SMART RING

A Single Phase Air Insulated Ring Main Unit and Compact Switchgear
Installation and Operating Instructions
OP2012V002

SMART RING 12 KV RING MAIN UNIT

CONTENTS

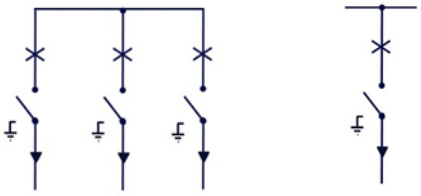
1. GENERAL DESCRIPTION

Smart Ring is a single phase insulated Ring Main Unit and Compact Switchgear for applications in medium voltage distribution networks. All live components and switching functions are installed in a sealed tank. Single-phase insulation is preventing lightning arcs from originating. This solution provides highest possible personnel safety and a virtually maintenance free system.

Smart ring is SF6 free and consists of a minimum of insulation details. This makes the switchgear a ”green” product all the way to destruction. 90-95% of the components are recyclable.

Smart Ring is provided with standard equipment as follows:

- Full range circuit breakers in every bay, with ratings 630A, 20 kA, 2 sec.
- Disconnector and Earthing switches with full making capacity
- Operating mechanisms with integral mechanical interlocking



Smart Ring is provided in two basic versions, a 3-bay and a 1-bay. Extensions can be made on both sides of the main switchgear, also after field installation. This makes Smart Ring very flexible and most suitable combinations can be achieved.

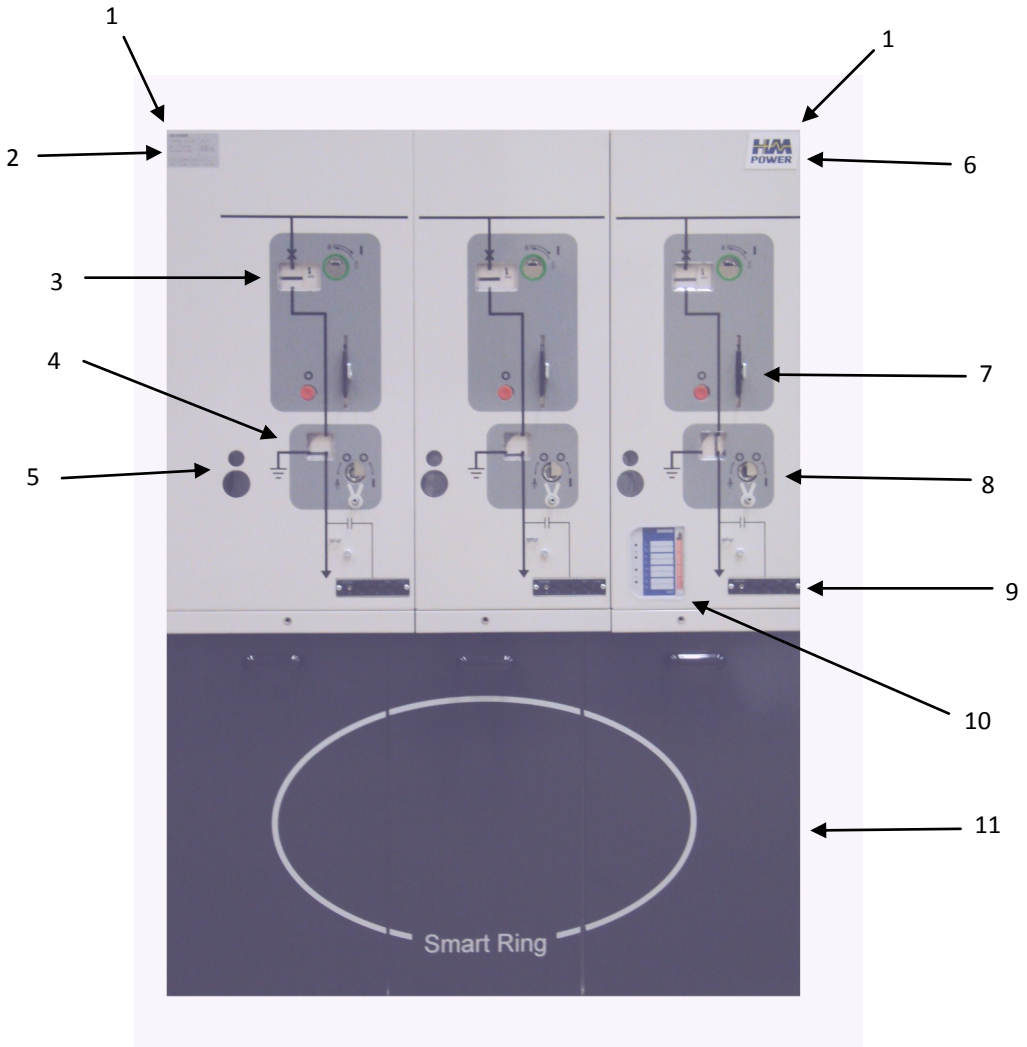
A transformer bay is obtained by adding a protection relay, CT’s and a tripping coil. The standard relay is based on digital technology and does not require an external power supply.

The switchgear is delivered from the factory ready for installation.
Routine tests and inspections are made before dispatch.
No special tools are required for installation.

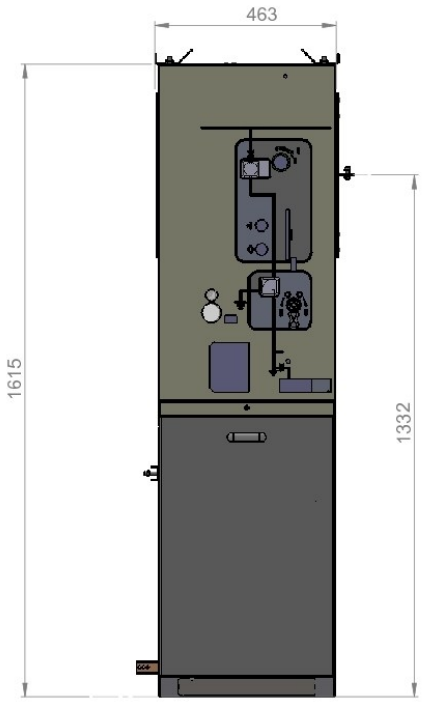
Smart ring is in compliance with IEC 62271-200 and 62271-1.

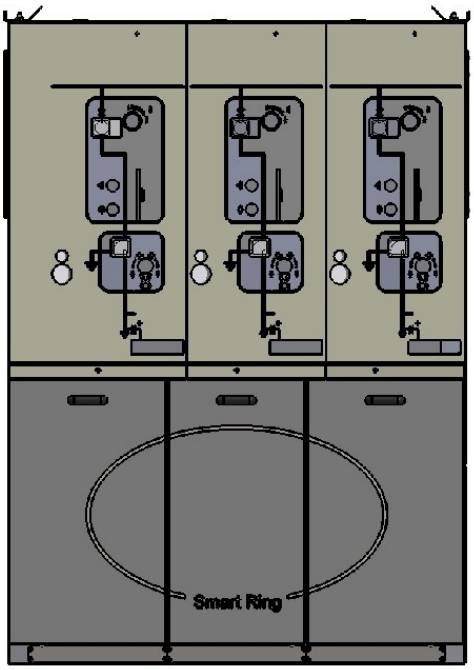
1.1 TABLE OF LOCATIONS

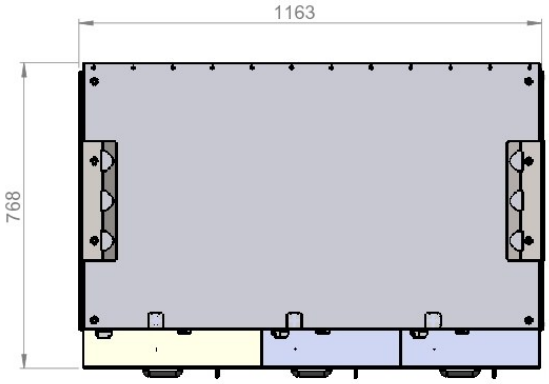
1. Lifting Ears
2. Legend plate + serial number
3. Circuit breaker section
4. Disconnector/earth switch section
5. Inspection hole (visible earth observation window)
6. Logo
7. Circuit breaker/disconnector access shutter
8. Disconnector/earth switch selector
9. Capacitive voltage indicator
10. Protection Relay (transformer bay only)
11. Cable compartment

