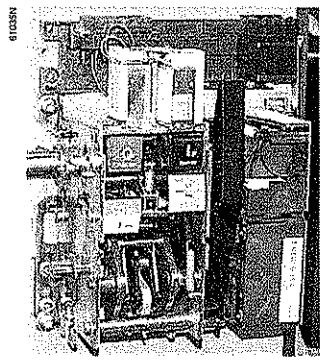


Single-function operating mechanism for the SF circuit breakers 24 kV and 36 kV and Evolis 24 kV lateral

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

Possible combinations between opening releases

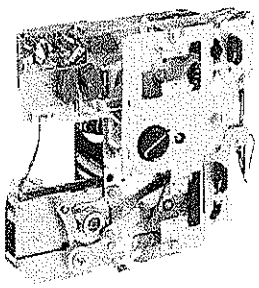
Release type	SF1						SFset			
	Combinations						Combinations			
	1	2	3	4	5	6	1	2	3	4
Mitop (low energy)	☒	☒	☒				☒	☒	☐	
Shunt trip		☒		☒	☒			☒		
Undervoltage			☒		☒	☒				☒



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

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

Auxiliaries

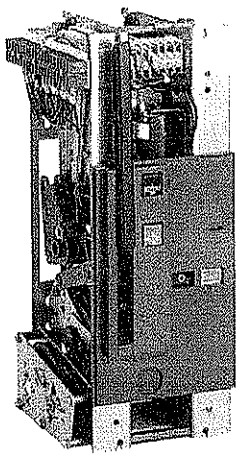


Motor option and releases for switch-units

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.*



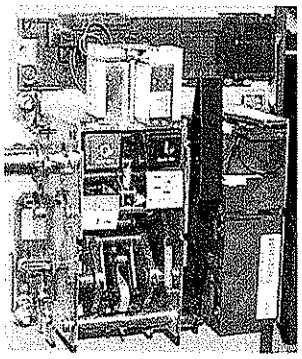
Motor option and releases for SF6 type circuit breakers and Evolis 24 kV lateral

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	

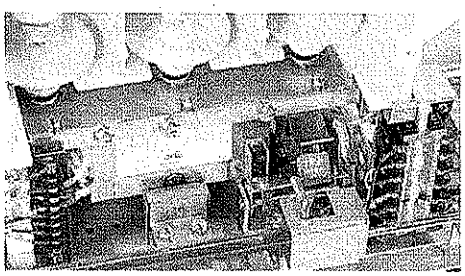
** Please consult us for other frequencies.*

Auxiliaries



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			



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.

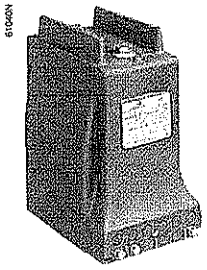
Characteristics		
Operating voltage	Minimum	48 V
	Maximum	480 V
Rated current		10 A
Breaking capacity	Vdc	60 W (L/R 150 ms)
	Vac	700 VA (power factor 0.35)

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 24 kV

Synthesis table by unit

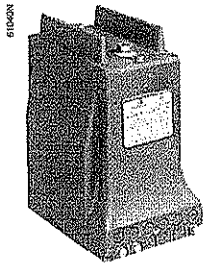
Units	QMC	CRM	CVM	DM1-A	DM1-D DMVL-D	DM1-W	DM2	GBC-A GBC-B	DMVL-A	DMV-A DMV-D	IMC	DM1-A DM1-D	DM1-W DM1-Z	GBC-A GBC-B	DMV-A DMV-D
TC				630 A								1250 A			
ARJP1	☒	☒	☒												
ARM3				☒	☒	☒	☒	☒	☒						
ARJP2										☒	☒				
ARJP3												☒	☒	☒	☒
CLP2					☒										
TLP130			☒	☒		☒									



Transformer ARJP1/N2F
- characteristics according to IEC standard 60044-1
- 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							

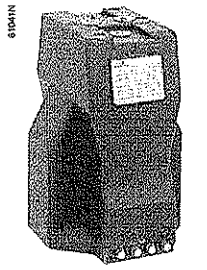


Transformer ARJP1/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

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.*



Transformer ARM3/N2F
- characteristics according to IEC standard 60044-1
- 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			

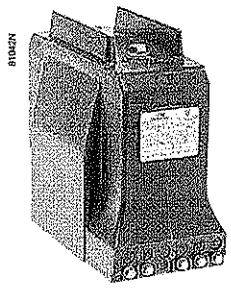
** For 5 A protection*

- characteristics according to IEC standard 60044-1
- 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		

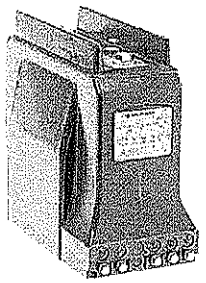
Current transformers for 24 kV



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

Short-time withstand current Ith (kA)

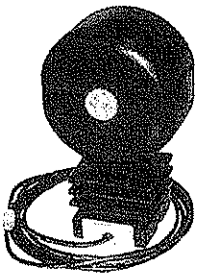
I1n (A)		50	100	200	400	600
Ith (kA)		25				
t (s)		1				
Measurement and protection	5 A	10 VA class 0.5	15 VA class 0.5	15 VA class 0.5	15 VA class 0.5	20 VA class 0.5
	5 A	2.5 VA 5P20	2.5 VA 5P20	5 VA 5P20	5 VA 5P20	7.5 VA 5P20



