

SmartCELL SCELL®

Technical Manual



**Compact air insulated switchgear with
instant digital network functionality**

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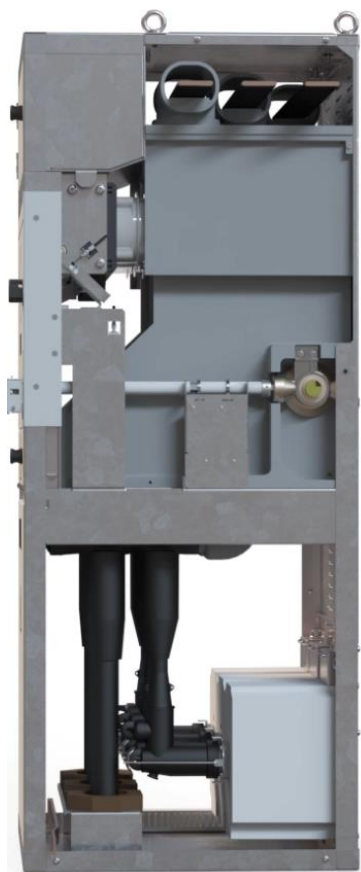
1. General

1.1. Abbreviations

AC	Alternating Current	PD	Partial Discharge
CB	Circuit Breaker	PI	Insulating Partitions (class)
CB-L	Coupler Breaker (left)	R&D	Research and Development
CB-R	Coupler Breaker (right)	RTU	Remote Terminal Unit
CC	Cable Compartment	SA	Surge Arrester
CM	Control Module	SF6	Sulfur Hexafluoride
CO	Close-Open (operation)	SG	Switchgear
COS	Change-Over Switch	SP	Switchgear Panel
CS-L	Coupler Switch (left)	ST	Service Transformer panel
CS-R	Coupler Switch (right)	TEL	Tavrida Electric
CTF	Cable Testing Facility	TF	Transformer Feeder
DC	Direct Current	TLF	Time Limit Fuse
DIN	German Institute for Standardization	VDS	Voltage Detecting System
EM	Electromagnetic	VI	Voltage Indicator
EMC	Electromagnetic Compatibility	VPIS	Voltage Presence Indicating System
EU	European Union	VS	Voltage Sensor
GB	Great Britain	VT	Voltage Transformer
GOST	State Standard of the Russian Federation		
HCD	Handheld Closing Device		
IAC	Internal Arc Classification		
IEC	International Electrotechnical Commission		
IED	Intelligent Electronic Device		
IP	Ingress Protection		
ISM	Indoor Switching Module		
LD	Low Duty		
LED	Light-Emitting Diode		
LF	Line Feeder		
LFVT	Line Feeder with Voltage Transformer		
LI	Line Input		
LS	Line Switch		
LV	Low Voltage		
M	Metering panel		
MD	Medium Duty		
PB	Power Block		
PCD	Pole-Center Distance		

1.2. Presentation

Thank you for choosing this Tavrida Electric product. The SCELL series switchgear is designed for primary and secondary distribution networks intended for indoor and outdoor installation. SCELL panel is designed using combined insulation: solid and air as interrupting medium. It is the most compact panel in the class of non-extensible and extensible SF6-free switchgear up to 24 kV.



Main features:

SCELL panel is a universal building block to build up customer's sophisticated network of any configuration and functionality thanks to its instant digital network readiness, powerful electrical parameters, functional versatility and compact size.



- SCELL intelligence is provided by a powerful Intelligent Electronic Device (IED) with digital current and voltage inputs, rich protection, automation and communication features.



- SCELL heart represents a standard combination of:
 - 3 position (service, earthed, isolated) Change-Over Switch COS with detachable earthing blades;
 - Fast vacuum circuit breaker ISM with magnetic actuator. Simple, durable and safe with extremely long electrical and mechanical life.

Both of switching devices are capable to perform as of "isolation device" as per IEC 61140.



- SCELL sensing includes digital current and voltage sensors, temperature and PD sensors.

1.3. Reference standards

SCELL series switchgear meet all the requirements for prefabricated metal enclosed switchgear for indoor and outdoor installation in accordance with the latest revision of IEC 62271-200. A complete list of applicable standards is given in Table 1.1.

Table 1.1 Applicable standards

Equipment	Standard
HV switchgear and control gear: common specifications	IEC 62271-1
AC metal enclosed switchgear and control gear	IEC 62271-200
Alternating current circuit breakers	IEC 62271-100
Alternating current disconnectors and earthing switches	IEC 62271-102
Current transformers	IEC 61869-2
Voltage transformers	IEC 61869-3
Measuring relays and protection equipment	IEC 60255
International protection	IEC 60529
Voltage detecting systems (VDS)	IEC 61243-5

Equipment	Standard
VPIS systems for rated voltages between 1kV and 52kV	IEC 62271-206
Protection against electric shock - Common aspects for installation and equipment	IEC 61140
EU LV directive	2014/35/EU
EU EMC directive	2014/30/EU

1.4. Normal service conditions

The rated characteristics of the switchgear are guaranteed under the ambient conditions given in Table 1.2.

Table 1.2 Service conditions

Parameter	Value
Minimum ambient temperature, °C	-5 ¹
Maximum ambient temperature, °C	+50 ²
Maximum altitude above sea level, m	1000 ³
Maximum relative humidity	95%
Ambient atmosphere in accordance with IEC 60721-2-1- "Wda": non-explosive, uncontaminated and non-corrosive. Atmosphere type II according to GOST 15150-69.	

Note:

¹Value is limited by instrument transformers

²IEC 62271-200 limits the upper level of ambient temperature at +40°C

³For installations in altitudes above 1000 m, the external insulation is calculated as multiplication of rated insulation with Ka in accordance with IEC 62271-1

1.5. Rated characteristics

The main rated characteristics of the switchgear are given in Table 1.3.

Table 1.3 Rated characteristics

Type of panel	SG15_SCELL		SG25_SCELL	
Applicable CB	ISM25_LD	ISM15_MD	ISM25_LD	ISM25_Shell
Rated voltage, kV	12	17,5	24	
Rated frequency, Hz	50/60	50/60	50/60	
Rated power frequency withstand voltage,	28	38	50	
Across COS and ISM ¹ open contacts,	32	45	60	
Rated lightning impulse withstand voltage,	75	95	125	
Across COS and ISM ¹ open contacts,	85	110	145	
IAC classification	A-FL; A-FLR with rear attachment			
IA Isc, s	16(25)kA, 1s			
Loss of service continuity	LSC2B			
Partition type	PI			
Partial discharge level at 1.1 x U _{rated} , pC	<20			
Degree of protection indoor	IP4X (IP41)			
Degree of protection outdoor	IP54 (outdoor design)			
Auxiliary voltage, V	24/48/110/220DC; 230AC			
Rated peak withstand current, kA	40	64	40	64
Rated short-time withstand current, kA (3s)	16	25	16	25
Rated current, A	630	1250	630	1250
Circuit breaker class	M2 (30.000CO), S2, E2, C2			
Autoreclosing cycle	O-0,3s-CO-10s-CO			

Type of panel	SG15_SCELL	SG25_SCELL
COS class as Disconnecter	M1	
COS class as Earthing switch	M1, E2	
Dimensions (WxDxH), mm	500x600x1450 ⁴	
Dimensions with rear attachment ²	500x900x1450 ⁴	
Dimensions with front ³ and rear	500x1200x1450 ⁴	

Note:

¹As per IEC 61140 an "isolation device"

²A-FLR design

³Front attachment for extra cables

⁴1695mm with ISM25_Shell

2. Safety information

2.1. General recommendations

The instructions in this manual are not intended as a substitute for competency in the use of the equipment described. Installation, use and repair should only be carried out by trained and experienced personnel, who are familiar with the equipment and with electrical safety requirements.

Pay attention to the following recommendations:

- Make sure that during installation, commissioning and operation, the respective legal regulations (GB/IEC/GOST) and appropriate national safety regulations are adhered to.
- Only install and operate the switchgear in an environment suitable for the installation and operation of electrical equipment.
- Make sure that the specified data are not exceeded under the switchgear operation.
- Make sure that this manual is available to all persons concerned with installation, commissioning and operation.
- Pay special attention to the hazard statements described in Section 2.2.

2.2. Hazard statements

This manual may contain three types of hazard statements:



WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury



CAUTION: Indicates a potentially hazardous situation that, if not avoided, could result in personal injury or equipment damage



NOTE: Indicates important items of information throughout the manual

2.3. Personnel safety

2.3.1. Internal Arc Classification (IAC)

The personnel safety factor was a primary goal when SCELL switchgear was designed. Thus, the SCELL switchgear has been designed and tested to withstand an internal arc due to a short-circuit current of the same levels as the panel rated breaking currents. These tests ensure that the metal construction of the SCELL switchgear is able to protect personnel operating near the switchgear subjected to an internal arc fault. The internal arc is treated to be the most unlikely event from all type of faults, however, a small percentage of occurrence still exists due to many factors including improper connection of incoming cables and tightening contact connections, intrusion of animals, deterioration of insulation over time, severe atmospheric conditions and human factors. The proven characteristics of the SCELL switchgear drastically reduce the incidence of these causes in generation of faults, but not all can be fully eliminated. An internal arc event produces a large amount of energy which instantly transforms into phenomena such as rapid increase of internal pressure and temperature, visual and sound effects, which consequently result in high mechanical stresses on the switchgear structure, and/or in melting and evaporation of the materials. Such significant stresses, unless properly controlled, may cause a serious threat to the service personnel due to harmful effects (shock-wave, flying parts, doors opening, emission of hot gases, open flame).

