Sabre *EcoTec*

Ring Main Unit up to 12kV

Installation, Test and Commissioning Manual

Lucy Electric

TABLE OF CONTENTS

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 February 2025, 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. GENERAL PRODUCT INFORMATION

The SabreEcoTec is a compact Ring Main Unit (RMU) in a range of configurations comprising of load switches and circuit breakers. The unit can be mounted to the smallest distribution transformer, or be sited in a free standing format. Designed to be used both indoors and outdoors, the unit has a long life and requires virtually zero maintenance.

3.1 SabreEcoTec Range

SabreEcoTec VRN2e

SabreEcoTec VRN6e

3.2 SabreEcoTec Range Features

Stainless steel gas enclosure – The synthetic air enclosure is manufactured from stainless steel and fabricated utilising automatic 'robot welding' techniques to produce consistent leak-free equipment.

Housing – The housing of the SabreEcoTec is fully treated; using zinc coated steel and electrostatically applied oven cured paint, to resist weather and pollution attacks. All units are provided with a hinged, weatherproof and lockable door. The external support legs can provide a Tee-Off bushing height of 1320mm or 1100mm.

Operation – All operating positions and instructions are indicated on the main panel at the front of the unit. Operation is by means of manually independent mechanisms, which are mounted externally to the gas enclosure.
The t-off vacuum circuit breaker has two operating positions, 'ON' or 'OFF', with an off-load interlocked three position disconnector allowing isolation & earthing of the tee-off circuit.
A single, ratchet type operating handle is stored inside the front door.

Interlocks – Positive operation safety interlocks are incorporated on all load break switches and circuit breaker positions.

Load Break Switch – The switches are of the single
break, fault-make/load-break 3 position types '**ON**', '**OFF**' and '**EARTH ON**'

T-Off Circuit Breaker - The tee-off circuit breaker comprises of three vacuum interrupters, which have a fault-make, fault-break rating 3 position '**ON**', '**OFF**' and '**EARTH ON**'. Opening of the circuit breaker is achieved by manually operating the handle as standard.
Earthing of the outgoing cable, from the t-off circuit breaker, is achieved by the use of the circuit breaker in series with the off-load disconnector/ selector switch

⚠ CAUTION

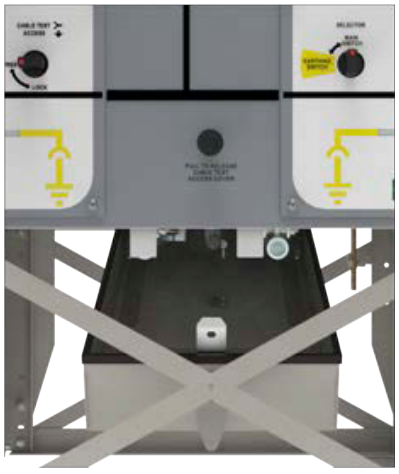
If the operator does not follow the correct operating procedure whilst operating either mechanism there is the potential for the fail-safe facility within the handle to operate and render the operating handle useless for further operations.

3.3 Test facilities

3.3.1 VRN2e Test Facilities

The SabreEcoTec VRN2e has fully interlocked integrated load break switch cable test facilities in accordance with ENATS 41-41 requirements.

Access to the load break switch test terminals is achieved by pulling knob located at the bottom of the front fascia of the unit. This will allow the cover underneath the unit to drop down.

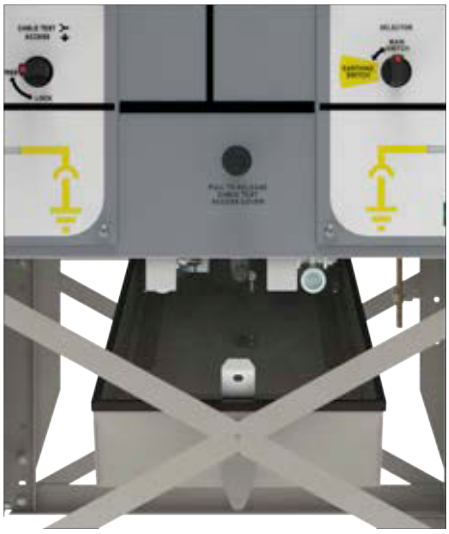


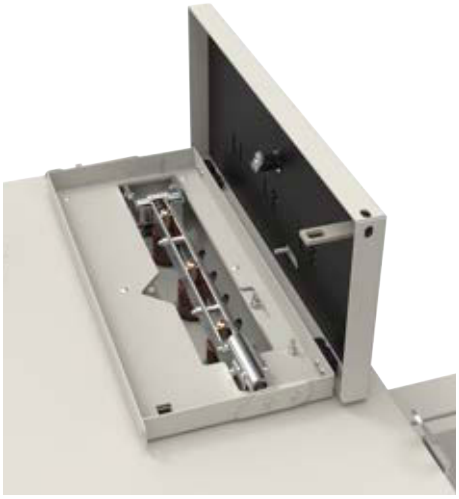
3.3.2 VRN6e Test Facilities

The SabreEcoTec VRN6e has fully interlocked integrated load break switch and circuit breaker T-off cable test facilities in accordance with ENATS 41-41 requirements.

Access to the load break switch test terminals is achieved by pulling knob located at the bottom of the front fascia of the unit. This will allow the cover underneath the unit to drop down.

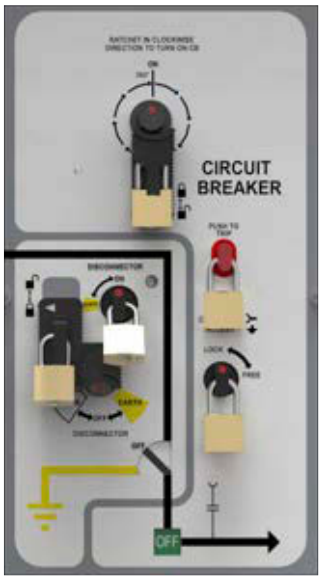
Access to the circuit breaker test terminals is achieved by rotating knob on the roof cover in an anticlockwise direction. Note: The cover will only open when ‘CB Test Interlock’ is in the ‘unlock’ position.





3.4 Padlocks

The door has a quarter-turn handle that can be padlocked Both Load Break Switches/Circuit Breaker as well as Selector/Disconnector positions can be padlocked. The Slide Covers and Rotating Knobs have an 8.5mm diameter hole size.



3.5 Pressure Indicators

The SabreEcoTec unit has three options of pressure indicator available, see below for further information.

Normal Pressure Gauge
Non temperature compensated

Gas Density Indicator
Non temperature compensated

Gas Density Monitor with alarm contact
Temperature compensated

Alarm Contacts and Switching Power	
Number:	2 magnetic snap-action contacts.
Switching function:	1 Normally closed and 1 normally open contact.
Maximum switching voltage:	250 V
Switching power:	30V 50VA, Max. 1 A
Material of the contacts:	80% Ag 20% Ni, gold-plated
Switch Bounce:	Approx. 500mS

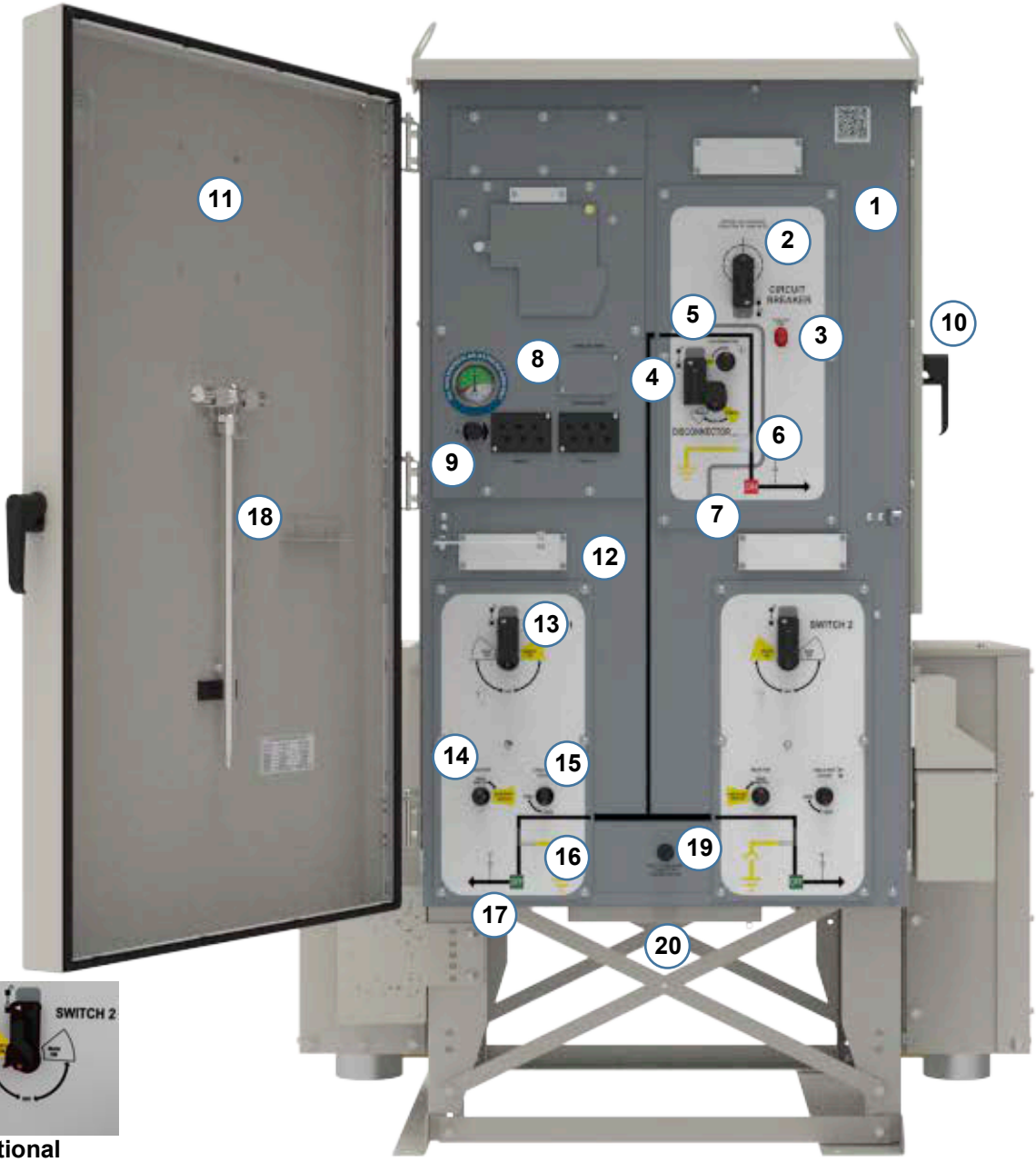
Switching accuracy in the temperature range -20... +40 °C	
Switch point= calibration pressure PE:	As measuring span
Switch point= calibration pressure PE:	Shifted parallel to calibration pressure
High-voltage test	2 kV, 50 Hz, 1 s (wiring against case)

