Sabre *EcoTec*

Ring Main Unit up to 12kV

Operation and Maintenance Manual

Lucy Electric

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1. DOCUMENT SYMBOLS

The symbols shown below are found throughout this document, indicating awareness and hazard levels depending on the situation.

All symbols below are to ISO 3864-2.

INFORMATION: please pay special attention to this instruction.

CAUTION: Failure to follow this instruction may result in injury or damage to plant.

WARNING: Failure to follow this instruction may result in death or serious injury or damage to plant.

DANGER: Failure to follow this instruction will result in death or serious injury or damage to plant.

2. VALIDATION

2.1 Validity

This is not a commercial document, it is strictly a technical document provided by Lucy Electric Technical Department.

The objective of this publication is to provide directives for correct installation, test and commissioning procedures for the SabreEcoTec range. Produced in July 2024, this manual applies to the SabreEcoTec range only.

Due to Lucy Electric's policy of continuous research and development, Lucy Electric reserves the right to change the design and specification of products without prior notice.

2.2 Safety

Operators of this equipment must have experience and expertise with switchgear.

To prevent personal injury or equipment damage, this manual must be read carefully.

This manual MUST be readily available whenever the unit is handled or installed.

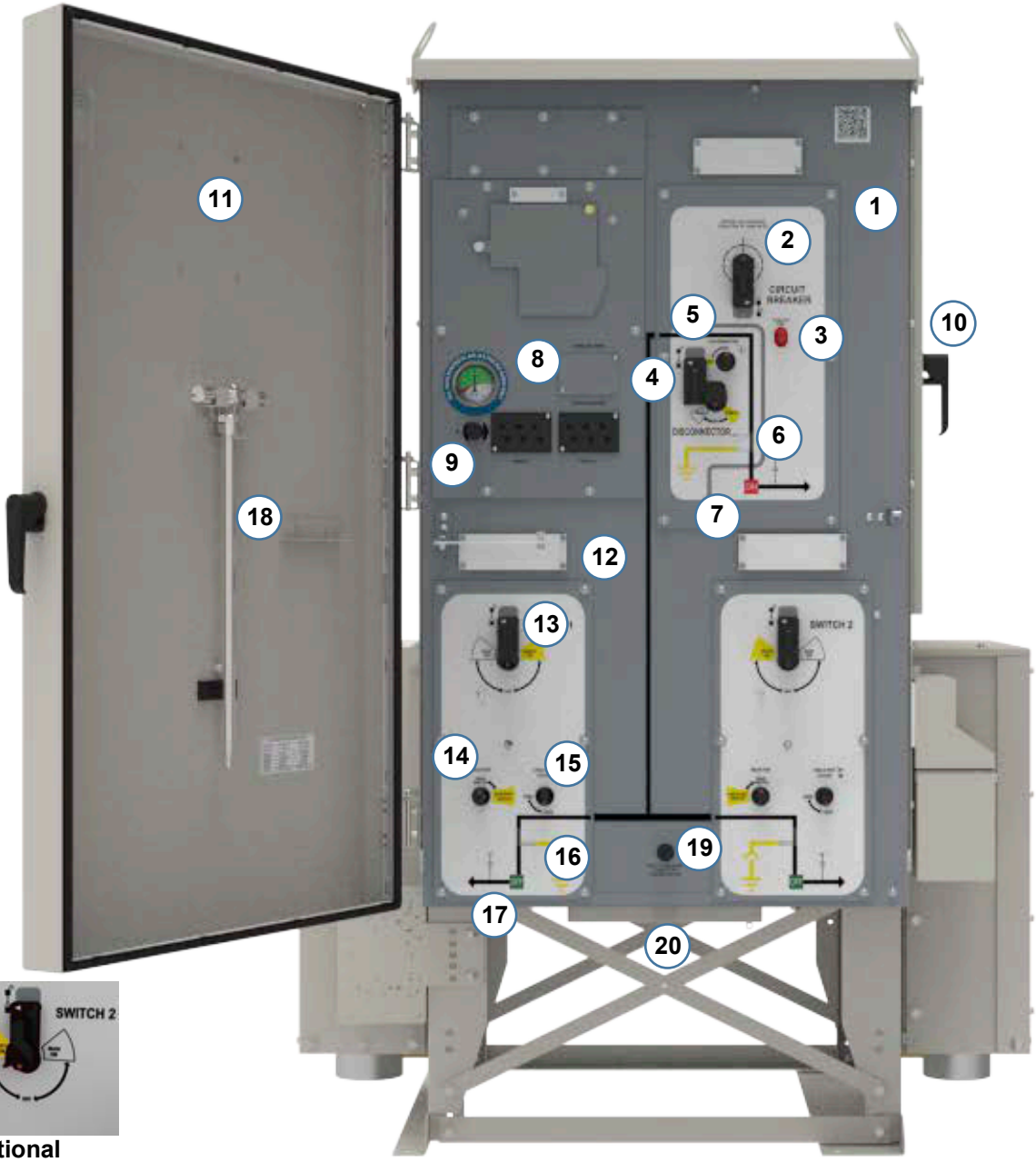
If this equipment suffers from any fault or damage, contact the manufacturer and/or supplier immediately.

- Before commencing any work, ensure that the necessary safety precautions, risk assessments, and safety documents are in place.
- Installation must be carried out observing the Operational Safety Rules.
- Check substation earth is intact - if missing, seek advice.
- In all instances, risk assessments should be undertaken prior to undertaking any new activity where potential hazards are concerned. This is particularly important in order to identify the necessity for specific Personal Protective Equipment, that may be required and that cannot be avoided even with safe systems of work in place.
- It is strongly recommended when undertaking any form of switching operation that the appropriate PPE is worn. PPE suppliers provide Flash resistant or Arc Flash clothing for this purpose.

This manual covers the complete range of SabreEcoTec units and therefore images shown may not be the unit being installing.

3. FRONT PANEL LAYOUT

3.1 SabreEcoTec VRN2e

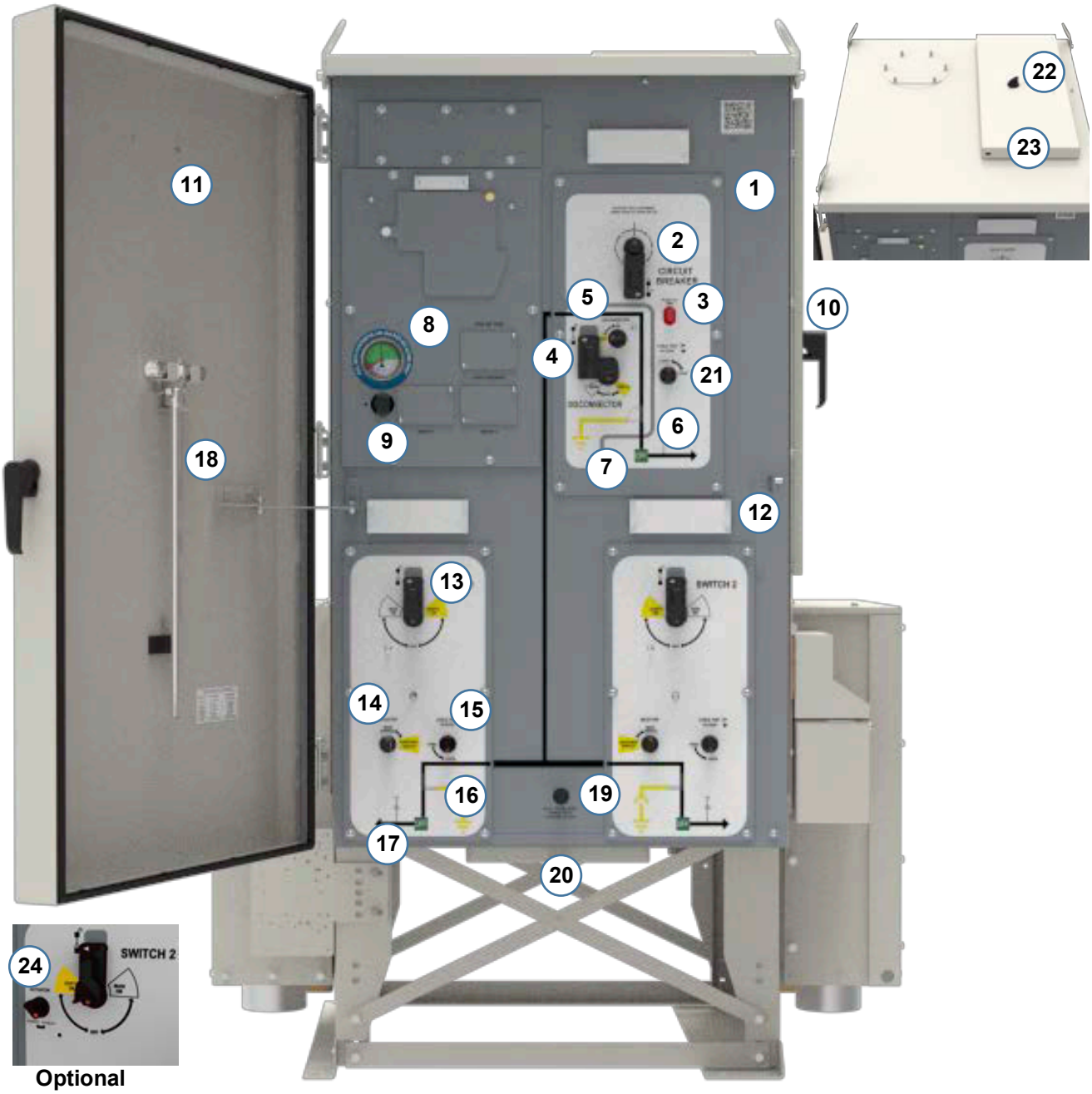


Optional

Key:

1 : Fascia/Front Panel
2 : Circuit Breaker/T-Off Operation
3 : 'Push To Trip' Button
4 : Circuit Breaker Disconnector Operation
5 : Circuit Breaker Disconnector Selector
6 : Circuit Breaker Disconnector Indication
7 : Circuit Breaker Indication
8 : Pressure Indication
9 : Self Sealing Top Up Valve - ½"BSP
10 : Marshalling Box
11 : Front Door
12 : Circuit Label - Customer Customisation
13 : Load Break Switch Operation
14 : Load Break Switch Selector Operation
15 : Load Break Switch Cable Test Interlock
16 : Load Break Switch Selector Indication
17 : Load Break Switch Indication
18 : Operating Handle
19 : Load Break Switch Cable Test Access Cover Release
20 : Load Break Switch Cable Test Access
21 : Actuator Enable/Disable Selector (Optional)

3.2 SabreEcoTec VRN6e



Optional

Key:

1 : Fascia/Front Panel
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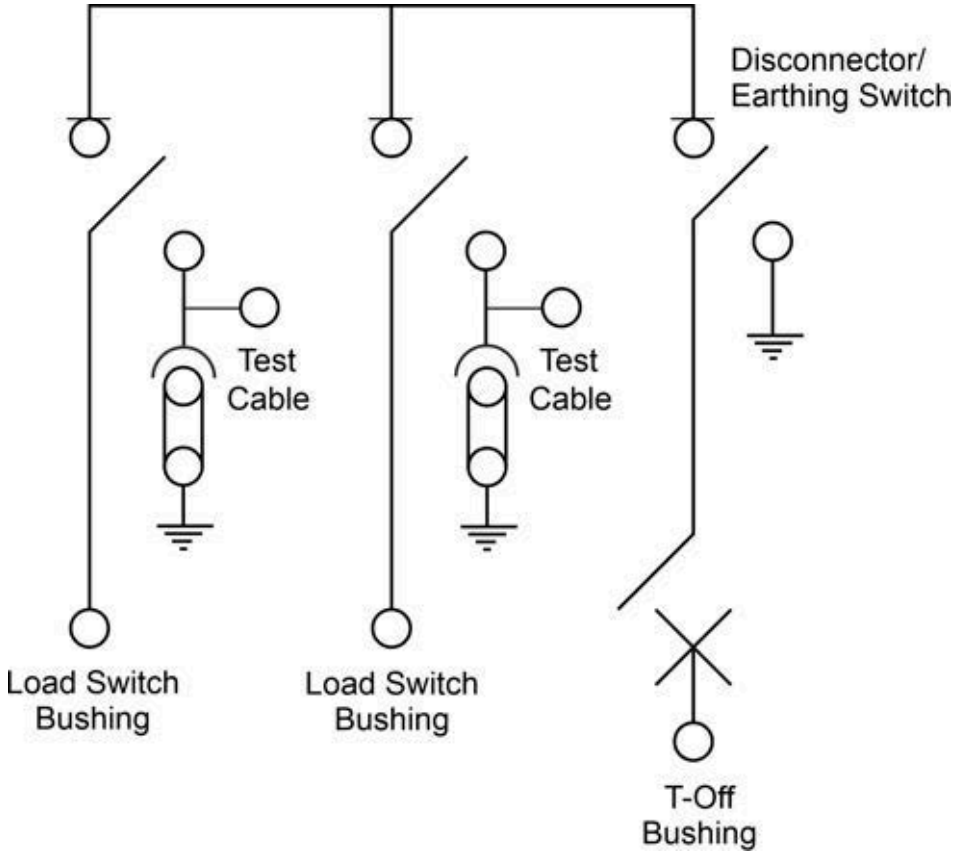
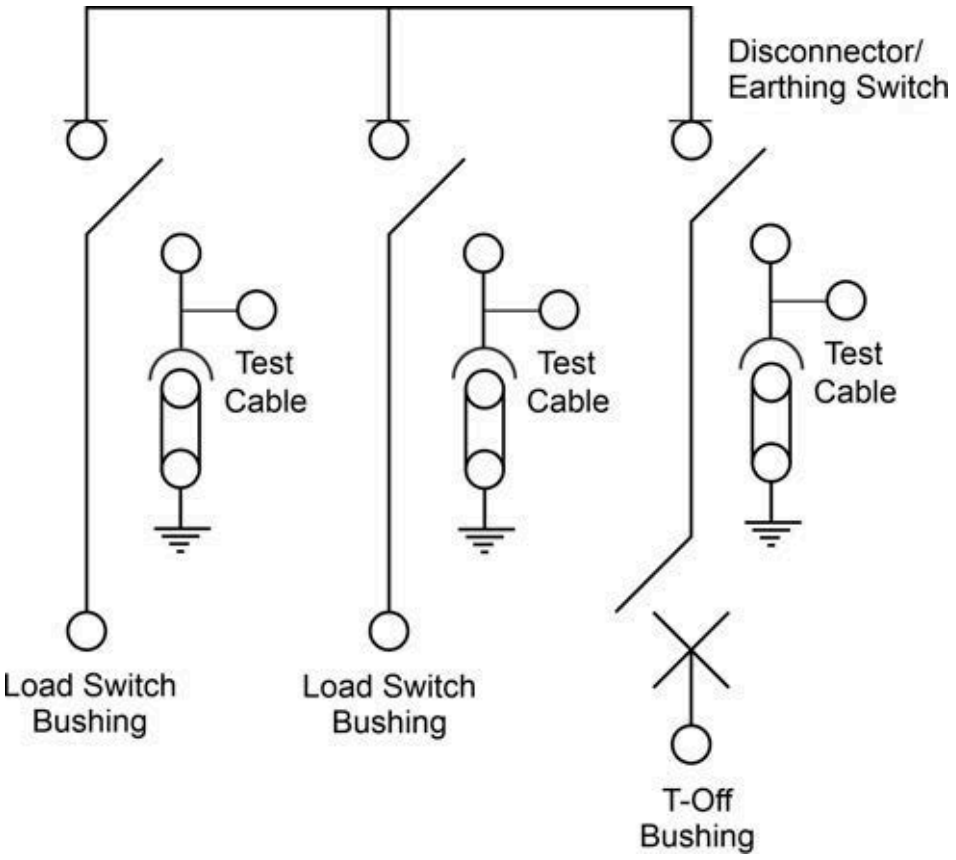
16 : Load Break Switch Selector Indication
17 : Load Break Switch Indication
18 : Operating Handle
19 : Load Break Switch Cable Test Access Cover Release
20 : Load Break Switch Cable Test Access
21 : Circuit Breaker Cable Test Interlock
22 : Circuit Breaker Cable Test Access Cover Knob
23 : Circuit Breaker Cable Test Access Cover
24 : Actuator Enable/Disable Selector (Optional)

4. LINE DIAGRAMS

4.1 VRN2e



4.2 VRN6e

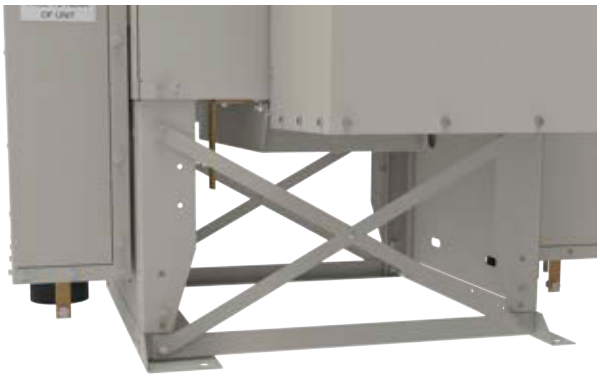


5. PRIOR TO ENERGISING

⚠ CAUTION

Check that the connection bushings are fitted with connectors or with insulating caps.

