MEDIUM VOLTAGE SWITCHGEARS

Metal Enclosed Switchgears
Metal Clad Switchgears

AKTiF
ELEKTROTEKNiK
a Friem & Aktif Group Company

AKTİF ELEKTROTEKNİK

Aktif trade mark for Medium voltage switchgears, Switching equipment and Kiosks with high quality and environmentally sensitive

AKTİF MÜHENDİSLİK

Aktif trade mark for Capacitor Banks, Harmonic Filters, Resistors, Medical Insulated Power Panels, Synchronization and Energy automation Panels with high quality and environmentally sensitive

actWin®

Aktif trade mark for Measuring, Protection, Automatic Meter Reading, Billing and Energy Management Software.

asset®

Aktif trade mark for Measuring, Protection, Control and Power Quality products with high quality, long life and environmentally sensitive

Identifies the product as top quality, safe and one step forward of the similar ones.

Symbolizes measurable energy saving products helps to energy continuity.

Identifies smart control logic.

Identifies easy to use products, simplifies the difficult tasks.

Green products, respects to the nature and our future.

Index

TECHNICAL SPECIFICATIONS A

METAL ENCLOSED SWITCHGEARS B

METAL CLAD SWITCHGEARS C

AUXILIARY EQUIPMENT D

Company Profile

Aktif Mühendislik Ltd.

Aktif Engineering (AMDT) is established in 1996 Measuring, Protecting and Quality of Electricity.

2200m2 headquarter of AMDT is located in Istanbul consisting of 35 employees. Since establishment AMDT provides high quality engineering, supplying and start-up services for the power quality, energy saving, energy metering, protection.

AMDT provides standard and custom designed solutions to domestic and international customers, with over 15 years of experience.

Aktif Raylı Sistemler Ltd.

Aktif Railway Systems (ARS) is established in 2008 for the designing and providing of traction systems' substations as well as providing on-board equipment used on vehicles.

The main purpose of ARS is providing engineering services and products to public bodies and companies in this sector.

Even though it is a brand new company, ARS managed to complete successfully both Antalya Light Rail System project as well as Istanbul Metro Stinger System projects.

Aksis Enerji Sistemleri Ltd.

Aksis Energy Metering Systems (AKS) is established in 2003 for providing metering solutions like Automatic Meter Reading, Billing Software in every level of energy sector. The company is focused on saving and efficient using of energy by its Meter Management and Loss & Leakage tracing solutions.

AKS answers all expectations in power systems with high quality products and custom design software solutions.

AKS customers create over 100 million Euro energy bills using different Metering, Management and Billing methods of AKS.

Company Profile

Aktif Elektroteknik A.Ş.

The company is established to manufacture Switchgears and Kiosks under the name of "Setas" in 1981. First in 2008, company merged to Aktif Group as Aktif Elektroteknik (AET) and then the company becomes international after significant participation of Italian Friem S.p.A in 2009.

9000m2 factory of AET is located in Ankara consisting of over 100 employees.

AET operates with its 30 years of manufacturing experience, modernized machinery line, ever increasing know-how, experienced Turkish and Italian R&D teams, quality products type tested by the leading accredited European laboratories and the vision of new ideas to meet with future expectations.

Friem S.p.A.

Friem manufactured over 40 million ampere and 1000 power rectifiers for the worldwide since it's established in Milan at 1950.

Having technical knowledge of energy and electro mechanics along with ability of complete design of conversion systems, FRIEM provides also high voltage DC insulators, DC switches, anodic control and protection products and auxiliary equipments like polarization products to its customers.

Friem is a share holder of Aktif Elektronik in Turkey and also COET S.r.L in Italy.

Coet S.r.L.

Since establishment in 1962 in Milan, COET has been producing AC/DC switching equipments and panels that are used safely by its customers thanks to the COET's work on industrial and electric equipment and patents obtained in this field.

All manufactured products are the result of long technical research and development work. This way, the company is known for the originality and diversity of its planned solutions.

COET has been working on Industrial and railway systems and has become one of the leading companies in the field of supplying switching equipments for traction substation.

Company Profile

Introduction

Aktif Group is in continuous development with its customer oriented activities, advanced engineering know-how, R&D works, software developing abilities and with the continuous support of loyal customers that are attained and protected by precise work and ethical principles of the company.

The group companies have ISO 9001 since 90s and our factory has ISO 14001 Environment and ISO 18001 Occupational Health and Safety Certificates.

Mission

By the help of our following missions are continuing to announce product quality and knowledge of our company and country in best possible way by meeting rising customer expectations.

- open minded approach
- high quality policy
- innovative ideas
- constantly improved processes
- polished employees
- knowledge based decisions

Technology

The most important activities of Aktif is R&D and increase the Employee quality which the investment amount of these activities are more than average.

All mechanical projects are designed by 3D-CAD platforms. Power flow, test and quality works are calculated by Worldwide accepted simulation software and ActWin software as well as developing software for different platforms.

In order to increase the production quality and capacity all machinery within the facility are renewed with latest technology equipment in 2009.

Vision

To increase the number of our loyal customers in global market, hence increasing the market share and becoming reputable, reliable and preferred company as worldwide with our;

prominent quality difference,
customer oriented approach,
innovative activities,
open minded approach.

Company Profile

High Performance, Durable and Simple

Endurance of our products, which are produced with high level of awareness and accurateness in addition to follow international standards, ensures an outstanding performance for the users. Therefore our products are considered as top of the line products.

Visual simplicity and being user friendly are the design criteria for the software and hardware of our products. Our products have the most simple and functional features for emergency applications as well as persistence of habits and customer satisfaction are basics in design, production and shipment.

Local & Remote Monitoring

Energy continuity and efficiency can be ensured only by monitoring of equipments local and remotely.

Our products are designed with remote monitoring and management features by the help of our software development abilities on different platforms and hardware capabilities. This will ensure the saving and profitability, directly.

Security

The human safety and security are the main concerns in all of our products.

Design, Interlock logics and documentation of our products are implemented, manufactured and tested in order to reach the highest safety level.

Furthermore, services and site works are done according to human safety rules by taking into account the dangerous of electricity.

Service Continuity

The service continuity means efficiency of power consequently profitability of the business.

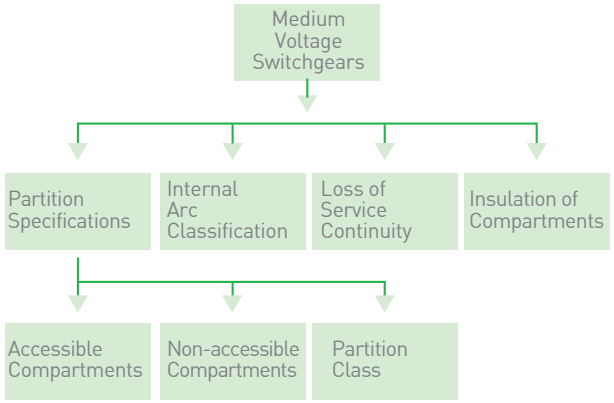
Our products are designed and manufactured in order to ensure energy sustainability and provide the best service availability.

This policy is the cornerstone of our orientation and training programs and it is fully applied by our technical and administrative staff.

Technical Information A

A

Technical Information



Switchgears classification according to IEC 62271-200

Metal Enclosed switching and control equipment between the rated voltage 1 - 52 kVac are defined in IEC 62271-200 standards.

It is possible to classify the Switchgears in accordance with the specifications given in IEC 62271-200 standard conveniently in the below given table.

A 1 Partition Specifications

The structure of the switchgears partitions and their features are provided in 3 main headings as seen in the attached table.

A 1.1 Accessible Compartments

- Interlock-controlled accessible compartment: Compartment containing high voltage parts, intended to be opened for normal operation and/or normal maintenance as stated by the manufacturer, in which Access is controlled by integral design of the switchgear and controlgear. Installation, extension, repairing are not considered as normal maintenance
- Procedure-based accessible compartments: Compartments containing high-voltage parts, intended to be opened for normal operation and/or normal maintenance as stated by the manufacturer, in which Access is controlled by suitable procedure combined with locking. Installation, extension, repairing are not considered as normal maintenance
- Tool based accessible compartments: Compartment containing high-voltage parts, that may be opened, but not for normal operation and maintenance. Special procedures are required. Tools are necessary for opening.

A 1.2 Non-accessible Compartments

Compartments that should not be needed to open and the opening may damage the integrity which contains high-voltage.

A 1.3 Partition Class

It is a classification that defines whether metallic or non-metallic parts to be used or not for the purpose of segregating the compartments contains live parts.

Partition class PM	Switchgear providing continuous metallic partitions and/or shutters, intended to be earthed, between opened accessible compartments and live parts of the main circuits
Partition class PI	Switchgear having one or more non-metallic partitions or shutters between opened accessible compartments and live parts of the main circuit

A 2 Internal Arc Classification

It is a classification for metal enclosed switchgear and controlgear, to ensure that in case of an internal arc the defined conditions for protecting people are met and verified by the appropriate test.

Three types of accessibility are defined, by considering possible accessibility of Switchgears at site.

Accessibility Type A: Restricted to the authorized personal only

Accessibility Type B: Unrestricted accessibility, open to any people

Accessibility Type C: Accessibility restricted by installation which is out of reachable distance for pole mounted switchgears. The allowable minimum height of the facility should be defined by the manufacturer.

The metal enclosed switchgear and controlgear may have different accessibilities for different directions. The following codes should be used to define accessibility from different directions.

F : Front
L : Side
R : Back

A 3 Loss of Service Continuity

It is a classification which defines the keeping of other Switchgears and/or functional units in energizing position when main circuit compartment of a switchgear is opened.

LSC2: It shows the having to other accessible compartments out of the main busbar compartment of single busbar switchgear and controlgear. Two subsections are defined.

LSC2B: defines the Switchgears that opening and interfering of switching compartment is allowed while both cable and busbar compartment is energized.

LSC2A: defines the Switchgears that opening and interfering of switching compartment is allowed while only busbar compartment is energized.

LSC1: defines the Switchgears that opening and interfering of switching compartment is not possible while any of busbar or cable compartments is energized since cable and current-voltage transformers are located in a single section.

SMC series Metal Clad Switchgears

SME series Metal Enclosed Switchgears

A 4 Insulation of Switchgear

Switchgears may have different types of insulations as follows:

- Air Insulated
- Gas Insulated
- Liquid Insulated

A 5 Comparison Table

Specifications	Metal Clad Switchgears	Metal Enclosed Switchgears	RMU Units
LSC	2B-PM	2A-PI	PM
IAC	AFLR	AFL	AFL
IP	40	40	67
Ur	Up to 40.5 kV	Up to 40.5 kV	Up to 40.5 kV
Ir	Up to 4000 A	Up to 1250 A	Up to 1250 A
Ik	Up to 50 kA	Up to 25 kA	Up to 25 kA

A 6 Related Standards

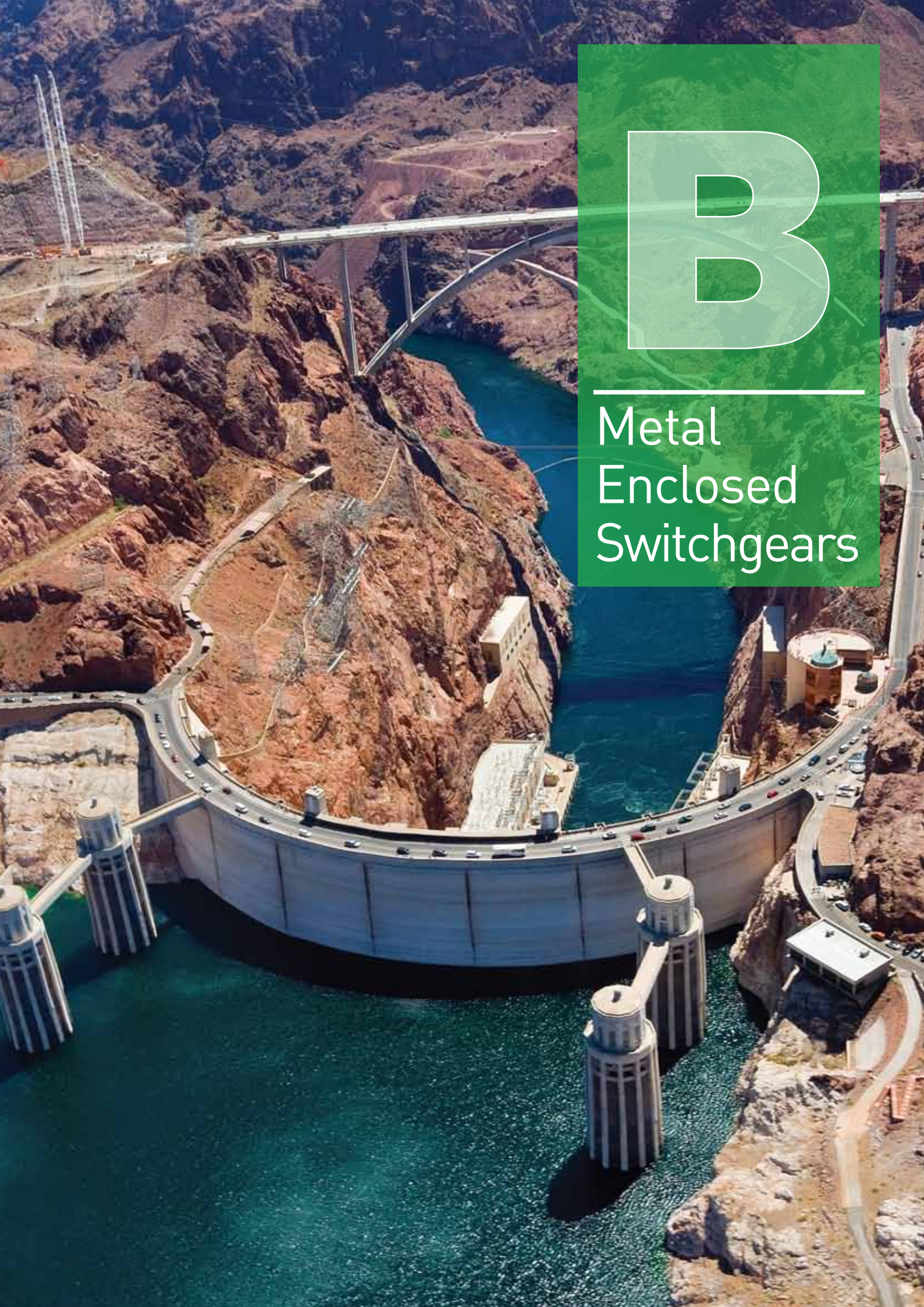
The IEC 60298 was able to meet the standards while it was utilized in previous years. However, due to the advancement of the technology and developments in Switchgears designs, and bringing the safety to the forefront, the standard was no able to handle the power cuts of the systems as well as maintenance needs of the users.