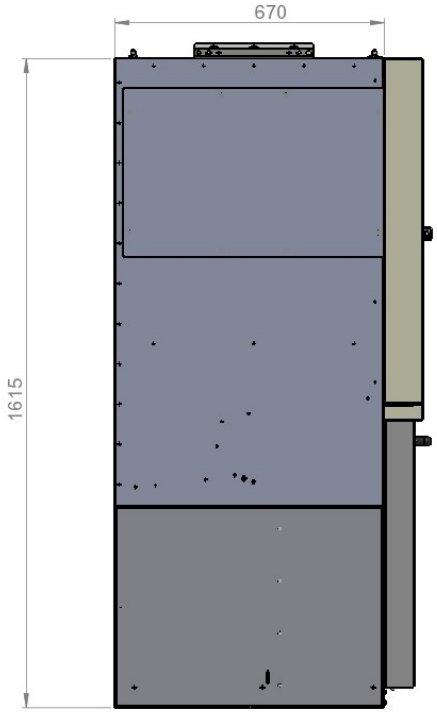


1.2 DIMENSIONAL DRAWINGS

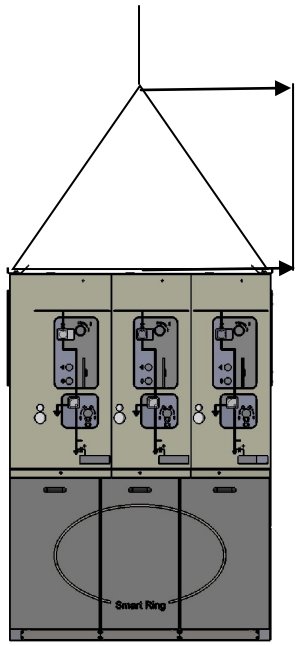








Unit	Length (mm)	Width (mm)	Height (mm)
1-bay	487	800	1647
2-bay	958	800	1647
3-bay	1187	800	1647
4-bay	1658	800	1647
5-bay	2129	800	1647
6-bay	2358	800	1647



Unit	H_{min} (mm)
1-bay	200
2-bay	350
3-bay	520
4-bay	680
5-bay	850

2. TRANSPORT AND HANDLING

The units are delivered ready for installation.
Weight table for standard versions

3-bay LLT	450 kg
3-bay LLL	450 kg
4-bay LLTT	600 kg
4-bay LLLT	600 kg
4-bay LLLL	600 kg
5-bay LLLTT	750 kg
5-bay LLTTT	750 kg

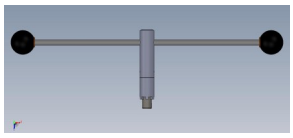
The weights are including packing.
Smart Ring is equipped with lifting ears, but can also be moved on pallet with a forklift truck.

2.1 BY RECEIVEING INSPECTION

Upon receiving check that the delivered equipment has not been damaged during transport.
If any damage has occurred, a claim must be submitted to the carrier immediately.

After unpacking the following must be checked;

1. Operating handle—1 piece should be included
2. Carry out a function test on the mechanical parts



Any faults must immediately be reported to the supplier

HM POWER			
MV Switchgear Air insulated			Year: 2011
Type: 12-3-2 Smart Ring			IEC 62271-1
Circuit Breakers in all bays			IEC 62271-100 IEC 62271-200
U_r 12 kV	U_p 75/95 kV	U_d 28/42 kV	t_k 2s
I_r 630 A	I_k 20 kA	I_p 50 kA	I_{sc} 20 kA

2.2 STORAGE

Smart Ring must be stored indoors in a dry and well-ventilated area until it is installed and put into operation. It can be stored in temperatures between –50 and +50 degrees Celsius, and humidity <70%.

3. TECHNICAL DATA

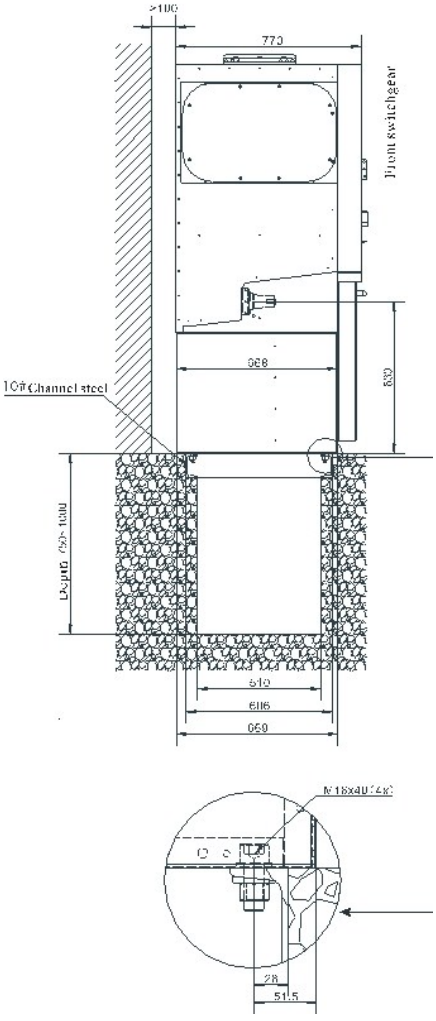
Smart Ring	**Vacuum Circuit Breaker**	**Earthing Switch**
Rated Voltage (kV)	12	12
Power frequency withstand voltage (kV)		
- Phase-to-earth (Europe)	28	28
- Phase-to-phase (Europe)	32	32
- Between open contacts (Europe)	42	42
- Phase-to-earth (China)	42	42
Impulse withstand voltage (kV)		
- Phase-to-earth (Europe)	75	75
- Phase-to-phase (Europe)	85	85
- Between open contacts (Europe)	95	95
- Phase-to-earth (China)	75	75
	95	95
Temperature rise test with load, (50 Hz)		
- Europe	630A	
- China	1,1x639 = 693A	
Mechanical operation test, circuit breaker (Europe)	2000 operating cycles (close-to-open)	
Mechanical operation test, earthling switch (Europe)	1000 operating cycles (close-to-open)	
Short-time withstand current test (Ik/Ip)		
- Europe	20kA/50kA, 2 sec	
- China	20kA/50kA, 4 sec	
Making and breaking capacity of ciruit breakers:		
- Europe	20 kA (5 times at 100%)	
- China	20 kA (30 times at 100%) class E2	
Making capacity of earthing switch:		
- Europe	20 kA, 2 times class E1	
- China	20 kA, 5 times class E2	
Smart Ring switchgear can be operated in temperatures between – 50 - +40 degrees Celsius.		
Protection relay can be operated in temperatures between -40 - + 40 degrees Celsius.		

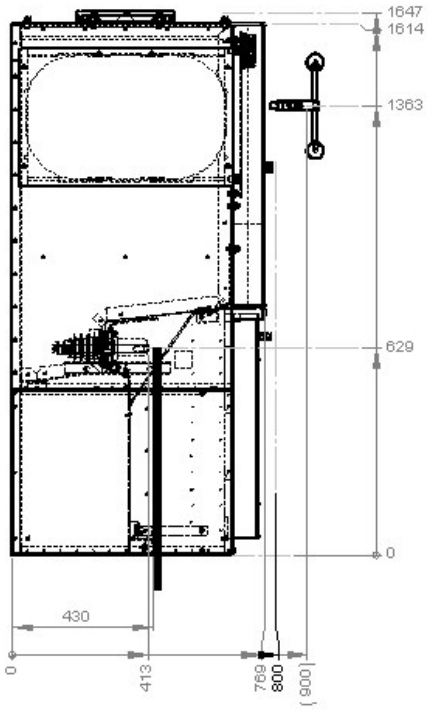
Enclosure acc. To IEC 62271-200

IP4X, LSC2B

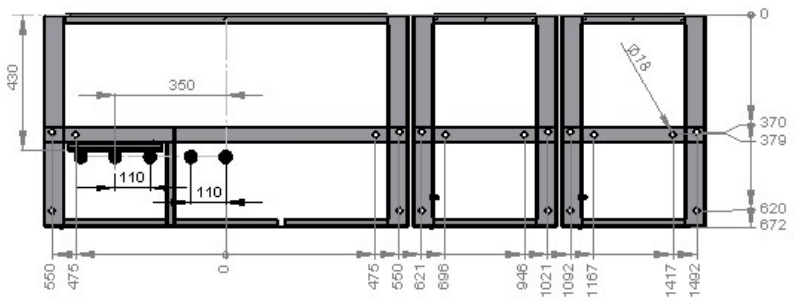
4. INSTALLATION

The base must be flat (+/- 2 mm per meter) and fitted with anchor bolts in accordance with the dimensional drawing for the number of units. To avoid problems with surface in old rooms, steel base frame is recommended (dim. according to switchgear footprint).