The IEC 62271-200 Standard describes the test methods required. The SCELL switchgear conforms to all criteria stated in Annex A of the standard:

The doors of the switchgear must remain closed and no opening of the cover panels must occur
No part of the switchgear, which may be hazardous for personnel, may be ejected
Arcing does not cause holes in the accessible sides up to a height of 2 m
Vertically and horizontally arranged fabric indicators placed outside the switchgear may not get burnt
All the switchgear earthing connections must remain effective

The SCELL switchgear is IAC classified: A-FL(R) 20(25kA, 1s. For the installation of the SCELL switchgear the following factors are obligatory to be considered:

Level of the fault current (16...25 kA)
Duration of the fault current (0.1...1s)
Hot gases evacuation routes
Dimensions of the switchboard room, with special attention to the height

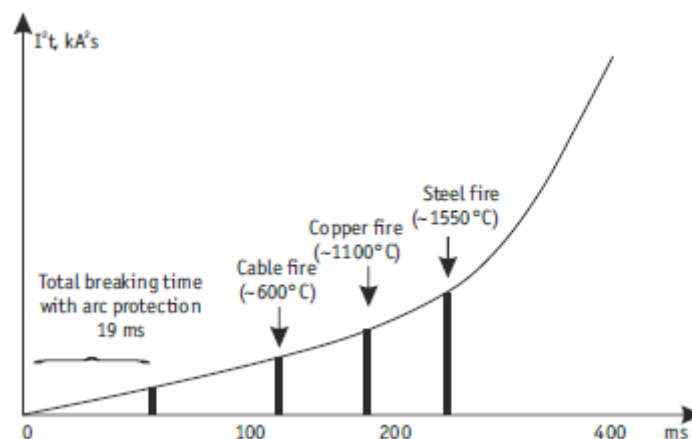


Fig.2.1. Internal arc development

2.3.2. Interlocks and locking devices

The SCELL switchgear is fitted with all interlocks needed to guarantee the highest level of safety for operators.

The interlocking devices prevent:

Opening and closing of the CB when the COS is in the intermediate position
Opening and closing of the CB when the ISM is in the closed position
Opening of the cable compartment door until the COS is in the open/earthed position
Opening of the cable testing compartment door unless the COS is in the open/earthed position

The full list of interlocking conditions is given in Table 2.1.

All doors of the SCELL switchgear equipped with the key-locks and padlock facilities.

Table 2.1 Interlocking conditions

<u>Operations</u>	CB		COS		CC door Interlock			Cable Test knife		CTF door			Busbar Earth Switch External	
	Open	Closed	Earthed	Service	Installed	Removed	Locked	Earthed	Opened	Open	Closed	Locked	Open	Closed
CB closing	X			X *	X*		X*	X*		X*	X*		X	
CB opening		X		X *	X*		X*	X*		X*	X*		X	
CB Emergency trip		X	any		any			any		any			any	
COS closing	X*		X		X*			X*		X*			X	
COS opening	X*			X	X		X*	X*		X*	X*		X	
CC Door														
Installing	X*		X*			X		X		X*			any	
Removal	X*		X*		X			X		X*			any	
CTF door														
open	X*		X*		X*		X*	X		X			any	
close	X*(any)		X*		any			X		X			any	
Cable Test knife														
Opening	X*		X*		X*		X*	X		X			any	
Earhting	X*(any)		X*		X*		X*		X	X			any	
Bus Earth Switch (el.magnet)														
Closing	X		X		any			any		any			X	
Opening	X		X		any			Any		any				X
X - Conditions to be Satisfied														
* - Shall be a Mechanical Interlock														

Note:

- 1) For motorized COS an electromechanical interlock shall be provided to block unauthorized operations due to auxiliary supply loss or external signal absence
- 2) All mechanical and electromechanical interlocks have defeat option

3. Design

3.1. General

The SCELL switchgear panel is assembled with standard, pre-fabricated, hot-dip zinc galvanized sheet steel units forming a rigid, free standing structure. The switchgear consists of five compartments described in Sections 3.2-3.5 which are separated from each other by means of insulating material partitions. The design category of SCELL series switchgear is defined as LSC2B-PI. The overall design is presented in Fig.3.1 and Fig.3.2.

- 1 Low voltage compartment
- 2 Mimic diagram
- 3 Nameplate
- 4 Inspection window
- 5 CB trip button
- 6 COS operation
- 7 Cable test facility
- 8 Cable access door
- 9 Earthing bar

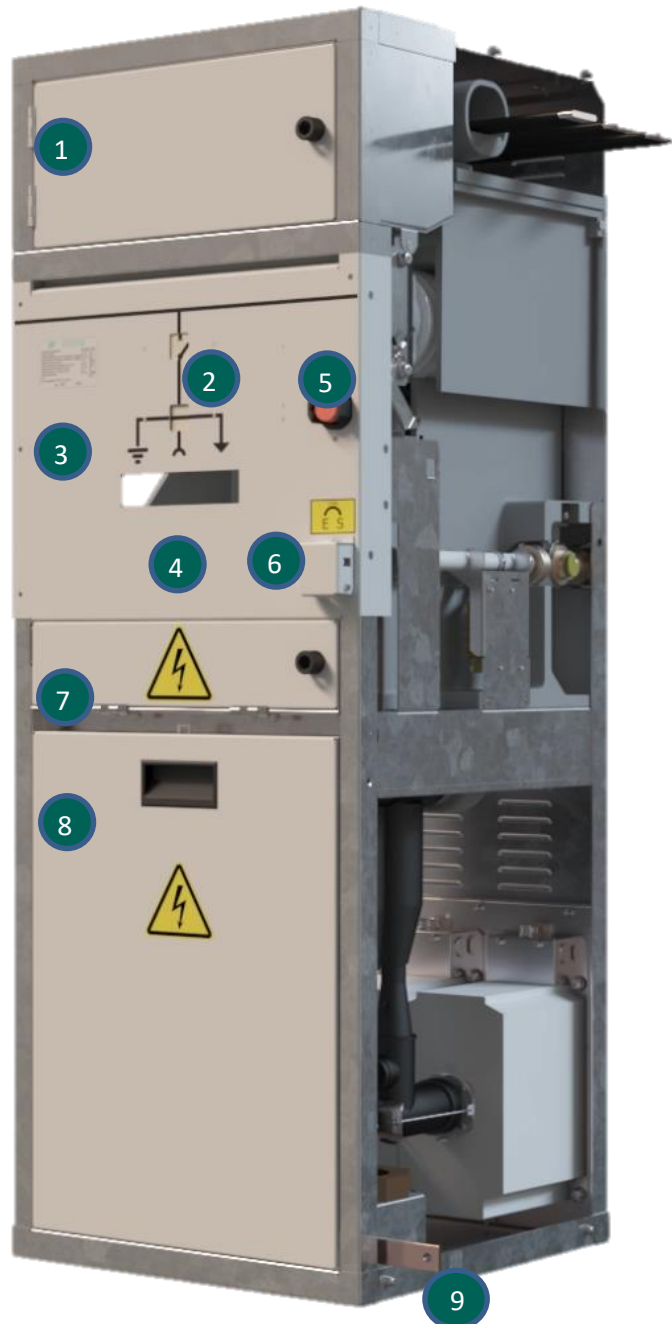


Fig.3.1. SCELL panel (front view)

- 1 Main busbars
- 2 Circuit breaker
- 3 COS
- 4 Arc duct
- 5 Cables
- 6 Extra cables

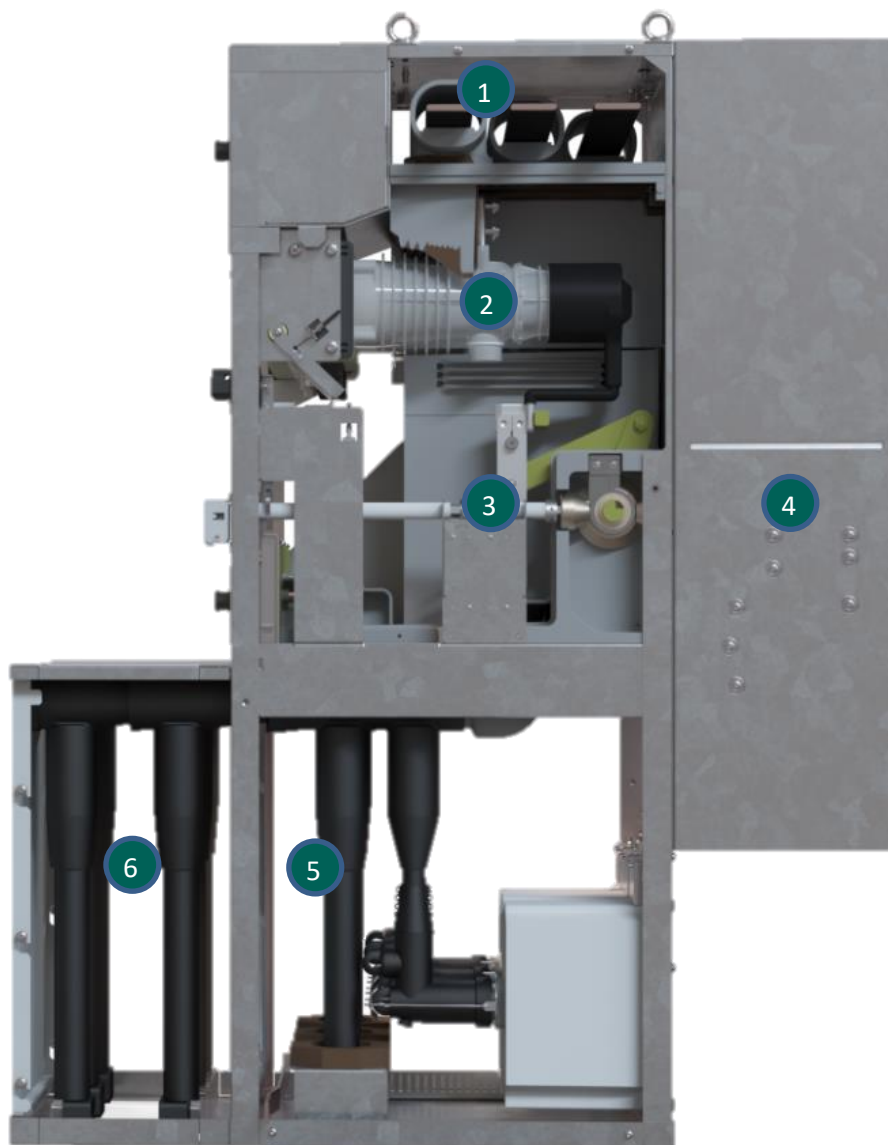


Fig.3.2. SCELL panel (inside view)

3.1. Busbar compartment

The busbar compartment (see Fig.3.3) houses the main busbar system connected to the fixed upper isolating contacts of the circuit breaker by means of branch connections. The main busbars are made of electrolytic copper and covered with heat shrinkable insulation sleeves. The busbar compartment of each panel is segregated from the busbar compartments of the neighbouring panels with bushing insulators. The bushing insulators were tested with electrodynamic forces load withstand during the flow of fault current.