4. TECHNICAL DATA

		SabreEcoTec VRN2e	SabreEcoTec VRN6e
Rated Voltage		12kV	
Impulse Withstand Voltage		75kV(95kV)	
Normal Current	**Load Break Switches**	630A	
	Tee-Off Circuit Breaker	250A	630A
Short Circuit Peak Making Current	**Load BreakSwitches**	50kA	
	Tee-Off Circuit Breaker	50kA	
Short Circuit Breaking Current	**Tee-Off Circuit Breaker**	20kA RMS	
3 Second Short Time Current	**Load BreakSwitches**	20kA	
	Tee-Off Circuit Breaker	20kA	
Earth Switch Peak Making Current	**Load Break Switches**	50kA	
	Tee-Off Circuit Breaker	7.5kA	50kA
Internal Arc Rating	**Freestanding**	20kA 1 sec	
Optional Cable Boxes Internal Arc Rating	**Standard Type**	Up to 20kA 1 sec	
Gas pressure	**Min Operating Pressure**	0.4 Bar G	
IP Rating		Up to IP54W	
Weight *		430kg	
Testing standards		BS EN 60265-1 / BS EN 62271-103	
		BS EN 60129 / BS EN 62271-102	
		BS EN 60694 / BS EN 62271-1	
		BS EN 60298 / BS EN 62271-200	
		IEC 60056 / BS EN 62271-100	
		ENA TS 41-41	
		IEC 62271-102	
		IEC 62271-100	
		IEC 62271-103	

5. FRONT PANEL LAYOUT

5.1 SabreEcoTec VRN2e

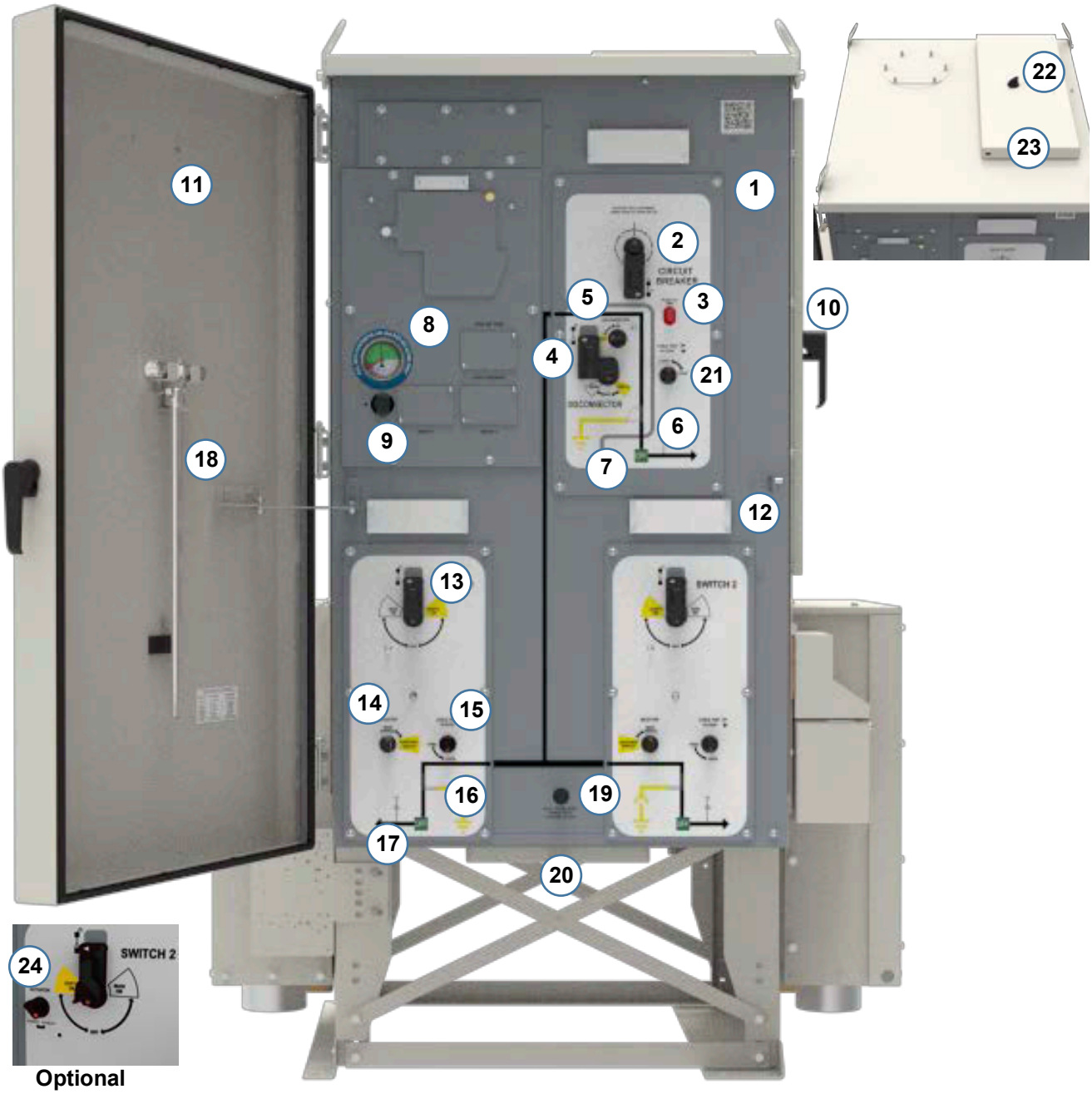


Optional

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)

5.2 SabreEcoTec VRN6e



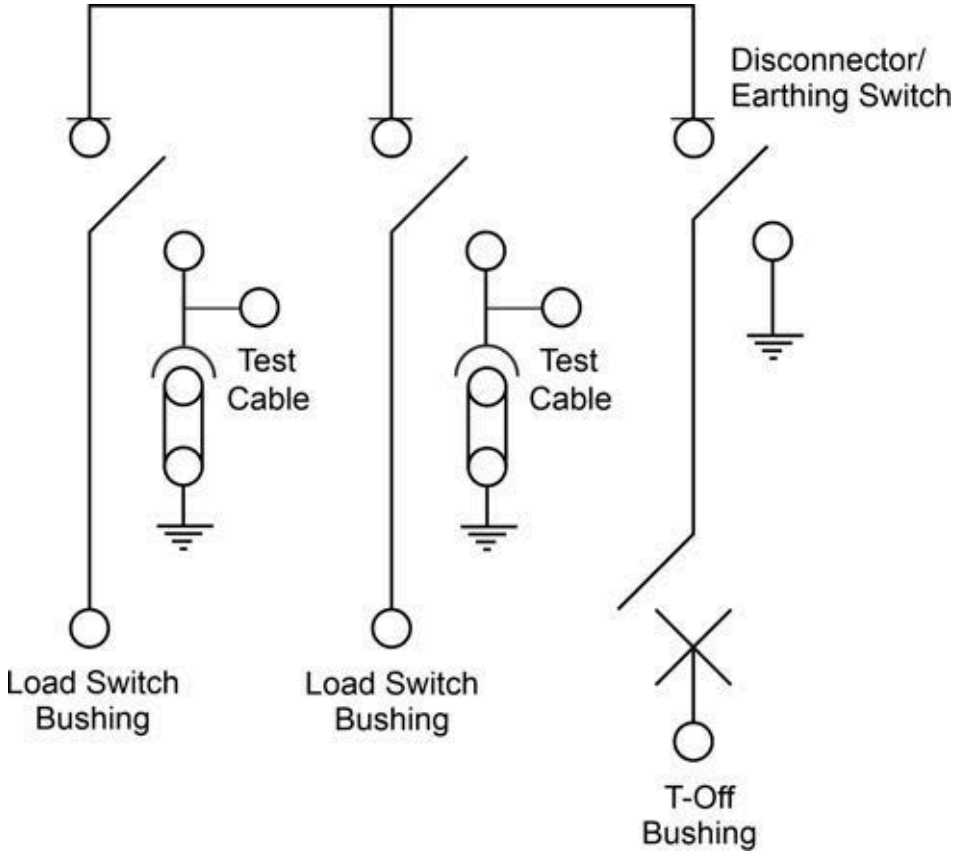
Optional

Key:

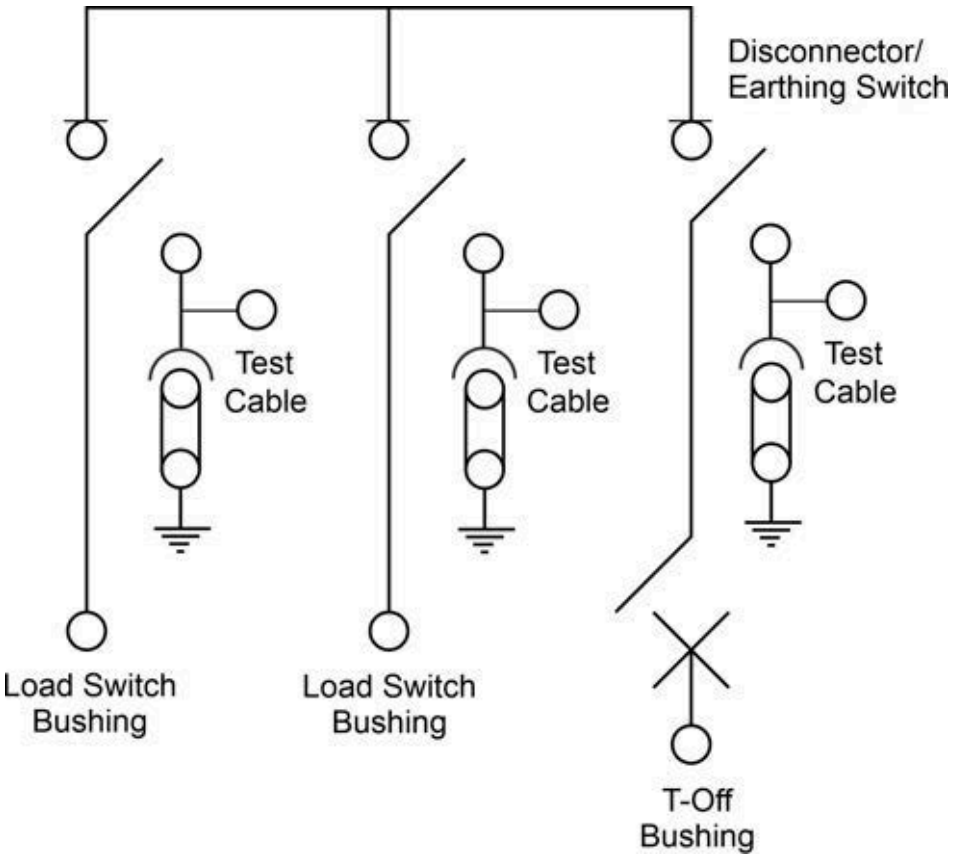
1 : Fascia/Front Panel
2 : Circuit Breaker/T-Off Operation
3 : 'Push To Trip' Button
4 : Circuit Breaker Disconnector Operation
5 : Circuit Breaker Disconnector Selector
6 : Circuit Breaker Disconnector Indication
7 : Circuit Breaker Indication
8 : Pressure Indication
9 : Self Sealing Top Up Valve - 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 : 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)