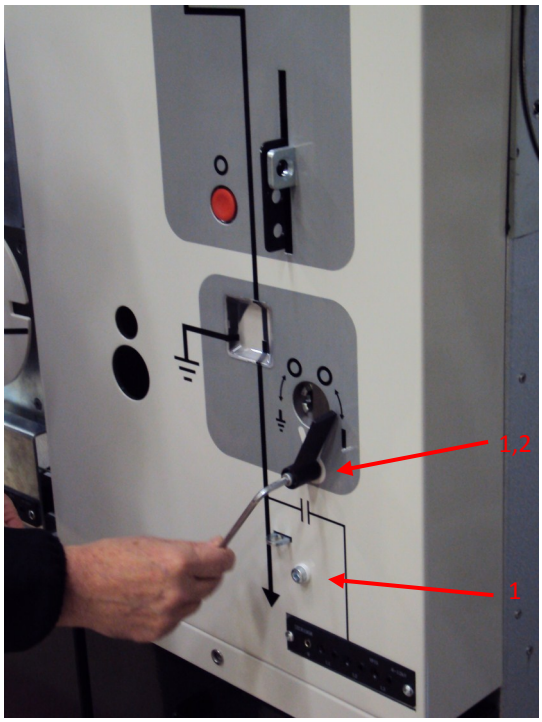


FOOTPRINT 3 BAY, 4 BAY , 5 BAY



SECTION A-A

4.1 FRONT COVERS



1. Loosen the two screws.

<u>Removal of the front covers</u>

1. Loosen the two screws on the front cover.

   One Allen wrench is needed.

2. Remove the selector.

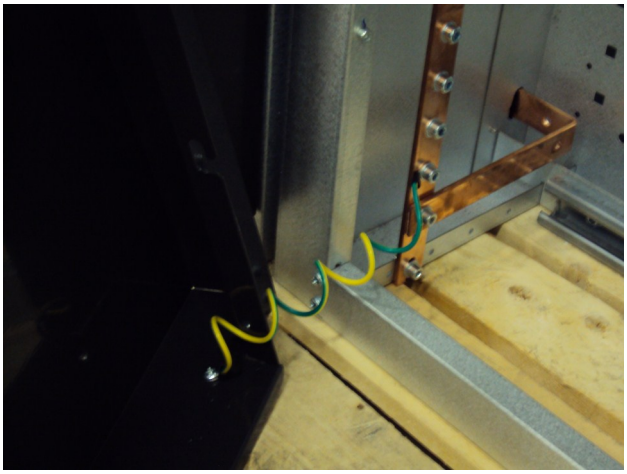
3. Pull off the front cover.

3. Pull off the front cover.

4.2 CABLE COMPARTMENT

Cable Compartment

1. Lift up and pull out the door.
2. Remove earthing cable.



Do NOT forget to re-attach the earthing cable.

Cables to be properly fitted to the anchor bar with cable clamps.

4.3 CABLE CONNECTION

Smart ring is equipped with external bushings which comply with DIN47636T1 & T2/EDF HN 525-61 for termination of cables. The bushings manage 630A when using bolt type connections.

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

Switchgear is suitable for cables up to 300 $mm^{2.}$

Two cables in parallell can be connected and existing cable cover can be used.

(If there are other requirements, please contact us.)

Cable terminations

The following types are recommended:

ABB Kabeldon

ABB Kabel und Draht

Elastimold

Raychem

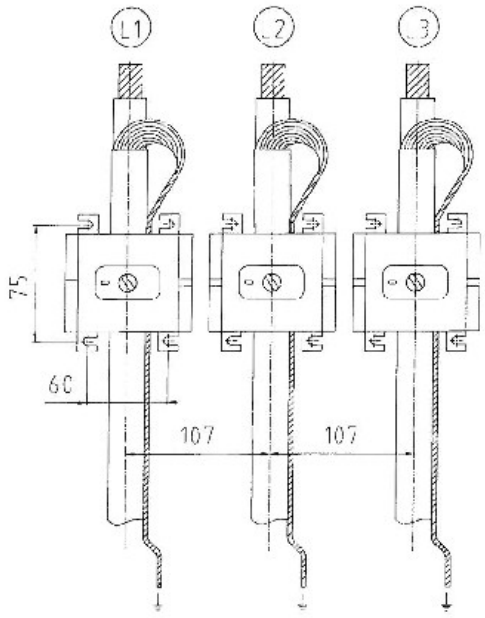
Cooper

3M

See supplier documentation for details.

The manufacturer's installation instructions must be followed.

4.4 CURRENT TRANSFORMERS FOR RELAY PROTECTION



Installing current transformers. The cable shielding is led back through the center hole and earthed.

A protection relay ian be installed in each bay. The cables from the protection relay to the current transformers are placed in the cable compartment, ready for connection to the three current transformers supplied.

Before installation:

- Check that the three current transformers have been delivered and that they are all of the same type.
- Check that the CT's are of the correct type, with the correctly rated transformer ratio, for the distribution transformer's rated current and for the adjustment range on the protection relay (see protection relay manual).

Each current transformer must be mounted onto its high voltage cable before the cable termination is fitted.
The earth shield on the cable must be led back through the center hole in the current transformer and earthed on the earthing bar in the cable compartment. A mounting plate for the current transformers is fitted in the cable compartment.

After the current transformers have been installed in the unit, the cables from the protection relay are connected. Consult the manual supplied with the protection relay for a description of the connections.

4.5 Protection Relay

Smart Ring transformer bays are equipped with protection relays type SEG WIC1-2PE. It is a CT-powered protection relay with inverse time and definite time protection characteristics and is specifically designed for switchboards with circuit breakers and small rated output currents. Together the specific CTs and the WIC1 form a joint protective system. No external auxiliary supply is needed for correct functioning, only a low-energy tripping coil.

Smart Ring can easily be combined with advanced protection relays. The CT's are placed in the cable compartments and the protection relays in a separate enclosure or cubicle above or beside the switchgear. Those kinds of protection relays require external auxiliary supply. To make installation and commissioning more convenient a termination box is recommended to which all internal wires are connected.
Available as an option, see chapter 5.7.

Dependent on the rated primary power and voltage of the system, the following CT's can be used. WIC1-W2 or WIC1-W3 are included in our offer, if requested, other CT types can be supplied.

CT Type	Rated CT current IS
WIC1-W1	8-28 A
WIC1-W2	16-56 A
WIC1-W3	32-112 A
WIC1-W4	64-224 A
WIC1-W5	128-448 A
WIC1-W6	256-896 A

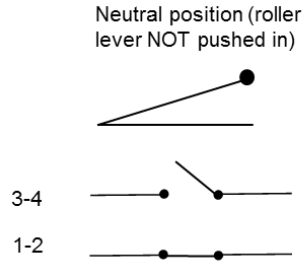
5. ADDITIONAL EQUIPMENT

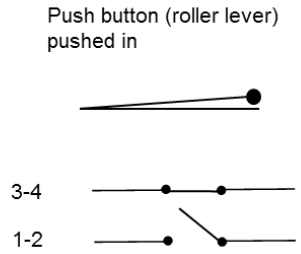
5.1 Auxiliary Switches

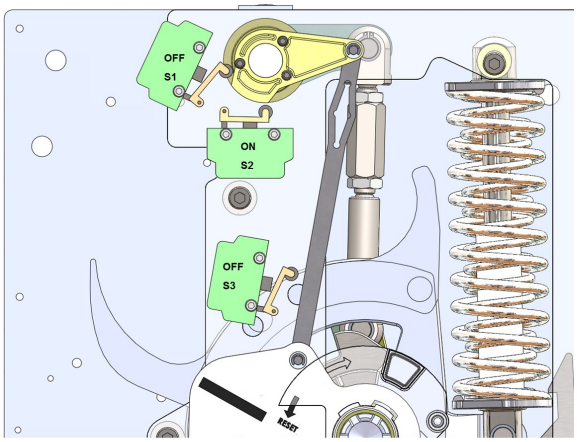
Microswitches can be supplied to indicate circuit breaker position and position of disconnector/earthing switch. A shunt for external tripping of the circuit breaker (AC or DC) can be provided. Function and location is described below.

X= pushed in

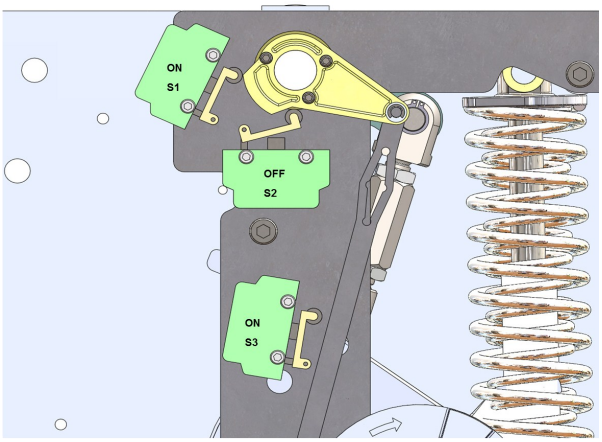
Switch	Breaker ON	Breaker OFF	RESET position	PRIMED RC position	Earth ON	Earth OFF	Discon ON	Dicon OFF	Shutter mid position	Shutter NOT mid position	Red button IN	Red button OUT	MD parked	MD RESET	MD starts	Solenoid external "OFF"	Solenoid for RC "Off"
S1		X													x		
S2	X																
S3		X													x	x	
S4							X										
S5					X												
S6					X			X									
S7										X							
SW1													X				
SW2														X			
RC1				x													x
RC2			x	x													