In the following table the new IEC 62271 standard and its sections and corresponding old standard numbers are written as it's published by SC17A and SC17C committees.

IEC 62271	HIGH VOLTAGE SWITCHGEAR AND CONTROLGEAR	
Section	New Heading	Old IEC Number
1	Common specifications for high-voltage switchgear and controlgear standards	IEC 60694
2	Seismic Competence for rated voltage of 72.5 kV and above	-
100	High-voltage alternating current circuit-breakers	IEC 60056
101	Synthetic testing of high voltage alternating current circuit breakers	IEC 60427
102	Alternating current disconnectors and earthing switches	IEC 60129
103	Switches for rated voltages above 1 kV and less than 52 kV	IEC 60265-1
104	High voltage switches for rated voltages of 52 kV and above	IEC 60265-2
105	Alternating current switch-fuse combinations	IEC 60420
106	High voltage alternating current contactors and contactor-based motor-starters	IEC 60470
107	High voltage alternating current switchgear-fuse combinations	-
108	Switchgear having combined functions	-
109	Alternating-current series capacitor by-pass switches	-
200	AC metal enclosed switchgear and controlgear for rated voltages above 1 kV and up to an including 52 kV	IEC 60298
201	AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to an including 38 kV	IEC 60466
202	High-voltage/low-voltage prefabricated substations	IEC 61330
203	Gas-insulated metal enclosed switchgear for rated voltages of 72.5 kV and above	IEC 60517
204	Rigid high-voltage, gas-insulated transmission lines for rated voltages of 72.5 kV and above	IEC 61640
300	Guide for seismic qualification of high-voltage alternating current circuit breakers	IEC 61666
301	High-voltage alternating current circuit breakers - Inductive load switching	IEC 61233
302	High-voltage alternating current circuit breakers - Guide for short circuit and switching test procedures for metal-enclosed and dead tank circuit breakers	IEC 61633
303	High-voltage switchgear and controlgear - Use and handling of SF6 in high voltage switchgear and controlgear	IEC 61634
304	Additional requirements for enclosed switchgear and controlgear from 1 kV to 72.5 kV to be used in severe climatic conditions	IEC 61932
305	Cable connections for gas-insulated metal-enclosed switchgear for rated voltages of 72.5 kV and above - Fluid filled and extruded insulation cables-Fluid-filled and dry type cable terminators	IEC 60859
306	Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 72.5 kV and above.	IEC 61639
307	High-voltage switchgear and controlgear - The use of electronic and associated technologies in auxiliary equipment of switchgear and controlgear	IEC 62063
308	Guide for asymmetrical short-circuit breaking test duty T100a	-
309	TRV parameters for high voltage switchgear and controlgear with rated value ove 1 kV and under 100 kV	-
310	Electric endurance test for circuit breakers with rated voltage of 72.5 kV and above	-

Metal Enclosed Switchgears

B



B

Metal Enclosed Switchgears

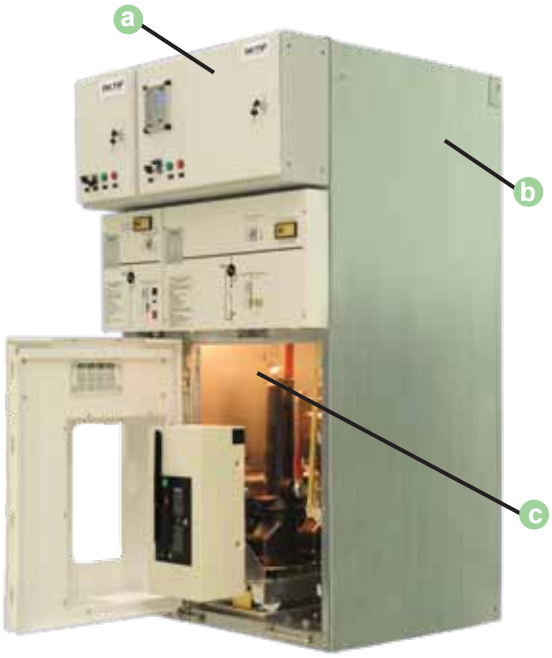
SME series Metal Enclosed Switchgears are the switching and control equipment between 1 kV and 40.5 kV, manufactured in conformity with IEC 62271-200.

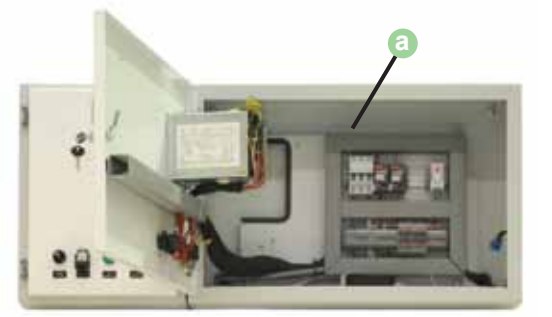
The first Metal Enclosed Switchgear of Turkey is manufactured in Aktif factory in 1995 and tested in international test laboratories.

SME series Metal Enclosed Switchgears are manufactured by galvanized metal sheet with 2 mm thickness and painted by electro-static powder paint in colors conforming to RAL coding.

SME series Metal Enclosed Modular Switchgears manufactured by Aktif Elektroteknik are defined with following features as per IEC 62271-200 standards:

- Air insulated
- LSC 2A Loss of Service continuity
- PI Partition Class
- AFL Internal Arc Classification
- 3 accessible compartments





B 1 Compartments

SME series Metal Enclosed Switchgears contain 3 segregated compartments.

a - Low Voltage Compartment
b - Busbar Compartment
c - Switching Equipment Compartment

a - Low Voltage Compartment

This compartment contains all secondary circuits for measurement, protection, control, monitoring, communication and other associated systems.

b - Busbar Compartment

Busbar Compartment mainly consists of;

- Electrolytic copper busbars according to rated current.
- Epoxy resin post insulators

Access to busbar compartment is possible with special safety procedures and tools.

c - Switching Equipment Compartment

In this Compartment following equipment is contained according to the project specifications:

- Switching equipment
- Current transformers
- Voltage transformers
- Surge arresters
- Grounding
- Capacitive voltage divider
- Cable connection couplings

Furthermore, this compartment also contains following switching equipment:

- SF6 Gas or vacuum circuit breaker
- SF6 Gas insulated Load Break Switch
- SF6 Gas insulated or Rotary Disconnector
- Vacuum Contactor

Switching compartment access is controlled by integral design of Metal Enclosed Switchgear to ensure safe operation according to IEC 62271-200

The following mechanic Interlocks are provided as standard:

performing of Load Break switches with/without fuses is not possible when;
the Switching compartment door is open and/or,
the Grounding disconnector is in Closed position

switching of Disconnectors used together with circuit breakers is not possible when;
the Switching compartment door is open ,
the Circuit Breaker is Closed position and/or,
the Grounding disconnector is in Closed position

switching of Grounding disconnector is not possible when;
the Line Disconnector is in Closed position.

B 2 Application Areas

Metal Enclosed Switchgears are especially used in the transformer centers, distribution systems, renewable energy production and industrial plants where the rated current up to 1250 A and short circuit current up to 25 kA.

- Energy Distribution Centers
- Hydroelectric and Wind Energy Applications
- Diesel and Natural Gas Power Plants
- Transformer Substations
- Cement Factories
- Auto Industry
- Petroleum and Chemical Industry
- Iron and Steel Industry
- Rolling Mills
- Pipe lines
- Shipyards
- Emergency Situation and Stand-by Power Facilities
- Ore Mines
- Railway Substations

B 3 Advantages

- LSC2A service continuity
- Grounded metal separation between compartments
- Maximum human safety with AFL internal arc testing feature
- Safe electrical and mechanical Interlock systems do not allow to operational faults
- SF6 gas insulated Circuit breaker allows fast and easy servicing
- Grounding system with ensured continuity
- Modular design, which allows extension easily
- Tested short time withstand current up to 25 kA / 1 s.
- Interactive mimic diagram
- Proven reliability with unique design
- Low maintenance cost
- Easy and safety operation with inverlock
- After sale service and spare parts availability

B 4 Standards Complied

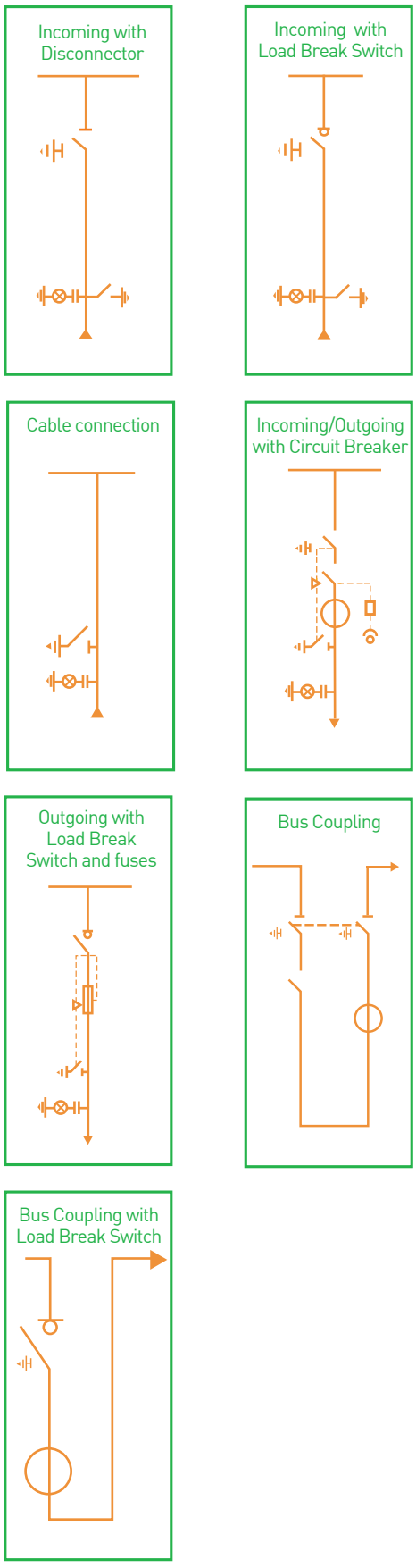
SME series Switchgears are manufactured in conforming to following standards:

- IEC 62271-1 : General articles relating to High Voltage Switchgears
- IEC 62271-200 : Metal Enclosed Switchgears (1 - 52 kVac)
- IEC 62271-100 : Circuit Breakers (1 - 52 kVac)
- IEC 62271-102 : Main Circuit and grounding Disconnectors
- IEC 62271-105 : AC Switch and Fuse combinations
- IEC 61869-2 : Current Transformers
- IEC 61869-3 : Voltage Transformers
- IEC 60273 : Insulators
- IEC 60051 : Measuring Devices
- IEC 60255 : Secondary Protection relays

B 5 Technical Specifications

Technical Spesifications								
Descriptions		SME 3,6	SME 7,2	SME 12	SME 17,5	SME 24	SME 36	SME 40,5
Rated Voltage (rms)	kV	3,6	7,2	12	17,5	24	36	40,5
Power frequency withstand voltage 50 Hz, 1 min (rms) between phases and phase-ground	kV	10	20	28	38	50	70	85
Lightning impulse withstand voltage 1.2/50ms (peak) between phases and phase-ground	kV	40	60	75	95	125	170	185
Rated frequency	Hz	50 - 60						
Rated (rms) current of switchgears with								
Busbars	A	630 ... 1250			630 ... 1250		630 ... 1250	
C/B and Disconnector	A	630 ... 1250			630 ... 1250		630 ... 1250	
Load break switches	A	630			630		630	
Rated short time withstand (rms) current with								
C/B and Disconnectors	kA	16 - 20 - 25			16 - 20 - 25		16 - 20 - 25	
Load break switches	kA	16 - 20			16 - 20		16 - 20	
Rated short time withstand (peak) current with								
C/B and Disconnectors	kA	40 - 50 - 63			40 - 50 - 63		40 - 50 - 63	
Load break switches	kA	40 - 50			40 - 50		40 - 50	
Short circuit withstand time	s	1			1		1	
Internal Arc Failure								
Current	kA	16 - 20 - 25			16 - 20 - 25		16 - 20 - 25	
Duration	s	1			1		1	
Earthing Disconnector								
Rated short circuit current making capacity	kA	16 - 20 - 25			16 - 20 - 25		16 - 20 - 25	
Rated short time withstand (peak) current	kA	40 - 50 - 63			40 - 50 - 63		40 - 50 - 63	
Rated short circuit withstand time	s	1			1		1	
Switchgear Structure as per the loss of service continuity		LSC 2A						
internal arc classification		AFL						
partition class		PI						
Protection Class when doors are closed		IP 3X						
between compartments		IP 2X						
Color		RAL 9003 / 7035						
Standards complied		IEC 62271-200						

Note: Full type tests of SME series switchgears up to 25 kA are performed at VEIKI accredited laboratories in Hungary.



B 6 Switchgears Types

- **Incoming Switchgear with Disconnector**

  Is the switchgear without protection and on load switching features, with the rated current up to 1250 A and short circuit level up to 25 kA.

- **Incoming Switchgear with Load Break Switch**

  Is the switchgear which allows the switching on load but without protection features with the rated current up to 630 A and short circuit level up to 20 kA.

- **Cable Connection Switchgear**

  Is the switchgear to connect the distribution busbar with the cables connected from the bottom without using any switching and protection features with the rated current up to 1250 A and short circuit level up to 25 kA.

- **Incoming/Outgoing Switchgear with Circuit Breaker**

  Is the switchgear for the incoming of distribution busbar with rated current up to 1250 A and short circuit current up to 25 kA which allows the protection and switching operation during short circuit.

- **Outgoing Switchgear with Vacuum Contactor**

  Is the switchgears used where frequent switching operation is required with rated voltage up to 24 kV and rated current up to 400 A.