6. LINE DIAGRAMS

6.1 VRN2e



6.2 VRN6e

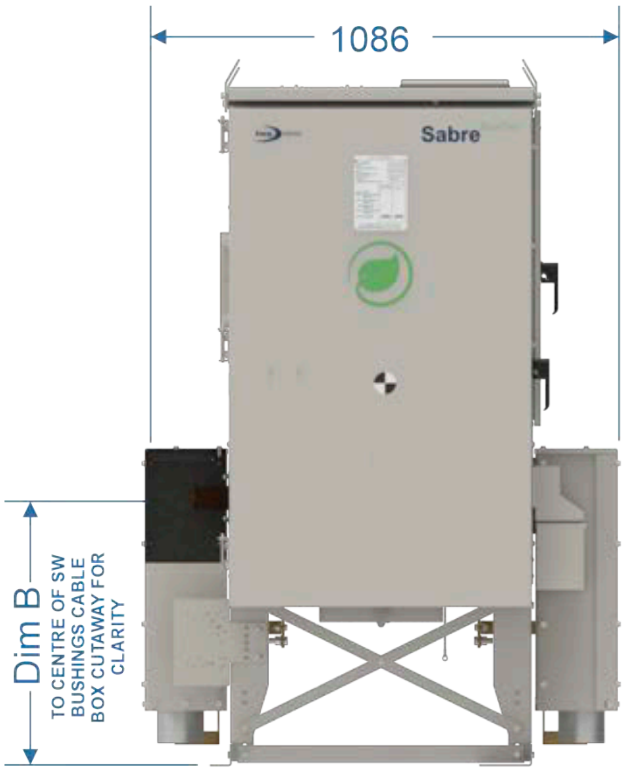


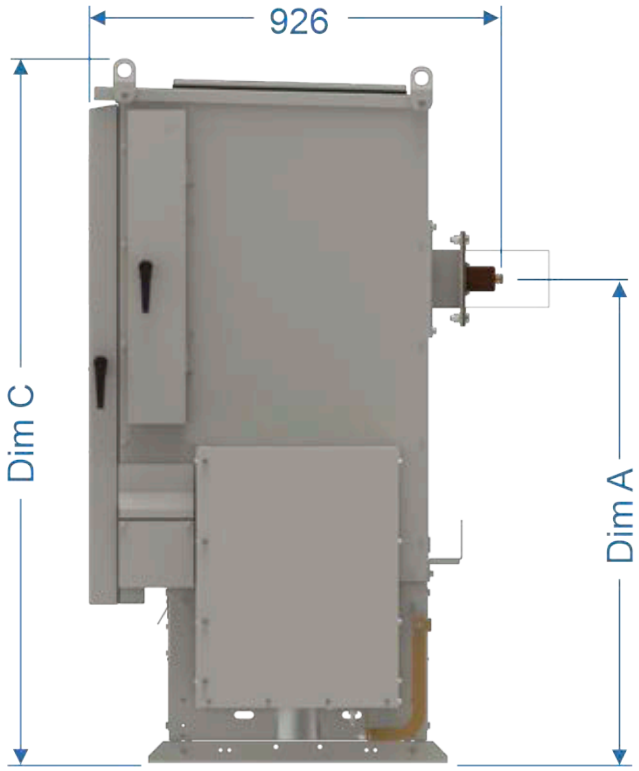
7. DIMENSIONAL DRAWINGS

7.1 VRN2e

Dim A (T-Off Bushing Height)	Dim B (Load Break Switch Bushing Height)	Dim C
1320	827	1821
1100	607	1601

All dimensions in millimetres





7.2 VRN6e

Dim A (T-Off Bushing Height)	Dim B (Load Break Switch Bushing Height)	Dim C	Dim D
1320	827	1821	2200
1100	607	1601	1980

All dimensions in millimetres

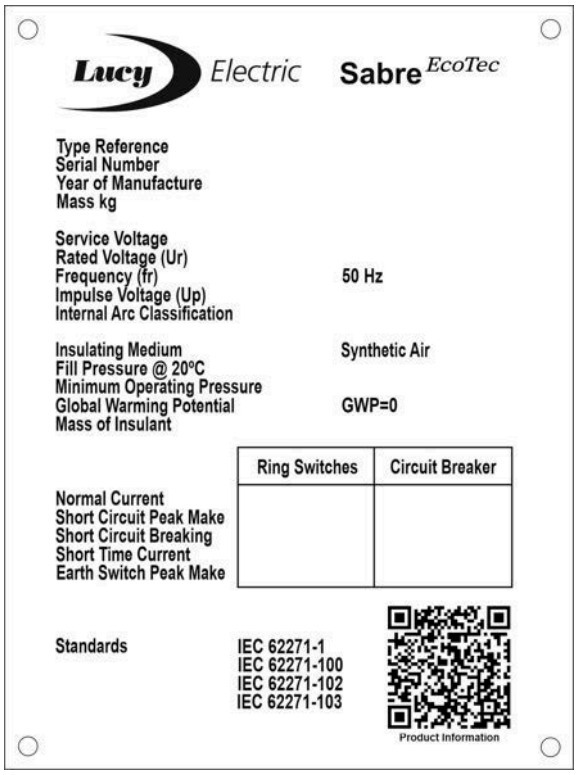
7.3 Weights

SabreEcoTec Unit	Weight (KG)
VRN2e/VRN6e	430

8. RATING PLATE

8.1 Unit Rating Plate Details

The rating plate is located on the front door of the unit.



8.2 Standards

SabreEcoTec complies with the latest standards:

IEC 62271 - 100	High-voltage switchgear and controlgear - Part 100:Alternating current circuit breakers.
IEC 62271 - 102	Alternating current disconnectors and earthing switches.
IEC 62271 - 103	Switches for rated voltages between 1kV and 52kV.
IEC 62271 - 200	AC metal enclosed switchgear and controlgear.
IEC 62271 - 1	HV switchgear and control gear: Common specifications.
IEC 62271 - 213	Voltage detecting systems (VDS).
IEC 60255	Measuring relays and protection equipment.
IEC 60529	Degrees of Protection.

9. HANDLING

9.1 Acceptance of unit

- The original packaging must be in good condition covering the unit on arrival.
- On arrival carry out a visual inspection of the unit and its functional components.
- Verify that the rating plate data matches the original order.

9.2 By receiving inspection

Before the unit is accepted it should be inspected carefully for loss or damage incurred during transit.
The order must be in good condition at the time of receipt. If any such damage has occurred, a claim must be submitted to the carrier immediately.

9.2.1 Unit RAL colour information

Below are the standard colours of a SabreEcoTec unit.

- Unit Cladding, Panels, Doors and Cable Boxes = **RAL 7032** – Grey
- Fascia = **RAL 7046** - Telegrey

Although these are the standard colours, units are also supplied in 'customer specific' colours - call for further details.

9.3 Symbol guidance

All symbols are to be taken as strict guidelines and are adhered too, as a prevention of damage to the unit and injury to user.

Keep dry

Handle with care

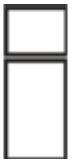
This way up

Keep away from direct sunlight

Storage Temp

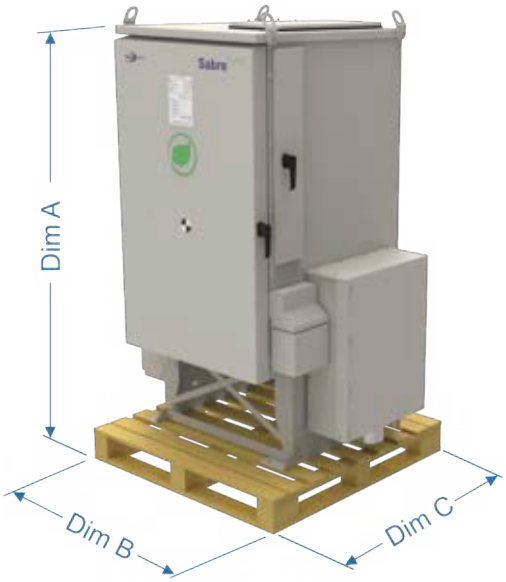
Do not step on

High centre of gravity



Do not stack

9.4 Packaging Dimensions



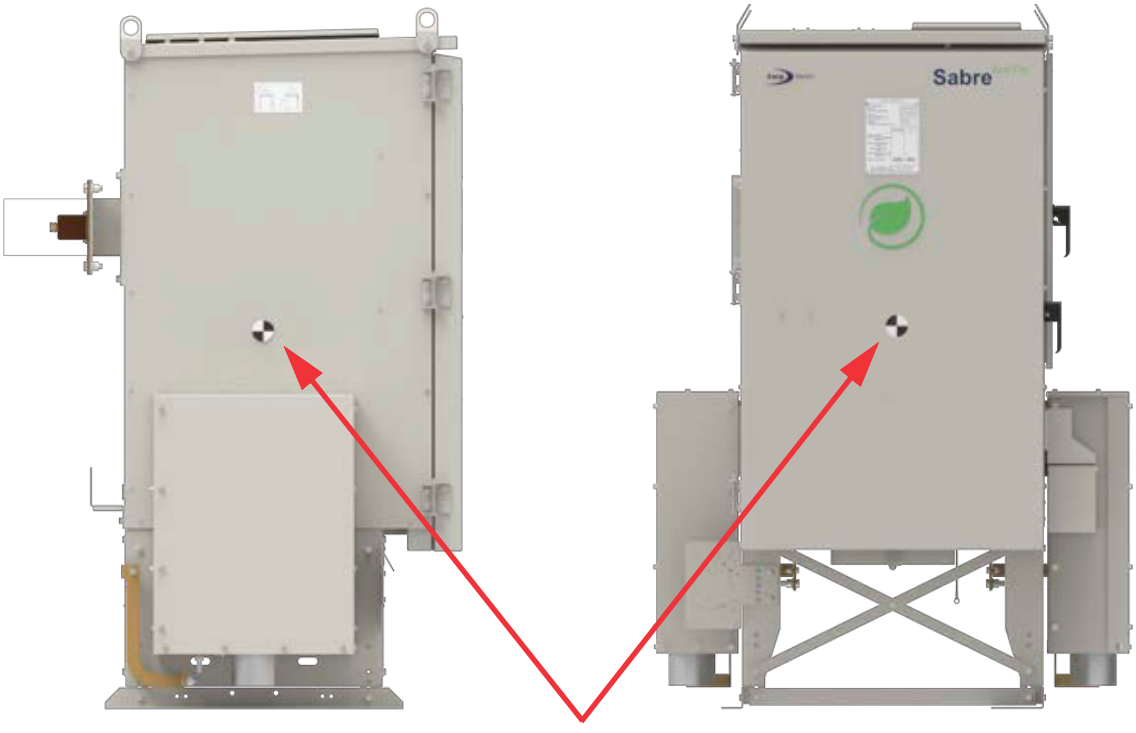
Pallet Dimensions			
T-Off Height	**Dimensions in mm**		
	Height (A)	Width (B)	Depth (C)
1100	1751	1150	1200
1320	1971	1150	1200

For unit weights, see see “7. Dimensional Drawings” on page 14.

9.5 Transportation ‘centre of gravity

Keep the unit in upright position to avoid damage to the unit and/or injury to the user.