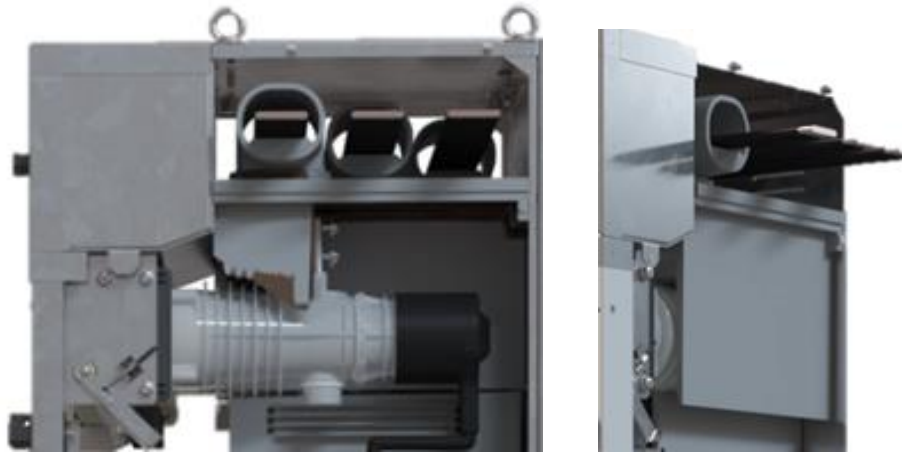


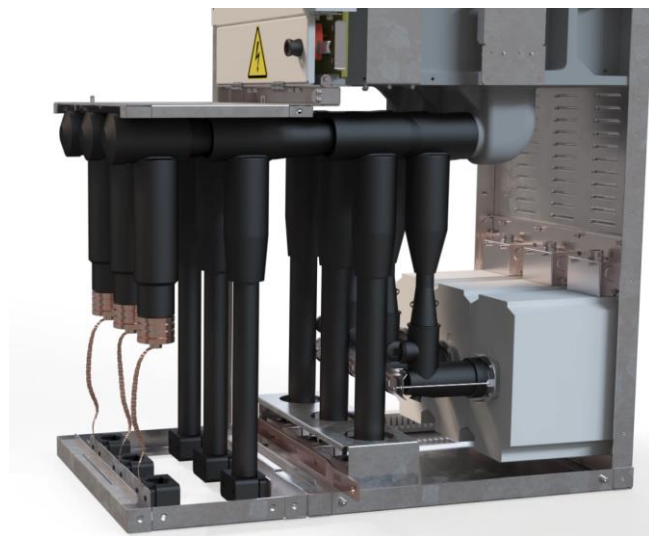
Fig.3.3. Busbar compartment

3.2. Cable compartment

The cable compartment (see Fig.3.4) is located at the front of the panel with horizontally mounted DIN 400 Type C bushings for ease of cable connection. The cable compartment houses the branch connections, earthing busbar, power cables, surge arresters, instrument transformers or sensors. The cable compartment design allows up to 4 cables per phase connections with an additional front attachment.



Without front attachment



With front attachment

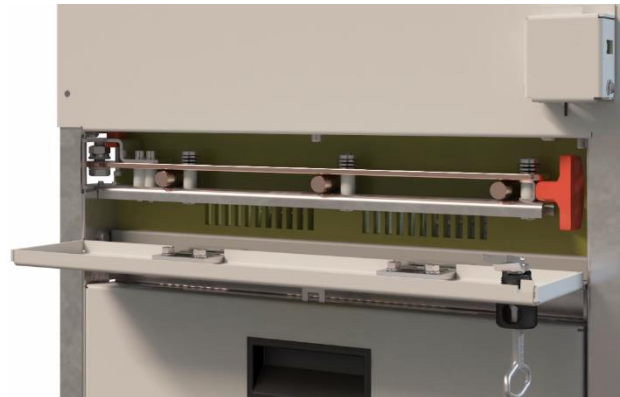
Fig.3.4. Cable compartment

3.3. Cable testing facility

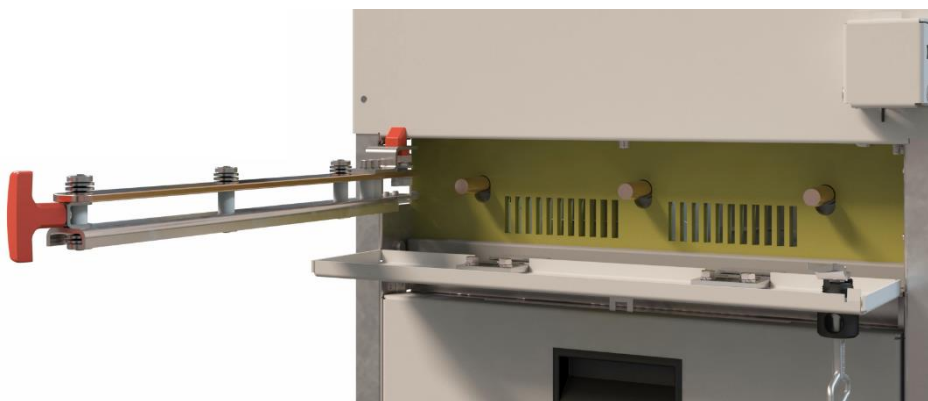
For convenience and ease of cable testing, a special cable testing facility (see Fig.3.5) is provided at the frontal part of the panel. The compartment door can only be opened in case of the COS is opened and earthed. After door opening, an earth jumper should be removed and the voltage application pins shall be accessible for testing cables.



Door closed



Door open



Earthing knife removed

Fig.3.5. Cable testing facility

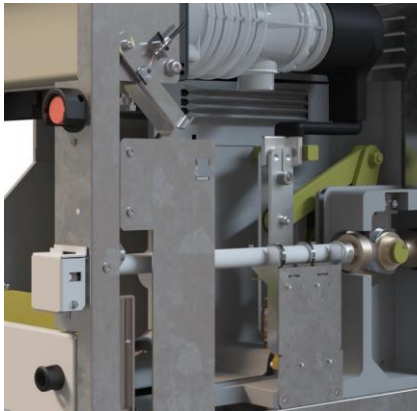
Test values for cable testing are given in Table 3.1.

Table 3.1 Test values for cable testing

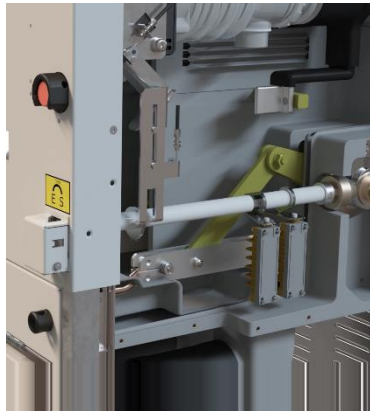
AC testing	DC testing	VLF testing
Phase-to-phase value for 5 mins between conductor and metallic screen/sheath	As per cable or test equipment manufacturer recommendations	As per cable or test equipment manufacturer recommendations

3.4. Circuit breaker compartment

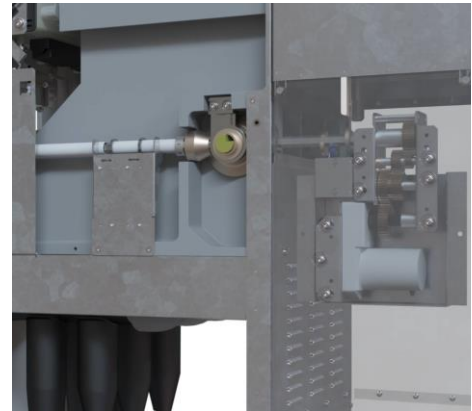
The circuit breaker compartment houses the COS (see Fig.3.6) and fixed circuit breaker ISM (see Fig.3.7). The position of the circuit breaker can be seen from the front of the panel through the inspection window.



Service position

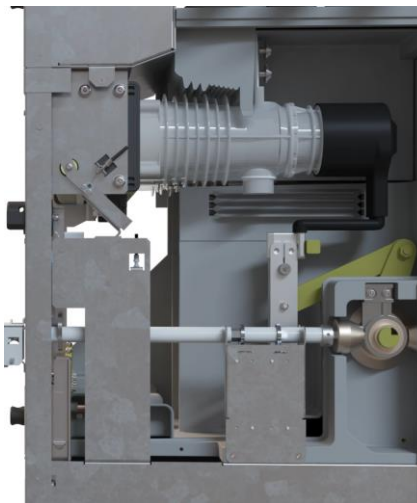


Earthed position

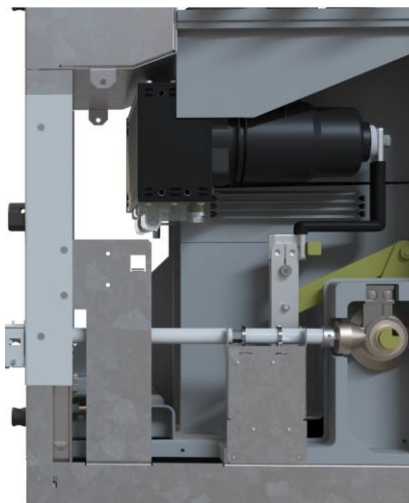


Motor operated

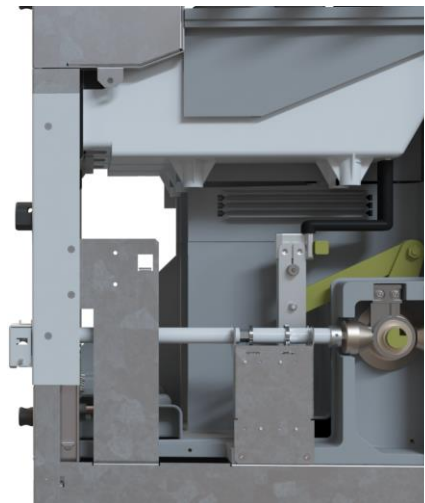
Fig.3.6. COS



ISM25_LD



ISM15_MD



ISM25_Shell

Fig.3.7. Circuit breaker

3.1. Low voltage compartment

The low-voltage compartment (see Fig.3.8) is designed to mount all secondary circuit connections within the single panel as well as interconnections between adjacent panels and transit connections. Special holes are provided for transit cables. The spacious compartment allows the installation of multi-functional microprocessor protection relay, energy meters, lighting, heating and many other devices. The sensors, indicators, microprocessor protection relay management blocks, mimic diagram, and control buttons are placed on the front panel. Two version of the low voltage compartment are available: standard (height 250 mm) and extended (height 400 mm).