- **Outgoing Switchgear with Load Break Switch and Fuse**

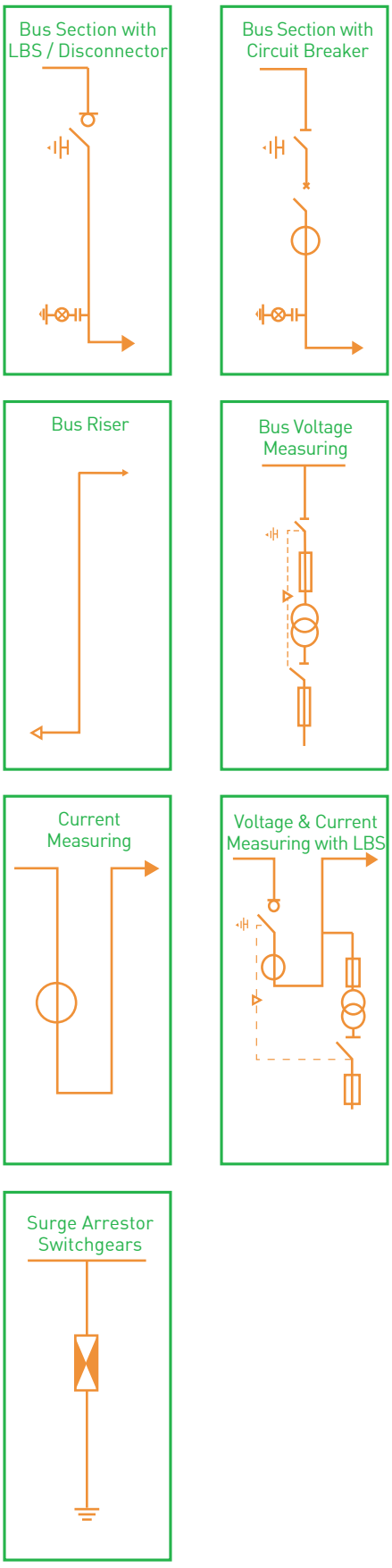
  Is the switchgear which allows the switching on load and contains short circuit fuses for protection features with the rated current up to 630 A and short circuit level up to 20 kA.

- **Bus Coupling Switchgear**

  Switchgear to connect the different busbars whether feed by the same or different supply with rated current up to 1250 A and short circuit current up to 25 kA. This switchgear is a combination of Bus section and Bus riser switchgears.

- **Bus Coupling Switchgear with Load Break Switch**

  Switchgear where the connection of two different busbars are realized manually without protection and paralleling features whether feed by the same or different supply with rated current up to 630 A and short circuit current up to 20 kA.



- **Bus Section Switchgear with Load Break Switch**

  Switchgear where the connection of two different busbars are realized manually without protection and paralleling features whether feed by the same or different supply with rated current up to 630 A and short circuit current up to 20 kA.

- **Bus Section Switchgear with Circuit Breaker**

  Switchgear where the connection of two different busbars are realized automatically with protection and paralleling features whether feed by the same or different supply with rated current up to 1250 A and short circuit current up to 25 kA.

- **Bus Rising Switchgear**

  Switchgear Is used for the connection of Bus section switchgear' busbars by rising up to other busbar system with rated current up to 1250 A and short circuit current up to 25 kA.

- **Bus Voltage Measuring Switchgear**

  Switchgear is used for obtaining voltage information for the measurement and protection purposes in the metal enclosed busbar with rated current up to 1250 A and short circuit current up to 25 kA with the help of Secondary protection relays and measurement devices like Voltmeter, Power Analyzers, Electricity meters, etc ...

- **Bus Current Measurement Switchgears**

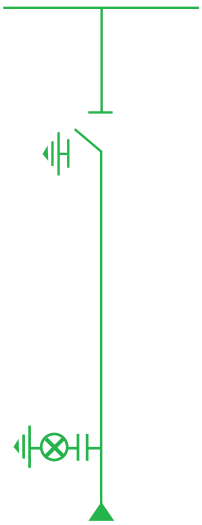
  Switchgear with rated current up to 1250 A and short circuit current up to 25 kA in where the current information of the distribution busbars is obtained for the using of Secondary protection relays and measurement devices such as Ammeter, Analyzers and Electricity Meters.

- **Current & Voltage Measuring Switchgears**

  Switchgear with rated current up to 630 A and short circuit current up to 20 kA in which the current and voltage information of the distribution busbars is obtained to use at Secondary protection relays and measurement devices such as Ammeter, Voltmeter, Analyzers and Electricity Meters.

- **Surge Arrester Switchgear**

  It is used on the busbars rated current up to 1250 A and short circuit current up to 25 kA, to protect the system and apparatus against temporary over voltages caused by the lightning surges and switching surges.

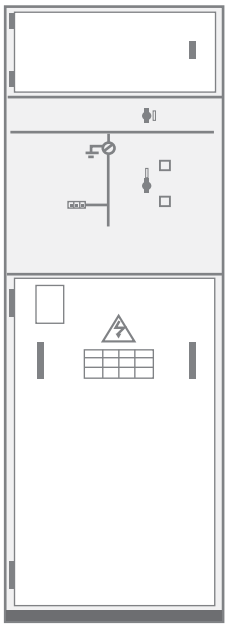


B 6.1 Incoming Switchgear with Disconnector

Is the switchgear without protection and on load switching features, with the rated current up to 1250 A and short circuit level up to 25 kA.

In this switchgear 3 poles and 3 positioned (open– close- earthed) SF6 gas insulated disconnector is used as standard and alternatively Rotary Disconnectors may be used.

Incoming switchgears with disconnectors are used on;
Incoming of MV distribution busbar which does not stand protection and load switching.

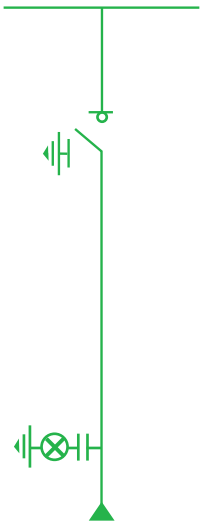


Switchgear Equipment	Standard	Options
SF6 Gas Insulated Disconnector	x	
Air Insulated Rotary switch *		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Fault Location indicator	x	
Surge Arrestor		x
Current Transformer		x
Ammeter		x
Test Terminal		x
Cable Connection Terminal	x	
SCADA Connections		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40.5	750	1400	2250

B 6.2 Incoming Switchgear with Load Break Switch

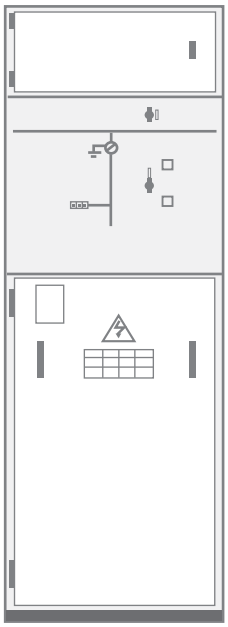


Is the switchgear which allows the switching on load but without protection features with the rated current up to 630 A and short circuit level up to 20 kA.

In this switchgear 3 poles and 3 positioned (open-close-earthed) SF6 gas insulated Load Break switch is used as standard.

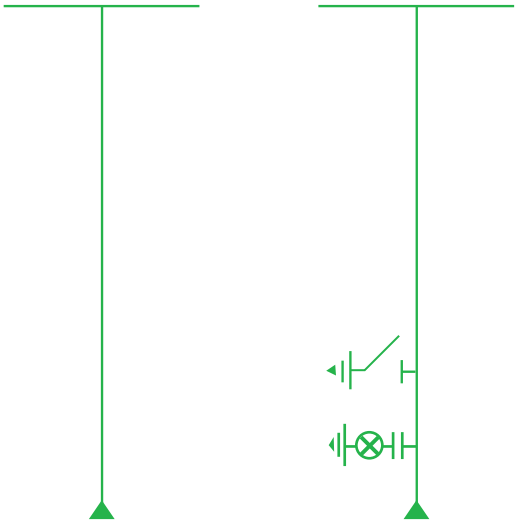
Incoming switchgears with Load Break Switch are used at;
- Incoming of MV distribution busbars and
- In some applications also at outgoing feeders

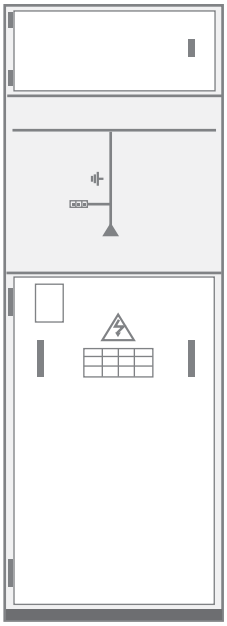
where there is no need for protection.



Switchgear Equipment	Standard	Options
SF6 Gas Insulated Load Break Switch	x	
Motor operation mechanism		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Fault Location indicator	x	
Surge Arrestor		x
Current Transformer		x
Ammeter		x
Test Terminal		x
Remote Operation set		x
Cable Connection Terminal	x	
SCADA Connections		x
Interlock	x	

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40.5	750	1400	2250





B 6.3 Cable Connection Switchgear

Is the switchgear to connect the distribution busbar with the cables connected from the bottom without using any switching and protection features with the rated current up to 1250 A and short circuit level up to 25 kA.

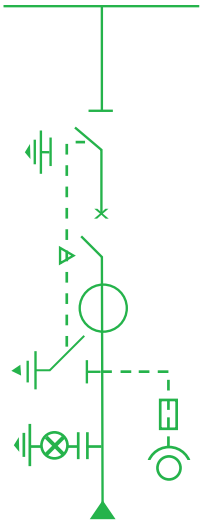
Busbar connection switchgears are used to supply;
- Side connected Incoming switchgears
- Outgoing switchgears and
- Opposite busbar incoming fed from the outgoing cubicle at opposite arrangement of switchgears.

which consist of switching and protection.

Switchgear Equipment	Standard	Options
Earthing Disconnector		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set		x
Cable Connection Terminal	x	
SCADA Connections		x
Interlock		x

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40.5	750	1400	2250

B 6.4 Incoming Switchgear with Circuit Breaker

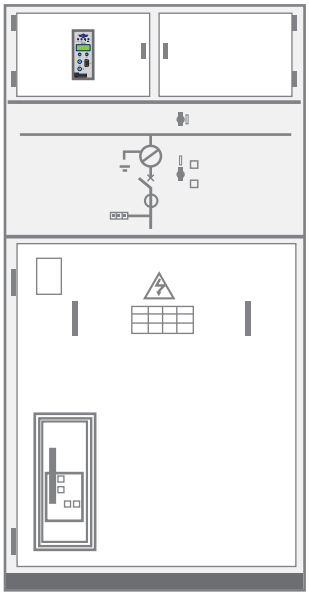


Is the switchgear for the incoming of distribution busbar with rated current up to 1250 A and short circuit current up to 25 kA which allows the protection and switching operation during short circuit.

Switching is operated by 3 poles SF6 gas insulated Circuit Breaker and Disconnection operation is realized by the using of 3 positioned (open-close-earthed) SF6 gas insulated disconnector as standard or Rotary switch as an option.

Incoming Switchgears with Circuit Breaker are used in;
- Network or Generator incoming feeders,
- Incoming feeders of Open/Close Ring operated networks.

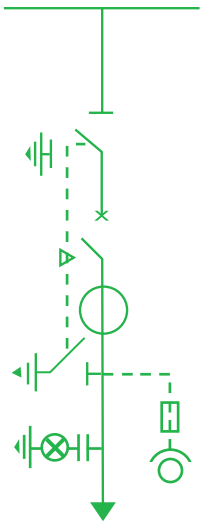
Standard incoming switchgears are used also as outgoing switchgear for any kind of application.

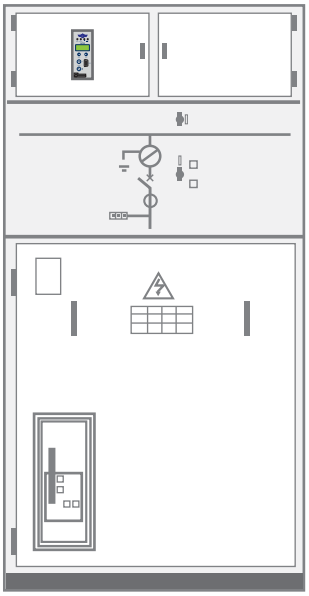


Switchgear Equipment	Standard	Options
Circuit Breaker	x	
SF6 Gas Insulated Disconnector	x	
Air Insulated Rotary Switch *		x
Main Busbar Earthing Disconnector		x
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Thermostat and Heater Kit	x	
Surge Arrestor	x	
Voltage Transformer and MV Fuse		x
Voltmeter and Commutator set		x
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay		x
Other secondary protection relays	x	
Cable Connection Terminal		x
SCADA Connections	x	
GSM-GPRS Modem Converter Set		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	900	1000	2000
36	1000	1400	2250
40.5	1000	1400	2250





B 6.5 Outgoing Switchgear with Circuit Breaker

Is the switchgear for the outgoing from distribution busbar with rated current up to 1250 A and short circuit current up to 25 kA which allows for the protection and switching operation during short circuit.

Switching is operated with 3 poles SF6 gas insulated Circuit Breaker and Disconnection operation is realized by the using of 3 positioned (open-close-earthed) SF6 gas insulated disconnector as standard or Rotary switch as an option.

Outgoing Switchgears with Circuit Breaker are mainly used in;
- Any load feeders supplied from Distribution Busbars
- Line feeders supplied from Distribution Busbars
- Outgoing feeders of Open/Close Ring operated networks.

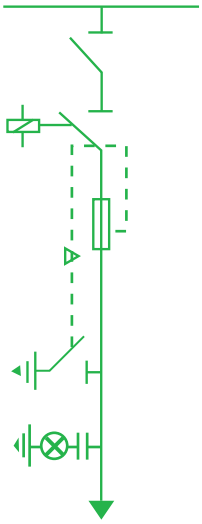
Standard outgoing switchgears are used as Incoming switchgears at some site application.

Switchgear Equipment	Standard	Options
Circuit Breaker	x	
SF6 Gas Insulated Disconnector	x	
Air Insulated Rotary Switch*		x
Main Busbar Earthing Disconnector		x
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Thermostat and Heater Kit	x	
Surge Arrestor		x
Voltage Transformer		x
Voltmeter and Commutator set		x
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relays		x
Cable Connection Terminal	x	
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	900	1000	2000
36	1000	1400	2250
40.5	1000	1400	2250

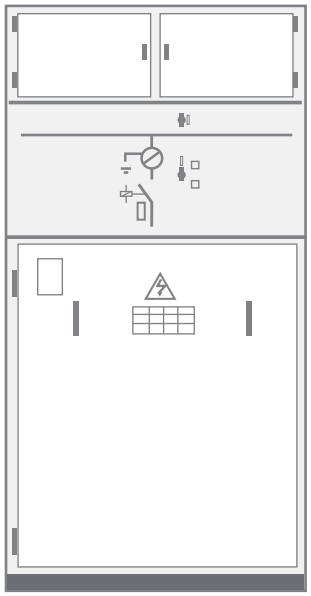
B 6.6 Outgoing Switchgear with Vacuum Contactor



Is the switchgears used where frequent switching operation is required with rated voltage up to 24 kV and rated current up to 400 A.