Check that the SabreEcoTec Unit is connected to the substation Earth.



Pressure check of the unit in operation

⚠ WARNING

The SabreEcoTec needle must be within the 'GREEN zone when checking the Pressure indicator.

If the needle in the RED zone, the unit must not be energised and should be replaced immediately. Contact Lucy electric for further information.

6. SabreEcoTec Operation

6.1 SabreEcoTec Unit

6.1.1 Obtaining the Operating Handle

Operating handle is located on the inside of the front door of the unit.
Detach handle from support brackets by lifting.

WARNING

Check the pressure indicator on the front panel. Ensure the pointer is in the GREEN zone before any switching operations are carried out.

INFORMATION

The operating handle has a ratchet system, therefore the position for the following images are for guide purposes only.

6.2 Operation Indication Symbols

INFORMATION

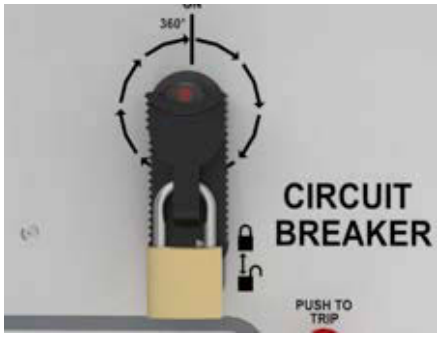
The SabreEcoTec unit has standard indications symbols that are used in this manual. These may be different to unit supplied, depending on country and/or customer (This does not affect the operation on the unit).

CAUTION

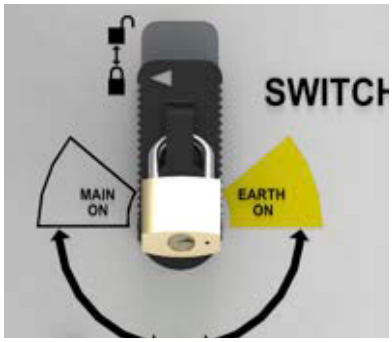
If the operator does not follow the correct operating procedure whilst operating either mechanisms there is the potential for the fail-safe facility within the handle to operate and render the operating handle useless for further operations

6.3 Padlock to Prevent Operation

Lock the **'CIRCUIT BREAKER'** slide cover in place using the padlock, as shown below



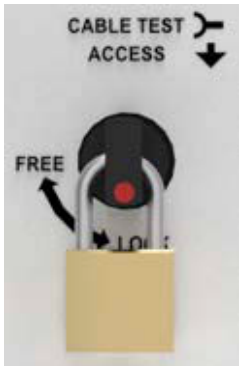
Lock the **'LOAD BREAK SWITCH** slide cover in place using the padlock, as shown below



Lock the '**DISCONNECTOR**' in two places slide cover in place using the padlock, as shown below

Lock the '**SELECTOR**' slide cover in place using the padlock, as shown below

Lock the '**CABLE TEST ACCESS SELECTOR**' using the padlock, as show below.



Lock the '**PUSH TO TRIP BUTTON**' using the padlock, as show below.

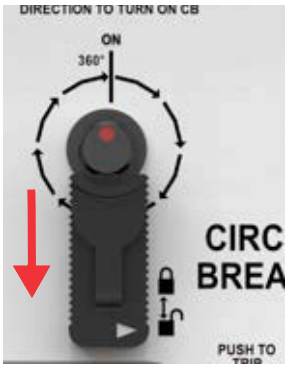
6.4 Circuit Breaker Operations

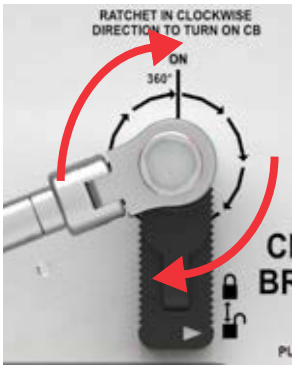
6.4.1 Circuit Breaker 'OFF' to 'ON'

INFORMATION

Check the Disconnector is in the 'ON' position before operating.

1 : Remove **'CIRCUIT BREAKER'** padlock if fitted and pull down the **'CIRCUIT BREAKER'** Slide Cover into the unlocked position.
With the operating handle on the **'CIRCUIT BREAKER'** boss, rotate the ratchet mechanism 360° clockwise. The ratchet mechanism enables this operation to be carried out in multiple small rotations.At the end of the operation the **'CIRCUIT BREAKER'** will close to main **'ON'**.





INFORMATION

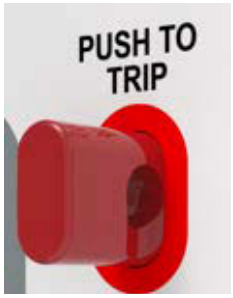
Indication now displays 'ON'.

INFORMATION

The round recess (red dot) on the 'Circuit Breaker' boss (shown below) should be at 12 O'clock. If not at 12 O'clock then the Circuit Breaker mechanism is partially charged.

6.4.2 Circuit Breaker ‘ON ’to ‘OFF’

1 : Remove padlock if fitted from Circuit Breaker PUSH TO TRIP button and Press in the Circuit Breaker Mechanism ‘PUSH TO TRIP’ button **(RED BUTTON)** to trip.



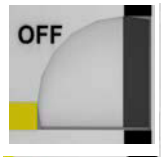
2 : Then release, once the Circuit Breaker has tripped.
(Optional) secure the Circuit Breaker PUSH TO TRIP button using a padlock.

WARNING **Do not use excessive force on the red button.**

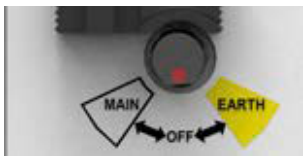
6.4.3 Circuit Breaker ‚MAIN’ to ‘OFF’ and ‘OFF’ to ‘EARTH ON”

INFORMATION **For this operation, the ’Circuit Breaker’ must be in its ’OFF’ position**

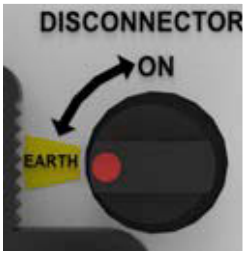
1 : Remove **’DISCONNECTOR’** padlock if fitted and lift up the **’DISCONNECTOR’** slide cover to the ‘unlocked’ position.



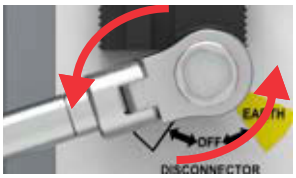
2 : With the operating handle on the **’DISCONNECTOR’** boss, rotate anti-clockwise into ’**OFF**’.

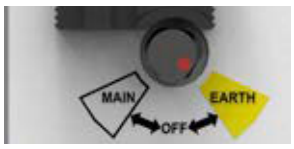


3 : Rotate the **'DISCONNECTOR'** knob anti-clockwise to '**EARTH**'.

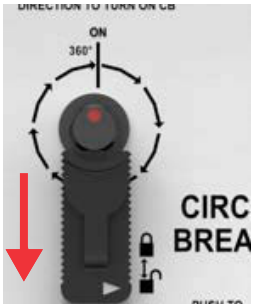


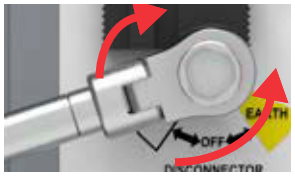
4 : With the operating handle on the **'DISCONNECTOR'** boss, rotate anti-clockwise into '**EARTH-SELECTED**'.





5 : Remove **'CIRCUIT BREAKER'** padlock if fitted and pull down the slide cover to the 'unlocked' position.With the operating handle on the **'CIRCUIT BREAKER'** boss, rotate the ratchet mechanism 360° clockwise. The ratchet mechanism enables this operation to be carried out in multiple small rotations.At the end of the operation the **'CIRCUIT BREAKER'** will close to main **'EARTH ON'**.





INFORMATION

Indication now displays 'EARTH ON'.

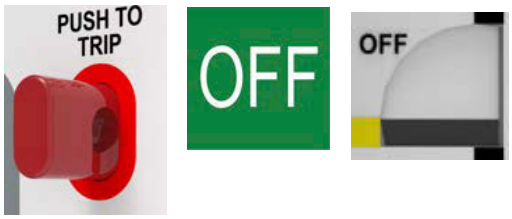
INFORMATION

The round recess (red dot) should always face 12 O Clock, if not, the mechanism has been only been partially charged.