⚠ CAUTION **Take note of the ‘centre of gravity’ indicators when moving the unit.**



Centre Of Gravity Indicators

CAUTION

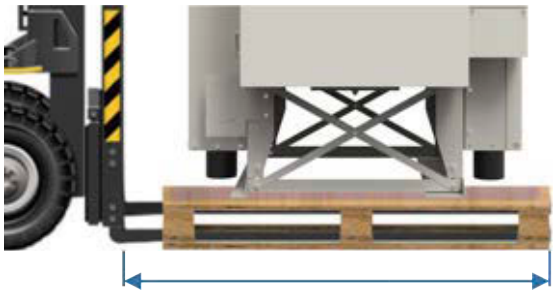
Keep all SabreEcoTec unit surfaces clear, Do not place/rest objects on top of the SabreEcoTec unit.

9.6 Forklift Truck

WARNING

When handling with a fork lift truck, beware the centre of gravity of the unit, see **see "9.5 Transportation 'centre of gravity" on page 18.**

The forks are to be moved apart to support the unit both ends.



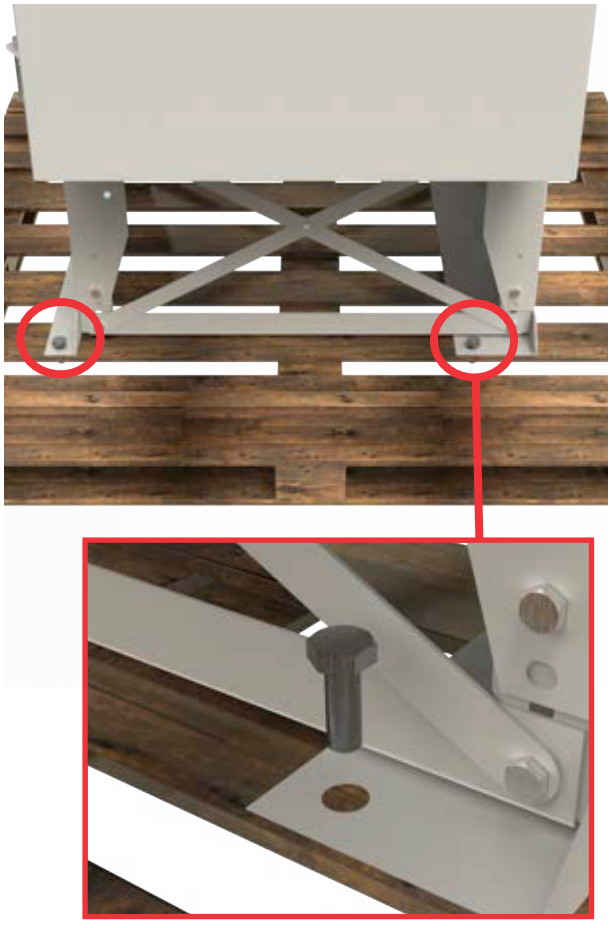
The forks are to be long enough to support the unit, front to back.

9.7 Removing unit from pallet

1 : Place the device with pallet on the ground.

2 : Located at the rear of the unit are the remaining fixings in place, shown below (see “12.4 SabreEcoTec Unit Floor Mounting Details” on page 27 for hole positions). Remove the bolt fixings from the pallet to free the unit.

3 : Unscrew and remove the bolts from pallet.

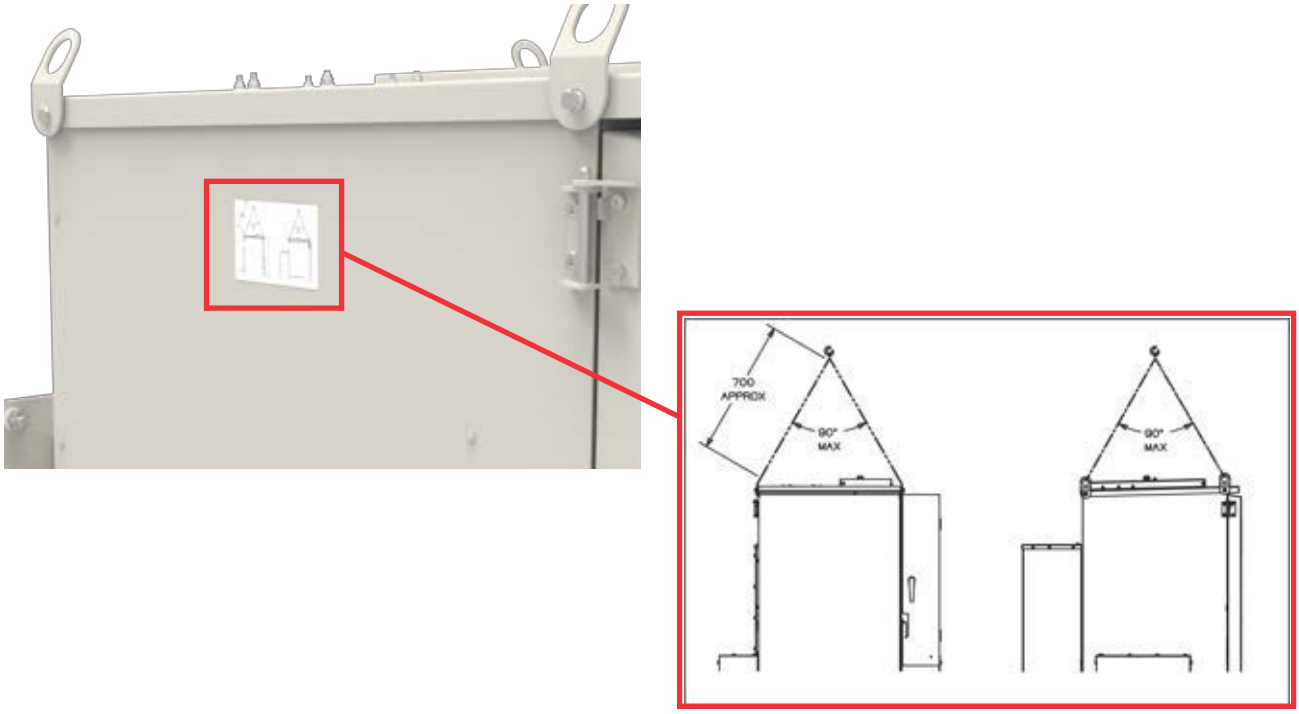


4 : The unit is now free from the pallet and can now be prepared for lifting, using chains.

9.8 Lifting Options

9.8.1 Lifting Label Location

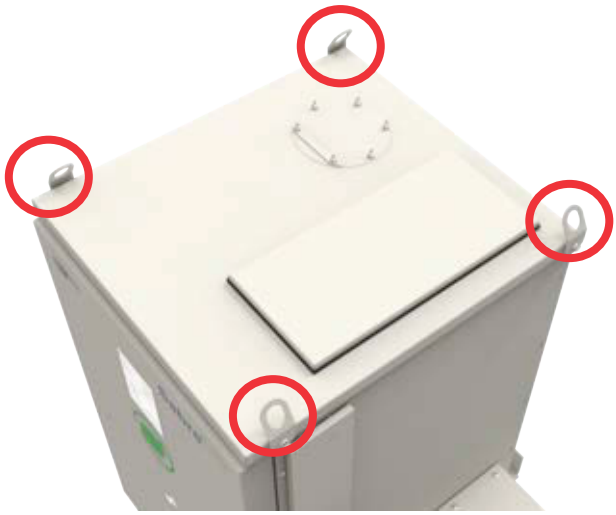
The lifting label is located on the left hand side of the unit, as shown below.



9.8.2 Lifting Lugs

⚠ CAUTION **The unit should always be lifted using all four lifting lugs.**

1 : Lifting lugs are located on top of the unit.



2 : Chain hooks can be attached to the unit's 4x lifting lugs.

3 : The unit can now be crane lifted.

9.8.3 Lifting SabreEcoTec AMU Combination Unit

⚠ CAUTION **The combination unit should only be lifted as one unit using the slinging arrangement shown below.**

1 : Lifting hooks are located on top of the units. Chain hooks can be attached to both unit's lifting lugs.

9.9 Packaging

Once the unit has been removed, the wooden pallet it must be recycled appropriately. When unpacking, check the functioning of SabreEcoTec units (**see LIOM19-003 Operating & Maintenance manual for further information**).

Our standard packaging consists of the unit secured to a pallet. This may vary in accordance with local shipping or contractual requirement.

10. STORAGE

INFORMATION

All load break switches and circuit breakers are in the 'OFF' position.

INFORMATION

Where possible, check the information on the rating plates and compare against the order confirmation.

CAUTION

If any anomaly or damage to the unit is apparent, do not install it, and please contact Lucy Electric as soon as possible.

10.1 Storage Guide

Keep dry

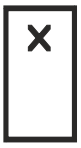
This way up

Storage Temp

Do not stack

Handle with care

Do not step on



High centre of gravity

Keep away from direct sunlight

The unit must be kept in its original packaging throughout its whole storage period.

- When stored, the units must remain in their original packaging, under shelter, and on a dry floor.
- When storing long term, regularly check the condition of the protective cover.

CAUTION

Following prolonged storage periods, all insulating parts must be thoroughly cleaned before use. Clean using a sponge and clean water. Do not use any alcohol or other cleaning solvents.

All panels are to be dusted using a clean, dry cloth.

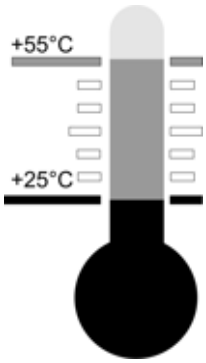
11. INSTALLATION RECOMMENDATIONS

11.1 Operating Conditions

WARNING

The operating ambient air temperature of the SabreEcoTec must be between -25°C and +55°C.

Relative humidity over a period of 24 hours must be a maximum of 98%.



11.2 Installation recommendations

DANGER

DO NOT OPERATE THE UNIT IF IT IS DAMAGED.

CAUTION

Condensation can cause problems with Switchgear, an indications such as water on the floor or within the trench area are causes of condensation and must be investigated.

It is important to control any cause of condensation

CAUTION

Electrical testing done during the commissioning phase of installation is to be conducted by competent and responsible electrical personnel only.

12. UNIT INSTALLATION

⚠ CAUTION **Electrical testing done during the commissioning phase of installation is to be conducted by competent and responsible electrical personnel only.**

12.1 Acceptance of unit

- The original packaging must be in good condition covering the unit on arrival.
- On arrival carry out a visual inspection of the unit and its functional components.
- Verify that the rating plate data matches the original order.

12.2 By receiving inspection

Before the unit is accepted it should be inspected carefully for loss or damage incurred during transit.

The order must be in good condition at the time of receipt. If any such damage has occurred, a claim must be submitted to the carrier immediately.

12.2.1 Unit RAL colour information

Below are the standard colours of a SabreEcoTec unit.

- Unit Cladding, Panels, Doors and Cable Boxes = **RAL 7032** – Grey
- Fascia = **RAL 7046** - Telegrey

Although these are the standard colours, units are also supplied in ‘customer specific’ colours - call for details.

12.3 Check synthetic air

Before installation and energising, check that the synthetic air pressure gauge indicator is in the green zone.