For the switching operation 3 poles vacuum contactor is used and disconnection operation is realized by 3 poles 3 positioned (open-close-earthed) SF6 gas insulated disconnector as standard or air insulated Rotary Switch as an alternative.

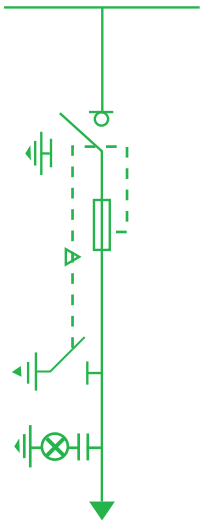
Outgoing Switchgear with contactor is used for feeding of;
- Capacitor Banks
- Harmonic Filters
- Shunt Reactors and
- Motors

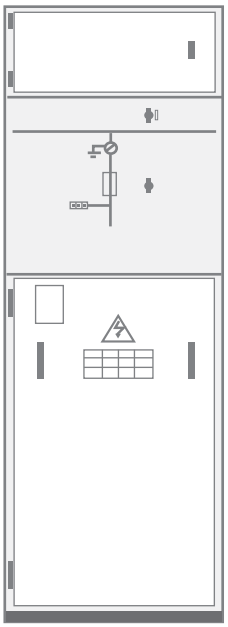


Switchgear Equipment	Standard	Options
Vacuum Contactor	x	
SF6 Gas Insulated Disconnector	x	
Air insulated Rotary Switch *		x
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
M.V. Protection Fuses	x	
Thermostat and Heater Kit	x	
Surge arrester		x
Current Transformer		x
Ammeter		x
Over Current Relay		x
Other secondary protection relays		x
Test Terminal		x
Cable Connection Terminal	x	
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	750	900	2000





B 6.7 Outgoing Switchgear with Load Break Switch and Fuse

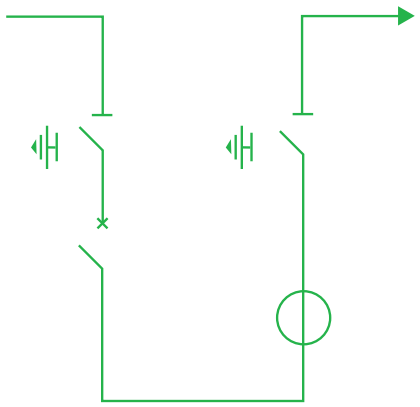
Is the switchgear which allows the switching on load and contains short circuit fuses for protection features with the rated current up to 630 A and short circuit level up to 20 kA.

In this switchgear 3 poles and 3 positioned (open-close-earthed) SF6 gas insulated Load Break switch is used as standard.

Outgoing switchgear with fused type Load Switch is used for;
- Feeding of Transformers with rated power up to 400 kVA
- Feeding of Transformers with rated power up to 1600 kVA with the condition of being in the same location with distribution transformer.

Switchgear Equipment	Standard	Options
SF6 Gas Insulated Load Break Switch	x	
Motor operating mechanism		x
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
M.V. Protection Fuses	x	
Thermostat and Heater Kit	x	
Remote Operation set	x	
Cable Connection Terminal	x	
SCADA Connections		x
Interlock	x	

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40.5	750	1400	2250

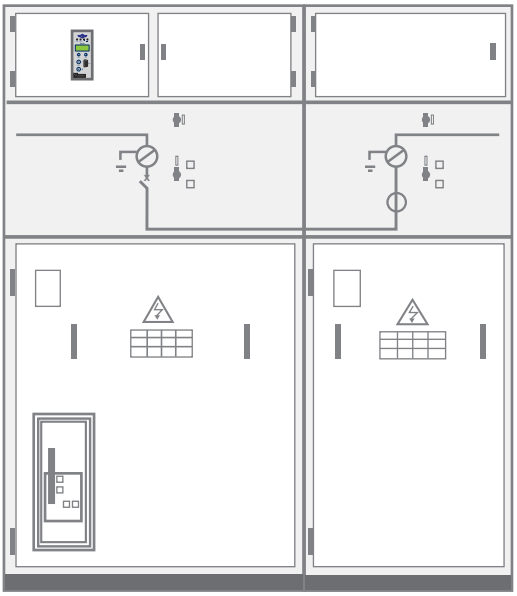


B 6.8 Bus Coupling Switchgear

Switchgear to connect the different busbars whether feed by the same or different supply with rated current up to 1250 A and short circuit current up to 25 kA. This switchgear is a combination of Bus section and Bus riser switchgears.

Inside the switchgear 3 poles SF6 gas insulated Circuit Breaker and 2 pieces of 3 positioned (open-close-earthed) SF6 gas insulated Disconnectors are used as standard.

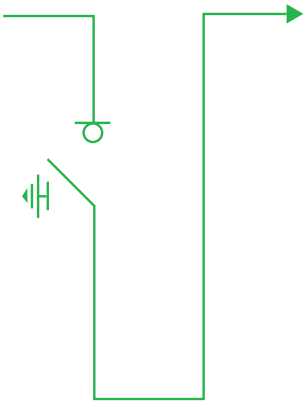
Bus Coupling Switchgears are used to;
- Connect two different busbars and
- Synchronizing of Power plants or Renewable Energy supplies to the network.



Switchgear Equipment	Standard	Options
Circuit Breaker	x	
SF6 Gas Insulated Disconnectors	x	
Air Insulated Rotary Switches *		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Voltage Transformer		x
Voltmeter and Commutator set		x
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relays		x
Cable Connection Terminal	x	
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	1125 *	900	2000
17.5 - 24	1400 *	1000	2000
36	1750 *	1400	2250
40.5	1750 *	1400	2250

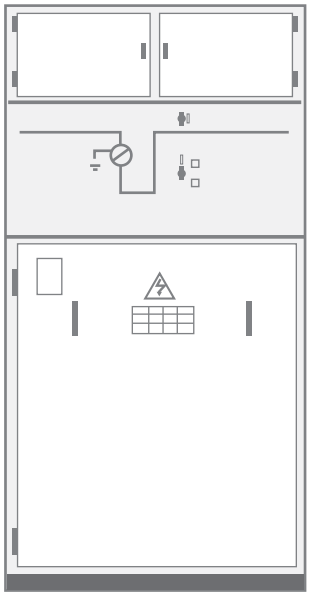


B 6.9 Bus Coupling Switchgear with Load Break Switch

Switchgear where the connection of two different busbars are realized manually without protection and paralleling features whether feed by the same or different supply with rated current up to 630 A and short circuit current up to 20 kA.

In this switchgear SF6 gas insulated Load Break switch with 3 poles and 3 positions (open-close-earthed) is used as standard. Instead of LBS, SF6 gas insulated disconnector or Rotary switch can be used optionally also to increase the rated current to 1250A, and short circuit current to 25 kA.

Bus Coupling Switchgear with Load Break switch is used to connect two busbars each other manually or automatically without protection.

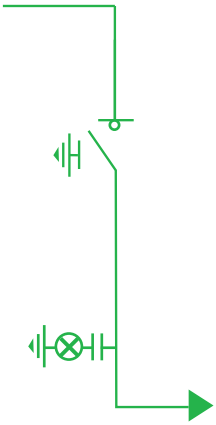


Switchgear Equipment	Standard	Options
SF6 Gas Insulated Load Break Switch	x	
SF6 Gas Insulated Disconnector *		x
Air Insulated Rotary Switch *		x
Motor set for spring charging		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Voltage Transformer		x
Voltmeter and Commutator set		x
Current Transformer		x
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Motor set for Remote Open-Close		x
SCADA Connections		x
Interlock	x	

* These products are the option of SF6 gas insulated Load Break switch when there is no need to switching on-load.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	1000	1000	2000
36	1150	1400	2250
40.5	1150	1400	2250

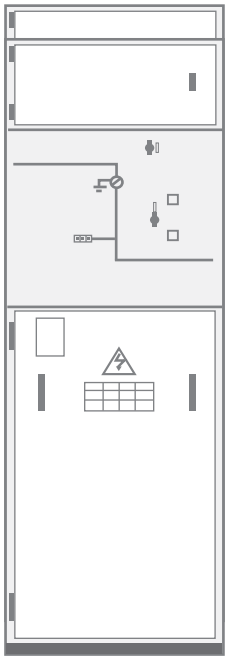
B 6.10 Bus Section Switchgear with Load Break Switch



Switchgear where the connection of two different busbars are realized manually without protection and paralleling features whether feed by the same or different supply with rated current up to 630 A and short circuit current up to 20 kA.

In this switchgear SF6 gas insulated Load Break switch with 3 poles and 3 positions (open-close-earthed) is used as standard. Instead of LBS, SF6 gas insulated disconnector or Rotary switch can be used optionally also to increase the rated current to 1250A, and short circuit current to 25 kA.

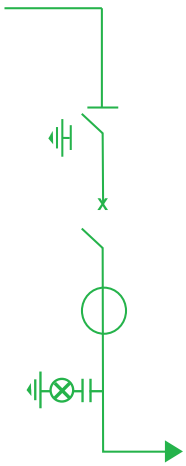
Bus Section Switchgear with Load Break switch is used to connect two busbars each other manually or automatically without protection especially at opposite arrangement of busbars.

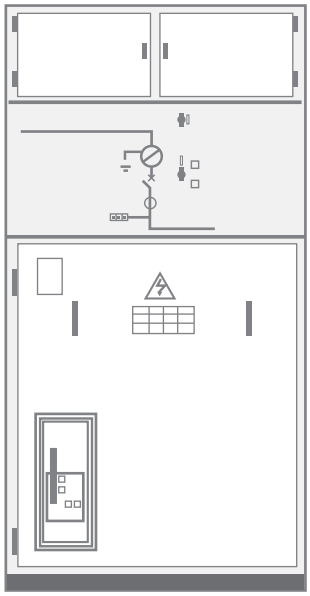


Switchgear Equipment	Standard	Options
SF6 Gas Insulated Load Break Switch	x	
SF6 Gas Insulated Disconnector *		x
Air Insulated rotary Disconnector *		x
Motor set for spring charging		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Current Transformer		x
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Motor set for remote open-close		x
SCADA Connections		x
GSM/GPRS Modem Converter Set		x
Interlock	x	

* These products are the option of SF6 gas insulated Load Break switch when there is no need to switching on-load.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40.5	750	1400	2250





B 6.11 Bus Section Switchgear with Circuit Breaker

Switchgear where the connection of two different busbars are realized automatically with protection and paralleling features whether feed by the same or different supply with rated current up to 1250 A and short circuit current up to 25 kA.

3 poles SF6 gas insulated Circuit Breaker with 3 poles and 3 positions (open-close-earthed) Disconnector is used as standard in this switchgear. Also air insulated Rotary Switch can be used as a disconnection option.

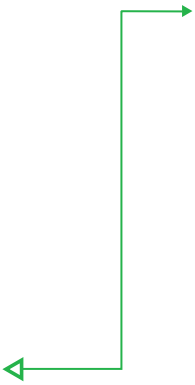
Busbar Coupling Switchgear with Circuit Breaker is used;
- Connect two different busbars and
- Synchronizing of Power plants or Renewable Energy supplies to the network especially at opposite arrangement of busbars.

Hücre Donanımları	Standart	Opsiyonel
Circuit breaker	x	
SF6 Gas insulated Disconnector	x	
Air type Rotary switch *		x
Thermostat and heater kit	x	
Copper busbar	x	
Capacitif voltage indicator	x	
Current transformer	x	
Ammeter		x
Power Analyzer		x
Electricty meter		x
Over current relay	x	
Other secondary protection relays		x
SCADA connection		x
GSM-GPRS Modem/Converter Set		x
Interlock	x	

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	900	1000	2000
36	1000	1400	2250
40.5	1000	1400	2250

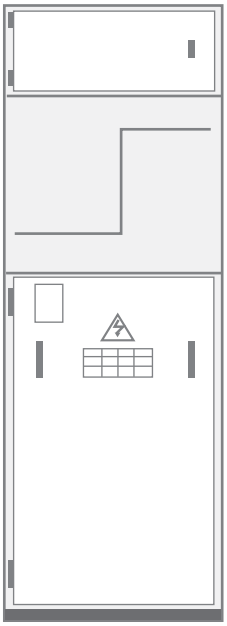
B 6.12 Bus Rising Switchgear



Switchgear Is used for the connection of Bus section switchgear' busbars by rising up to other busbar system with rated current up to 1250 A and short circuit current up to 25 kA.

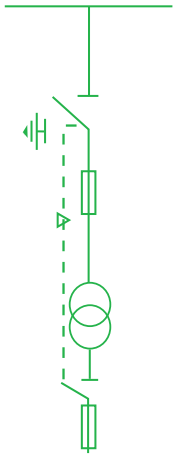
Bus riser switchgears may contain 3 poles 3 positioned (open-close-earthed) disconnector or rotary switch in case of switching necessity.

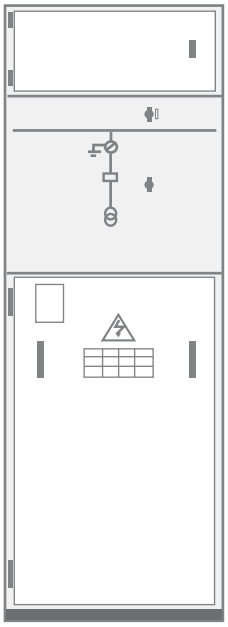
Bus Riser switchgear is used with Bus Section to connect two busbars.



Switchgear Equipment	Standard	Options
SF6 gas insulated disconnector		x
Air insulated Rotary switch		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Voltage Transformer		x
Voltmeter and Commutator set		x
Current Transformer		x
Ammeter		x
Power Analyzer		x
Electricity Meter		x

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40,5	750	1400	2250





B 6.13 Bus Voltage Measuring Switchgear

Switchgear is used for obtaining voltage information for the measurement and protection purposes in the metal enclosed busbar with rated current up to 1250 A and short circuit current up to 25 kA with the help of Secondary protection relays and measurement devices like Voltmeter, Power Analyzers, Electricity meters, etc ...

In this switchgear SF6 gas insulated Disconnector with 3 poles and 3 positions (open-close-earthing) is used as standard and also Air insulated rotary switch can be used as an option.

Bus Voltage Measuring Switchgears are used for the receiving of;
- Measurement and protection basis Voltage data.
- Billing basis Energy consumption measurement.
- Providing auxiliary power up to 2.5 kVA in Low Voltage.