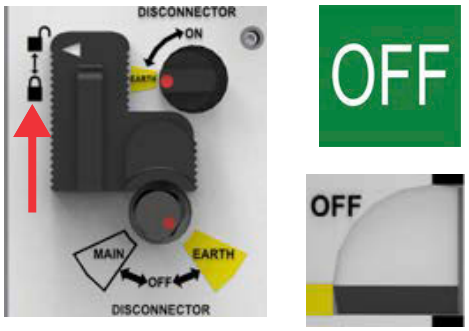
6.4.4 Circuit Breaker 'EARTH-ON' to 'OFF' & DISCONNECTOR to 'MAIN SWITCH'

1 : Press the Red **PUSH TO TRIP** Button.

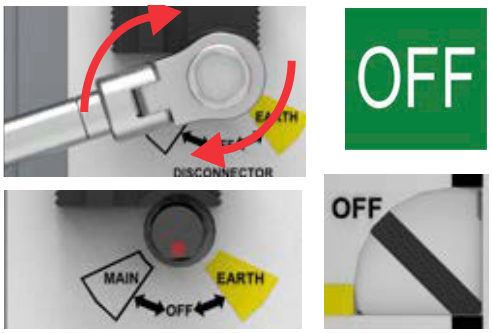
2 : Indicator shows '**OFF**'



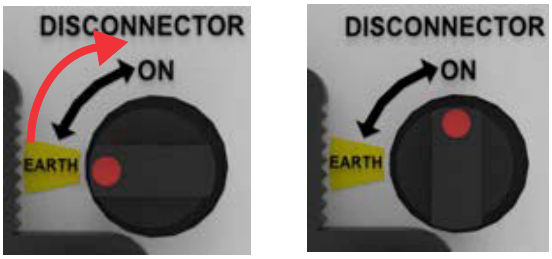
3 : Remove **'DISCONNECTOR'** padlock if fitted and Lift up the DISCONNECTOR slide cover to the 'unlocked' position.



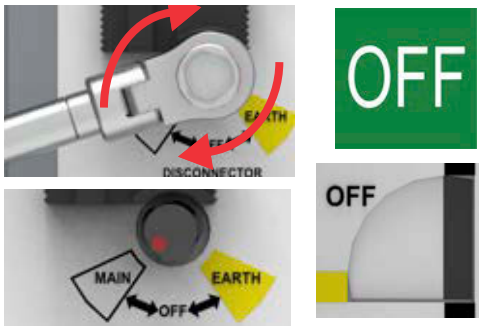
4 : Rotate the **'DISCONNECTOR'** boss clockwise to **'OFF'**.



5 : Rotate the **DISCONNECTOR** knob clockwise to **'ON'** Switch.



6 : With the operating handle on the **DISCONNECTOR** boss, rotate clockwise into '**MAIN**'.



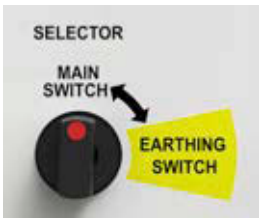
WARNING

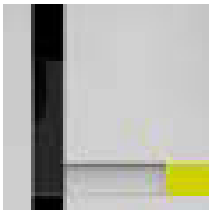
If the operator does not follow the correct operating procedure whilst operating either mechanisms there is the potential for the fail-safe facility within the handle to operate and render the operating handle useless for further operations.

6.5 Load Break Switch Operations

6.5.1 Load Break Switch 1 from 'OFF' to 'ON' (‘MAIN SWITCH’ selected)

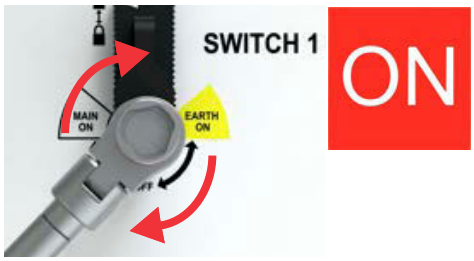
For this operation, the **’SELECTOR’** knob must be in the ‘**MAIN SWITCH**’ position.
Note: Active mimic changes in accordance with the selector position.





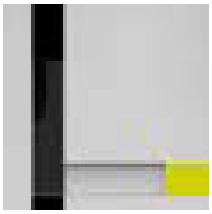
1 : Remove **’SWITCH 1’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.

2 : With the operating handle on the switch boss, rotate clockwise until the switch closes ‘**ON**’.



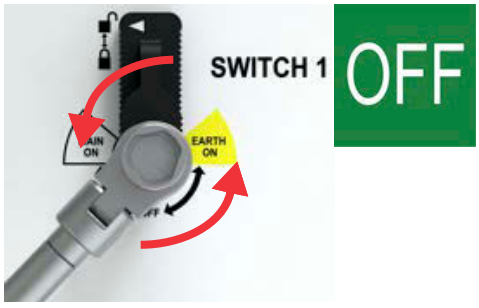
6.5.2 Load Break Switch 1 from 'ON' to 'OFF'

For this operation, the **’SELECTOR’** knob must be in the ‘**MAIN SWITCH**’ position.
Note: Active mimic changes in accordance with the selector position.



1 : Remove **’SWITCH 1’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.

2 : With the operating handle on the switch boss, rotate anti-clockwise until the switch opens ‘**OFF**’.

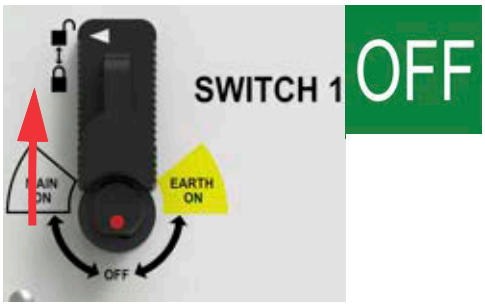


6.5.3 Load Break Switch 1 from ’OFF’ to 'EARTH-ON'

For this operation, the ‘**SWITCH 1**’ must be in the ‘**OFF**’ position.

1 : Rotate the **’SELECTOR’** knob (by hand) clockwise to ‘**EARTHING SWITCH**’.

2 : Remove **’SWITCH 1’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.



3 : With the operating handle on the **’SWITCH 1’** boss, rotate anti-clockwise until the switch closes ‘**EARTH ON**’.

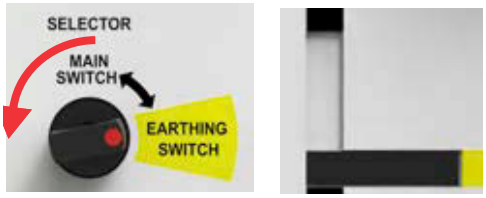
6.5.4 Load Break Switch 1 from 'EARTH-ON' to 'OFF' & selector to 'MAIN SWITCH'

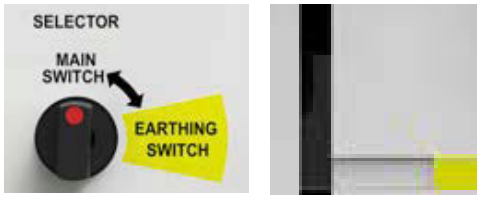
For this operation, the '**SWITCH 1**' must be in the '**EARTH ON**' position.

4 : Remove **'SWITCH 1'** padlock if fitted and lift up the switch slide cover to the 'unlocked' position.

5 : With the operating handle on the switch boss, rotate clockwise until the switch opens '**OFF**'.

6 : Rotate the selector knob (by hand) anti-clockwise to '**MAIN SWITCH**'.



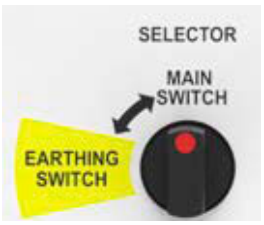


WARNING

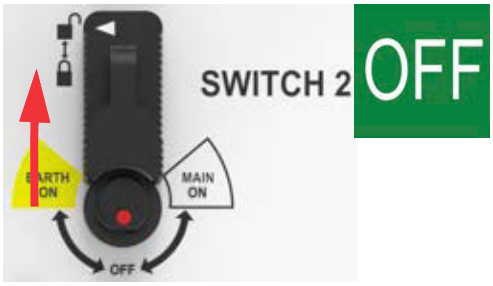
If the operator does not follow the correct operating procedure whilst operating either mechanisms there is the potential for the fail-safe facility within the handle to operate and render the operating handle useless for further operations.