- 1 Relay
- 2 Local/Remote switch
- 3 CB trip button
- 4 CB close button
- 5 Voltage indication
- 6 Lock

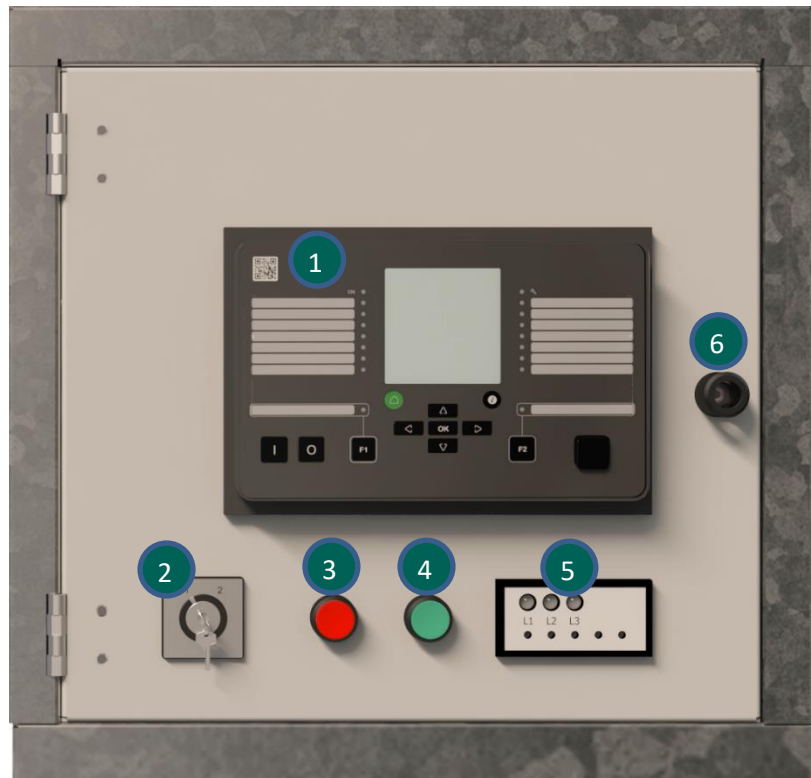


Fig.3.8. Low voltage compartment

3.2. Attachments

Rear arc duct attachment is designed to provide A-FLR classification with gases exhaust directed vertically. Front cable attachment is designed to accommodate extra 2 cables. The depth of each attachment is 300mm.



NOTE! Rear attachment needed to be specified when the COS is equipped with motor.

- 1 Front attachment
- 2 Arc duct



Fig.3.9. SCELL attachments

4. Equipment

4.1. Circuit breaker

4.1.1. Presentation

The circuit breaker version is based on a fixed type TEL indoor switching module ISM and control module CM.

These modules, developed with the latest switching and electronic control technology are used as the core components of medium voltage switchgear. There are three basic module types:

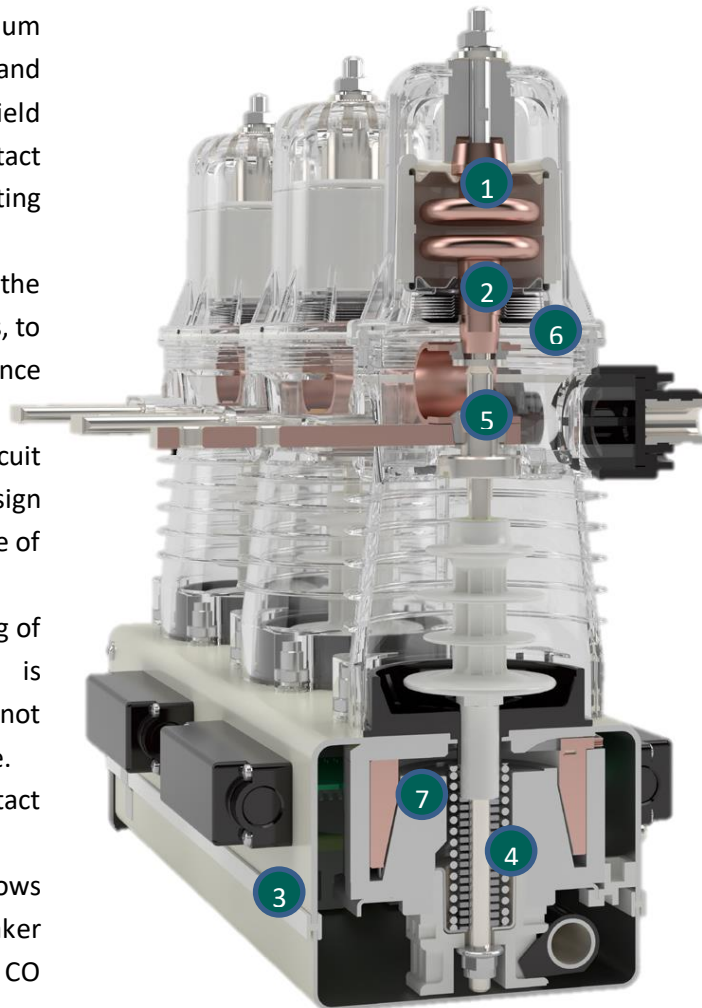
- Circuit breakers (LD, MD or Shell types) are used to close and open primary circuits
- Control modules (CM) are used to provide control (close and trip operations) of LD, MD or Shell modules

Circuit breakers are three pole units. Each pole incorporates a vacuum interrupter and single-coil magnetic actuator encapsulated in solid insulation.

Control modules are microprocessor-based electronic units, containing built-in close and trip capacitors. The close and trip capacitors can be discharged onto the actuator coil to provide appropriate operations. The ability to choose switching and control modules separately allows any type of switchgear to be easily configured with regard to its primary and auxiliary circuits.

The LD, MD and Shell circuit breakers and the CM control modules are the result of years of R&D by Tavrida Electric scientists and engineers. Their use in the SCELL switchgear allow users to benefit from a unique combination of features:

- 1 Tavrida Electric manufactures small, compact vacuum interrupters with an extraordinarily long mechanical and electrical lifespan. A specially designed axial magnetic field distribution provides an even current density over the contact surface, substantially improving the vacuum interrupting performance.
- 2 Vacuum interrupter contacts have unique design, based on the mixture of copper and chromium metals and various dopants, to ensure long electrical life of contacts, low contacts resistance and chopping current.
- 3 The patented, super-compact actuator design allows the circuit breaker to be installed directly underneath each pole. The design is optimal in terms of reliability, dimensions, weight and ease of installation.
- 4 A spring charged by the magnetic actuator during the closing of the circuit breaker ensures main contacts pressure is maintained. The spring is integrated in the actuator and does not require any maintenance during the circuit breaker's lifetime.
- 5 Circuit breaker terminals are designed to reduce contact resistance and mitigate the risk of contacts overheating.
- 6 The use of robot welded steel discs as opposed to folded bellows eliminates the main failure point of conventional circuit breaker designs and allows interrupter to do more than 150,000 CO cycles and contain high vacuum (10^{-6} Pa) for the entire lifetime.
- 7 Tavrida Electric realized early on that the complexity and bulk of conventional operating mechanisms made them unreliable and reduced their lifespan. Every Tavrida Electric circuit breaker uses patented actuators designed and fabricated within our own facilities to drive the interrupter contacts. All switching elements of a pole are assembled along a single axis meaning all mechanical movements are direct and linear.



- 8 Self-supervision system continuously monitors control, switching modules, functional wiring and auxiliary power supply quality. CM16 allows the user to forget about scheduled trip and close wiring inspections - as in the event of malfunction corresponding notification will be sent to the operator using one of the inbuilt output relays and indicated by inbuilt in CM LEDs.
- 9 Low power consumption. Vacuum circuit breakers equipped with the CM16 control module need less than 42W in charging mode – just 10% of what the best alternatives available on the market need! Such low power consumption finally solves the problem of auxiliary power supply – much less powerful source and UPS can now provide substation auxiliary equipment with required power.
- 10 Ease of use and robustness. CM16 type control modules are connected with the circuit breaker they control and supervise by means of simple wires. It allows the CM installation to be located at any position convenient for the OEM, system integrator or End-user location. Very compact dimensions and low weight further simplify the process. CM16 has a robust design, enclosed in an aluminum housing it provides high EMC level confirmed by KEMA test laboratories.

4.1.1. Range of circuit breakers

The range of circuit breakers is shown in Fig.4.1.



ISM15_MD



ISM25_LD



ISM25_Shell

Fig.4.1. Circuit breaker range

Circuit breaker rated characteristics are presented in Table 4.1.

Table 4.1 Circuit breaker rated characteristics

Parameter	Value		
Circuit breaker type	ISM15_MD	ISM25_LD	ISM25_Shell
Rated voltage, kV	17,5	24	
Rated Frequency, Hz	50/60		
Rated power frequency withstand voltage, kV	38	50	
Rated lightning impulse withstand voltage, kV	95	125	
Rated peak withstand current, kA	82	40	64
Rated short-time withstand current, kA (4s)	31.5	16	25
Rated current, A	1250	800	1600
Closing time, ms, not more than	20	35	30
Opening time, ms, not more than	8	15	8
Breaking time, ms, not more than	18	25	18
Circuit breaker class	M2 (30.000CO), S2, E2, C2		
Autoreclosing cycle	O-0,3s-CO-10s-CO		
Dimensions (WxDxH), mm	535x674x516	560x265x510	560x240x560
Weight. kg	33	35	50

4.1.2. Range of control modules

Control module rated characteristics and range are presented in Table 4.2.

Table 4.2 Control module rated characteristics

Parameter	Value	
Control module type	CM_16_1(60)	CM_16_1(220)
Rate supply voltage, V	24/48/60 DC	110/220 DC, 100/127/220 AC
Operating power supply voltage range, V	19 to 72 DC	85 to 265 AC/DC
Power consumption, VA, no more than		
Standby	55	
Charging the close/trip capacitors	5	
Mechanical vibration withstand capability	Class 4M4	
Dimensions (WxDxH), mm	190x165x45	
Weight. kg	1	

4.1.3. Handheld closing device

The handheld closing device (HCD) is used to charge the CM capacitors to perform the first close in case of auxiliary power supply outage (see Fig.4.2). It is kept in the low voltage compartment and used when needed. This device provides additional safety to an operator, compared to manual closing mechanisms of conventional circuit breakers. The operator can step aside from the switchgear panel at a safe distance before closing the ISM. The HCD range is given in Table 4.3.