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

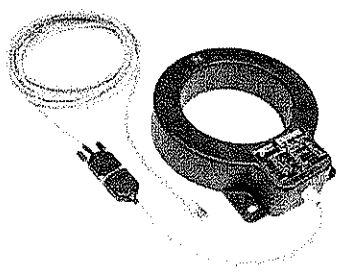
Short-time withstand current Ith (kA)

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	



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

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



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

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

Current transformers for 36 kV

Current transformer ARM6T

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

Transformer ARM6T/N1 or N2

- characteristics according to IEC standard 60044-1
- 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

Current transformer ARM9T

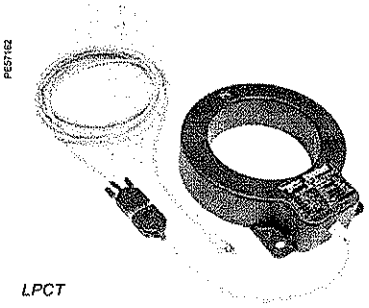
For units DM1-A, DM1-D, DM2, DM2-W

Transformer ARM9T

- characteristics according to IEC standard 60044-1
- 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



LPCT

Low Power Current Transformer (LPCT) for units DM1-A, DM1-W

Transformer TLP 130, TLP 190

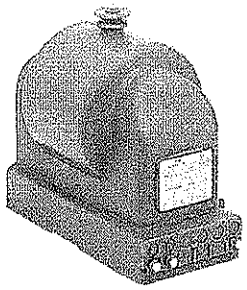
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 0.72 kV
- internal diameter 130 or 190 mm
- in SM6-36, TLP 130 can be used for 630 A, TLP 190 can be used up to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

	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 24 kV

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		■											

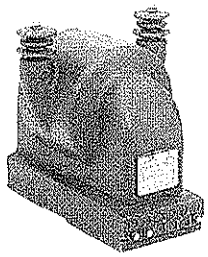


Transformer VRQ2-n/S1 (phase-to-earth) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

Rated voltage (kV)	24			
Primary voltage (kV)	10/√3	15/√3	15-20/√3	20/√3
Secondary voltage (V)	100/√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 60044-2.

Rated voltage (kV)	17.5	
Primary voltage (kV)	10/√3	15/√3
Secondary voltage (V)	100/√3	
Thermal power (VA)	250	
Accuracy class	0.5	
Rated output for single primary winding (VA)	30	



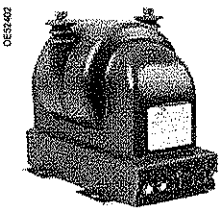
Transformer VRC2/S1 (phase-to-phase) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

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

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

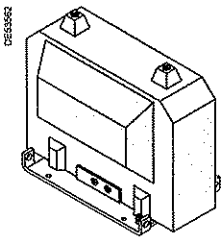
	Rated voltage (kV)	12	17.5	24
	Primary voltage (kV)	10/√3	15/√3	20/√3
	Secondary voltage (V)	100/√3 - 100/3		
First secondary	Thermal power (VA)	200		
	Accuracy class	0.5		
	Rated output for single primary (VA)	30-50		
Second secondary	Thermal power (VA)	100		
	Accuracy class	3P		
	Rated output	50		

Voltage transformers for 24 kV



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

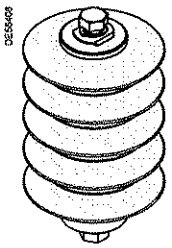
Rated voltage (kV)	7.2				
Primary voltage (kV)	3.3	5	5.5	6	6.6
Secondary voltage (V)	110	100	110	100	110
Thermal power (VA)	300				
Accuracy class	0.5				
Rated output for single primary winding (VA)	100				



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.



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 36 kV

PE57223

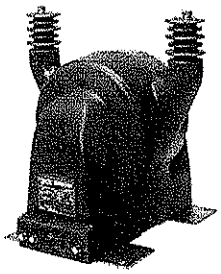
Voltage transformer VRF3

For units CM, GBC-A, GBC-B

Transformer VRF3n/S2 (phase-to-earth)
- single primary winding
- single secondary

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

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

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

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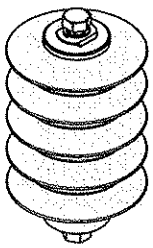

Surge arresters

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 CRM units

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

Starting current (A) Id/In = 6	Starting time (s) 5		10		20		Maximum service voltage (kV)
	Number of starts per hour 6	12	6	12	6	12	
1410	250						
1290	250	250	250				
1140	250	250	250	250	250		
1030	250	250	250	250	250	250	3.3
890	250	250	250	250	250	250	
790	200	250	250	250	250	250	
710	200	200	200	250	250	250	
640	200	200	200	200	200	250	
610	200	200	200	200	200	200	6.6
540	160	200	200	200	200	200	
480	160	160	160	200	200	200	
440	160	160	160	160	160	200	
310	160	160	160	160	160	160	
280	125	160	160	160	160	160	
250	125	125	125	160	160	160	
240	125	125	125	125	125	160	
230	125	125	125	125	125	125	
210	100	125	125	125	125	125	
180	100	100	100	100	100	125	
170	100	100	100	100	100	100	11

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 3	6	3	6	3	6
	Id = 6 x Ie	Ie						
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

Fuse ratings for SM6 protection units such as PM, QM, QMB and QMC depend, among other things, on the following criteria:
- service voltage
- transformer rating
- fuse technology (manufacturer)

Different types of fuses with medium loaded striker may be installed:
- Solefuse fuses as per standard UTE NCF 64.210
- Fusarc CF fuses as per IEC 60.282.1 recommendation and dimensions are related to DIN 43.625 standard.

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

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

Fuse selection table

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

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

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.