⚠ WARNING **If pressure indication is in the red zone, then DO NOT OPERATE and contact Lucy Electric immediately.**

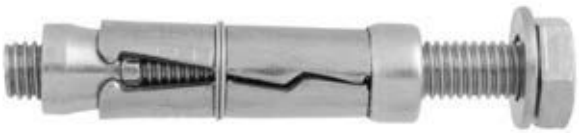
12.4 SabreEcoTec Unit Floor Mounting Details

12.4.1 Floor fixing

The unit must be fixed to a concrete plinth that must be of a high quality and flat.
The SabreEcoTec units are designed to be bolted down to a concrete plinth using FAZ II 12 anchor bolts.

INFORMATION

For Floor fixing details please refer to the contract drawing.



CAUTION

The concrete plinth must have no unevenness of greater than 7mm over a length of 1m and a width of 1m.

The Sabre EcoTec unit MUST BE bolted to the floor in all

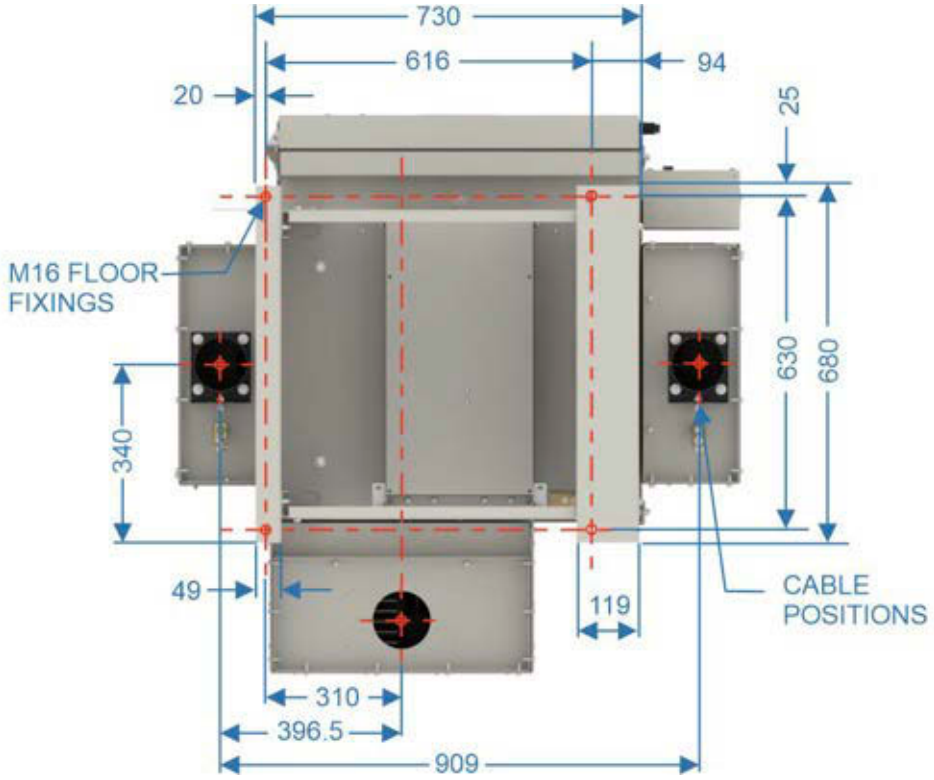
When mounting the unit to the floor a few items must be temporarily removed to access the four mounting holes, **see section 9.7, "Removing unit from pallet," on page 20.**

Prepare the ground for floor mounting by marking out, then drilling the required holes to suit the M12 bolts supplied.

12.5 SabreEcoTec Unit Floor Mounting Dimensions

The units are designed for bolting down onto a concrete plinth using 4 - M16 bolts.

12.5.1 VRN2e/VRN6e



Dimensions in millimeters

12.5.2 Unit Location

Authorities will have their preferred instructions for the installation of electrical equipment and these must be adhered to. If none are available, however, the following sequence is recommended.

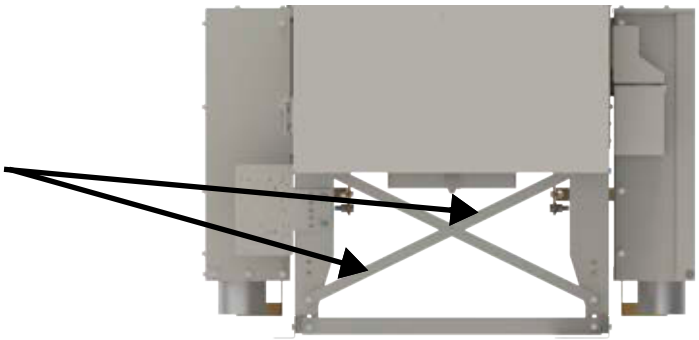
1 : Prepare the plinth, casting in floor chases in accordance with the Company's contract or arrangement drawings.
2 : Locate the unit, loosely assemble the floor fixings and grout in the rag bolts.
3 : When the cement has hardened, tighten the fixings - shimming under the unit base as required to level the unit and ensure that it rests equally at each fixing.

Metering Units for connection to transformers are equipped with jacking studs, which facilitate accurate final alignment with the transformer flange.

12.6 Stand Cross Brace Removal

Once the SabreEcoTec unit has been securely bolted to the floor as previously described or transformer mounted, the two stand front cross braces can be removed to give more access to the cable test access area.

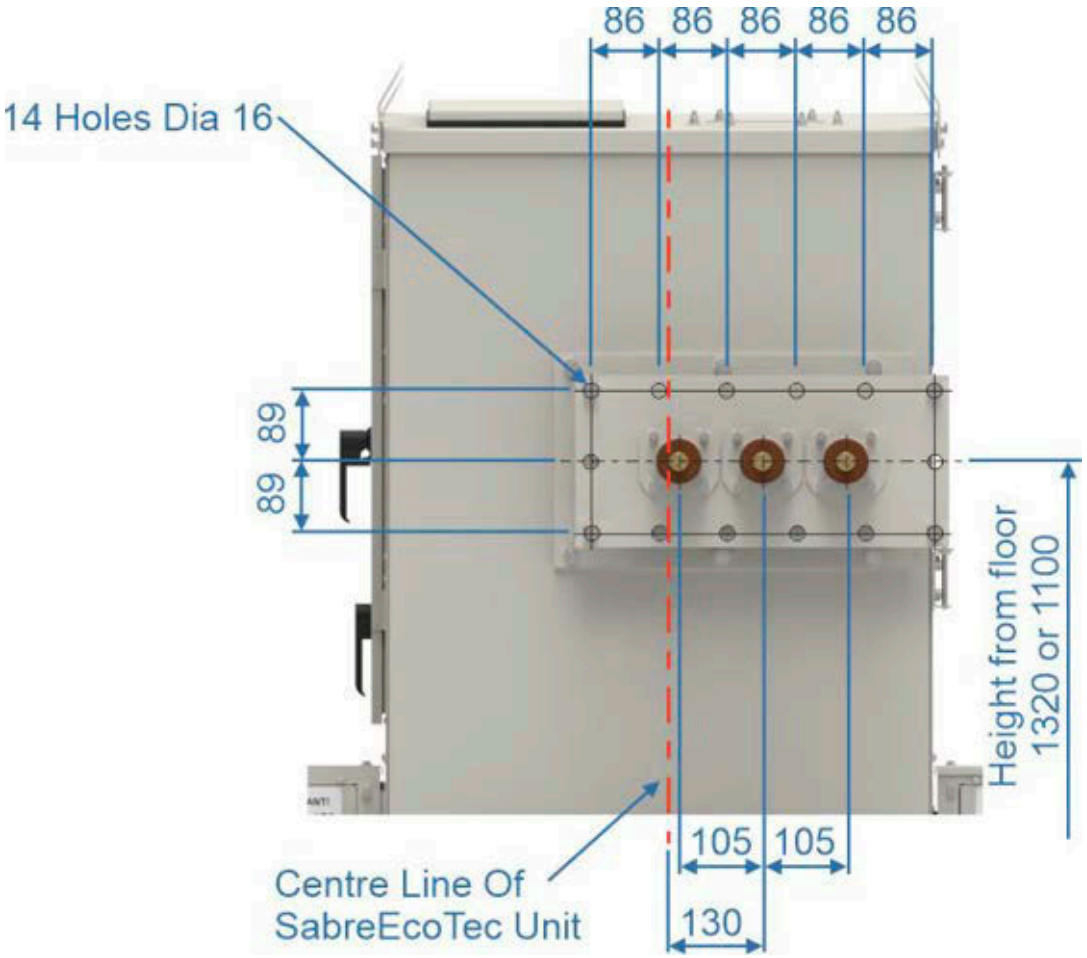
These front cross braces can be removed after installation



12.7 T-Off Mounting Flange

The SabreEcoTec unit can be fitted with a T-Off mounting flange to ENA TS 41-41 issue 2 fig 3 for cable boxes and metering units.

12.7.1 ENA TS 35-1 Transformer Mounting Flange



Dimensions in millimeters

SabreEcoTec VRN2e Transformer Mounted

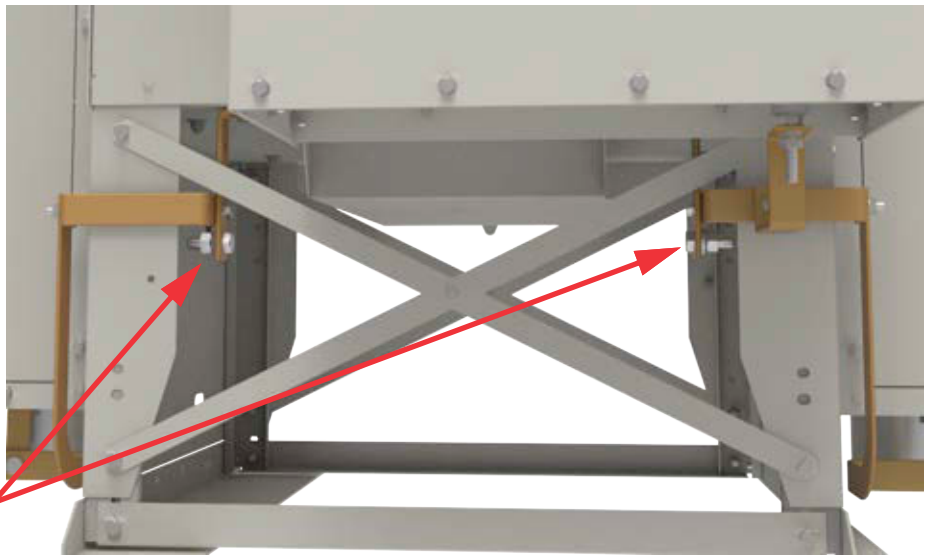
When transformer mounting the SabreEcoTec VRN2e unit, ensure the transformer support bracket is fitted and also the unit stand is set to 1100mm height.

Transformer Support Bracket

Typical SabreEcoTec VRN2e Package Substation

12.8 Earthing

The SabreEcoTec unit must be earthed at one of the primary earth points. These M12 earth points are located at the bottom rear of the unit, on both sides of the cable test access cover as shown.



Primary Earth Point

12.9 Marshalling Box

The marshalling box is located on the right hand side of the unit and houses the terminals for all customer options including load break switch motors, pressure switch and EFT CT's.

12.9.1 Marshalling Box Cable Entry

Any external cables are to be entered via the cable entry at the base of the marshalling box.