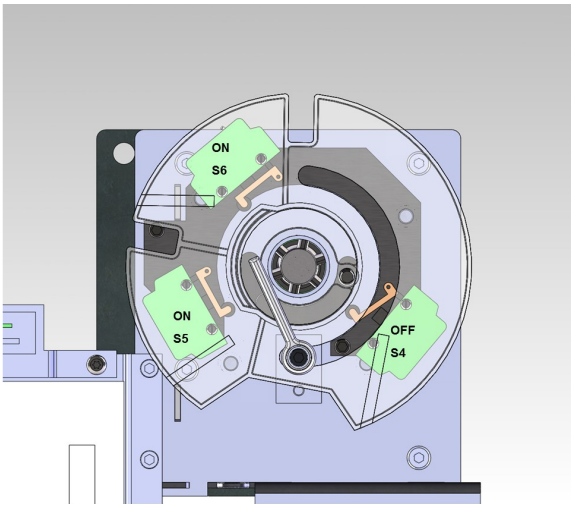




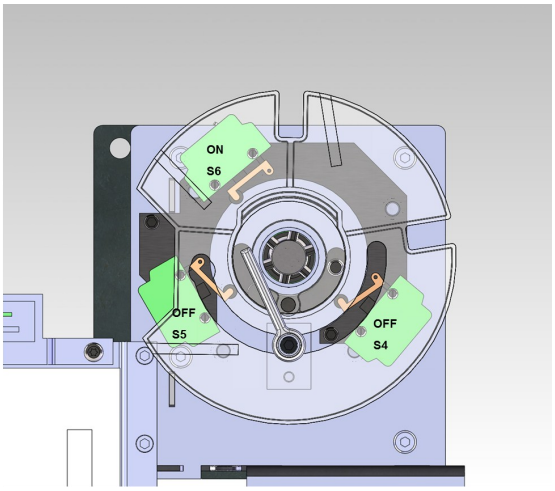
2000 MECH CLOSED POSITION



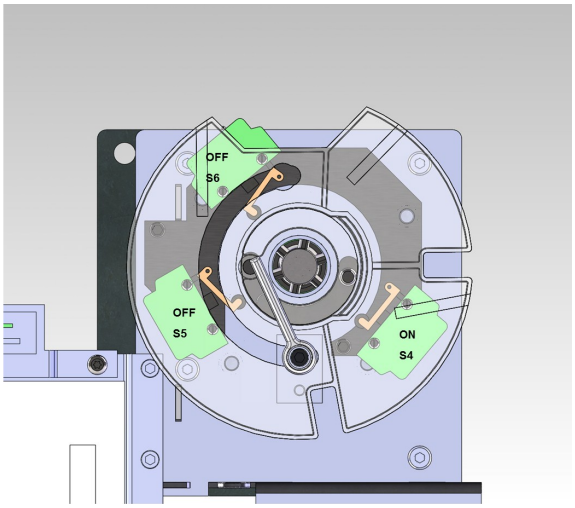
2000 MECH OPEN POSITION



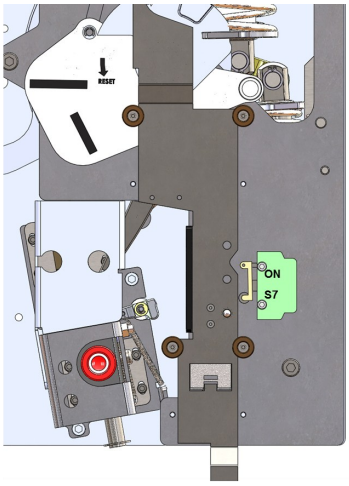
2100 EARTH POSITION



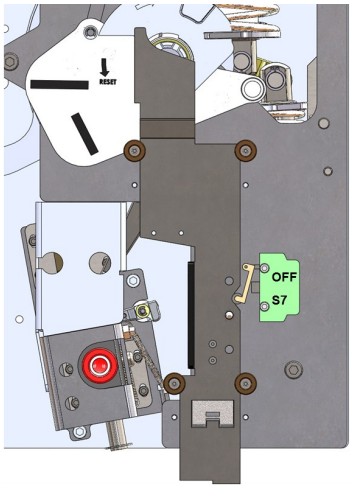
2100 OFF POSITION



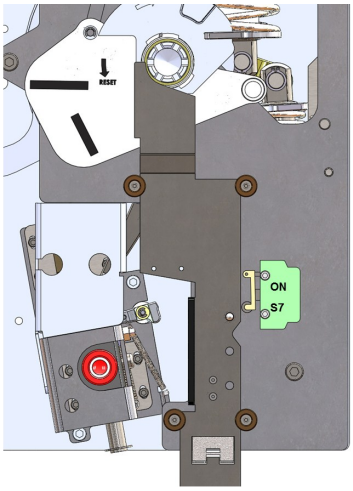
2100 ON POSITION



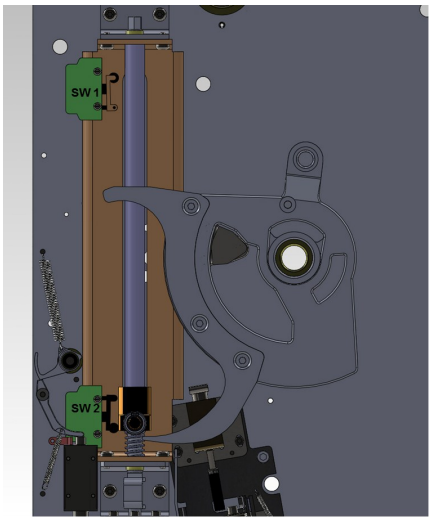
SHUTTER UPPER POSITION



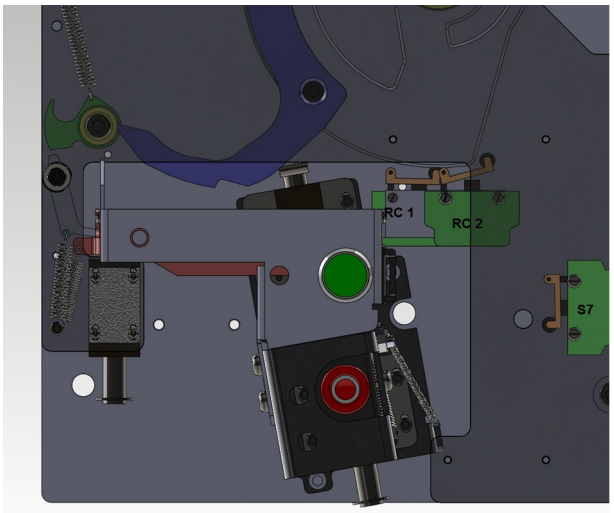
SHUTTER MIDDLE POSITION



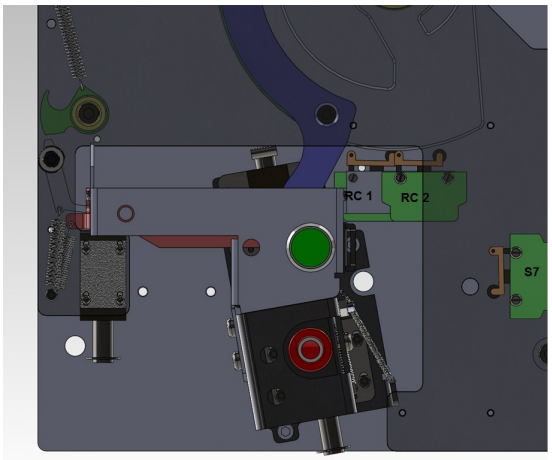
SHUTTER DOWN POSITION



MOTOR DRIVE – HERE SHOWN DOWN



RC in PRIMED POSITION



RC in RESET POSITION

5.2 Motordrive

Version 1

Smart Ring can be equipped with a motor drive for remote control. The function is such that after remote start impulse, the motor starts to charge (about 20 secs) the springs and will continue with the maneuver until the circuit breaker is switched to ON position. The breaker is switched OFF by a shunt trip coil or by a push button on the front cover. A detailed manual is available.

Version 2

Smart Ring can be equipped with a motor drive for remote control. The function is such that the motor drive will start to charge (about 15 secs) the springs as soon as the breaker reaches OFF position. The springs will be charged and the operational mechanism stays in a position ready to close the circuit breaker. The breaker is then switched ON remotely by a shunt trip coil or with a push button on the front cover. The breaker is switched OFF by a shunt trip coil or by a push button on the front cover. A detailed manual is available.

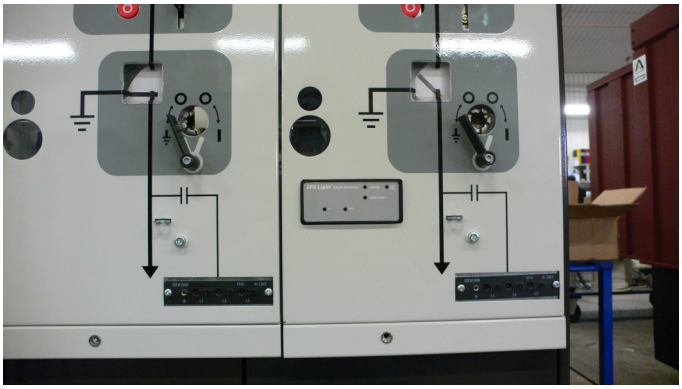
Available supply voltage for MD 24 VDC, 48 VDC, 110 VDC and 230 VAC (rectifier is needed).