Table 4.3 HCD range

HCD	SGkit_HCD_01-60	SGkit_HCD_01-220
Control module type	CM_16_1(60)	CM_16_1(220)
Rated voltage, VDC	35	110
Auxiliary power source	AA-size 1.5V LR6 battery (10 pcs)	



Fig.4.2. HCD

4.2. Change-Over Switch (COS)

COS (see Fig.4.3) provides disconnecter and earthing switch functions for the SCELL switchgear:

- Closing of the main circuit
- Opening of the main circuit including visual gap;
- Reliable earthing.

Three positions are available: service (closed), earthed and isolated.

Isolated position is achieved by manual removal of the earthing knife for the purpose of cable testing (refer to Section 3.3).

- 1 Load carrying knife
- 2 Gear mechanism
- 3 Charging spring
- 4 Earthing busbar with three cable testing points

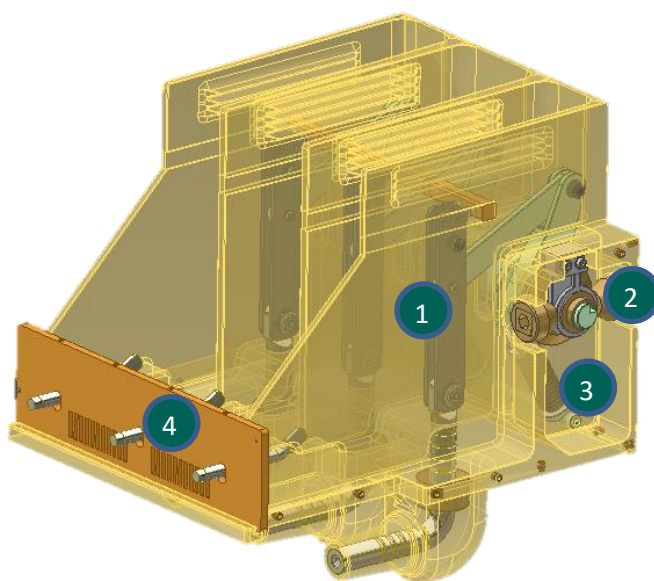


Fig.4.3. COS

The range of COS switches is given in Table 4.4.

Table 4.4 COS range

COS type	Description
COS(150_0)	150mm PCD without EM interlock
COS(150_1)	150mm PCD with EM interlock 110VDC
COS(150_2)	150mm PCD with EM interlock 220VDC
COS(150_4)	150mm PCD with EM interlock 48VDC
COS(150_5)	150mm PCD with motor 110VDC and without EM interlock
COS(150_6)	150mm PCD with motor 220VDC and without EM interlock
COS(150_7)	150mm PCD with motor and EM interlock 110VDC
COS(150_8)	150mm PCD with motor and EM interlock 220VDC

Main technical data and control module technical parameters are presented in Table 4.5.

Table 4.5 COS rated characteristics

Parameters	Value
COS as Disconnecter IEC62271-102	
Rated voltage, kV	24
Rated current, A	630/1250
Rated peak withstand current, kA	64
Rated short-time withstand current, kA (3s)	25
Mechanical endurance class	M1 (2000 CO)
COS as Earthing switch IEC62271-102	
Rated voltage, kV	24
Rated peak withstand current, kA	64
Rated short-time withstand current, kA (3s)	25
Mechanical endurance class	M1 (2000 CO)
Electrical endurance class	E2

4.3. Current transformers

The ring core current transformers are used to provide current information from the line to protection relays, control systems and power metering devices. All active parts are solidly insulated with cast resin. All current transformers comply with IEC 60044-1, GOST 1983-89 and DIN 42600. The SCELL switchgear is designed for mounting many different types of manufactures of support type current transformers.

4.1. Voltage transformers

The voltage transformers are used to provide voltage information from the line to protection relays, control systems and power metering devices. All active parts of transformer are solidly insulated with cast resin. This material performs both the electrical insulating and the mechanical functions.

The voltage transformers can be equipped with protection fuses with a striker system. This system can also send a signal of a blown fuse to SCADA. The transformers comply with IEC 60044-2, GOST 1983- 89 and DIN 42600.

4.2. Zero sequence transformer

The zero sequence current transformers are used for measuring phase currents or detect earth fault currents. They are solidly insulated with cast resin. Transformers can be mounted inside a panel or fitted to the bottom of switchgear in a cable cellar.

4.1. Current sensors

Current sensors are based on the Rogowski coil principle. A Rogowski coil is a toroidal coil without an iron core placed around the primary conductor. Current sensors are used to provide current information from the line to protection relays, control systems and power metering devices. The current sensors comply with IEC 60044-8.

4.2. Voltage sensors

Voltage sensors are based on the capacitive divider principle. Voltage sensors are used to provide current information from the line to protection relays, control systems and power metering devices. The current sensors comply with IEC 60044-7.

4.3. Surge arresters

The switchgear can be equipped with the “T-shaped” screened, separable surge arresters. They are used to protect the panel against lightning and switching overvoltages and are installed in the cable compartment. Surge arresters conform to IEC 60099-4 and GOST 163576-83 standards.

4.4. Voltage indicators

Voltage indicators are used to detect the presence or absence of medium voltage.

SCELL panels can be equipped with voltage presence indication systems (VPIS) or voltage detection systems (VDS) integrated directly into the main busbar or integrated into “T-shaped” screened, separable cable connectors in accordance with IEC 62271-206 and IEC 61243-5.

5. Selection

5.1. Available configurations

The SCELL range is available in extensible format, ranging from 1-panel to 5-panel configurations. An overview of available configurations is given in Table 5.1.

Table 5.1 SCELL range

LI	LS	LF; LFVT	CB (L or R)	CS (L or R)	M	ST	BE
Line input	Line switch	Line feeder	Coupler breaker	Coupler switch	Metering panel	Service transformer	Busbar Earthing

5.2. Ordering details

All major parts, components or accessories are grouped into different kits. Each kit belongs to a certain component group, subgroup, has a type and parameter, which may vary depending on the quantities, ratings or characteristics. The combination of the kits forms the unique code of the panel, indicating what equipment is in each panel. The basic groups, subgroups, types and parameters of the SCELL series switchgear are presented below:

Group	_____	SGX5_SCELL_X
SubGroup	_____	
Type	_____	

Parameters:

(X_W(X)_M(X)_X(x)_CA(x)_LV(x)_PBmet1(x)_Cx(x)_CT0_VT(x)_Ins(x)_COSx(x)_X(X)_ScLock(IND)_Mupasz(x)_SCELL(X)_BusIns(x)_Wire(1)_Fast(2)_CF(x)_MachP(1)_X(X)_SA(X)_GET(X)_Tconx_X(x)_HT(1_5))

If any of the kits is not included, a “0” is displayed.

Classifier Group	Abbreviation	Description	
	SG25	Fully assembled and routine tested panel up to 24kV	
	SG15	Fully assembled and routine tested panel up to 17,5kV	
SUBGROUP	SCELL	SCELL series switchgear	
TYPE	LD1	Switchgear panel with LD vacuum breaker Ur = 24kV, Isc = 16kA	
	Shell1	Switchgear panel with Shell vacuum breaker Ur = 24kV, Isc = 25kA	
	MD1	Switchgear panel with MD vacuum breaker Ur = 17,5kV, Isc = 31,5kA	
Type Nr.	Type(Parameter)	Classifier Group_Subgroup	Description
PARAMETERS	LI	(1) SCellType Type of panel	Line input
	LS		Line switch
	TF		Transformer feeder
	LF		Line feeder
	LFVT		Line feeder VT
	CS-R		Coupler switch right
	CS-L		Coupler switch left
	CB-R		Coupler breaker right
	CB-L		Coupler breaker left
	M		Metering panel
	ST		Service transformer panel
	W(500)	(2) ScellWidth_Scellwidth Panel width	500mm
	W(750)		750mm
	W(1000)		1000mm
	M(630)	(3) SGkit_Busbars Main busbar rated current	Rated current 630A
	M(1250)		Rated current 1250A
	LD(630)	(4) VCBScell_ISM Circuit breaker	ISM25__LD_1 with insulation hoods Ir=800A
	Shell(1250)		ISM25__Shell_2 with insulation covers Ir=1250A
	MD(1250)		ISM15__MD_1 with insulation covers Ir=1250A
	CA(1)	(5) SGkit_Attach Front attachment for cables	Front attachment for extra 1 cable connection
	CA(2)		Front attachment for extra 2 cable connection
	LVStd(Sc250)	(6) SGkit_LVmet LV cabinet	LV cabinet standard size 250mm
	LVEExt(Sc450)		LV cabinet extended size 450mm

	PBmet1(Sc1_500)	(7) SGkit_PBmet Enclosure type	Metal enclosure without LV compartment for quantities <3 and IP4X size 500mm
	PBmet1(Sc1_750)		Metal enclosure without LV compartment for quantities <3 and IP4X size 750mm
	PBmet1(Sc1_1000)		Metal enclosure without LV compartment for quantities <3 and IP4X size 1000mm
	PBmet1(Sc3_500)		Metal enclosure without LV compartment for quantities >=3 for outdoor size 500mm
	PBmet1(Sc3_750)		Metal enclosure without LV compartment for quantities >=3 for outdoor size 750mm
	PBmet1(Sc3_1000)		Metal enclosure without LV compartment for quantities >=3 for outdoor size 1000mm
	CTK(1)	(8) SGcomp_CT Current transformer	Kuvag slip on phase CT JW 18/03, 1 winding
	CTK(2)		Kuvag slip on phase CT JW 18/03, 2 windings
	CSR(1-78)		Teleradio Wawa phase current sensor CR1-78
	CSR(1-50)		Teleradio Wawa phase current sensor CR1-50
	CSZ(1)		Zelisco phase current sensor
	CT0(1)	(9) SGcomp_CT0 Zero current transformer	Zero-sequence CT any parameters
	VTA(VEI-24A)	(10) SGcomp_VT Voltage transformer	Alce plug in type VEI-24A VT, 1-3 windings
	VSR(UR56)		Voltage sensor Teleradio Wawa UR56 for Cellpack/Nexans connectors
	Ins(1250)	(11) SGkit_Ins Insulators kit (fixed contact and through)	Insulator kits for up to 1250A, w/o capacitive divider
	Ins(1250_1)		Insulator kits for up to 1250A, with capacitive divider
	COS(150_0)	(12) SGcomp_ES COS	150mm PCD without EM interlock
	COS(150_1)		150mm PCD with EM interlock 110VDC