13. COMMISSIONING TESTS

WARNING **Commissioning should only be carried out by competent persons who are experienced with the use of the test**

13.1 Operation Tests

Before commencing commissioning, conduct a few operations on the unit. Operate each function ON - OFF - EARTH. **See LIOM19-003 Operation & Maintenance manual for further information.**

13.2 Main Circuit Resistance Tests

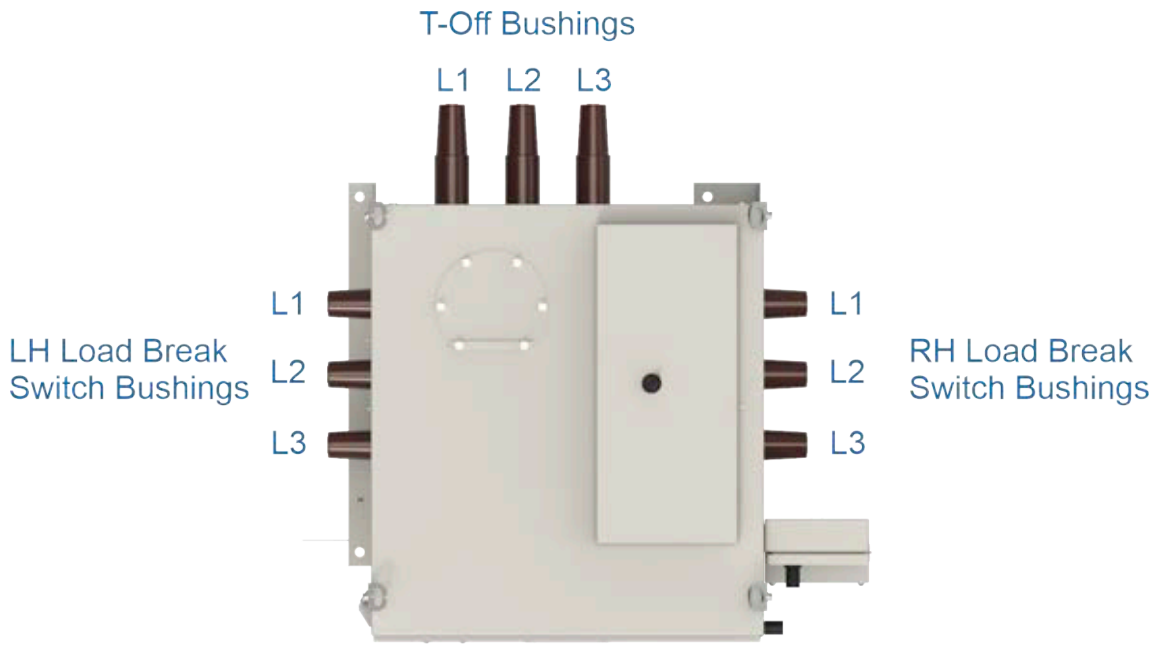
INFORMATION **It is recommended that Electrical Circuit Resistance readings are taken. This is to ensure the good working order of all moving parts inside the unit and to make sure the unit is safe to operate for testing.**

Resistance readings should be taken for the following circuit path for each phase:

These readings taken are to be compared with the following maximum values.

630A Load BreakSwitch and 630A T-Off							
		LBSW1 – RSW2	LBSW1 - Earth	LBSW2 - Earth	LBSW1 - T-Off	LBSW2 - T-Off	T-Off - Earth
Phase	L1	128	65	65	170	140	150
	L2	128	65	65	175	145	155
	L3	128	65	65	180	150	160

INFORMATION **Values shown are the maximum permissible in microhms (μΩ).**
Any readings which are above these maximum values should be reported to appropriate supervising personnel for review.



13.3 HV Tests Before Cabling or Connection To Transformer

The following tests are to be undertaken AFTER ensuring the Main Circuit Resistance' readings are within specification (see section 13.2, "Main Circuit Resistance Tests," on page 32).

Ensure appropriate screened insulations boots are used when HV testing

13.4 HV Insulation Resistance Testing

Using a suitable insulation resistance test device (1kV or 5kV dc megger), measure the insulation resistance to earth of each phase, in turn, with the other two earthed. The readings should not be less than 100 megohms, lower values may indicate damaged or dirty insulation.

For HV tests, the Load Break Switch must be in the '**ON'** position, and the following tests are taken through the cable terminals.

The following tests should not be undertaken if these readings are less than 100 megohms

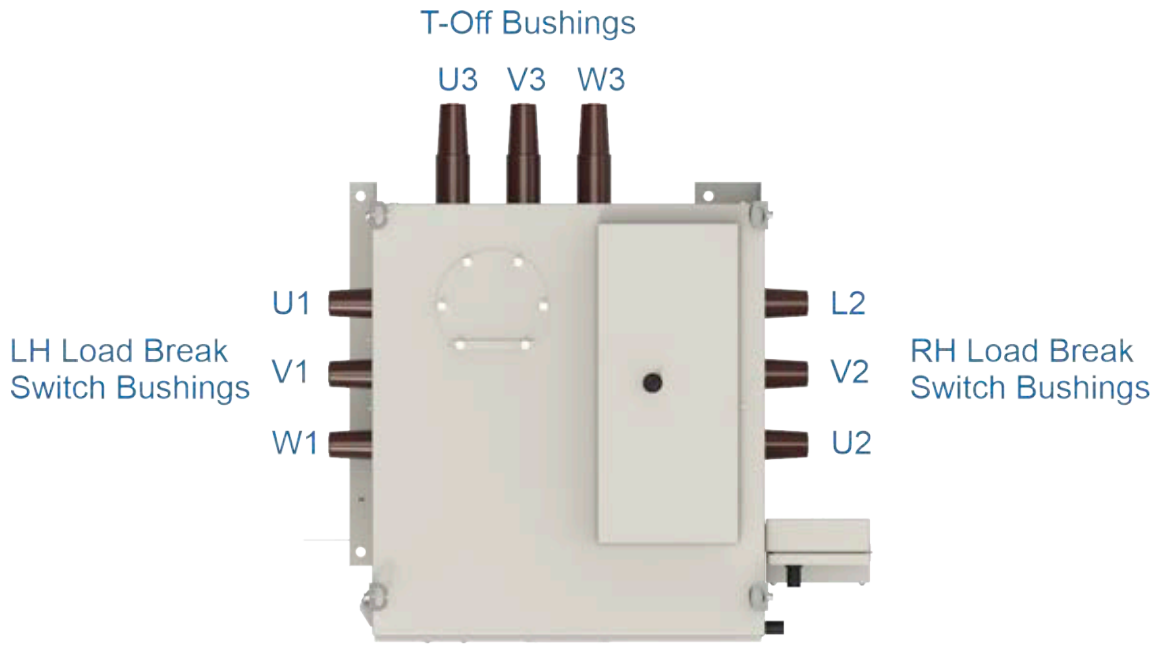
13.5 Power Frequency Testing

These test values are to IEC 62271-1.

Conduct these tests as follows:

- Ensure unit has correct gas pressure.
- Ensure the VPIS (if fitted) is shorted to earth.
- Follow the test checks below and apply Voltage Test checks using table, **see "section 13.5.2 Test Voltages Checks" on page 34**
- The test is considered acceptable when neither breakdown or flash-over has occurred (where necessary, fit additional insulation onto the bushings).

13.5.1 Test Checks



Test	RH Load Break Switch	LH Load Break Switch	Disconnector	CB Switch	Apply Test Voltage To:	Earth
Test Phase To Phase And Phase To Earth.						
1	Closed	Closed	Service	Closed	U1, W1	Frame, V3
2	Closed	Closed	Service	Closed	V1	Frame, U3, W3
3	Closed	Closed	Service	Open	U1, V1, W1	U3, V3, W3
4	Open	Open	Service	Closed	U1, V1, W1, U2, V2, W2	U3, V3, W3

13.5.2 Test Voltages Checks

Test Voltages (Represent 80% of the routine factory test voltage).

Test	12kV	15.5kV	Duration (Mins)	Fit Insulation Caps And Adaptors
1	22.4kV	30.4kV	1	Yes
2	22.4kV	30.4kV	1	Yes
3	25.6kV	36kV	1	Yes
4	25.6kV	36kV	1	Yes

13.6 Secondary Wiring Insulation Resistance Testing

In addition to this, the SabreEcoTec unit is also tested at 2kV during the manufacturing process and is not required to be re-tested at this voltage level.

It is recommended that sensitive electronic devices, motors and actuators and actuator control pcb's, be detached from the unit prior to testing (this includes any case earths found on relays etc). 1kV testing across auxiliary indication wiring and contacts across EFI's/FPI's is not recommended, unless approved by the manufacturer. If testing is conducted across such contacts, the applied test voltage must not exceed 1kV.

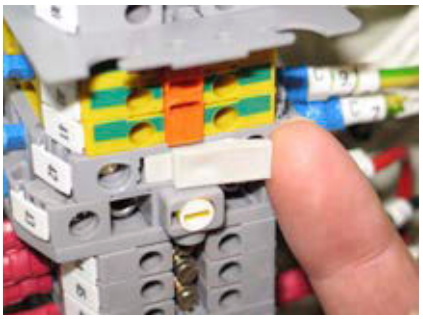
13.6.1 1kV test.

- Remove the earth link, **see "section 13.6.2 Removal of the Earth link" on page 35**.
- Where units are not fitted with a removable earth link, ensure all earths are removed from the unit, both internally and externally.
- If protection relays are fitted remove the relay from its housing on the front of the unit before commencing test.
- Attach the black (negative) lead of the test set to the unit at any point where a bolted connection is present (nut etc.).
- Using the red (positive) lead as a probe, test each of the connections located on the terminal block in the Marshalling box for approx 2 seconds.
- Any indication of continuity should be investigated and rectified.