5.3 Remote Control (RC), springs are manually charged

All bays can always be switched to Off position remotely by adding an optional shunt trip coil. It also possible to provide Smart Ring with an optional function which makes it possible also to switch On a circuit breaker remotely. Observe that the spring need to be charged manually and left in the position when operational mechanism stay in the position ready to close the circuit breaker. A micro- switch indicates when the spring is charged. This version is especially developed to be used in combination with fault indicators in a typical open loop cable system to avoid expensive and complicated motor drives.

5.4 Fault Indicators, type Protrol

Smart Ring is especially designed for combination with Pro Trol fault indicators which can be easily integrated into the switchgear. Normally it is enough to install a fault indicator in one of the cable feeder bays. Special low voltage CT´s is provided. The fault indicators manage not only to indicate short currents and the direction of the fault but also small earth fault currents in high resistance earthed systems and the direction of the fault. A more detailed description is available.



5.5 Extension with more bays at site

It is possible to extend the Smart Ring at site in both left and right direction. Busbar must be deenergized. Mandate to do the work has only persons with written authorization from HM Power. Please make contact with us for further information.

5.6 Change a line feeder into a transformer bay and vice versa

A transformer bay kit is provided for changing a line feeder into a transformer bay. The kit consists of CT's, a protection relay and tripping coil. By adding them to a line feeder a transformer bay is obtained.

By removing CT's, protection relay and tripping coil from a transformer bay it is changed into a line feeder.

5.7 Top entry box for low voltage cables

When using Smart Ring as a distribution center with motor drives in most of the bays,the switchgear is provided with a top entry box for easy installation and to simplify tests and commissioning. Easy access to the terminations is convenient during the switchgear's whole life-time because all circuits can be tested from the terminations in the box.

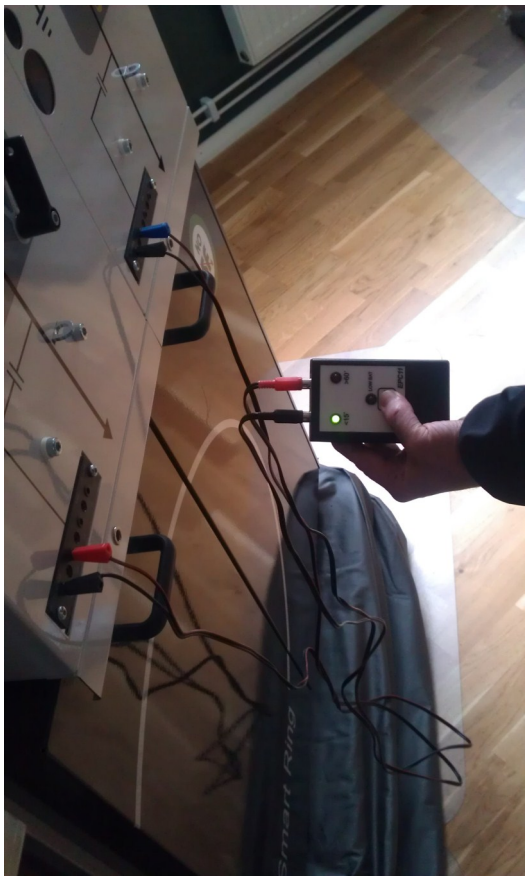
Top entry box can also be provided as an option when Smart Ring is used as a Ring Main Unit.

5.8 Metering Cubicle

Metering cubicle for hosting Current Transformers and single phase Voltage Transformers for metering purpose is available. The cubicle is single phase insulated. Connection with the switch gear is made by single phase insulated cable (normally not included).
Low voltage compartment is accessible from the front.

5.9 Electronic Phase comparator

Capacitive voltage indicators are included on all bays of Smart Ring.
An electronic phase comparator is used for phase comparison of two voltages.
It enables an easy and quick determination of phase balance or unbalance between two MV distribution systems.



6. ENVIRONMENTAL CERTIFICATION

Life Expectancy of Product

The product is developed in compliance with the requirements of standard IEC 62271.
Smart Ring is gas free and designed for an expected life time of 35-40 years.

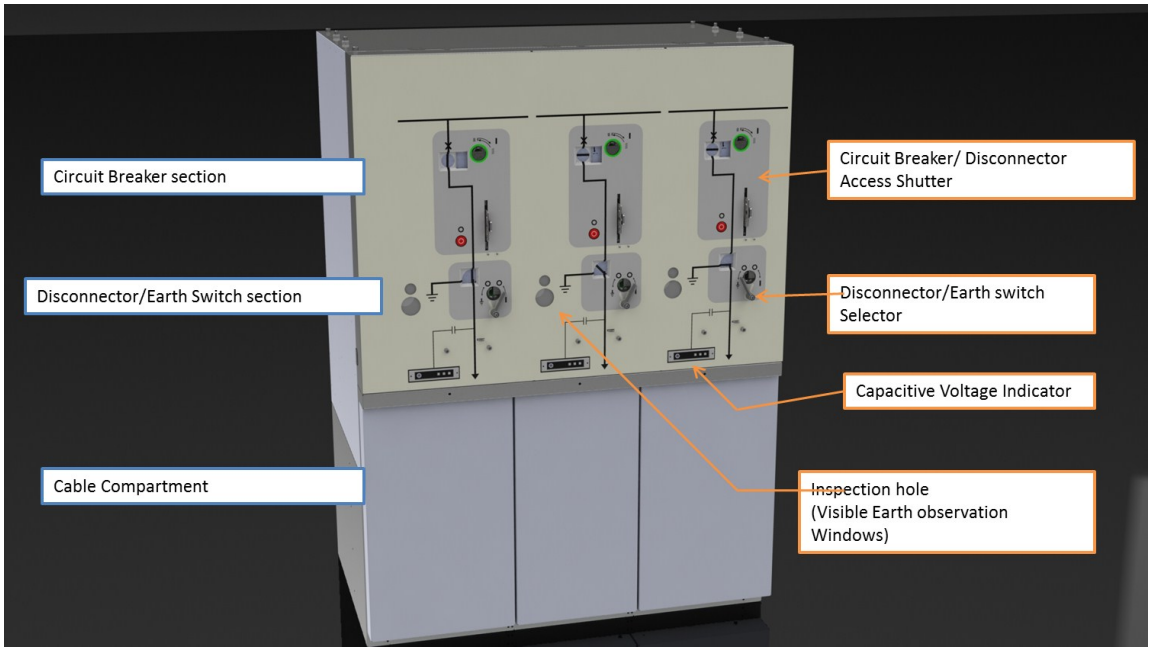
Recycling Capability

RAW MATERIAL	WEIGHT	% OF TOTAL WEIGHT 419 KG	RECYCLABLE	RECYCLING PROCESSES
Iron	259,67	61,97%	Yes	Utilise in favor of new source
Stainless Steel	11,24	2,68%	Yes	Utilise in favor of new source
Copper	70,80	16,90%	Yes	Utilise in favor of new source
Brass	1,15	0,27%	Yes	Utilise in favor of new source
Aluminium	4,92	1,17%	Yes	Utilise in favor of new source
Zinc	1,32	0,31%	Yes	Utilise in favor of new source
Silicon	0,66	0,16%	Yes	Utilise in favor of new source
Silver	0,15	0,03%	Yes	Utilise in favor of new source
Spring steel	4,67	1,11%	Yes	Utilise in favor of new source
Thermoplastics				Re-use or apply as energy superior in additive in refuse incineration
ABS	2,21	0,53%	Yes	
PC	4,88	1,16%	Yes	
PE	2,53	0,60%	Yes	
Polyester (PET)	26,78	6,39%	Yes	
Grivory (PPA)	2,75	0,66%	Yes	
Others	1,68	0,40%	Yes	
Epoxy	4,86	1,16%	Yes	Grind to powder and use as high-grade energy additive in cement mill
Rubber	1,77	0,42%	Yes	High-grade energy additive in refuse incineration
Total for recycling	**402,01**	**95,95%**		
Relay	0,50	0,12%		
Ceramic	7,86	1,88%		
Other material	9,00	2,15%		Paint, tiny components, stickers etc
Total vikt	**419**	**100%**		