	COS(150_2)		150mm PCD with EM interlock 220VDC
	COS(150_4)		150mm PCD with EM interlock 48VDC
	COS(150_5)		150mm PCD with motor 110VDC and without EM interlock
	COS(150_6)		150mm PCD with motor 220VDC and without EM interlock
	COS(150_7)		150mm PCD with motor and EM interlock 110VDC
	COS(150_8)		150mm PCD with motor and EM interlock 220VDC
	BS0(0_3)	(13) SGkit_VS Voltage indication kit	Voltage Indicator without relay connected to BS Ins at busbar side. Cable length 3m.
	BS0(R_3)		Voltage Indicator with 2CO connected to SGkit_Ins at busbar side. Cable length 3m.
	VS0(0_3)		Voltage Indicator without relay connected to COS Ins at cable side. Cable length 3m.
	VS0(R_3)		Voltage Indicator with 2CO connected to COS Ins at cable side. Cable length 3m.
	BSVS(0_3)		Voltage Indicator without relay connected to both BS Ins at busbar and COS Ins at cable side. Cable length 3m.
	BSVS(R_3)		Voltage Indicator with 2CO connected to both BS Ins at busbar and COS Ins at cable side. Cable length 3m.
	ScLock(IND)	(14) SGkit_Lock Locks kit	Hinges, handles and locks kit
	Mupasz(M101)	(15) SGcomp_Relay Protective relay	Mupasz101 A3B3C6D3E1F0
	Mupasz(M902E)		Mupasz902E A3B3C6D3E1F2G1
	SCELL(TLF)	(16) SGkit_LVcomp Aux wiring and accessories	Aux wiring and accessories for TLF arrangement
	SCELL(SCI)		Aux wiring and accessories for SCI arrangement
	SCELL(IED)		Aux wiring and accessories for IED arrangement

	BusIns(1)	(17) SGkit_BusIns Insulation kit	Heat-Shrink Insulation, incl. barriers as per GOST or IEC
	BusIns(2)		Soft covers for ISM and heat-shrink insulation kit
	Wire(1)	(18) SGkit_Wire Panel cabling	Internal panel cabling (CT-LV; COS-LV; CT0-LV)
	Fast(2)	(19) SGkit_Fastener Fasteners and fittings kit	Fasteners and standard fitting kit incl. panel interconnection
	CF(1)	(20) SGkit_CableFix Cable fixing kit (holders)	MV cable fixing for 1 cable per phase
	CF(2)		MV cable fixing for 2 cables per phase
	MachP(1)	(21) SGkit_MechDet Machining details kit	Small machining details or plastic alloys parts
	SP(Scell_1)	(22) Service_Assembly Assembly work and routine testing service kits	Panel assembly and Routine testing with auxiliary wiring and LV
	SP(Scell_TLF)		Panel assembly and Routine testing with TLF or SSI/SCS protection
	PB(Scell)		Panel assembly and Routine testing without auxiliary wiring and LV
	SA(1)	(23) SGcomp_SA Surge arresters kits	Set of SA integrated in plug in connector
	GET(R_300)	(24) SGkit_ArcDuct Gas exhaust duct	Rear GET attachment with top exhaust 300mm depth for Motor COS. Motor not included
	GET(R_150)		Rear GET attachment with top exhaust 150mm depth
	Tcon(3_250)	(25) SGkit_Con Elbow connector	Kit of T-connector plug in 250A for 3xsingle core cables
	Tcon(6_630)		Kit of T-connector plug in 630A for 6xsingle core cables
	TconVT(3_250)		Kit of T-connector plug in 250A for 3xsingle core cables and VT
	TconSA(3_250)		Kit of T-connector plug in 250A for 3xsingle core cables and integrated SA
	MiniRTU(Elseta)	(26) RecKit_RTU RTU	Elseta MiniRTU
	LTE(Teltonika_RUT955)		LTE dual-SIM router TELTONIKA with WiFi, 4xEthernet ports, I/O,

			RS232/RS485 including power supply cable and antenna.
	HT(1_5)	(27) SGcomp_HT House transformer	House transformer for ST panels, 1.5kVA up to 24kV

Note:

¹Motor drive for COS is available with rear attachment (SGkit_ArcDuct) only

Example:

SP25_SCELL_LD1(W(500)_ M(630)_ LD(630)_ CA(1)_ LVStd(Sc250)_ PBmet1(Sc1_500)_ CSR(1-50)_ 0_0_ Ins(1250_1)_ COS(150_1)_ BS0(R_3)_ ScLock(IND)_ Mupasz(M101)_ SCELL(IED)_ BusIns(1)_ Wire(1)_ Fast(2)_ CF(2)_ 0_ SP(Scell_1)_ SA(1)_ GET(R_150)_ Tcon(6_630)_ MiniRTU(Elseta)_ 0)

SP25	Fully assembled and routine tested panel up to 24kV
SCELL	SCELL series switchgear
LD1	Assembled switchgear up to 24kV. The Breaking Current of SP is up to 16kA
LF	Line feeder
W(500)	Panel width 500mm
M(630)	Main busbar rated current 630A
LD(630)	Circuit breaker ISM25__LD_1 with insulation hoods Ir=800A
CA(1)	Front attachment for extra 1 cable connection
LVStd(Sc250)	LV cabinet standard size 250mm
PBmet1(Sc1_500)	Metal enclosure without LV compartment for quantities <3 and IP4X size 500mm
CSR(1-50)	Teleradio Wawa phase current sensor CR1-50
0	Zero-sequence CT not included
0	VT not included
Ins(1250_1)	Insulator kits for up to 1250A, with capacitive divider
COS(150_1)	COS 150mm PCD with EM interlock 110VDC
BS0(R_3)	Voltage Indicator with 2CO connected to BS Ins at busbar side. Cable length 3m
ScLock(IND)	Hinges, handles and locks kit
Mupasz(M101)	Mupasz101 A3B3C6D3E1F0
SCELL(IED)	Aux wiring and accessories for IED arrangement
BusIns(1)	Heat-Shrink Insulation, incl. barriers as per GOST or IEC
Wire(1)	Internal panel cabling (CT-LV; COS-LV; CT0-LV)
Fast(2)	Fasteners and standard fitting kit incl. panel interconnection
CF(2)	MV cable fixing for 2 cables per phase
0	Small machining details or plastic alloys parts not included
SP(Scell_1)	Panel assembly and Routine testing with auxiliary wiring and LV
SA(1)	Set of SA integrated in plug in connector
GET(R_150)	Rear GET attachment with top exhaust 150mm depth
Tcon(6_630)	Kit of T-connector plug in 630A for 6xsingle core cables
MiniRTU(Elseta)	Elseta MiniRTU
0	House transformer not included

6. Installation

6.1. Transportation and handling

The panels are delivered from the factory ready for installation.

The panel is fitted with four lifting lugs on the top compartment (see Fig.6.1) and can be also moved on pallets with a forklift truck. The size of pallet is 600x800x160 mm (WxLxH).

The weight of one standard panel without additional equipment and attachments does not exceed 400 kg.

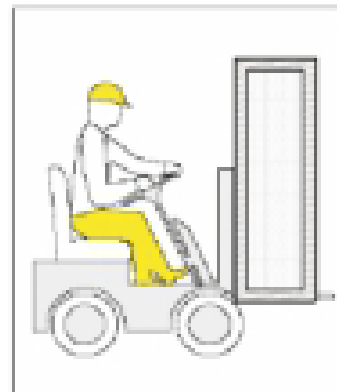


Fig.6.1. Lifting and handling

6.2. Storage

Panels, equipment, spare parts, and instructions must be stored indoors. The storage area must be free of dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts.

6.3. Unpacking and installation

6.3.1. Foundation surface

Installation of the panel requires a flat, concrete structure. The following floor surface requirements must be obeyed:

Evenness tolerance: $\pm 1\text{mm}$ within a measuring length of 1m
Straightness tolerance: 1mm per 1m, but not more than 3mm over entire length of frame

Floor, ceiling and walls of the building must be finished with materials, which do not raise or collect dust.

6.3.2. Unpacking

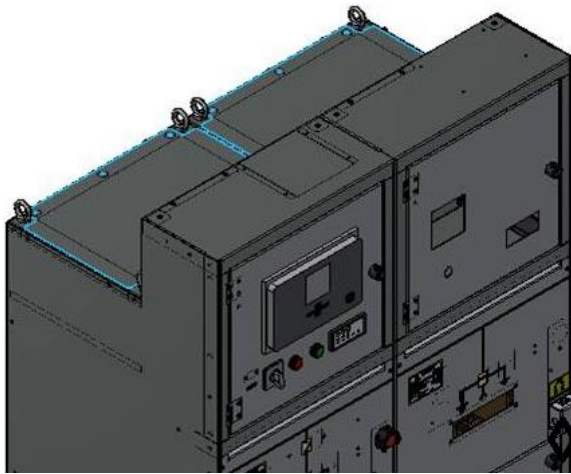
Unpacking panels should only take place on the installation site. Remove plastic stretch wrapping from the panel. Visually inspect the exterior of panel.

6.3.3. Installation

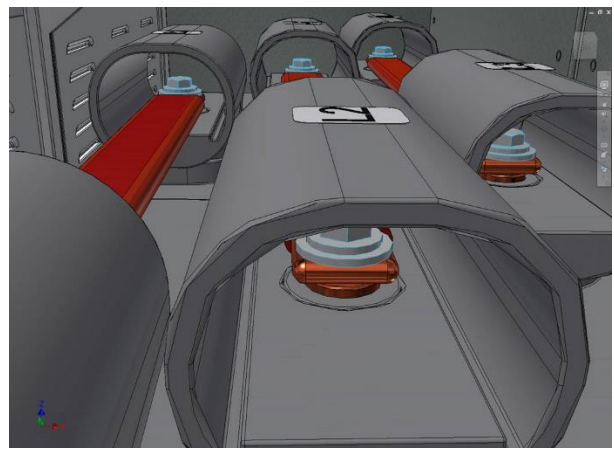
Panels must be positioned on the site in accordance with developed and approved civil project and single line diagram. Floor openings for high-voltage cables must be provided. The dimensional drawing of two connected panels (LI+LF configuration) is shown in Fig. 10.1 (refer to Appendix 1).