13.6.2 Removal of the Earth link

1. Position of earth link

2. Lift link with finger.



3. Rotate the link completely

13.7 DAT TLF Type Protection Test

The commissioning tests for DAT TLF protection can be taken from the **LIOM19-004 Sabre EcoTec DAT Time Limit Fuse (TLF) Setup Manual.**

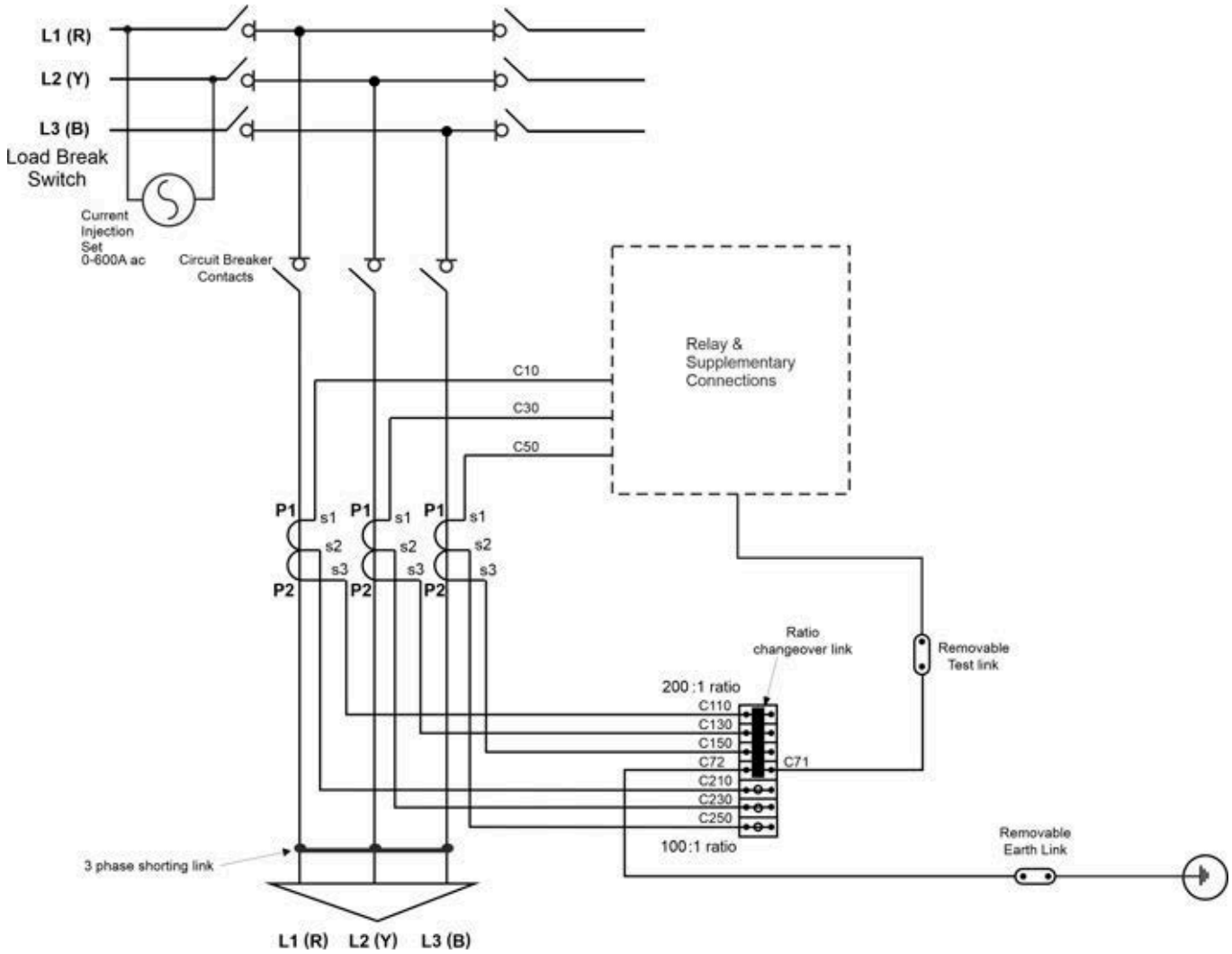
13.8 Relay Type Protection Tests

INFORMATION

The following test diagrams in this section are generic and only explanation purposes for relay type systems. Although only 200/1 and 100/1 ratios have been used, all ratios must be tested using diagram supplied with each unit.

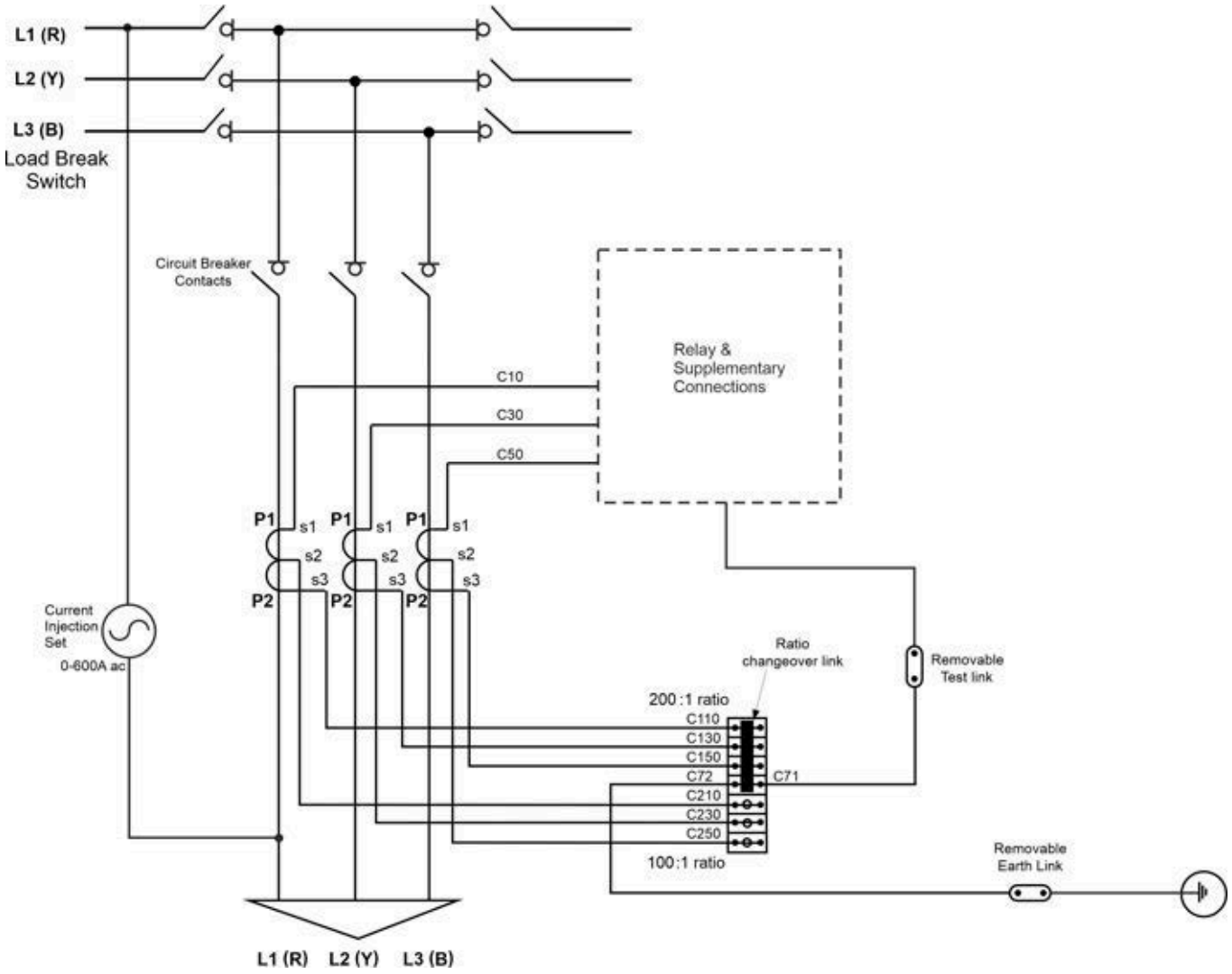
13.8.1 Relay Primary Injection Test - Overcurrent Test

- Ensure the load break switches and circuit breaker are closed.
- Setup test as shown, ensuring the removable earth link & test link are fitted and closed.
- Ensure the 3 phase shorting link (100A rating) is fitted as shown.
- Setup relay for overcurrent test, including settings.
- Apply the appropriate test current to the relay setting and CT ratio.
- Repeat for each phase.
- Repeat for each ratio - values to be recorded if necessary.



13.8.2 Relay Primary Injection Test - Earth Fault Test

- Ensure the load break switches and circuit breaker are closed.
- Setup test as shown, ensuring the removable earth link & test link are fitted and closed.
- Setup relay for earth fault test, including settings.
- Apply the appropriate test current to the relay setting and CT ratio.
- Repeat for each phase.
- Repeat for each ratio - values to be recorded if necessary.



13.8.3 Relay Secondary Injection Tests - Overcurrent and Earth Fault Test

Consult the appropriate relay technical documentation for recommended secondary injection procedure, commissioning checks and any necessary equipment required.

13.9 Current Transformer Tests

13.9.1 Polarity Test

- Set the CB under test and adjacent function to the Closed (**ON**) position.
- Remove the shorting link from the CT ratio change over terminals in the marshalling box, terminals 101-107.
- Select a phase to test.
- Connect an analogue meter, with the positive (red) lead to the secondary injection terminal for the phase under test (marshalling box terminals 46,47or 48)[1] and the negative lead of the analogue meter to the high ratio terminal of the ratio change over terminals for the phase under test (ratio change over terminals 101 - L1, 102 - L2, 103 - L3).
- Set the meter to the µA scale.
- Testing each phase individually, apply a small (typically 9V DC) voltage instantaneously (pulse) adjacent function bushing and CB phase bushing under test. The positive lead going on the ring phase bushing & the negative going onto the circuit breaker phase bushing.
- The needle should jump instantaneously to the right (positive direction) & then settle back to zero. Instantaneous deflection in the negative (Left) direction indicates that the CT connections are the wrong way round or the CT is incorrectly mounted.
- Repeat this test on all phases with CTs', ensuring that all movement indicated on the analogue meter scale is in the same direction.
- Replace the shorting link on the CT ratio change over terminals on the fascia panel, ensuring it is correct as per the marshalling box terminal label.

[1] Note that where secondary injection terminals are not available:
Relay units the ammeter positive lead (red) can be connected to the high ratio terminal of the ratio change over terminals for the phase under test (ratio change over terminal 1-L1, 2 -L2 or 3-L3), and the and the negative (black) lead of the analogue meter to the low ratio terminal of the ratio change over terminals for the phase under test (ratio change over terminal 5-L1, 6 -L2 or 7-L3).

13.9.2 Ratio Test (Relay Units)

Testing via relay display

This is the preferred method of testing as it ensures the CT ratio is correctly set on the relay.

For instructions on how to set relay parameters please refer to the relay manufacturers instruction manual.

All CT ratios must be tested

- Ensure the CT ratio setting on the relay is the same as that selected via the CT ratio change over link in the LV.
- Set the current display mode of the relay to display primary current.
- Set the CB under test and adjacent function to the Closed (**ON**) position.
- Select a phase to be tested
- Using a Primary injection set, inject current from the adjacent function through to the CB, appropriate to the CT ratio on the test phase selected.
- Read the current displayed from the relay ensuring the value is correct as per the injected current. Also check that current is ONLY present in the phase being energised.
- Repeat for all phases.
- Repeat for all available CT ratios.
- Ensure the CT settings are the same across the ratio change over terminals in the LV compartment, the CT ratio label on the marshalling box door, and the setting in the relay.

Testing by use of Ammeter\Clamp meter

- Set the CB under test and adjacent function to the Closed (**ON**) position.
- Open the test link (terminal 114) in the marshalling box.
- Check the CT ratio change over link on the front panel is fitted and note the CT ratio.
- Select the phase to be tested.
- Connect ammeter (or test link and clamp meter) between the relay secondary injection terminal for the phase under test (LV fascia terminals 46,47,48)[1] and the lower side (wire number C70 connected) of the removable test link.
- Inject current between adjacent function and circuit breaker bushings, each time relevant to the available CT ratio.

  E.g.: 200 A for 200:1 CT ratio
  100 A for 100:1 CT ratio
- Record the secondary current, which should be approximately the rated CT secondary current (E.G.: 1Amps).
- Checks should be made to ensure no circulating currents in phases not being energised.
- Repeat for all phases and CT ratios.
- Replace test link (Terminal 114).
- Ensure the CT settings are the same across the ratio change over terminals in the fascia panel, the CT ratio label on the marshalling box door, and the setting in the relay.