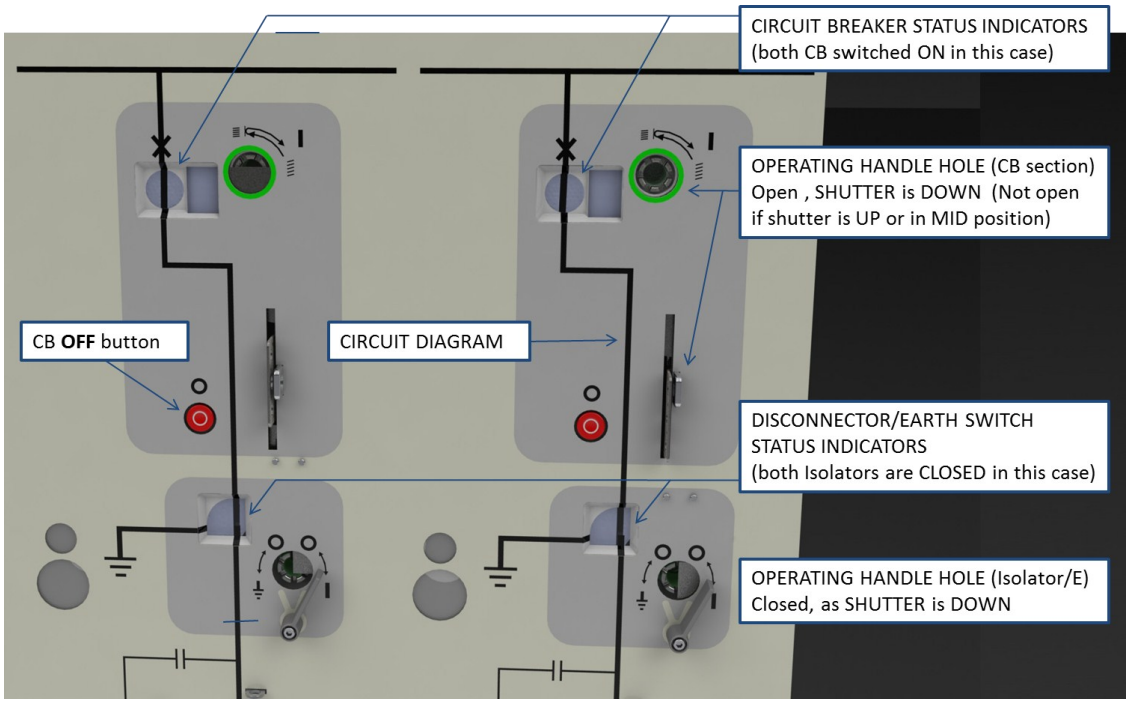
All figures are based on a Smart Ring LLT, 3-bay with one transformer bay.

Smart Ring is constructed of material that has a limited effect on the environment or that can be recycled. We do NOT use SF6 gas that affect the ozone layer and contribute to the Greenhouse Effect. Smart Ring is recyclable to 96%.

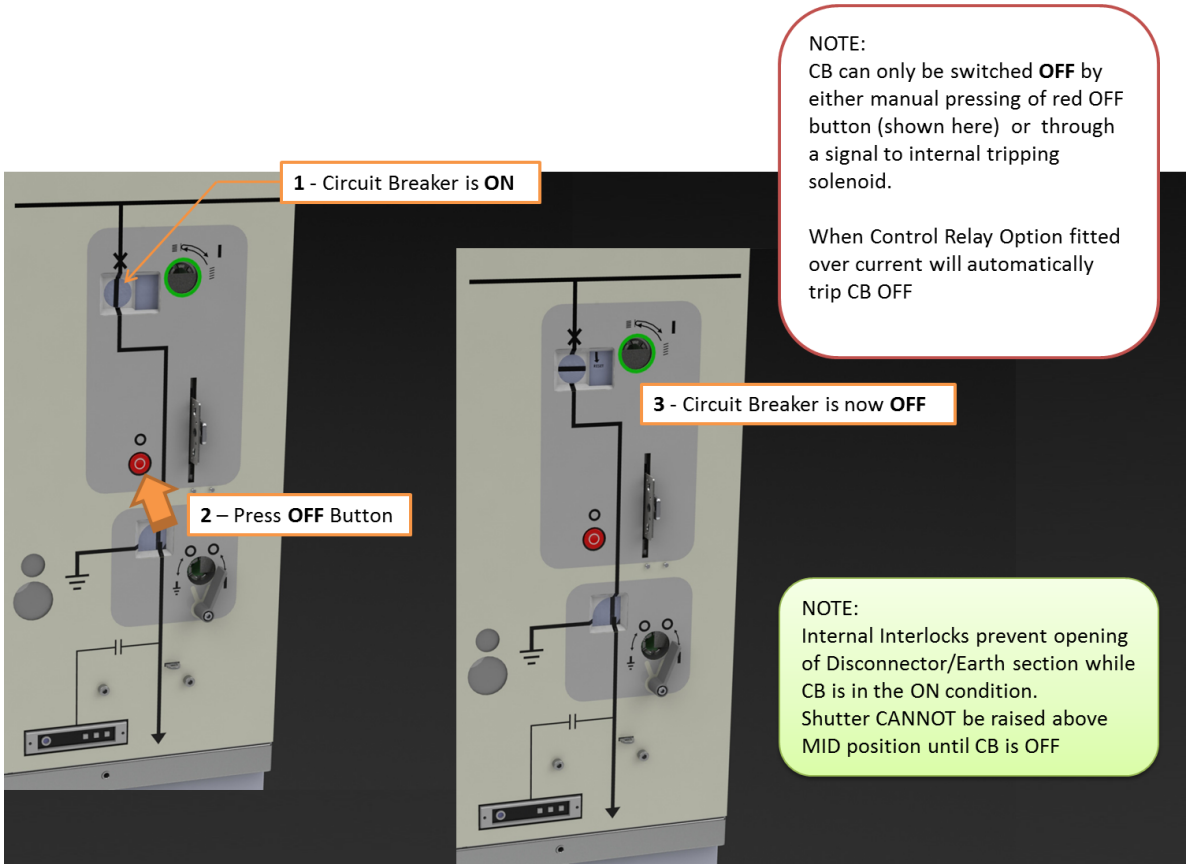
7. SMART RING—INTERFACE AND OPERATING INSTRUCTIONS



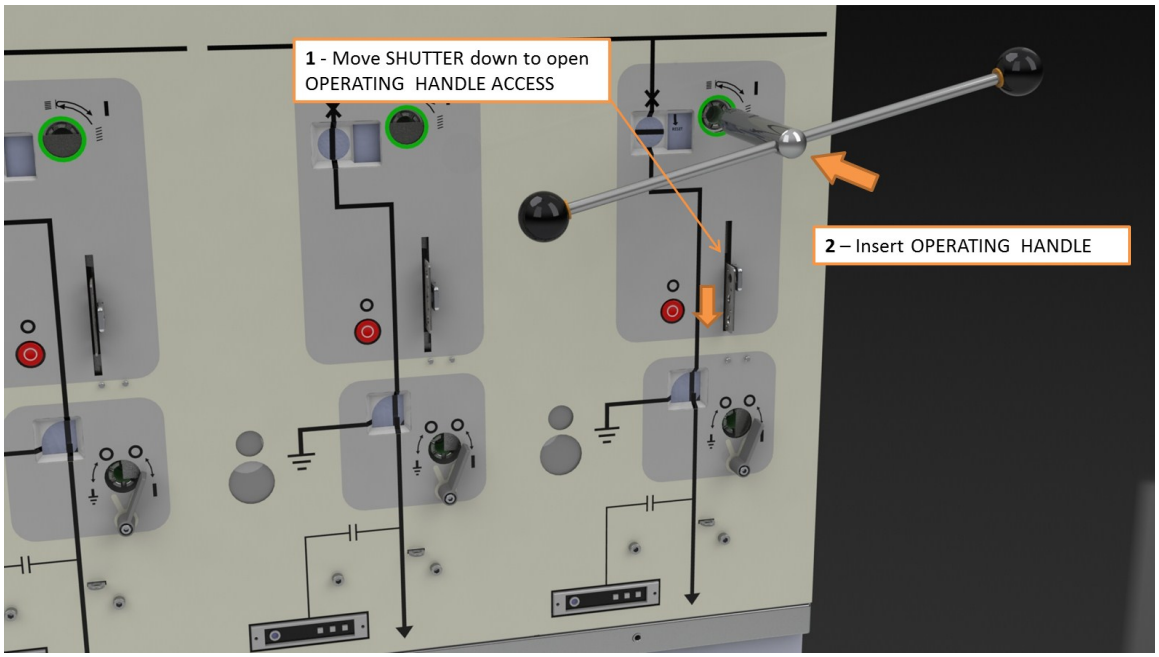
General arrangement of front panel (center & right bay of RMU shown)