6.3.4. Connecting panels

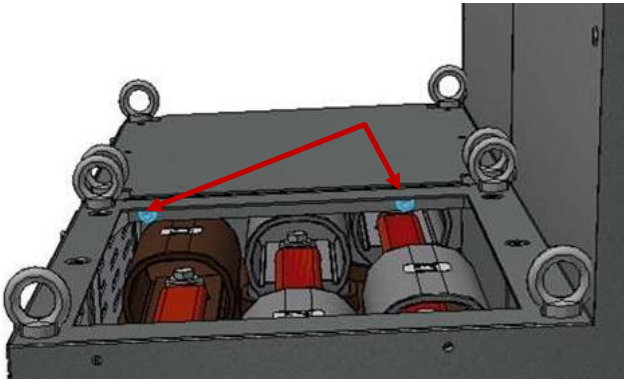
Make sure that all panels are perpendicular in relation to the floor surface. Align the front facing panels. Proceed with the layout of the other panels by repeating the same checks each time.



1. Release the top covers by removing 6x M6 bolts.
(M6x16 bolt, D6 washer and D6 spring washer)



2. Install the busbars and insulating caps using 6x M12 bolts (M12x40 bolt, D12 washer and D12 spring washer).



3. Fix two panels together with 4x M8 bolts (M8x20 bolt, D8 washer and D8 spring washer) using openings in the busbar and cable compartments.

4. Fix the top covers to complete the installation.

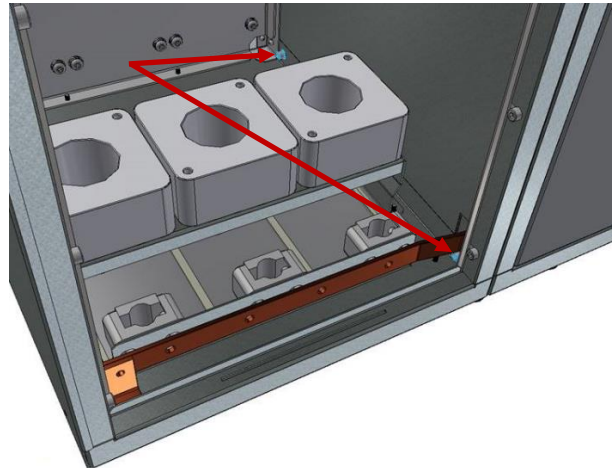


Fig.6.2. Connecting panels



NOTE! Fasteners, busbars and insulating caps are included in the standard delivery.



CAUTION! Use a torque wrench to prevent over-tightening problems and avoid damage of equipment during the installation. Torque values for bolted connection are given in Table 6.1.

Table 6.1 Tightening torque table

Bolt size ¹	Torque value for copper connections, N·m	Torque value for other connections, N·m
M6	-	9.4
M8	-	23
M12	77,8	-

Note:

¹Durability class 8.8

6.3.5. Connecting cables

Remove the cable compartment door using the handle.



NOTE! The cable compartment door can only be accessed when the COS is in the earthed position.

SCELL is equipped with DIN 400 Type C bushings for termination of cables (see Fig.6.3).

The bushings are situated in the same height from the floor and are protected by the cable cover.

Follow cable manufacturer's installation instructions to connect the cables.

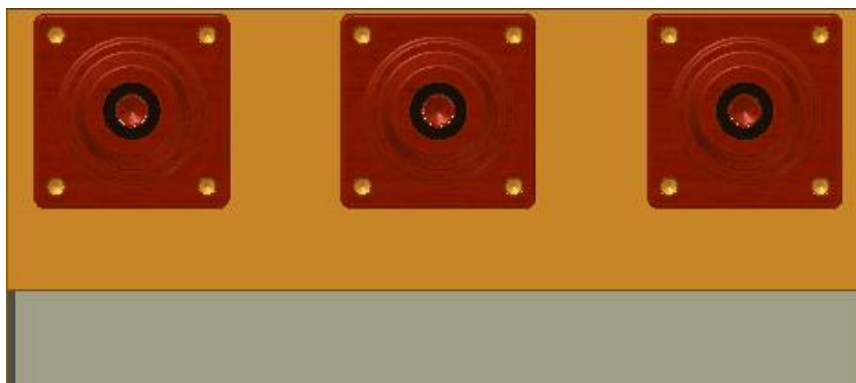


Fig.6.3. SCELL cable bushings



NOTE! Lubricate the bushings thoroughly with the silicone grease.

6.3.1. Earthing

The earthing bar is inserted into the cable compartment through the special rectangular openings and fixed by bolt (see Fig.6.4). Make sure that the contact surface of earthing busbar is flat and clean. Adjoin the earthing busbar to the connection point and fix with M12 bolt.



Earthing busbar connection point

Fig.6.4. SCELL earthing



WARNING! Connection between panel earthing busbar and the substation main earthing bar must be done according to maximum earth-fault current of switchgear.



NOTE! Connection of cable or wire with earthing contour at substation is permitted, if their cross-section conforms to short-circuit current.

7. Operation

7.1. General

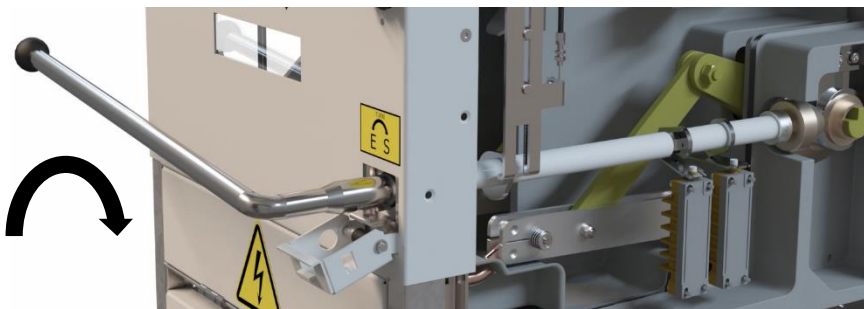
COS is operated with the included operating handle (see Fig.7.1). Circuit breaker is normally operated with the close/open buttons located at the front of low voltage compartment. Emergency opening is possible with the manual trip button located at the front of circuit breaker compartment. Emergency closing is possible with the handheld closing device. Internal mechanical interlocking between the COS and circuit breaker prevents incorrect operation. The operation of the COS can be restricted by means of a padlock.



Fig.7.1. Operating handle

7.2. COS operation

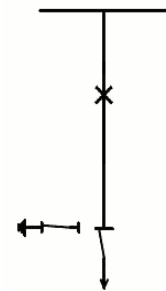
Follow the following instructions to manually operate the COS:



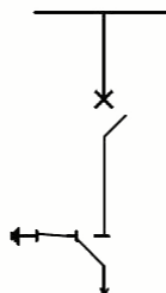
To Close: Turn the operating handle clockwise



To Open: Turn the operating handle anti-clockwise



Service position



Earthed position

Fig.7.2. COS operation

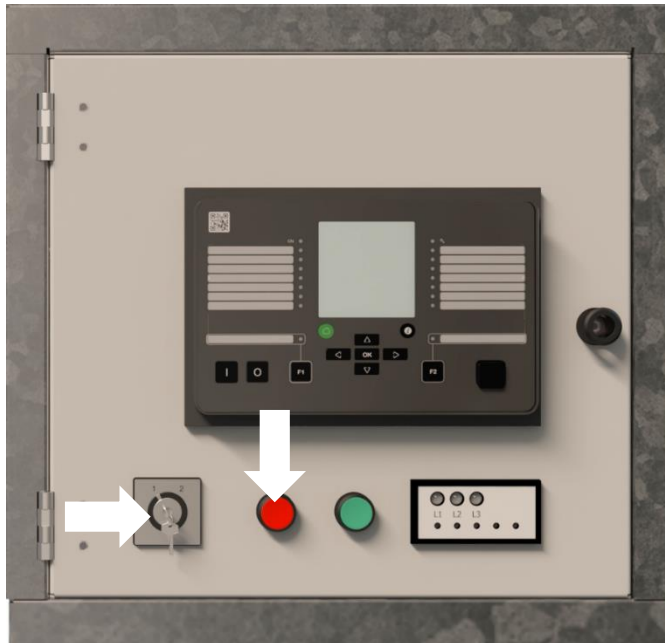


NOTE! Ensure that the switch is in the closed position before operating the COS.

7.3. Circuit breaker operation

7.3.1. Normal operation

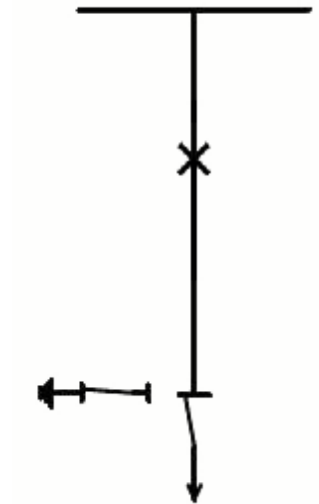
Follow the following instructions to manually operate the circuit breaker in case of the presence of auxiliary power supply:



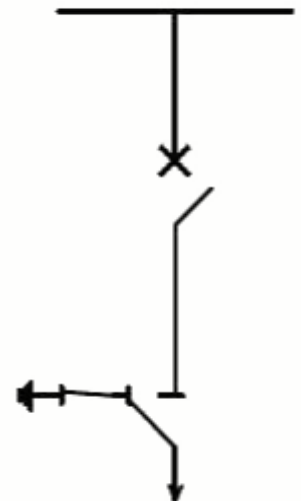
To Close: Switch the Local/Remote switch to Local position and push the red button.