6.5.5 Load Break Switch 2 from 'OFF' to 'ON' (‘MAIN SWITCH’ selected)

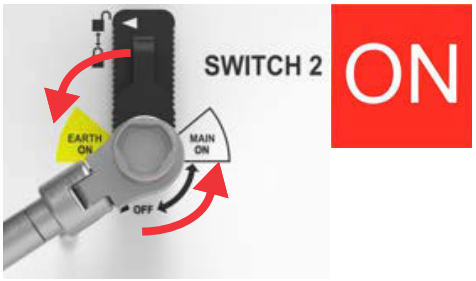
For this operation, the selector must be in the ‘**MAIN SWITCH**’ position .
Note: Active mimic changes in accordance with the selector position.



1 : Remove **’SWITCH 2’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.



2 : With the operating handle on the switch boss, rotate anti-clockwise until the switch closes ‘**ON**’.

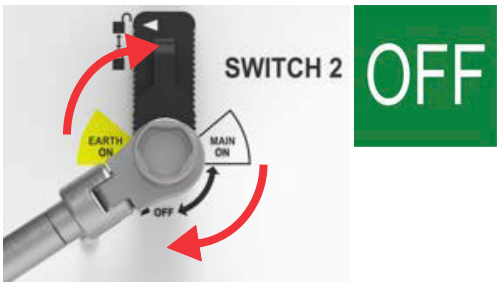


6.5.6 Load Break Switch 2 from 'ON' to 'OFF'

For this operation, the selector must be in the ‘**MAIN SWITCH**’ position .
Note: Active mimic changes in accordance with the selector position.

1 : Remove **’SWITCH 2’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.

2 : With the operating handle on the switch boss, rotate clockwise until the switch opens ‘**OFF**’.

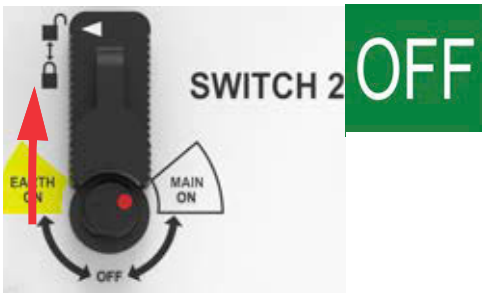


6.5.7 Load Break Switch 2 from ’OFF’ to 'EARTH-ON'

For this operation, the **’SWITCH 2’** must be in it’s ‘**OFF**’ position.

1 : Rotate the **’SELECTOR’** knob (by hand) anti-clockwise to ‘**EARTHING SWITCH**’.


2 : Remove **’SWITCH 2’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.

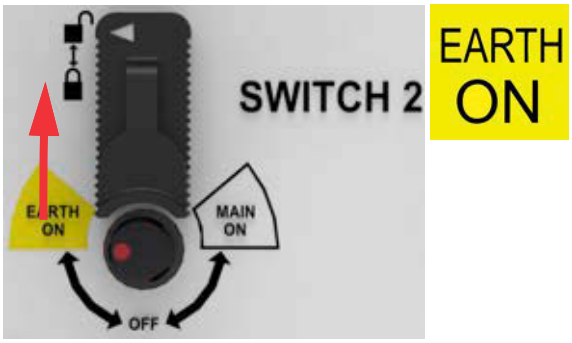


3 : With the operating handle on the **’SWITCH 2’** boss, rotate clockwise until the switch closes ‘**EARTH ON**’.

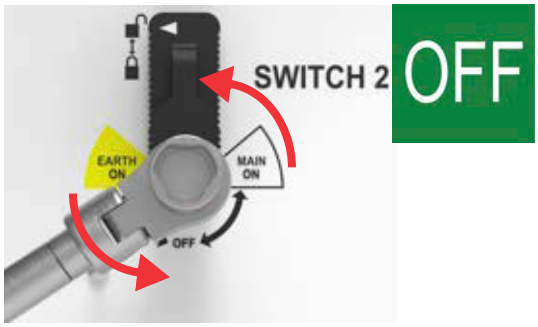
6.5.8 Load Break Switch 2 from 'EARTH-ON' to ’OFF’ & selector to ‘MAIN SWITCH’

For this operation, the ‘**SWITCH 2**’ must be in the ‘**EARTH ON**’ position.

1 : Remove **’SWITCH 2’** padlock if fitted and lift up the switch slide cover to the ‘unlocked’ position.



2 : With the operating handle on the switch boss, rotate anti-clockwise until the switch opens ‘**OFF**’.



3 : Rotate the selector knob (by hand) clockwise to ‘**MAIN SWITCH**’.


⚠ WARNING

If the operator does not follow the correct operating procedure whilst operating either mechanisms there is the potential for the fail-safe facility within the handle to operate and render the operating handle useless for further operations.

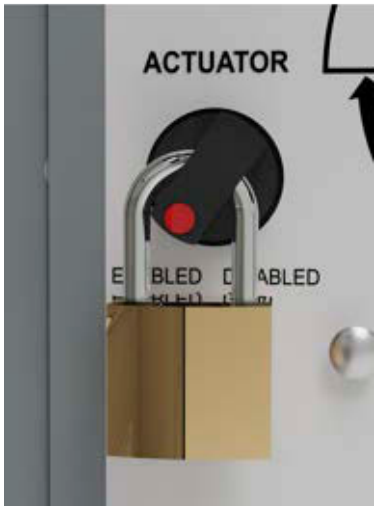
6.5.9 Load Break Switch Actuator Enable/Disabled

When an embedded RTU is fitted to the unit, there is an option for a actuator enable/disabled facility available.
If fitted, this can disable the load break switch motor from the RTU, so that the load break switch can be operated manually safely.

Rotate the selector to '**ENABLED'** for remote operation of the load break switches.

Rotate the selector to '**DISABLED**' for manual operation of the load break switches.

The Actuator selector can be padlocked in either position if required.



7. EARTH TEST CABLE INSTRUCTIONS

For this operation, ensure the relevant function is in the **'EARTH ON'** position. See section **"Circuit Breaker ,MAIN' to 'OFF' and 'OFF' to 'EARTH ON"" on page 12** and **"Load Break Switch 1 from 'OFF' to 'EARTH-ON"' on page 16** or **"Load Break Switch 2 from 'OFF' to 'EARTH-ON"' on page 19**.

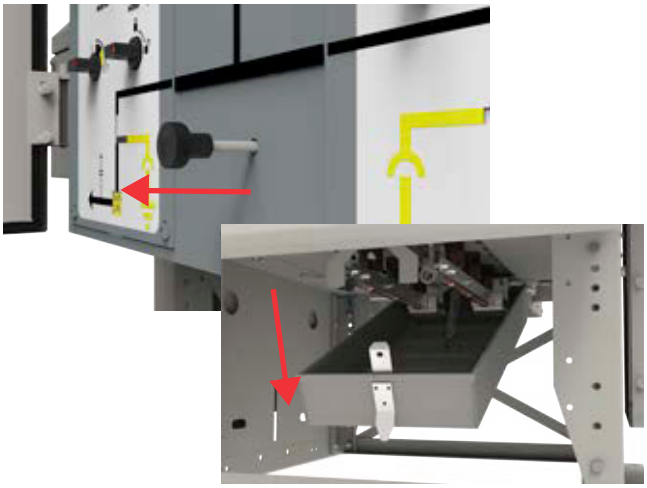
WARNING **To prevent removal of 'STAR POINT EARTH BAR' when in the 'EARTH ON' position, fit padlock through Cable Test Access selector in the 'LOCK' position.**

7.1 Load Break Switch Cable Test Access

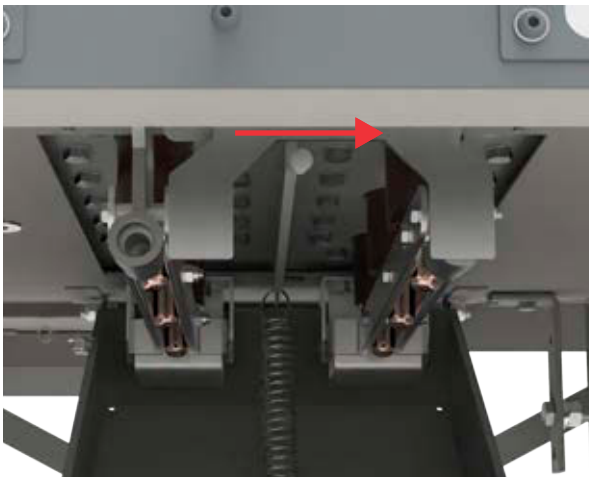
Rotate the Cable Test Access selector to '**FREE**' position.