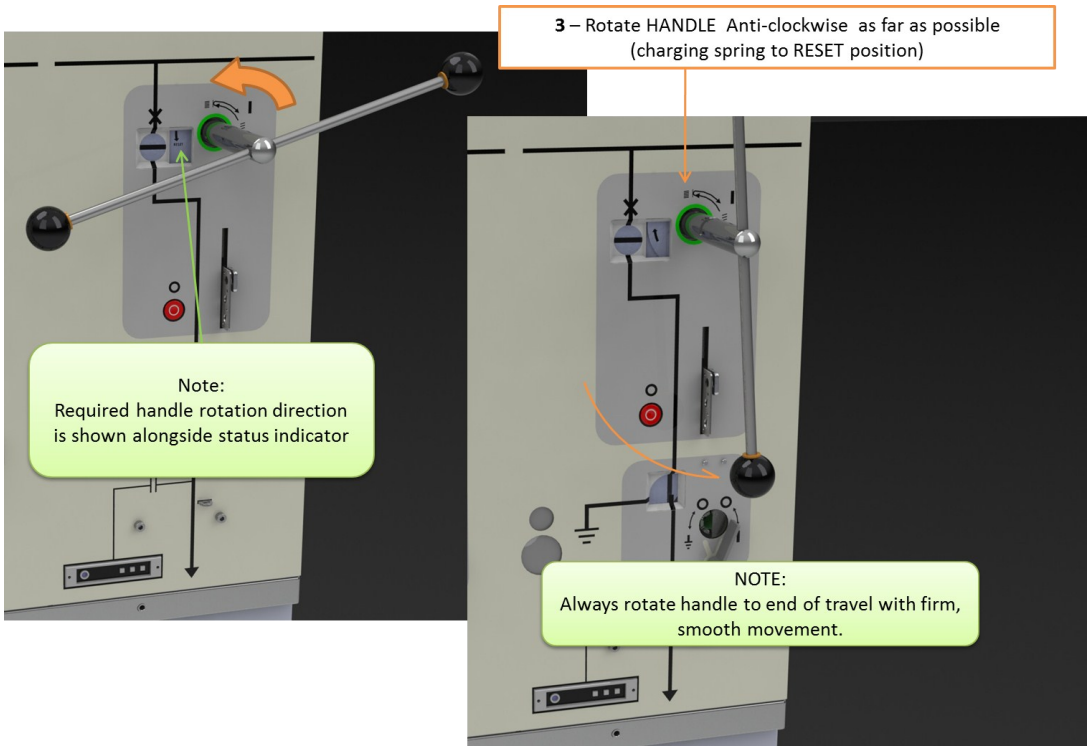
Switching Circuit Breaker (CB) from ON to OFF



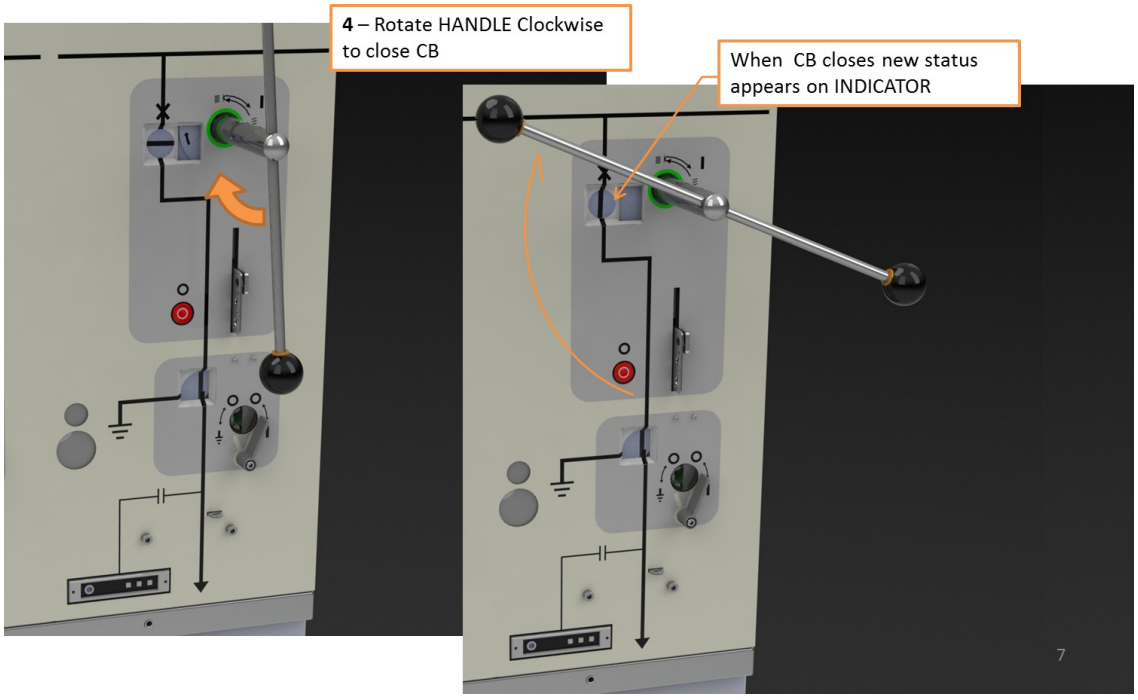
Switching CB from OFF to ON (steps 1-2)



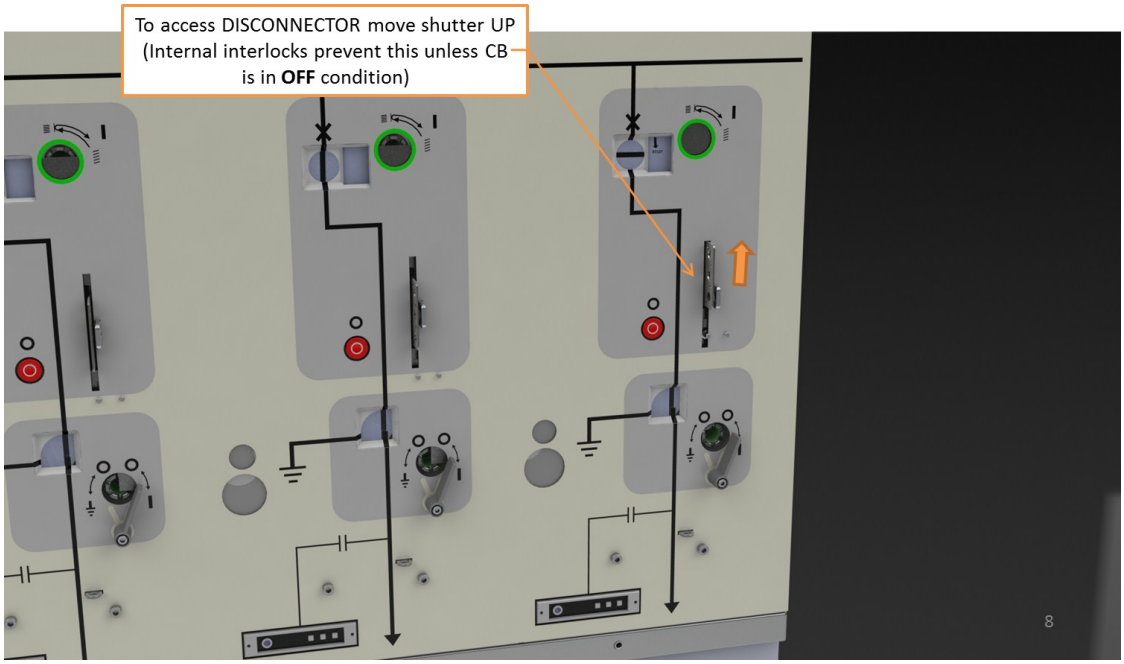
Switching CB from OFF to ON (steps 3)



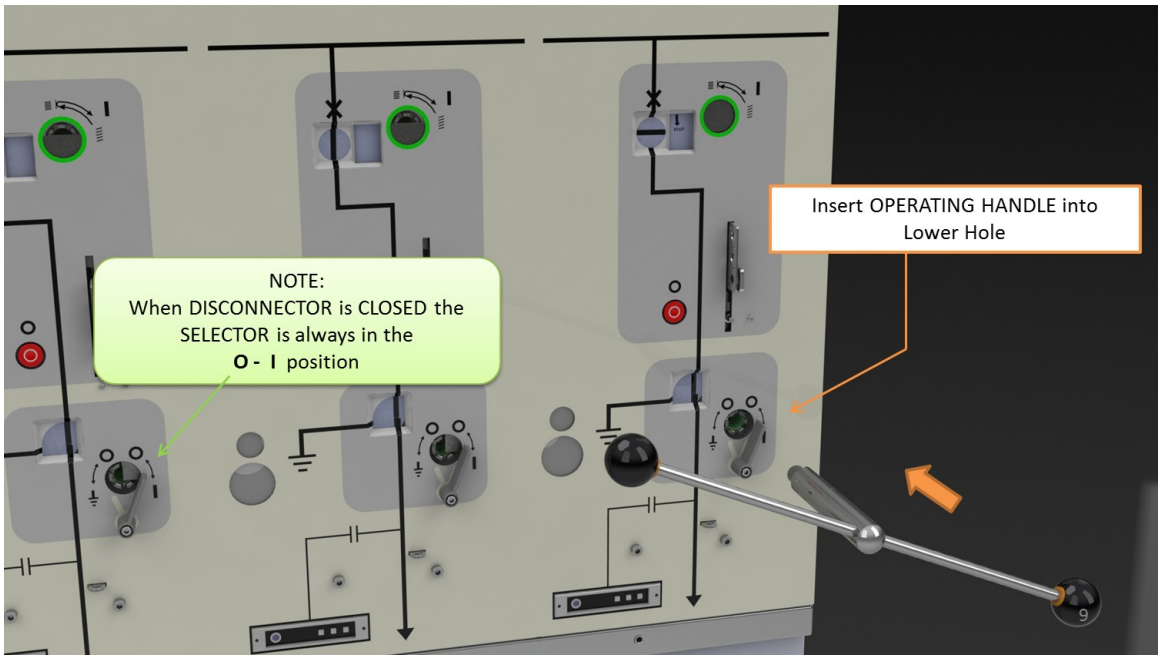
Switching CB from OFF to ON (steps 4)