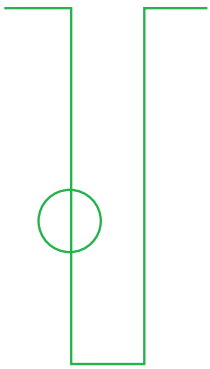
Switchgear Equipment	Standard	Options
SF6 Gas Insulated Disconnector	x	
Air-Insulated rotary Switch *		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuse	x	
Voltage Transformer	x	
Voltmeter and commutator set	x	
Power Analyzer		x
Electricity Meter		x
SCADA Connections		x

* This product is an option of SF6 gas insulated disconnector.

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375 *	900	2000
17.5 - 24	500 *	1000	2000
36	750 *	1400	2250
40,5	750 *	1400	2250

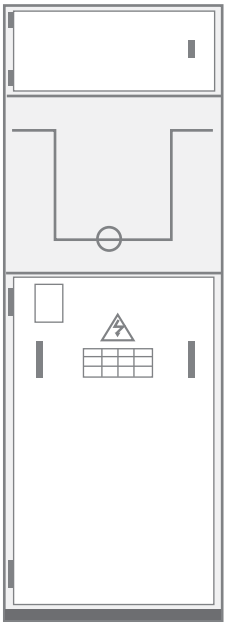
* When rotary switch is used 750 mm for 12 kV and 24 kV, 1000 mm for 36 kV.

B 6.14 Bus Current Measurement Switchgears



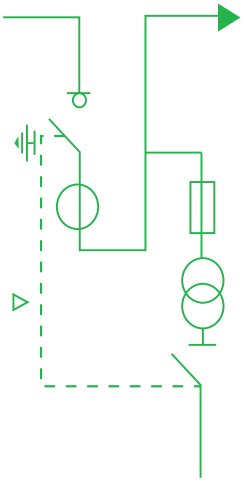
Switchgear with rated current up to 1250 A and short circuit current up to 25 kA in where the current information of the distribution busbars is obtained for the using of Secondary protection relays and measurement devices such as Ammeter, Analyzers and Electricity Meters.

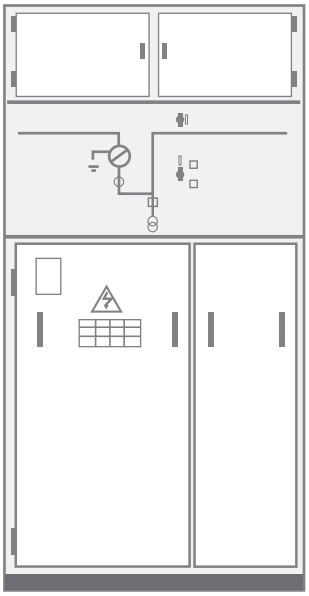
Bus Current Measuring Switchgear is used for the receiving of :
- Measurement and Protection basis Current data,
- Billing basis Energy consumption measurement.



Switchgear Equipment	Standard	Optional
Thermostat and Heater Kit	x	
Copper Busbar	x	
Current Transformer	x	
Ammeter		x
Electricity meter		x

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	900	2000
17.5 - 24	750	1000	2000
36	1000	1400	2250
40,5	1000	1400	2250





B 6.15 Current & Voltage Measuring Switchgears

Switchgear with rated current up to 630 A and short circuit current up to 20 kA in which the current and voltage information of the distribution busbars is obtained to use at Secondary protection relays and measurement devices such as Ammeter, Voltmeter, Analyzers and Electricity Meters.

In this switchgear SF6 gas insulated Load Break switch with 3 poles and 3 positions (open-close-earthed) is used as standard. Instead of LBS, SF6 gas insulated disconnector or Rotary switch can be used optionally also to increase the rated current to 1250A, and short circuit current to 25 kA.

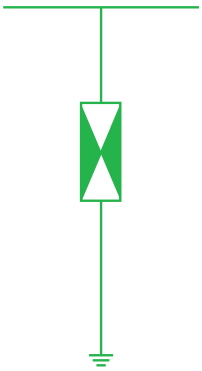
Current & Voltage Measuring Switchgear is used for the receiving of;
- Main Measurement basis Current and Voltage data,
- Billing basis Energy consumption measurement.

Switchgear Equipment	Standard	Optional
SF6 Gas Insulated Load Break Switch	x	
SF6 Gas Insulated Disconnector *		x
Air Insulated rotary Switch *		x
Motor set for spring charging		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuse	x	
Voltage Transformer	x	
Voltmeter and Commutator set	x	
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter	x	
Motor set for Remote open-close		x
SCADA Connections		x
GSM/GPRS Modem Converter Set		x
Interlock	x	

* If more current capacity is needed it's possible to use SF6 Disconnector or Rotary Switch instead of LBS.

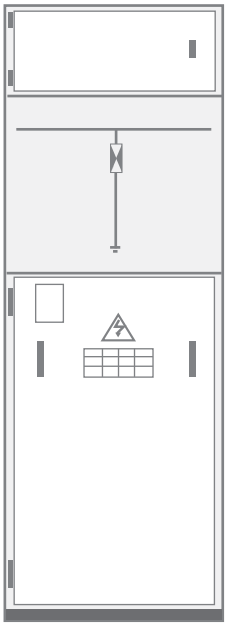
	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	750	1000	2000
17.5 - 24	1000	900	2000
36	1000	1400	2250
40.5	1000	1400	2250

B 6.16 Surge Arrester Switchgear



It is used on the busbars rated current up to 1250 A and short circuit current up to 25 kA, to protect the system and apparatus against temporary over voltages caused by the lightning surges and switching surges.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Surge Arrestor	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	375	900	2000
17.5 - 24	500	1000	2000
36	750	1400	2250
40,5	750	1400	2250

Metal Clad Switchgear C

C

Metal Clad Switchgear

C 1 Metal Clad Switchgearswith single Busbar

Metal Clad Switchgears are switching and control cabinets manufactured between 1 kV ... 40.5 kV in conformity with IEC 62271-200 standards.

The Metal Clad Switchgears are manufactured from steel structures in vertical position as free-standing which contain withdrawable/cassette type Circuit breakers, Main, distribution and grounding busbars, Current-Voltage Transformers, Protection and Control equipment.

Main structures consist of 3 mm sheet steels and painted with electrostatic powder paint in conformance with RAL codes.

Metal Clad Switchgears manufactured by Aktif Elektroteknik since 1989 as passed the tests successfully in the accredited international laboratories in Europe (CESI/Italy).

SMC series Metal Clad Switchgears are defined with following features according to IEC 62271-200.

- Air insulated
- LSC 2B Loss of Service continuity
- PM Partition class
- AFLR Internal Arc Classification
- 4 accessible compartments

C 1.1 Compartments

Metal clad Switchgears consist of 4 compartments segregated from each other by grounded metal compartments:

a - Switching Compartment
b - Low Voltage Compartment
c - Busbar Compartment
d - Cable Compartment

a - Switching Compartment

The switching compartment consists of following units:

- Switching Equipments (circuit breaker-contactor, etc.)
- Withdrawable truck
- Switchgear door contains operating mechanism of truck and earthing switch
- Individual and lockable grounded automatic shutters

Switching Compartment may have the following switching equipment according to the project.

- Vacuum circuit breaker
- SF6 circuit breaker
- Contactor
- Fuses

Switching compartment access is controlled by integral design of Metal Clad Switchgear to ensure safe operation according to IEC 62271-200

The following mechanic Interlocks are provided as standard:

- The withdrawal or engagement of the C/B is not possible during the C/B is “On” position
- The operation of the C/B is not possible unless it is in service and test position
- It is not possible to open the switching compartment door when it is in service position
- It is not possible to close the C/B when switching compartment door is open
- Closing of earthing switch is not possible if circuit breaker truck is in service position
- The operation of the C/B is not possible when earthing switch is closed

b - Low Voltage Compartment

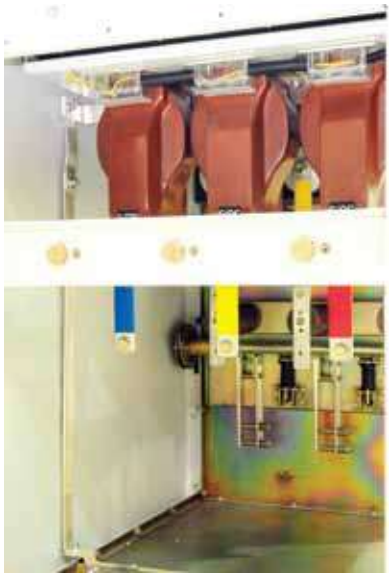
This compartment contains all secondary circuits for control, measurement, protection, monitoring, communication and other associated systems

c - Busbar Compartment

Busbar Compartment mainly consists of;

- Electrolytic copper busbars according to rated current.
- Epoxy resin post insulators

Access to busbar compartment is possible with special safety procedures and tools.



d - Cable Compartment

Followings equipment is located inside Cable compartments;

- Current transformer
- Voltage transformer
- Surge arrestor
- Earthing switch
- Capacitive voltage divider
- Cable gland and connection fixtures

Special procedures are required. Tools are necessary for opening for access.

Access to cable compartment is possible with special safety procedures and tools.

C 1.2 Application Areas

- Energy Transmission and Distribution Centers
- Hydroelectric Power Plants
- Diesel and Natural Gas Power Plants
- Transformer Substations
- Cement Factories
- Auto Industry
- Petroleum and Chemical Industry
- Iron and Steel Industry
- Rolling Mills
- Pipelines
- Electro Chemical Facilities
- Shipyards
- Emergency Situation and Stand-by Power Plants
- Ore Mines
- Railway Substations

C 1.3 Advantages

- LSC2B Maximum Service Continuity
- Earthed metal partitions between compartments
- Maximum human safety with AFLR internal arc testing feature
- Safety electrical and mechanical Interlocks doesn't allow to operational faults
- Withdrawable type Vacuum / SF6 Circuit breaker for fast and easy servicing
- Earthing system, continuity ensured
- Modular compact design, allows any future expansion
- Tested short time withstand currentat 31.5 kA / 3 s.
- Long operational life - 10.000 switching
- Interactive mimic diagram
- Proven reliability with unique design
- Low maintenance cost
- Easy and safety operation
- After sale service and spare parts availability

C 1.4 Standards Complied

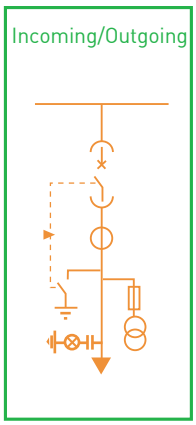
SMC series Metal Clad Switchgears are manufactured in conforming to following standards:

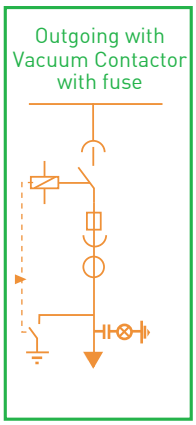
- IEC 62271-1 : General articles relating to High Voltage Switchgears
- IEC 62271-200 : Metal Enclosed Switchgears (1 - 52 kVac)
- IEC 62271-100 : Circuit Breakers (1 - 52 kVac)
- IEC 62271-102 : Main Circuit and grounding Disconnectors
- IEC 62271-105 : AC Switch and Fuse Combinations
- IEC 61869-2 : Current Transformers
- IEC 61869-3 : Voltage Transformers
- IEC 60273 : Insulators
- IEC 60051 : Measuring Devices
- IEC 60255 : Secondary Protection relays

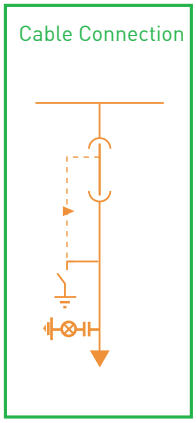
C 1.5 Technical Specifications

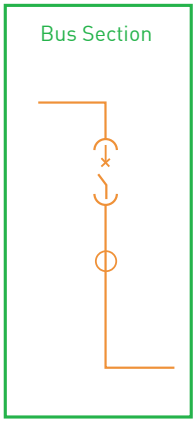
Technical Specifications								
Descriptions		SMC 3,6	SMC 7,2	SMC 12	SMC 17,5	SMC 24	SMC 36	SMC 40,5
Rated Voltage (rms)	kV	3,6	7,2	12	17,5	24	36	40,5
Power frequency withstand Voltage 50 Hz, 1 min (rms) between phases and phase-ground	kV	10	20	28	38	50	70	85
Lightning impulse withstand Voltage 1.2/50 ms (peak) between phases and phase - ground	kV	40	60	75	95	125	170	185
Rated frequency	Hz	50 - 60						
Rated (rms) current of switchgears with								
Busbars (with natural ventilation)	A	630 ... 3150			630 ... 3150		630 ... 3150	
Fan (forced ventilation)	A	5000			5000		5000	
C/B and Disconnector (with natural ventilation)	A	630 ... 3150			630 ... 3150		630 ... 3150	
(forced ventilation)	A	5000			5000		5000	
Load break switches	A	630			630		630	
Vacuum Contactors (inductive switching)	A	400			800		-	
Vacuum Contactors (capacitive switching)	A	250			200		-	
Rated short time withstand (rms) current with								
C/B and Disconnectors	kA	16 ... 50			16 ... 50		16 ... 50	
Load break switches	kA	16 - 20			16 - 20		16 - 20	
Vacuum Contactors	kA	8			8		-	
Rated short time withstand (peak) current with								
C/B and Disconnectors	kA	40 ... 125			40 ... 125		40 ... 125	
Load break switches	kA	40 - 50			40 - 50		40 - 50	
Vacuum Contactors	kA	20			20		-	
Short circuit withstand time								
up to 31.5 kV	s	3			3		3	
above 31.5 kV	s	1			1		1	
Internal Arc withstand								
Current	kA	16 ... 31.5			16 ... 31.5		16 ... 31.5	
Duration	s	1			1		1	
Earthing Disconnector								
Rated short time withstand current	kA	16 ... 50			16 ... 50		16 ... 50	
Duration (up to 31.5 kA)	s	3			3		3	
(above 31.5 kA)	s	1			1		1	
Switchgear Structure as per the								
loss of service continuity		LSC 2B						
internal arc classification		AFLR						
partition class		PM						
Protection Class								
when doors are closed - standard		IP 4X						
between compartments		IP 2X						
Color		RAL 9003 / 7035						
Standards complied		IEC 62271-200						

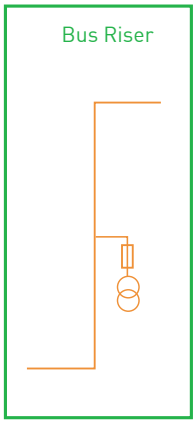
Note: Full type tests of SMC switchgears up to 31.5 kA are performed at CESI accredited laboratories in Italy.