7.1.1 Open Load Break Switch Cable Test Access Cover

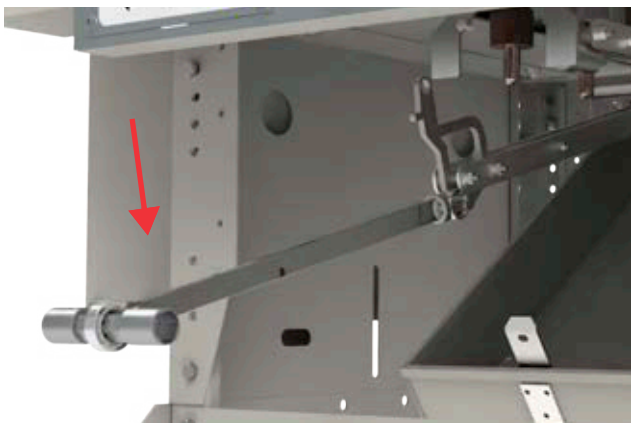
1 : Open the Load Break Switch cable test access cover by holding the cover, pulling the access knob forward, then gently lowering the cover.



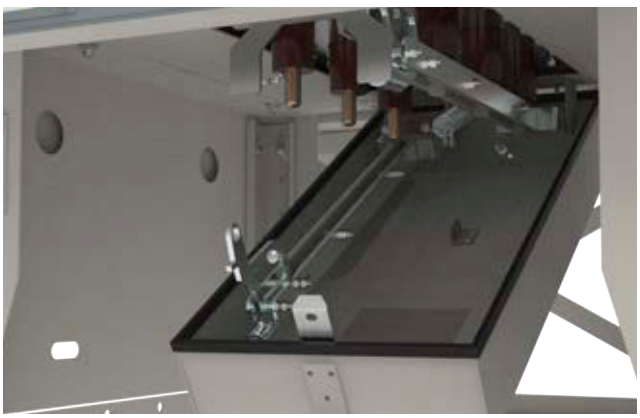
2 : Move the interlock flap sideways to give access to the required load break switch test bushings.



3 : Insert the operating handle into the star point earth bar and pull down away from the bushings.



4 : When the star point earth bar is clear from all the bushings, remove the operating handle and allow to rest on the access cover.

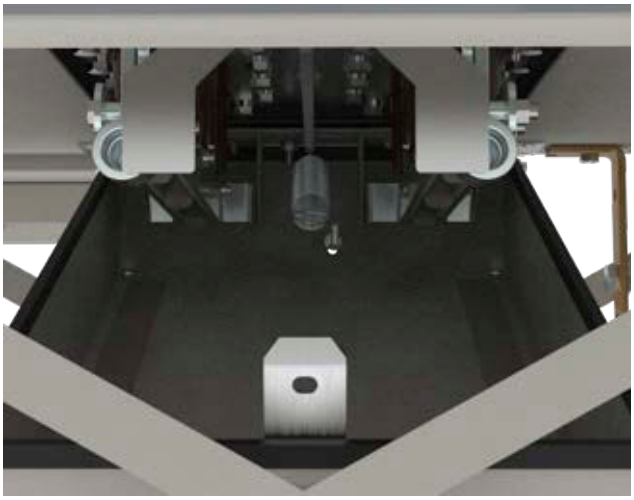


INFORMATION **Load break switches cannot be removed from 'EARTH ON' until the test access cover is closed.**

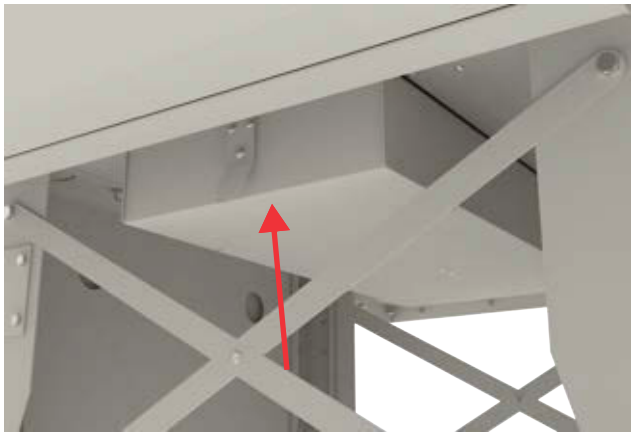
7.1.2 Close Load Break Switch Cable Test Access Cover

1 : Using the operating handle, pivot the star point earth bar back up onto the bushings and firmly ensure all 3 bushings are in full contact with the star point earth bar.

2 : Move the interlock flap back into the centre, covering access to both star point earth bars.



3 : Lift up and close the access cover ensuring catch is fully located.



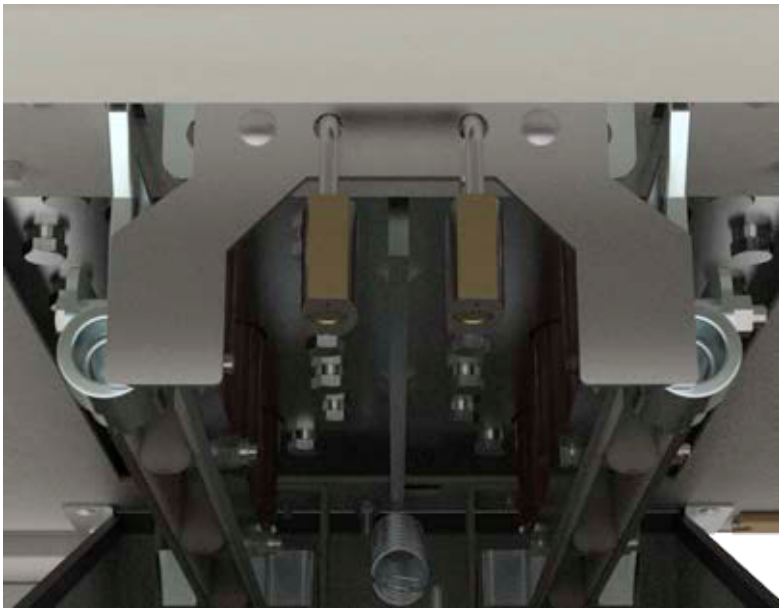
4 : Rotate the Cable Test Access selector back to the ‘LOCK’ position.

INFORMATION

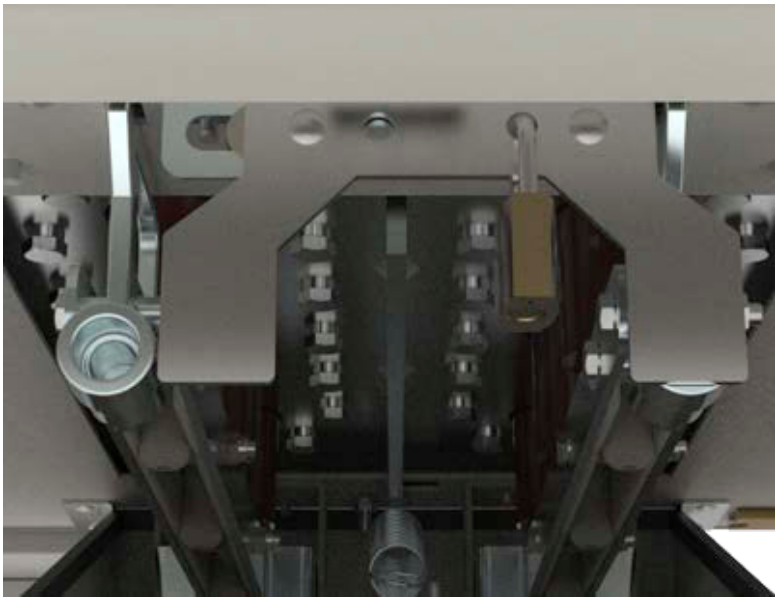
The load break switch can now be operated from ‘EARTH ON’ to ‘OFF ()

7.1.3 Load Break Switch Cable Test Padlock Facility

Access to the star point earth bars can be prevented by using a padlock for both switches as shown.



To allow access to a star point earth bar, remove the padlock on the side of the required earth bar, then slide the interlock flap clear.