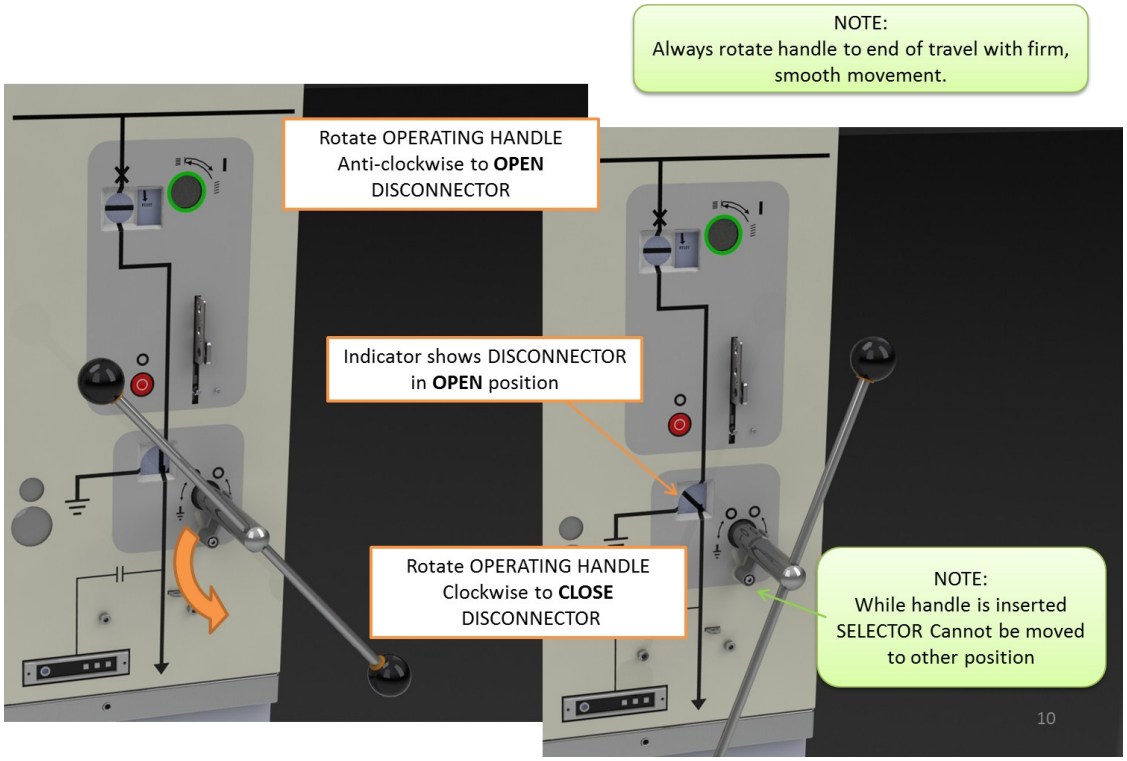
Accessing disconnector / earthing switch (when CB is OFF)



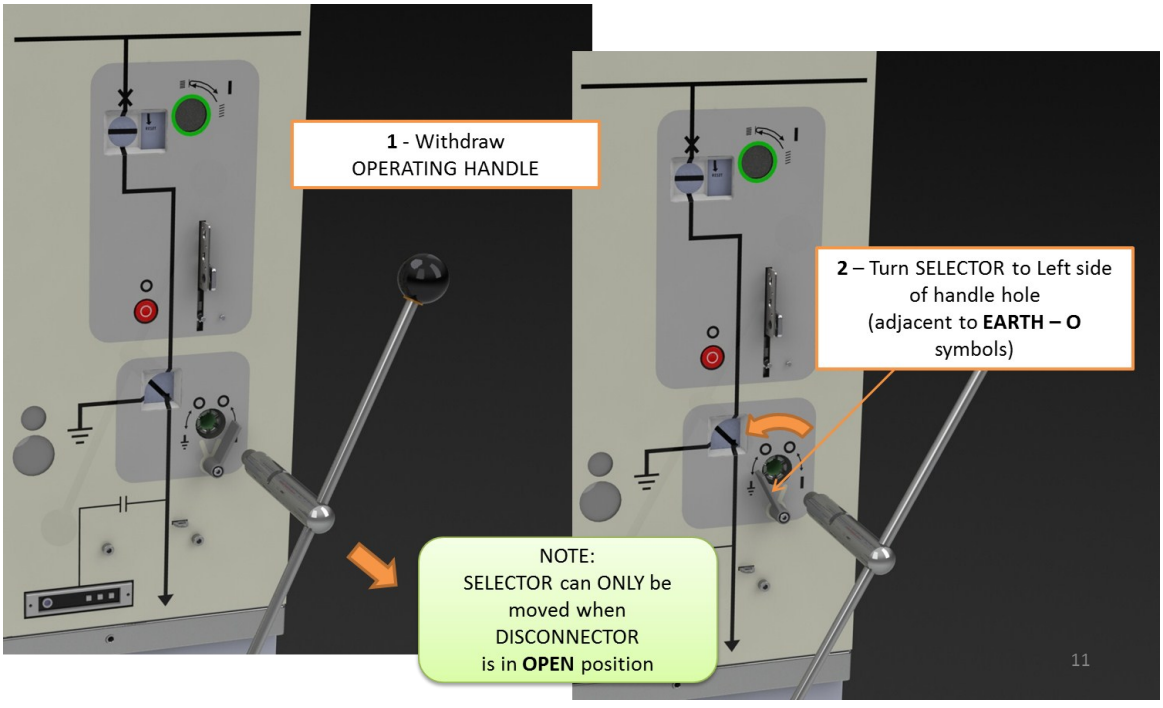
Operating disconnector switch



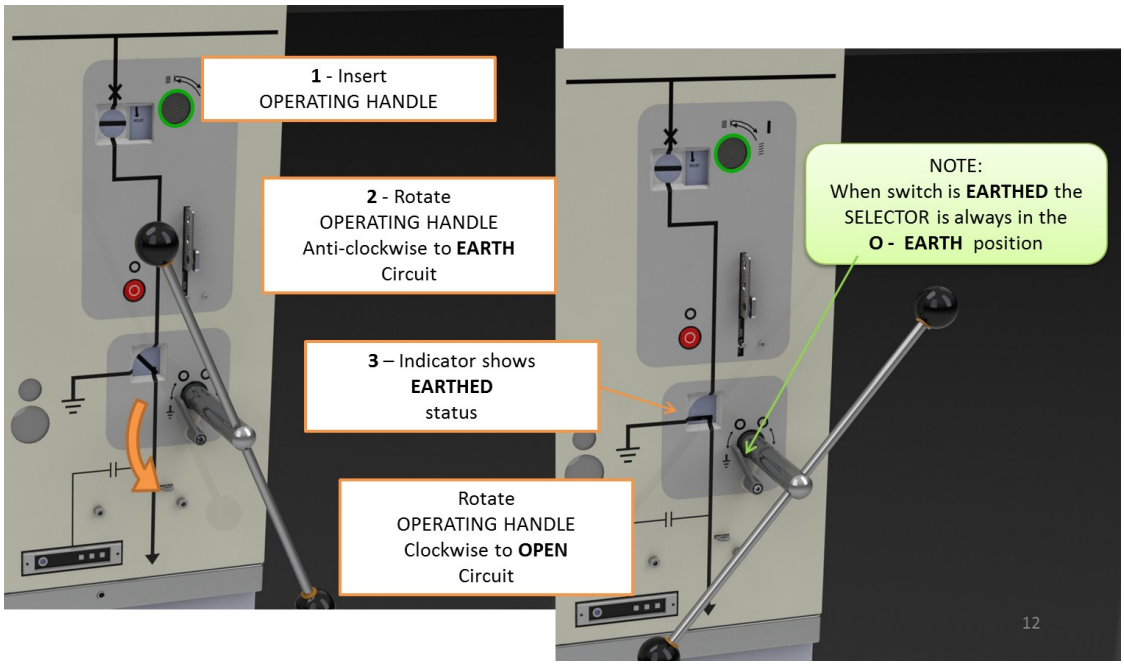
Operating disconnector switch



Accessing Earth switch



Operating earth switch



Smart Ring operating interface example