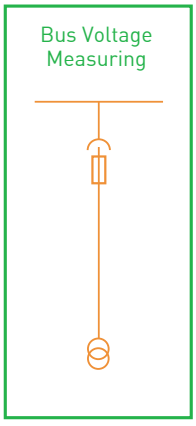


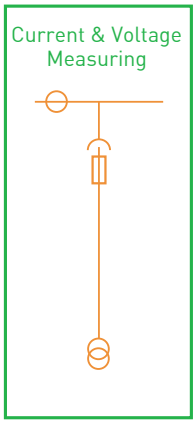












C 1.6 Switchgears Types

- **Incoming/Outgoing Switchgear**

  is the switchgear for incoming and outgoing from the distribution busbar with rated current up to 3150 A and short circuit current up to 50 kA which allows to switch operation during short circuit.

- **Outgoing Switchgears with Vacuum Contactor and fuse**

  is the switchgears used where frequent switching operation is required with rated voltage up to 24 kV and rated current up to 400 A.

- **Cable Connection Switchgear**

  is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA and the incoming distribution connection realized by busbar

- **Bus Section Switchgear**

  is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the dividing of the main busbar is needed and allows to switching operation during short circuit.

- **Bus Riser Switchgear**

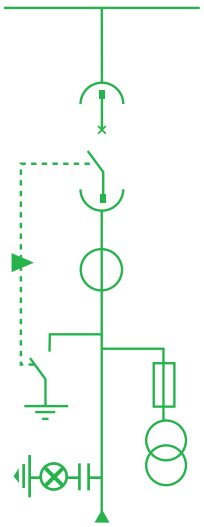
  is the switchgear used for the purpose of rising the busbar connections to the other busbar level which is divided by the Bus section switchgear, with rated current up to 3150 A and short circuit current up to 50 kA.

- **Bus Voltage Measuring Switchgear**

  is the switchgear used for obtaining voltage information for the measurement and protection purposes in the metal clad busbar with rated current up to 3150 A and short circuit current up to 50 kA with the help of Secondary protection relays and measurement devices like Voltmeter, Power Analyzers, Electricity meters...

- **Current & Voltage Measuring Switchgear**

  is the switchgear used for obtaining current information for the measurement and protection purposes in the metal clad busbar with rated current up to 3150 A and short circuit current up to 50 kA with the help Secondary protection relays and measurement devices like Ammeter, Power Analyzers, Electricity meters...

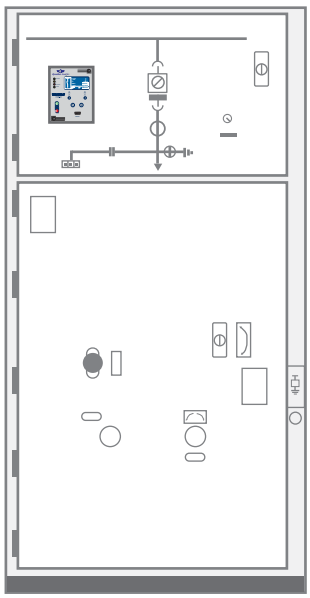


C 1 6.1 Incoming/Outgoing Switchgear

is the switchgear for incoming and outgoing of distribution busbar with rated current up to 3150 A and short circuit current up to 50 kA which allows the protection and the switching operation during short circuit.

Switching is operated by 3 poles Vacuum or SF6 gas insulated Circuit Breaker. Disconnection operation is realized by the turning of the unit in to the test position after the circuit breaker on withdrawable truck is switched to off position.

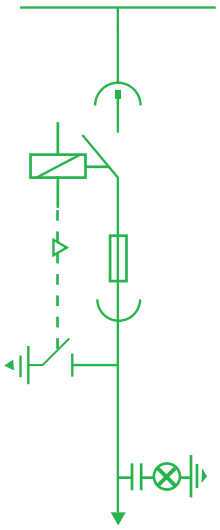
Incoming/Outgoing Switchgears with Circuit Breaker are used in;
- Network or Generator incoming feeders
- All Load feeders supplied from Distribution Busbars
- Incoming or Outgoing feeders of Open/Close Ring operated networks.



Switchgear Equipments	Standard	Options
Circuit Breaker	x	
Earthing Disconnector	x	
Main Busbar Earthing Disconnector		x
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Thermostat and Heater Kit	x	
Surge Arrestor		x
Medium Voltage Fuse		x
Voltage Transformer		x
Current Transformer	x	
Voltmeter and Commutator set		x
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relays		x
Cable Connection Terminal	x	
Fault indicator relay		x
SCADA Connectionss		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

	Switchgear Dimensions (Vacuum C/B)		
Rated Voltage (kV)	Width (mm)	Depth (mm	Height (mm)
3.6 - 24	800	2000	2100
36 - 40.5	1200	3000	2300

	Switchgear Dimensions (SF6 C/B)		
Rated Voltage (kV)	Width (mm)	Depth (mm	Height (mm)
3.6 - 24	1100	2350	2100
36 - 40.5	1400	3000	2300



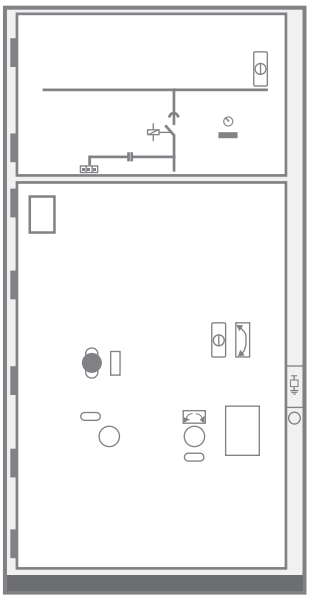
C 1 6.2 Outgoing Switchgears with Vacuum Contactor

the switchgears used where frequent switching operation is required with rated voltage up to 24 kV and rated current up to 400 A.

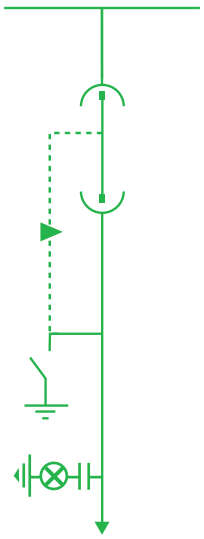
For the switching operation 3 poles vacuum contactor is used. Disconnection operation is realized by the turning of the unit in to the test position after the contactor on withdrawable truck switched to off position.

Outgoing Switchgear with contactor is used for feeding of;
- Capacitor Banks
- Harmonic Filters
- Shunt Reactors and
- Motors

Switchgear Equipments	Standard	Options
Vacuum Contactor	x	
Earthing disconnector	x	
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Medium Voltage Fuses		x
Current Transformers		x
Over Current Relay		x
Other secondary protection relays		x
Test terminal		x
Fault indicator device		x
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 12	800	2000	2100



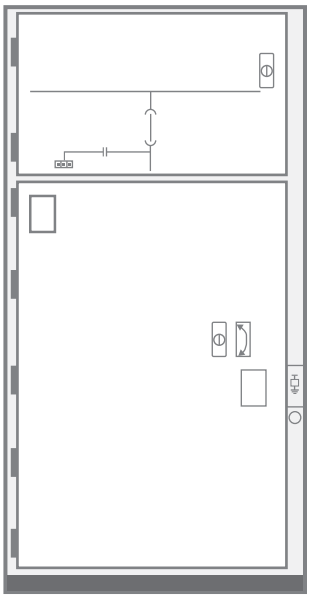
C 1 6.3 Cable Connection Switchgear

Switchgear allows to connect main busbar system from another busbar system up to 3150 A rated current and 50 kA short circuit current.

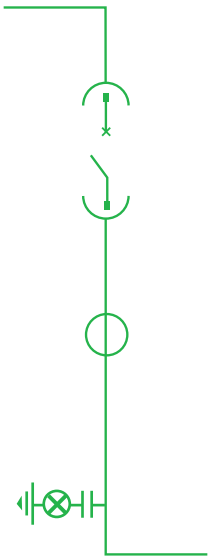
This switchgear doesn't contain any protection and breaking possibility. The disconnection is possible only by the turning the unit in to the test position to remove the connection busbar from the main distribution busbar after the circuit breaker on supply feeder is switched to off position.

Incoming Switchgears with busbar are used in;
- Opposite busbar incoming, fed from the outgoing cubicle at opposite arrangement of switchgears.

Switchgear Equipments	Standard	Options
Earthing Disconnector	x	
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Surge Arrestor *		x
MV Fuses		x
Voltage Transformer		x
Current Transformer		x
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Test Terminal		x
Cable Connection Terminal	x	
SCADA Connections		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2000	2100
36 - 40.5	1200	3000	2300



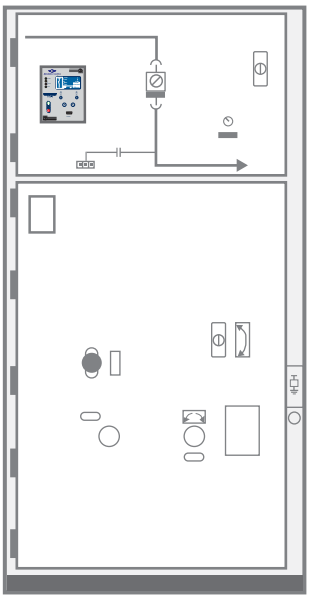
C 1 6.4 Bus Section Switchgear

the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the dividing of the main busbar is needed and allows for switching operation during short circuit.

For the switching operation 3 poles Vacuum or SF6 gas insulated Circuit Breaker is used on withdrawable truck. Disconnection operation is realized by the turning of the unit in to the test position after the circuit breaker on withdrawable truck is switched to off position.

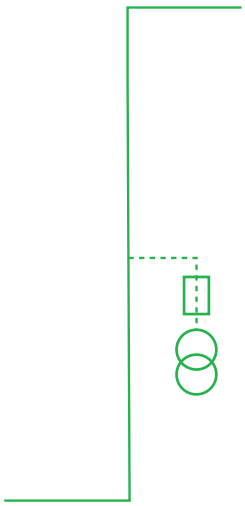
Bus Section Switchgear is used to connect/disconnect two Busbars automatically or with remote switching operation with Secondary Protection.

Switchgear Equipments	Standard	Options
Circuit Breaker	x	
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relay		x
Test Terminal		x
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	



	Switchgear Dimensions (Vacuum C/B)		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2000	2100
36 - 40.5	1200	3000	2300

	Switchgear Dimensions (SF6 C/B)		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	1100	2350	2100
36 - 40.5	1400	3000	2300



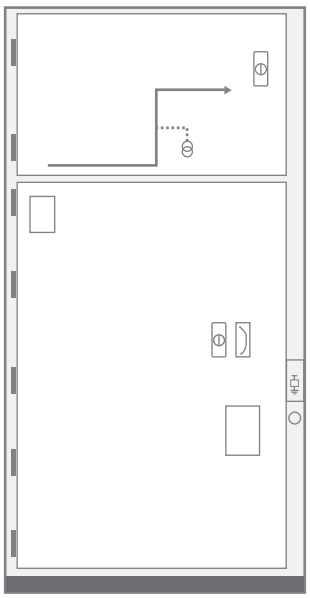
C 1 6.5 Bus Riser Switchgear

is the switchgear used for the purpose of rising the busbar connections to the other busbar level which is divided by the Bus section switchgear, with rated current up to 3150 A and short circuit current up to 50 kA.

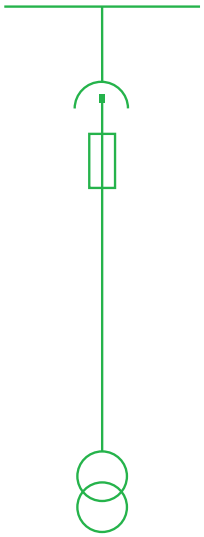
Voltage transformers can be used optionally in this switchgear to obtain voltage information.

Bus Riser Switchgear is used with Bus Section Switchgear.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Voltage Transformer and fuse		x
Voltmeter and Commutator set		x



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	500	2000	2100
36 - 40.5	800	3000	2300



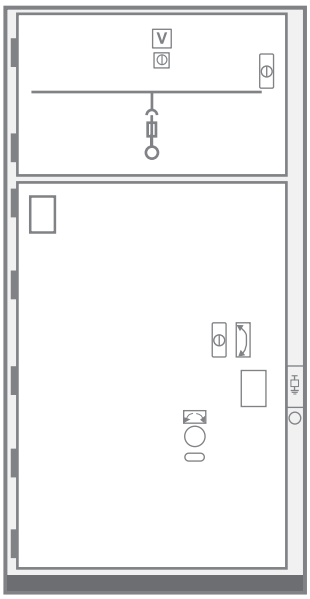
C 1.6.6 Bus Voltage Measuring Switchgears

Switchgear is used for obtaining voltage information for the measurement and protection purposes in the metal clad busbar with rated current up to 3150 A and short circuit current up to 50 kA with the help of Secondary protection relays and measurement devices like Voltmeter, Power Analyzers, Electricity meters, etc ...

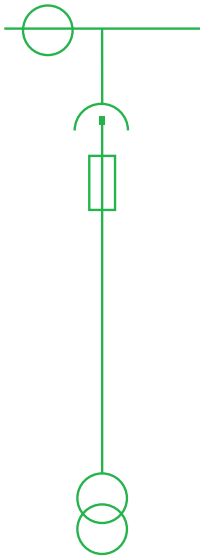
Disconnection is realized by the turning of the unit in to the test position.

Bus Voltage Measuring Switchgears are used in :
- Measurement and protection basis Voltage data reading.
- Billing basis Energy consumption measurement reading.
- Providing auxiliary power up to 2.5 kVA in Low Voltage.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuses	x	
Voltage Transformer	x	
Voltmeter and Commutator Set		x
Power Analyzer		x
SCADA Connections		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2000	2100
36 - 40.5	1200	3000	2300



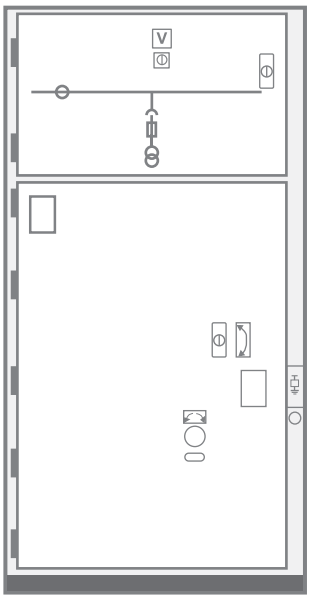
C 1.6.7 Current & Voltage Measuring Switchgears

Switchgear with rated current up to 3150 A and short circuit current up to 50 kA in which the current and voltage information of the distribution busbars are obtained by using Secondary protection relays and measurement devices such as Ammeter, Voltmeter, Analyzers and Electricity Meters.