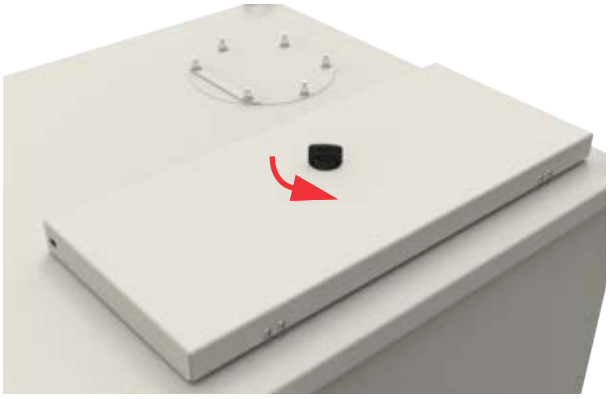


7.2 Circuit Breaker Cable Test Access (VRN6e Only)

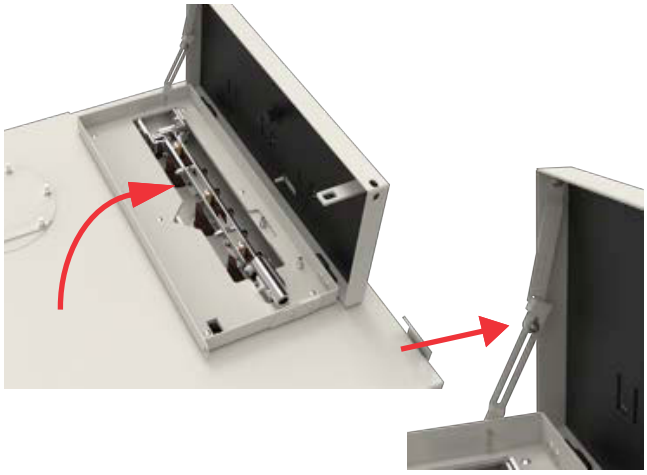
Rotate the Cable Test Access selector clockwise to '**FREE**' position.

7.2.1 Open Circuit Breaker Cable Test Access Cover

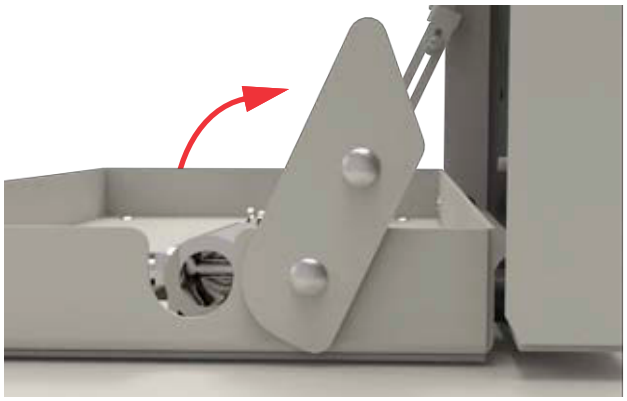
1 : Rotate the top cable access cover anti-clockwise 180°.



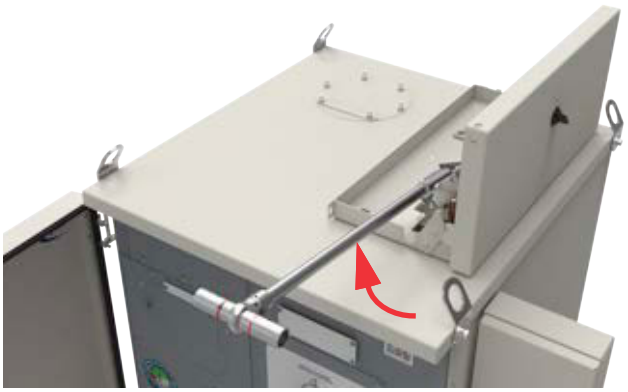
2 : Lift the top cable access cover up and clear. Ensure the cover stay bar is fully move back.



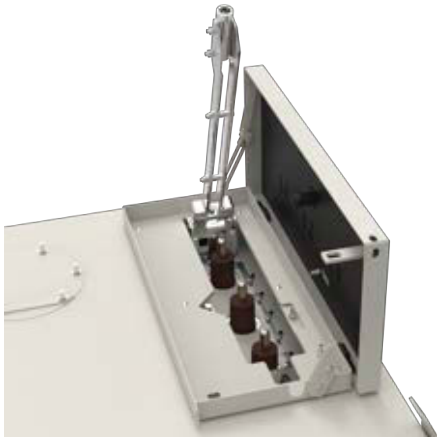
3 : Rotate the handle access flap up.



4 : Insert the operating handle into the star point earth bar and lift up away from the bushings.

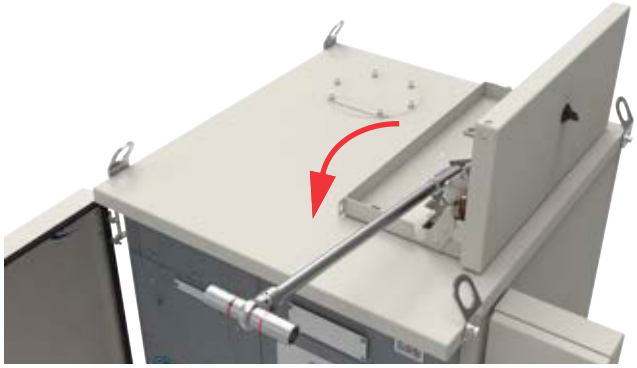


5 : Remove the operating handle and rotate the star point earth bar up clear of the bushings.

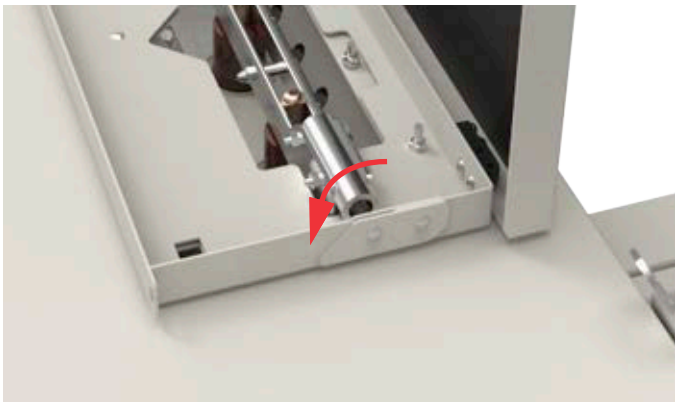


7.2.2 Close Circuit Breaker Cable Test Access Cover

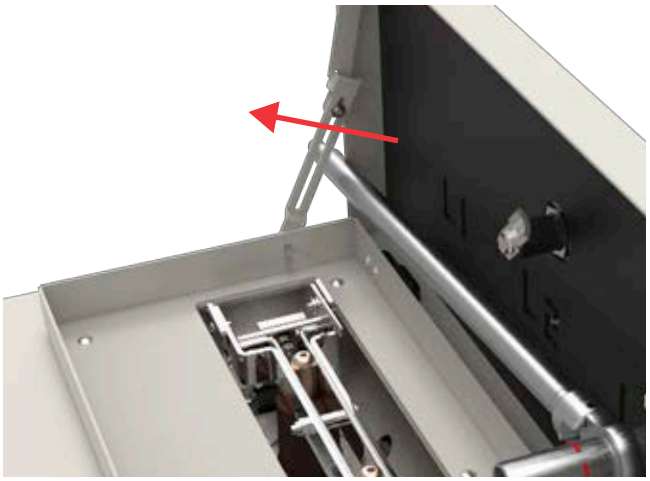
1 : Close down the star point earth bar back onto the three bushings using the operation handle. Ensure full contact is made on all three bushings.



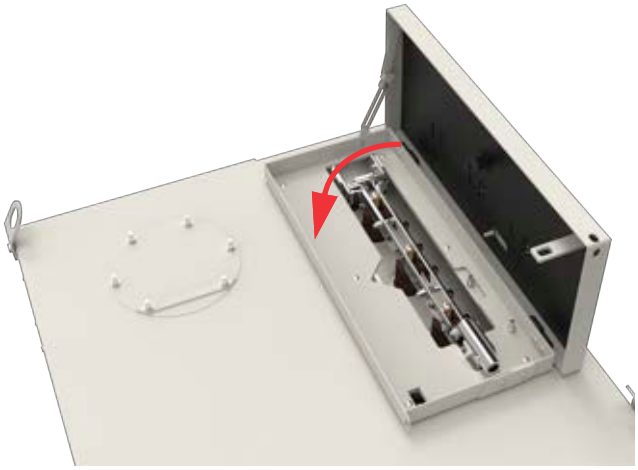
2 : Remove the operating handle and close down the handle access flap.