To Open: Push the green button



Service position

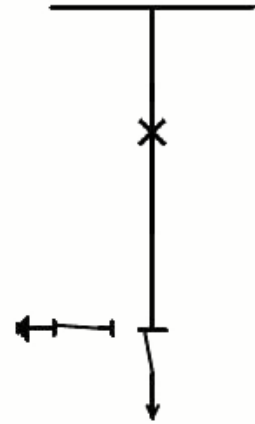


Open position

Fig.7.3. Circuit breaker operation

7.3.1. Emergency operation

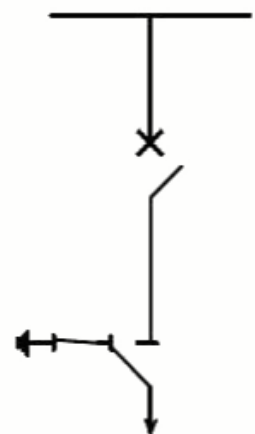
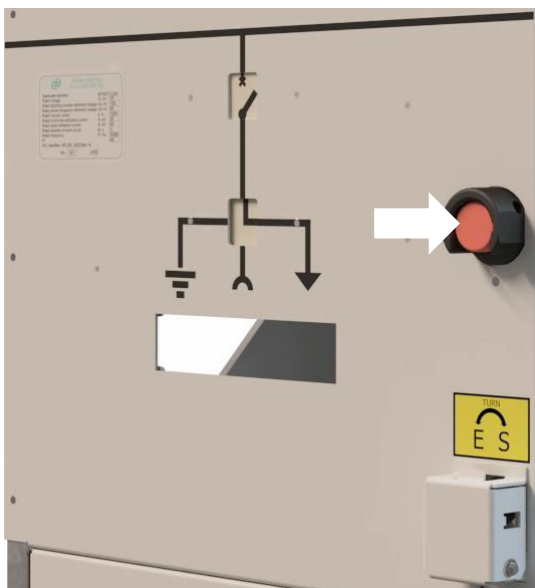
Follow the following instructions to manually operate the circuit breaker in case of the loss of auxiliary power supply (emergency close/trip):



Service position

To Close:

1. Connect the HCD to the socket located in the low voltage compartment.
2. Press and hold the "CM SUPPLY" button for up to 30 sec until the CM shows "READY" state. Activation time depends on the battery condition.
3. Press the "CB CLOSE" button while holding the "CM SUPPLY" button to close CB.
4. Release all buttons, remove the plug and put it into holder.
5. To check the battery level press and hold the "BATTERY TEST" button for up to 10 sec. If the light is green, the battery is good. If the light is red or there is no light, replace all batteries at the same time.



Open position

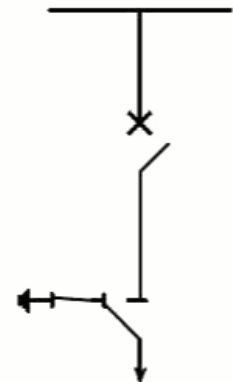
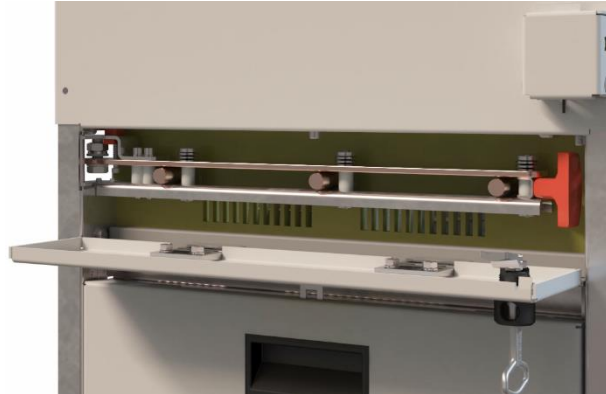
To Open: Push the red emergency button

Fig.7.4. Circuit breaker emergency operation

7.4. Cable testing

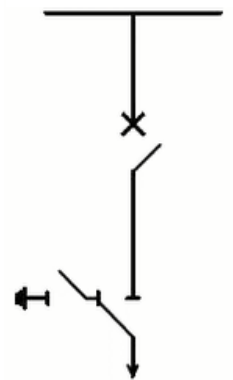
Follow the following instructions to access and use the cable testing facility:

Step1: Open the compartment door using 5-mm double-bit key.



Step 2: In the earthed position access the cable testing compartment

Earthed position



Step 3: Remove earthing by releasing the earthing knife and connect the voltage source to the test facility

Test position

Fig.7.5. Cable testing facility



NOTE! Ensure that the COS is in the open/earthed position before accessing the cable testing compartment.

8. Maintenance

All components are maintenance-free for the entire lifetime.

9. Troubleshooting

Table 9.1 Troubleshooting steps

Malfunction	Possible issue	Solution
Cannot open the cable compartment door	COS open	Check if the COS open by the indicator or through the front inspection window. Close the COS.
	Cable testing compartment door open	Apply earthing by closing the earthing knife and close the cable testing compartment door.
Cannot open cable testing compartment door	COS closed	Check if the COS open/earthed by the indicator or through the front inspection window. Open the COS.
Cannot close CB	COS in in the intermediate position	Check if the COS closed/open by the indicator or through the front inspection window. Open/close the COS.
	Internal malfunction or warning	Check if the LED indicator "Failure" blinking. See Table 10.2 for further instructions.
	CB operation mode set to the remote mode	Use a selector switch to choose the local CB operation mode. Close the CB.
	After manual trip RESET was not performed	Press OPEN button.
Cannot open CB	Internal malfunction or warning	Check if the LED indicator "Failure" blinking. See Table 10.2 for further instructions.
Cannot close COS	CB open	Check if the CB open by the indicator or through the front inspection window. Open the CB.
Cannot open COS	CB open	Check if the CB open by the indicator or through the front inspection window. Open the CB.
Blinking LED indicator "Failure"	Internal malfunction or warning associated with CM or CB operation	See Table 10.2 for further instructions.

Table 9.2 Troubleshooting steps associated with CM operation

Failure Code LED indication (No. of flashes)	Malfunction/Warning	Solution
1	Power outage exceeds 1,5 s \pm 0,5 s or applied voltage exceeds prescribed limit value	Check the presence of CM auxiliary power supply, its polarity and voltage level.
2	CB closing or tripping failure	Check the circuit of CB actuator coil connection with connector X3 of CM, check state of CB electrical interlocks.
3	Actuator-coil is open-circuited	Check the circuit of ISM actuator coil. connection with connector X3 of CM, check state of CB electrical interlocks.
4	Actuator-coil is short circuited	Check the circuit of ISM actuator coil connection with connector X3 of CM, check state of CB electrical interlocks.
5	CB opened and locked	Check the CB and its interlock state
6	Overheating of CM	Stop performing CO operations until the blinks stop.
7	CB emergency trip	Check the CB and its interlock state.
Continuous red	Internal failure of CM	Replace the CM.



NOTE! In case the actions listed above do not help, contact your local representative.

10. Disposal

The equipment and materials applicable in SCELL series switchgear do not contain any materials that are hazardous for the environment or for personnel. No special methods of disposal are required.

Appendix 1. Dimensions

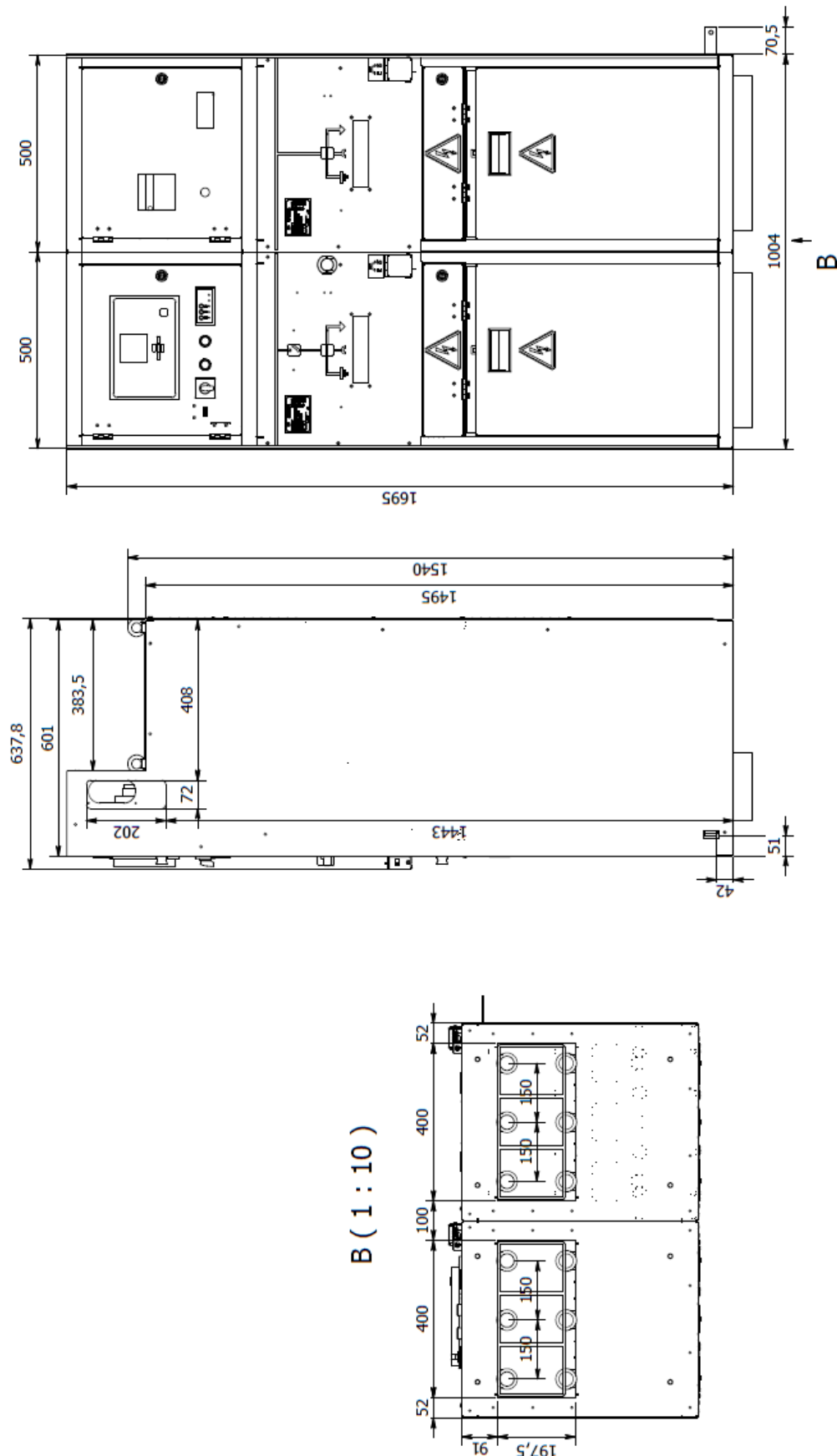


Fig.10.1. SCELL dimensions: LI+LF configuration (example)

Amendment list

Date	Page, clause	Scope	Reason
29.03.2019			Initial version