Disconnecting operation is not requested in such kind of feeders to be able to measure the energy consumption continuously.

Metering Switchgears are used for the receiving of;
- Main Measurement basis Current and Voltage data.
- Billing basis Energy consumption measurement.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuses	x	
Voltage Transformer	x	
Current Transformer	x	
Electricity Meter	x	
Voltmeter and Commutator Set	x	
Ammeter		x
Power Analyzer		x
SCADA Connections		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2000	2100
36 - 40.5	1200	3000	2300

C 2 Metal Clad Switchgears with Double Busbar

Switchgears with double busbar are used for balancing the load for the medium voltage distribution systems that feed from two different sources by taking the capacity into the consideration. Furthermore, it is also used for utilizing the busbar of one source when the other source cannot get energy to its busbar due to a power cut-off. It makes advantage to distribution system for the continuity of energy supply.

C 2.1 Compartments

Metal clad Switchgears with double busbar system contain the following compartments which are segregated from each other with grounded metal compartment.

a- Switching Equipment Compartment
b- Low Voltage Command Compartment
c- Busbar Compartments
d- Cable Compartment

a- Switching Equipment Compartment

Switching Compartment consists of the following units:

- Switching Equipment (Circuit breaker-contactor, etc.)
- Elevator type of withdrawable truck
- Switchgear door contains operating mechanism of truck and earthing switch
- Individual and lockable grounded metal separator

Switching compartment may have the following Switching Equipment as per the necessity of the project

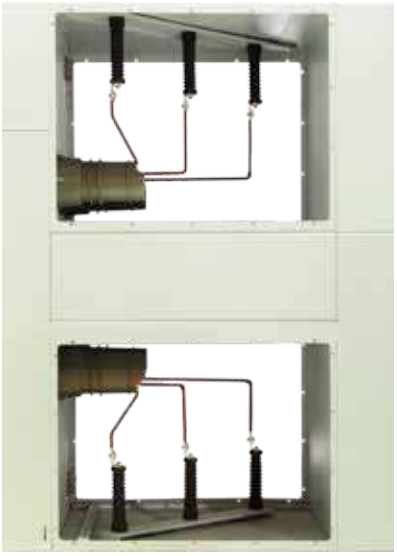
- Vacuum Circuit breaker
- SF6 Circuit breaker
- Contactor
- Fuses

In order to provide operational safety, the metal clad Switchgears are manufactured in line with the criteria defined in IEC 62271-200

Access to Switching compartment is controlled by integral design of Metal Clad Switchgear to ensure safe operation according to IEC 62271-200

The following mechanic Interlocks are provided as standard:

The withdrawal or engagement of the C/B is not possible during the C/B is "On" position
The operation of the C/B is not possible unless it is in service and test position
It is not possible to open the switchgear door when it is in service position
It is not possible to close the C/B when switching compartment door is open.
Closing of earthing switch is not possible if circuit breaker truck is in service position
The operation of the CB is not possible when earthing switch is closed.



b- Low Voltage Compartment

This compartment contains all secondary circuits for control, measurement, protection, monitoring, communication and other associated systems.

c- Busbar Compartment

Busbar Compartment mainly consists of;

Electrolytic copper busbars according to rated current.
Epoxy resin post insulators

Access to busbar compartment is possible with special safety procedures and tools.

d- Cable Compartment

Followings equipments are located inside Cable compartments;

- Current transformer
- Voltage transformer
- Surge arrestor
- Earthing switch
- Capacitive voltage divider
- Cable gland and connection fixtures

Access to Cable compartment is possible with special safety procedures and tools.

C 2.2 Application Areas

The industrial or distribution companies that get their energy from two different sources utilize double busbar systems in order to be able to perform load balancing at the main busbar.

In this application, bus A or bus B distributes uninterrupted power and also balances the loads on two busbars.

Energy Distribution Centers
Industrial Zones
Metallurgy and Cement Factories
Petrochemical Plants

C 2.3 Advantages

Minimum influences from the faults occurring energy feeding points.
More power distribution from a single energy center
Balancing energy consumption rates between two busbars in systems that are fed by two sources and providing uninterrupted power distribution.

C 2.4 Standards Complied

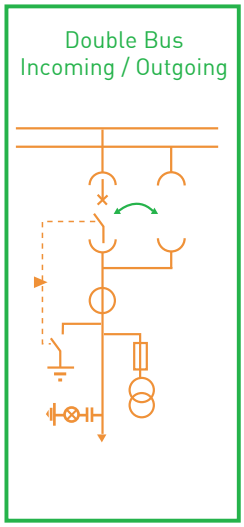
SMC series Metal Clad Switchgears are manufactured in conformance with the following standards:

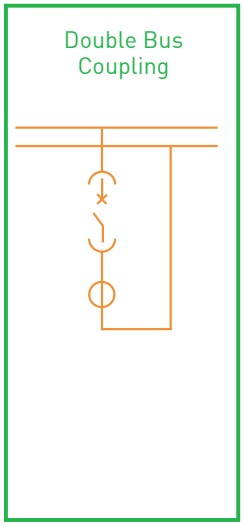
- IEC 62271-1 : General articles relating to High Voltage Switchgears
- IEC 62271-200 : Metal Enclosed Switchgears (1 - 52 kVac)
- IEC 62271-100 : Circuit Breakers (1 - 52 kVac)
- IEC 62271-102 : Main Circuit and Earthing Disconnector
- IEC 62271-105 : AC Switches and Fuse Combinations
- IEC 60044-1 : Current Transformers
- IEC 60044-2 : Voltage Transformers
- IEC 60273 : Insulators
- IEC 60051 : Measuring Devices
- IEC 60255 : Secondary Protection relays

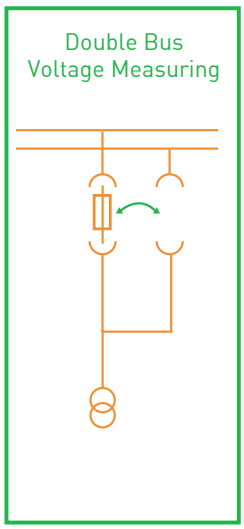
C 2.5 Technical Specifications

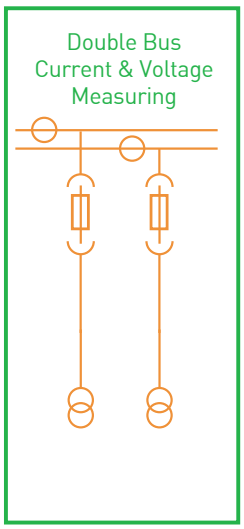
Technical Specifications								
Descriptions		SMC 3,6	SMC 7,2	SMC 12	SMC 17,5	SMC 24	SMC 36	SMC 40,5
Rated Voltage (rms)	kV	3,6	7,2	12	17,5	24	36	40,5
Power frequency withstand Voltage 50 Hz, 1 min (rms) between phases and phase-ground	kV	10	20	28	38	50	70	85
Lightning impulse withstand Voltage 1.2/50 ms (peak) between phases and phase - ground	kV	40	60	75	95	125	170	185
Rated frequency	Hz	50 - 60						
Rated (rms) current of switchgears with								
Busbars (with natural ventilation)	A	630 ... 3150			630 ... 3150		630 ... 3150	
(forced ventilation)	A	5000			5000		5000	
C/B and Disconnector (with natural ventilation)	A	630 ... 3150			630 ... 3150		630 ... 3150	
(forced ventilation)	A	5000			5000		5000	
Load break switches	A	630			630		630	
Vacuum Contactors (inductive switching)	A	400			800		-	
Vacuum Contactors (capacitive switching)	A	250			200		-	
Rated short time withstand (rms) current with								
C/B and Disconnectors	kA	16 ... 50			16 ... 50		16 ... 50	
Load break switches	kA	16 - 20			16 - 20		16 - 20	
Vacuum Contactors	kA	8			8		-	
Rated short time withstand (peak) current with								
C/B and Disconnectors	kA	40 ... 125			40 ... 125		40 ... 125	
Load break switches	kA	40 - 50			40 - 50		40 - 50	
Vacuum Contactors	kA	20			20		-	
Short circuit withstand time								
up to 31.5 kV	s	3			3		3	
above 31.5 kV	s	1			1		1	
Internal Arc withstand								
Current	kA	16 ... 31.5			16 ... 31.5		16 ... 31.5	
Duration	s	1			1		1	
Earthing Disconnector								
Rated short time withstand current	kA	16 ... 50			16 ... 50		16 ... 50	
Duration (up to 31.5 kA)	s	3			3		3	
(above 31.5 kA)	s	1			1		1	
Switchgear Structure as per the								
loss of service continuity		LSC 2B						
internal arc classification		AFLR						
partition class		PM						
Protection Class								
when doors are closed - standard		IP 4X						
between compartments		IP 2X						
Color		RAL 9003 / 7035						
Standards complied		IEC 62271-200						

C 2.6 Switchgears Types









- **Double Bus Incoming/Outgoing Switchgear**

  Is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the power incoming and outgoing realized by busbar and switching operation can be realized in short circuit situation.

- **Double Bus Coupling Switchgear**

  Is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the energy is supplied from two different sources.

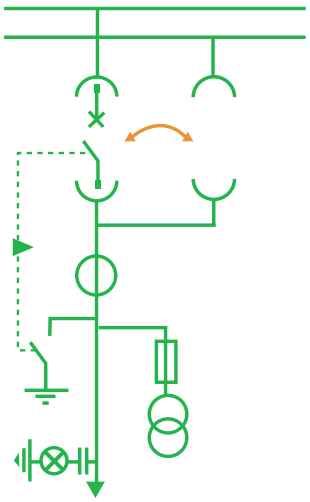
- **Double Bus Voltage Measuring Switchgear**

  It is used for obtaining voltage information for the measurement and protection purposes in the metal clad busbar with rated current up to 3150 A and short circuit current up to 50 kA with the help of Secondary relays and measurement devices such as Voltmeter, analyzers and Electricity Meters.

- **Double Bus Current & Voltage Measuring Switchgear**

  Switchgear with rated current up to 3150 A and short circuit current up to 50 kA in which the current and voltage information of the distribution busbars are obtained by using Secondary protection relays and measurement devices such as Ammeter, Voltmeter, Analyzers and Electricity Meters.

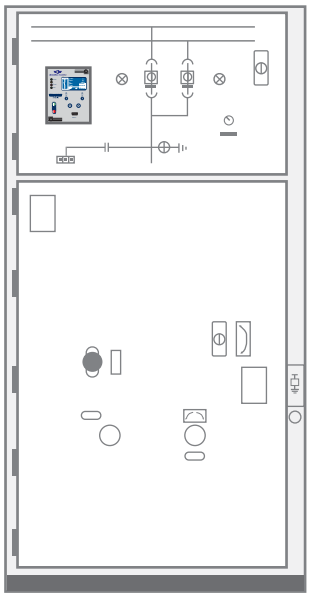
C 2.6.1 Double Bus Incoming / Outgoing Switchgears



Is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the energy incoming and outgoing realized by busbar and switching operation can be realized in the short circuit situation, with full protection frame.

Switching operation is realized by vacuum or SF6 gas insulated Circuit Breaker with 3 poles. The disconnecting operation is realized when withdrawable truck with the busbar on it shall be turned to the test position. The Bus connection is changed by lift.

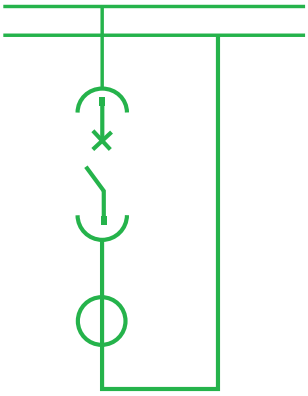
Incoming Switchgear with Circuit Breaker is used in;
- Distribution Busbars of Network and Generator Incoming feeders
- Any Load supply feeders of Distribution Busbars and
- Incoming and Outgoing of Open/Close Ring operated Networks.



Switchgear Equipment	Standard	Options
Withdrawable Circuit Breaker	x	
Earthing Disconnector	x	
Thermostat and Heater Kit	x	
Copper Busbar	x	
Capacitive Voltage Indicator Set	x	
Surge Arrestor		x
Voltage Transformer		x
Voltmeter Commutator Set		x
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relays		x
Test Terminal		x
Cable Connection Terminal	x	
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2350	2100
36 - 40.5	1200	3500	2450

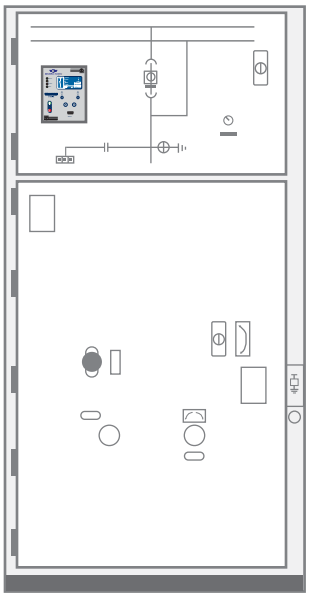
C 2.6.2 Double Bus Coupling Switchgear



Is the switchgear with rated current up to 3150 A and short circuit current up to 50 kA where the energy is supplied from two different sources, with full protection frame.

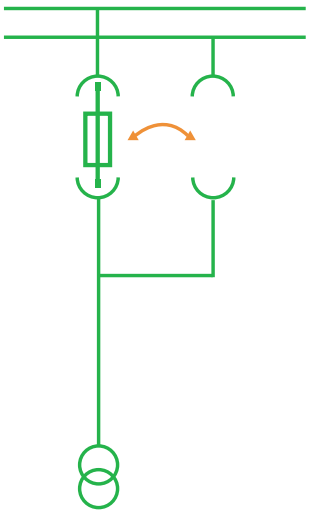
Switching operation is realized by Vacuum or SF6 gas insulated Circuit Breaker with 3 poles. The disconnecting operation is realized when withdrawable truck with the busbar on it shall be turned to the test position.

Double Bas Coupling Switchgears are used to connect two Busbars automatically or with local/remote switching operation.