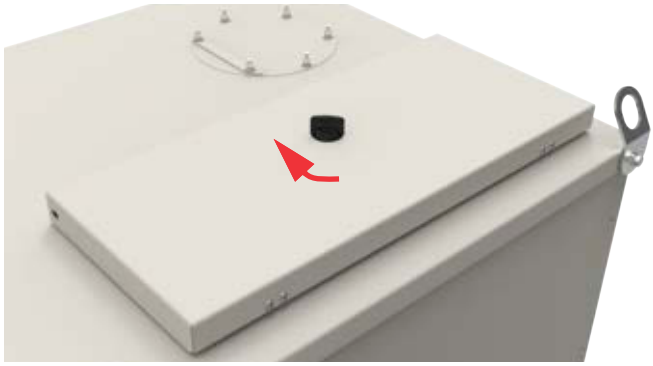
3 : Using the operating handle, push the cover stay bar out in the middle to release the cover.



4 : Close the top cable access cover.



5 : Rotate the top cable access cover clockwise 180° to lock the top cable access cover.



6 : Rotate the Cable Test Access selector back anti-clockwise to the ‘LOCK’ position.

INFORMATION

The circuit breaker can now be operated from ‘EARTH ON’ to ‘OFF’.

7.2.3 Circuit Breaker Cable Test Padlock Facility

Access to the star point earth bars can be prevented by using a padlock on the top cable access cover as shown.

8. MAINTENANCE

8.1 Preventative Maintenance

INFORMATION

Cleaning materials for specific areas of the SabreEcoTec unit Panelling - Cleaning - Cloth.

8.2 Unit panelling

The risk of using high pressure cleaning processes are damaging to the life of the SabreEcoTec unit. Lucy Electric cannot therefore guarantee the reliability of the SabreEcoTec equipment that have been cleaned in this manner.
Clean using a dry cloth.

CAUTION

Ensure a proper safety maintenance checklist as per international standards & safe practices of switchgear operation is used with any maintenance work.

8.3 Unit Maintenance

8.3.1 Maintenance warning

WARNING

Lucy Electric recommends below in addition to the above working practices:

- **Isolate the supply to the unit before accessing it and clearly put a tag mentioning it on both ends of the circuit.**
- **Check the VPIS (neon) and/or VDS - VPIS/VDS to re-ensure that there is no power flow through the unit. This is an additional checkpoint for units which have VPIS and/or VPIS/VDS.**
- **Discharge the static power in the circuit by touching the earth rod to the bushing copper connection as well as the cable which is disconnected.**

8.3.2 Operating conditions

'Ideal' in service conditions

- Unit is to be installed and commissioned in accordance with manufacturers instructions.
- Humidity to be below 40% with no dripping water.
- Indoors completely protected from the weather (unless installed in a outdoor clad unit).
- Minimal dust and adequate air circulation.
- Ambient temperature to be between -25°C and 55°C.
- No contact with chemical agents.
- No infestation of any animals.
- No contact with any plant life.
- No foundation movements.
- No damage to the unit of any kind.

'Standard' in-service conditions

- Unit is to be installed and commissioned in accordance with manufacturers instructions.
- Humidity to be below 60%.
- Unit to be used indoors or outdoors, but not subjected to extreme weather conditions eg: ice, snow, dust storms, heavy rain etc.
- Ambient temperature to be between -25°C and 55°C.
- No regular or thick covering of leaves or debris.
- No contact with chemical agents.
- No infestation of any animals.
- No contact with any plant life.
- No foundation movements.
- No damage to the unit of any kind.

Aggressive conditions - are any other conditions not covered in the descriptions of 'IDEAL' and 'Standard' conditions

8.4 Maintenance schedule

The following is the recommended maintenance schedule for the SabreEcoTec unit.

Gas Enclosure: No routine maintenance required.

Unit Exterior:

- Check all external fixings are present and tight.
- Check all labels are present.
- Check all earth connections are present.
- Check the operation of the unit (including interlocks with the unit isolated).
- Clean the unit thoroughly.
- Touch-up paint work as necessary.
- Check that the synthetic air indicator is in the green zone. If the indicator is in the red zone, See 9.4 below

Outdoor clad units:

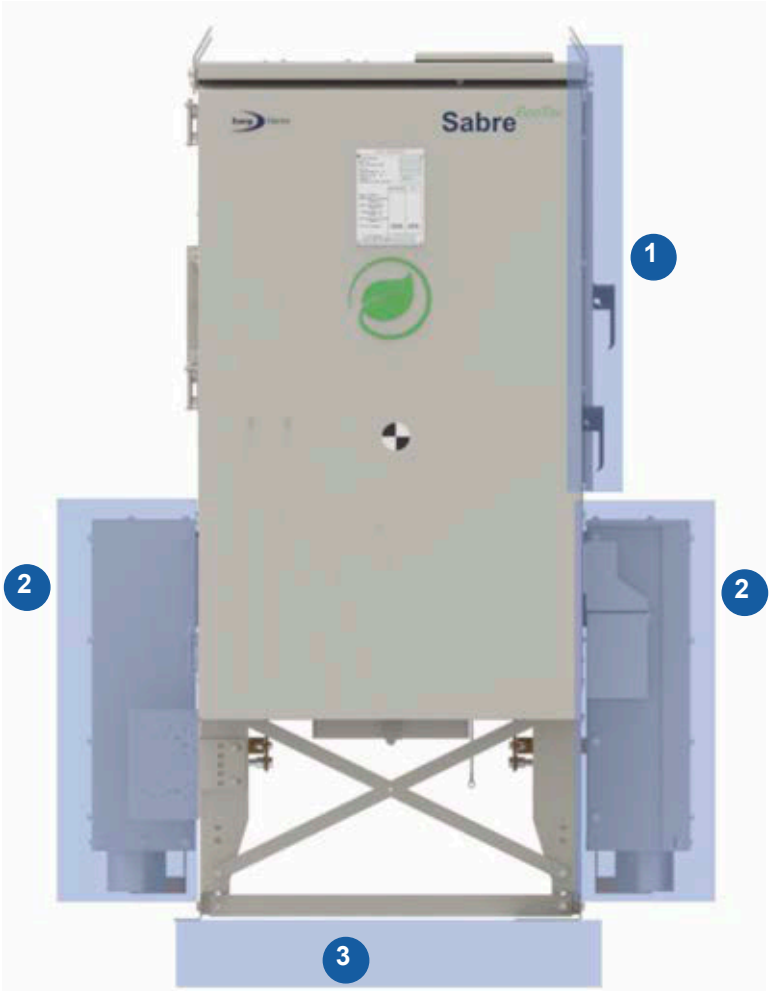
- Check the condition of the door seal.
- Check inside the door for:
- - heavy dust deposits
- - water ingress
- - contamination by animal, insects or plant life.
- Check all external fixings are present and tight.
- Check all labels are present.
- Check all earth connections are present.

8.5 Synthetic Air

Gas Leakage

If the unit suffers a loss of gas pressure the gauge pointer will be in the red zone. In this extremely unlikely event the unit should not be operated and you should contact your local Lucy Electric office immediately.

8.6 Maintenance Checklist



1

Marshalling Box Area
Check for rust on any electrical parts.
Reasons:
Condensation and humidity presence.
Solutions:
Dry the environment.
Replace any damaged parts.

2

Cable Box Areas
Check cable connections for any damage.
Reasons:
Presence of discharging.
Solutions:
Fit new cable connections

3

Trench
Check for presence of water in the trench.
Reasons:
Water ingress presence.
Solutions:
Pump out the water. Drain the trench.
Note: Take care that no additional stress is added to the bushings.

If a unit has not been operated for a considerable amount of time and it is practical to do so, operate the unit a few times to ensure that the unit is functioning correctly.

9. END-OF-LIFE-SERVICE

At the end of the service life of the switchgear, it must be disposed of in an environmentally friendly manner.

9.1 Switchgear Unit Recycling

Once the switchgear unit can be dismantled by trained and competent personnel, then all component parts sorted and recycled. All parts must be disposed according to local site disposal procedures.

Main Component Scrap Materials

Steel	- cladding and mechanisms
Stainless Steel	- tank
Copper	- busbars and earthing bars
Brass	- connectors
Silver	- Instrument contacts
Cast Resin - Epoxy Resin	- bushings
Plastics	- handles, hinges, switching devices and trippers
Cables	- bushings, instruments.
Rubber	- seals, gaskets

Any auxiliary devices are to be recycled as electronic scrap.

All batteries are to be recycled appropriately.

9.2 End-Of-Life Services

Conscious of its environmental responsibilities, Lucy Electric has the skills and capability to provide decommissioning solutions for the equipment. End-of-life procedures include a safe Ring Main Unit site removal and disposal.

For more information on end-of-life services, please contact our Energy Services response centre:

Tel: +44 (0) 1844 267 256

Fax: +44 (0) 1844 267 223

Email: energyservices@lucyelectric.com

For technical support or additional information on our products, please contact our technical department:

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