Switchgear Equipment	Standard	Options
Withdrawable Circuit Breaker	x	
Earthing Disconnector		x
Thermostat and Heater Kit	x	
Copper Busbar	x	
Current Transformer	x	
Ammeter		x
Power Analyzer		x
Electricity Meter		x
Over Current Relay	x	
Other secondary protection relays		x
Test Terminal		x
SCADA Connections		x
GSM-GPRS Modem Converter Set		x
Interlock	x	

	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2350	2100
36 - 40.5	1200	3500	2450



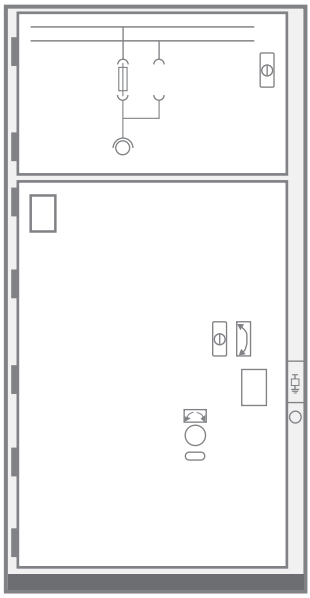
C 2.6.3 Double Bus Voltage Measuring Switchgears

Switchgear is used for obtaining voltage information for the measurement and protection purposes in the metal clad busbar with rated current up to 3150 A and short circuit current up to 50 kA with the help of Secondary protection relays and measurement devices like Voltmeter, Power Analyzers, Electricity meters, etc ...

Disconnection is realized by the turning of the unit in to the test position.

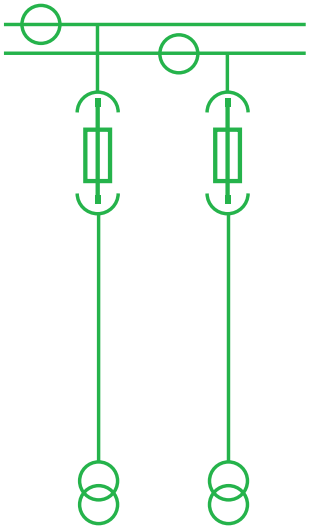
Bus Voltage Measuring Switchgears are used in :
- Measurement and protection basis Voltage data reading.
- Billing basis Energy consumption measurement.
- Providing auxiliary power up to 2.5 kVA in Low Voltage.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuses	x	
Voltage Transformer	x	
Voltmeter and Commutator Set		x
Power Analyzer		x
SCADA Connections		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2350	2100
36 - 40.5	1200	3500	2450

C 2.6.4 Double Bus Current & Voltage Measuring Switchgears

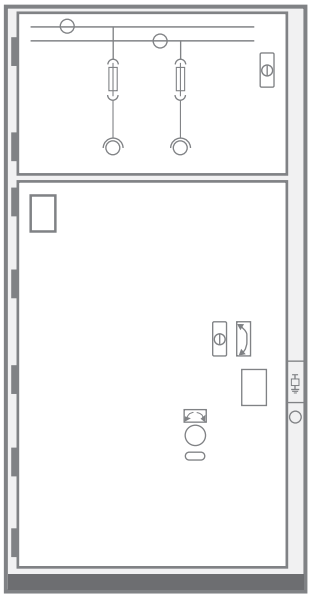


Switchgear with rated current up to 3150 A and short circuit current up to 50 kA in which the current and voltage information of the distribution busbars are obtained by using Secondary protection relays and measurement devices such as Ammeter, Voltmeter, Analyzers and Electricity Meters.

Disconnecting operation is not requested in such kind of feeders to be able to measure the energy consumption continuously.

Metering Switchgears are used for the receiving of;
- Main Measurement basis Current and Voltage data.
- Billing basis Energy consumption measurement.

Switchgear Equipment	Standard	Options
Thermostat and Heater Kit	x	
Copper Busbar	x	
Medium Voltage Fuses	x	
Voltage Transformer	x	
Voltmeter and Commutator Set		x
Power Analyzer		x
SCADA Connections		x
Interlock	x	



	Switchgear Dimensions		
Rated Voltage (kV)	Width (mm)	Depth (mm)	Height (mm)
3.6 - 24	800	2350	2100
36 - 40.5	1200	3500	2450

Auxiliary Equipment

D

D

Auxiliary Equipment

D 1.1.1 SION/3AH (Siemens) Vacuum Circuit Breaker

The vacuum breakers are subjected to routine tests during production and these tests are harder than the requirements of the standards.

- Current measurement data flow
- Decisive measurement data
- Low power loss
- Long term thermal stability
- The vacuum circuit breakers do not need maintenance
- Under normal operational conditions, 10000 opening and closing as per IEC 60694 and VDE 0670 part 1000
- The performance remains within the limits even in frequent usage after long term stand-by periods
- Environmentally sensitive.

D 1.1.2 EVOLIS (Schneider) Vacuum Circuit Breaker

Evolis vacuum breakers have 3 poles and they are for internal use. This kind of circuit breaker is used for the switching and protection purposes in the industry, public sector and energy distribution.

These types of breakers are suitable for LSC2B type metal partitioned metal clad sells.

Rated Voltage	: up to 24 kV
Rated Current	: up to 2500 A
Short Circuit switching Current	: up to 40 kA

D 1.1.3 SF1 type (Schneider) SF6 Gas insulated Circuit Breaker

SF1 with 3 poles is for medium voltage internal usage. Between 1 kV and 40.5 kV, this kind of circuit breaker is used for the switching and protection purposes in the industry, public sector and commercial distribution. The SF1 breaker equipped with automated compression technique and uses SF6 gas during current cutting phase. There are 3 types of SF1:

- Horizontal type suitable for metal enclosed LSC2A Switchgears

Rated Voltage	: up to 40.5 kV
Rated Current	: up to 1250 A
Short Circuit switching Current	: up to 25 kA

D 1.1.4 SF2 type (Schneider) SF6 Gas insulated Circuit Breaker

SF2 with 3 poles is for medium voltage internal usage. Between 24 kV and 38 kV, this kind of circuit breaker is used for the switching and protection purposes in the industry, public sector and commercial energy distribution. These types of breakers are suitable for LSC2B metal clad Switchgears.

Rated Voltage	: up to 40.5 kV
Rated Current	: up to 2500 A
Short Circuit switching Current	: up to 31.5 kA

SIEMENS

D 1.2 Vacuum Contactors

The vacuum contactors have 3 poles and have cycle capacity of over 1 million in the medium voltage facilities with their high electromagnetic characteristics.

The vacuum contactors are also performed for alternative current facilities for the below given purposes:

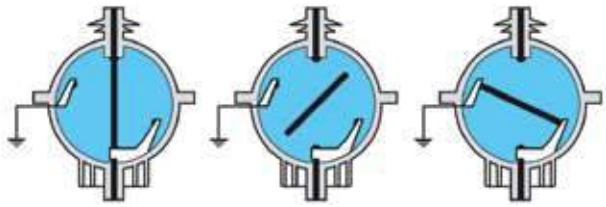
- Motor start-up
- Switching of transformers
- Switching of reactors
- Switching of big resistive loads similar to those in electric furnaces
- Switching of capacitor banks

Schneider Electric

D 1.3 Load Break Switches

SLB series Load Break Switches used are in conformanity with IEC 60295-1 and 62271-102 standards and load break switches are able to switch the circuit on load. The rated current is up to 630 A and the short circuit withstand is up to 20 kA.

The Load Break Switch has SF6 gas and it switches on load. It has 3 poles and 3 modes (open - close - earthed). The Earthing Disconnector is located in Load Break Switch structure.



In close position In open position Grounding

COET
COSTRUZIONI ELETTROTECNICHE

D 1.4 Disconnectors

D 1.4.1 SF6 gas insulated Disconnectors

SGD series SF6 gas insulated Disconnectors are used in conformity with IEC 60295-1 and 62271-102 standards. The rated current is up to 1250 A and the short circuit withstand is up to 25 kA.

Furthermore, it has SF6 gas and it has opening and closing feature without load. It has 3 poles and 3 modes (open - close - earthed). The Earthing Disconnector is located in Load Break Switch structure.

D 1.4.2 Air insulated Rotary Switches

SRS series Air Insulated Rotary Switches have rated current of up o 1250 A and short circuit withstand current of up to 25 kV and are used in Metal Enclosed Switchgears.

D 1.5 Earthing Disconnectors

SES series earthing switches are manufactured and produced with 3 second withstand up to 31.5 kA and 1 second withstand up to 50 kA.

D 2 Power & Energy Analyzers

Analyzers combine voltmeter, cosphimeter, wattmeter, var-meter and frequency-meter into single equipment. Therefore, it is possible to make savings from space, cable and cost of equipment.

The data read can be transferred to SCADA or energy Management Software on a computer via communication ports that on the equipment. Since this data is kept in the data base of the equipment, it provides simplicity in fault determination. Furthermore consumption figures for the past periods can be obtained hence planning towards future can be made more consistently.

Due to digital outputs provided by the equipment it has became indispensible part of SCADA systems. Transducer usage becomes unnecessary by the help of some models which have analog outputs.

Due to these features, the analyzers become essential part of any management or automation system.

D 2.1 NQM series Energy Analyzers

- Large 128 x 128 graphic LCD
- Embedded memory for measurements records (with extendable memory)
- Programmable digital outputs (maximum 6)
- Digital inputs may be used as a counter (for gas and water meters) and position monitoring (maximum 8)
- Programmable analog outputs (maximum 4)
- RS232 and RS485 communication ports
- Current and voltage waveform display on the screen
- Harmonic analysis
- Faulty connection warning

D 2.2 NPM series Power Analyzer

- RS485 communication port
- 4 LED screen that can be read remotely
- Display of more than 30 electrical parameter

D 2.3 Energy Management Software

Actwin Energy Management Software reads all energy parameters of Asset Power Analyzers and digital Electricity Meters and records the data with time labels. It supports various communication interfaces as well as communication protocols.

With different reporting and monitoring screens, various reports and invoices can be created by the parameters recorded and can be viewed in different formats in real time.

The most important feature of the software is that the data reading is possible from multiple ports simultaneously and this increases communication speed to a maximum level. In this manner, it is possible to obtain more reading and create much more detailed reports.

D 3 Measuring transformers

We use, depending on the requirement, either conventional type measurement transformers in conformity with IEC 61869-2 and IEC 61869-3 or Rogowski type cast resin measurement transformers in conformity with IEC 61869-10.

D 3.1 Current transformers

- Current/Voltage slope is extremely linear and does not get saturated
- Can work in many different frequencies
- Since it does not have iron core, fast current change and transient response is very well.
- Decreases the interaction due to magnetic field.

Rogowski and Conventional type of current transformers are used in SME series switchgears.

- Internal Type - with supports /bushings
- Internal Type - with capacitive layers
- External Type

Basic Specifications

Operational voltage	: up to 40.5 kV
Withstand voltage	: up to 85 kV
Short period testing voltage (1.2/50°s)	: up to 185 kV
Rated frequency	: 50 / 60 Hz
Rated primer current	: up to 4000 A
Secondary coils	: 1 / 5 A
Short period thermal withstand current (1s)	: up to 1000 In
Insulation Class	: E

D 3.2 Voltage transformers

The cast resin coated conventional voltage transformers used in our products are as follow:

- Internal type single pole insulated with circuit breaker
- Internal type single pole insulated without circuit breaker
- Internal type double pole insulated

Basic Specifications

Operational voltage	: up to 40.5 kV
Withstand voltage	: up to 85 kV
Short period testing voltage (1.2/50°s)	: up to 185 kV
Rated frequency	: 50 / 60 Hz
Rated primer current	: up to 40.5/√3 kV
Secondary Voltage	: 100/√3 V, 110/√3 V, 120/√3 V
Class	: 0,2 / 0,5 / 1
Nominal gerilim faktörü	: 1,9
Insulation Class	: E


IPH
TYPE TEST REPORT
Test Report
CESI
VEIKI-VNL ELECTRIC LARGE LABORATORIES LTD.
VNL EIKI
No. 5510/VNL
Test Report
No. 5811 / VNL
Test Report
No. 5584 /VNL
Test report
No. 5970/VNL
Test Report
Certificate of Registration
ÇEVRE YÖNETİM SİSTEMİ
AKTİF ELEKTROTEKNİK SAN. VE TİC. A.Ş.
ISO 14001:2004
Global Network System Co., Ltd.
ITY MANAGEMENT SYSTEM
MÜHENDİSLİK DIŞ TİC LTD. ŞTİ
O 9001:2008
IAF
NS

Medium Voltage Switchgears
Orta Gerilim Hücreler

Switching Equipments
Anahtarlama Ürünleri

Kiosk Type Substations
Köşk Tipi Trafo Merkezleri

Mobile Substations
Mobil Trafo Merkezleri

Distribution Transformers
Dağıtım Trafoları

Resistor Banks
Dirençler

Power Quality Solutions
Enerji Kalitesi Çözümleri

Medical Power Distribution
Tıbbi Güç Dağıtım Sistemleri

Power Capacitors & Reactors
Kondasatör ve Reaktörler

AMR, AMM & Billing
Sayaç Otomasyonu ve Faturalama

Measuring & Management
Ölçme ve Yönetim Sistemleri

Secondary Protection Relays
Sekonder Koruma Röleleri

Earth Leakage Relays
Kaçak Akım Röleler

Power Converters & Rectifiers
Yüksek Güç Dönüştürücüleri ve Redresörler

Solar Power Solutions
Güneş Enerjisi Çözümleri

Traction Substations
Cer Gücü Dağıtım Merkezi

Depot Area Solutions
Depo Alanı Çözümleri

On-Board Equipment
Araçüstü Ekipmanlar

Eubiq Flexible Power Outlet System
Eubiq Esnek Fiş - Priz Sistemleri

Watt White!

White…
Color of the beginning…
White, color of the purity, honesty and clarity…

Color of the stability and continuity, trust and quality…

Since 2010, we decided to apply white color which symbolizes all of these values to all of our products.

Beyaz...
Başlangıcın rengi...
Saflığın, dürüstlüğün, aydınlığın rengi beyaz...

İstikrar ve devamlılığın, güvenin, kalitenin rengi...

2010 yılından itibaren, tüm bu değerleri taşıyan beyazı, ürünlerimizin temel rengi olarak benimsedik ve uyguladık.

Doc. Nr. AET-SW 1425/C.Eng Owing to periodical improvements of our products the supplied products may differ in some details from the data stated in the prospectus material. Published by Aktif Elektroteknik A.S. Data subject to alteration without notice.
Design & Creation: Aktif Group / Photos: Aktif Group - Stock.xchng & Shutterstock

AKTİF ELEKTROTEKNİK
a Friem & Aktif Group Company

Factory Fabrika
Akşemsettin mah. Çatalca sk. No:113
06930 Sincan Ankara - Türkiye
Tel : +90 312 269 46 02
Fax : +90 312 269 45 01

Headquarter Merkez
Bayraktar Blv. Şehit sk. No: 5 Aktif Plaza
34775 Ümraniye Istanbul - Türkiye
Tel : +90 216 314 93 20
Fax : +90 216 314 93 60