[1] Note that where secondary injection terminals are not available the ammeter or clamp meter can be connected across the test link terminal - with the test link open. However, this will not verify that the CTs are connected to the correct phase.

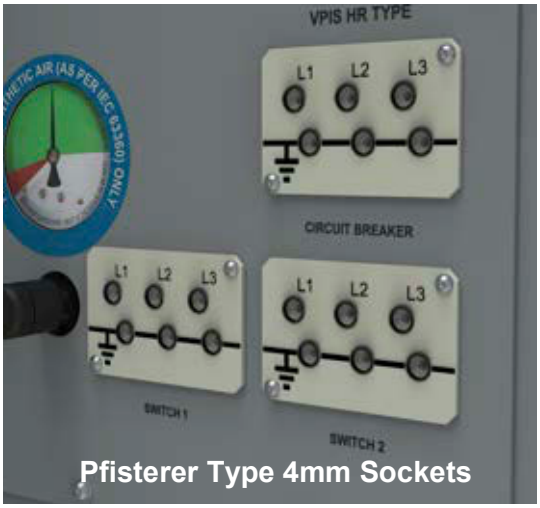
13.10 VPIS & VDS

13.10.1 VPIS & NEON Indication (if fitted)

Both VPIS (voltage presence indication system) & neon indication systems are available as an option..

The VPIS system is complete with voltage limiting devices to ensure safety in the event of an insulation failure.

VPIS can be used to test both for correct phase orientation of cables and for the presence of voltage. The VPIS system can be the Pfisterer type (4mm sockets LR system using relevant LR adapters) which comply with IEC 62271-213 either with or without push button neons.



Pfisterer Type 4mm Sockets

13.10.2 VDS Indication (if fitted)

The VDS is for the detection of voltage condition in high voltage equipment, according to IEC62271-213. It displays continuous three phase voltage indication.

The VDS includes a self-test which offers inherent safety, no external test device is required. The test is activated by the Test button and does not need any auxiliary supply. This test allows distinguishing between voltage absence and any device fault. This test is mandatory for safe detection of voltage absence.

13.11 VPIS & VDS Commissioning Checks

WARNING **The following tests should be made during commissioning where applicable.**

13.11.1 Pickup voltage

For a 12kV unit this value will be below 5kV.

Using a high voltage test set, apply the appropriate voltage to the unit between the selected phase (left or right side) and earth.

Insert the appropriate neon test device into the relevant socket and check that voltage presence is indicated by the flashing neon (in some cases the flashing may be very rapid and appear as continuous).

13.11.2 Crossover voltage

Once it is determined that the Neon indicators are functional and correct pickup values determined, proceed to completing a crossover check. Test as follows:

- Using a high voltage test set, apply the appropriate voltage to the unit between the selected phase (left or right side) and earth. For 12kV units this is normally 6.9kV.
- Insert a neon indicator into the appropriate phase and check operation.
- With power maintained on the unit, check each of the other phase neon's (both left and right) for any indication of voltage. There should be no indication on the other phases.

13.11.3 Phase comparator

The Pfisterer phase comparator can be used to determine correct phase connection of a cabled unit. Test as follows:

- Ensure both ring switches are open if the HV cables are going to be used to carry out the test.
- For 12kV and higher system voltages, ensure the LRM adapter is inserted into the sockets (or the Pfisterer converter).
- Connect the comparator according to the manufacturer's instructions and check the unit for correct connection of phase cables according to the coloured lights.
- The comparator can also be used as a neon voltage presence indicator.

13.12 Shunt Trip (if fitted)

Where shunt trip terminals have been fitted in the marshalling box, the following procedure is to be followed to ensure effective operation of the shunt trip device.

- Locate the shunt trip terminals on the marshalling box using the supplied wiring diagram to confirm the terminal numbering.
- Using appropriate test set, apply voltage to the two previously identified terminals
- If the unit is fitted with a DC shunt coil then tests should be done at 70% & 110% rated voltage.
- If the unit has an AC coil fitted, then testing should be done at 85% & 110% of rated voltage.
- The unit should trip.
- The operation of the shunt trip device is thereby confirmed. Any unexpected tripping operation during testing should be investigated and reported to the appropriate responsible person/supervisor.

13.13 Auxiliary Wiring Switch testing

Auxiliary wiring should be checked for continuity as well as various auxiliary switches and contacts. Please refer to the supplied marshalling box wiring diagram.

The following are to be checked on the unit, to ensure correct operation, before completing installation:

- Load break switch auxiliary contacts.
- CB/T-Off auxiliary contacts.
- Motorization indication circuits - operation of motor actuation should be checked if fitted/supplied with the unit.

13.14 Electrical Tests After Cabling or Connection To Transformer

Switch one of the ring switches into the '**EARTH ON**' position, slide the 'Ring Switch Selector' into the centre position, then open the cable test access cover.

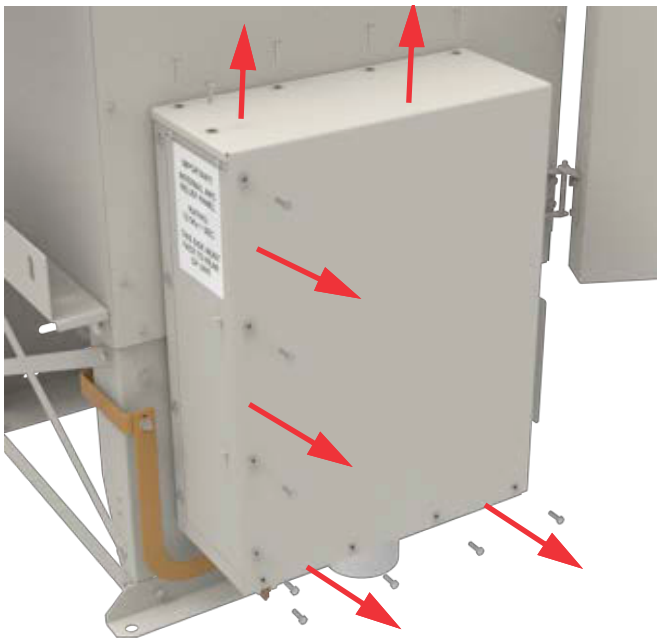
Apply a test voltage of 25kV dc (or as specified by network owner) to earth for 15 minutes. Repeat tests on the other ring switch.

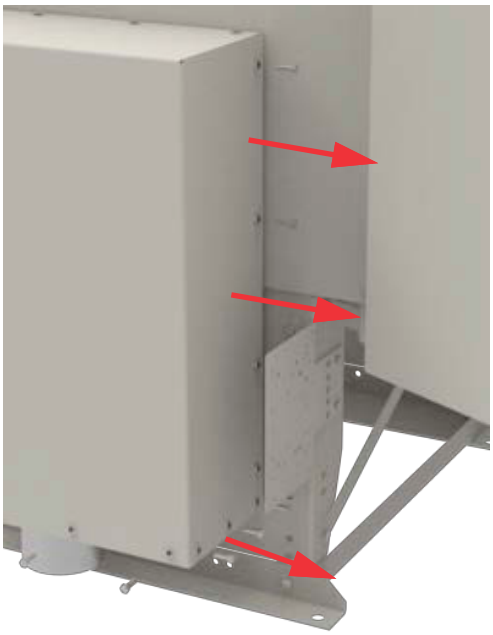
It should be noted that for transformer connected units, the circuit breaker or selector should be in the isolating position before proceeding to ensure the transformer does not suffer any damage.

14. CABLE BOXES

14.1 Removing Switch Cable Box Covers

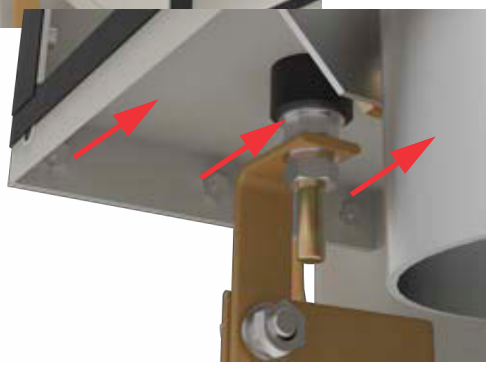
1 : Remove the M6 screws, washers and spring washers from around the cable box as shown.





2 : Lift off the main cable box cover.

3 : Remove the M6 screws, nuts and washers from the rear panel along the side and from under the gland plate as shown.

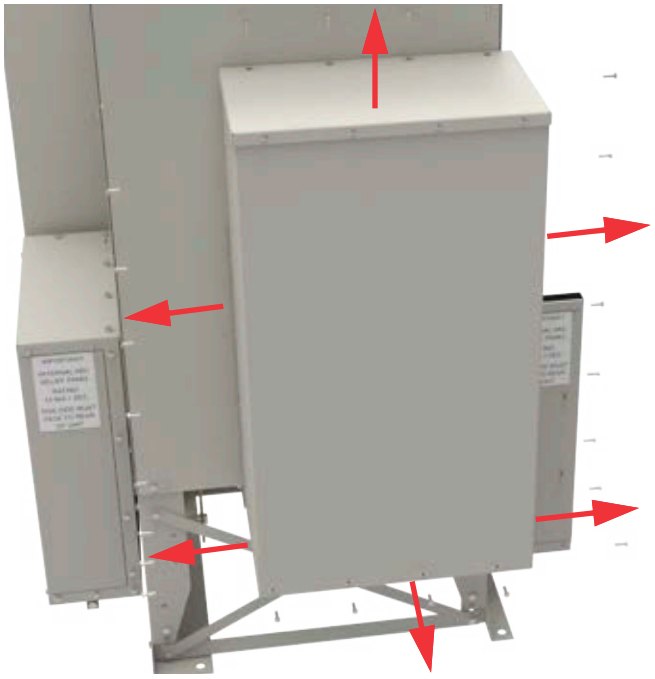


4 : Remove the rear cable box cover panel.

5 : Access is now available for cabling.

14.2 Removing T-Off Cable Box Cover

1 : Remove the M6 screws, washers and spring washers from around the cable box as shown.



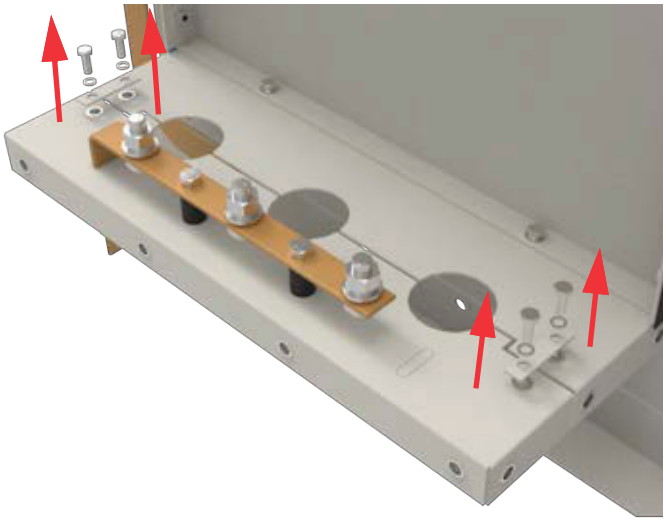
2 : Lift off the cable box cover.

3 : Access is now available for cabling.

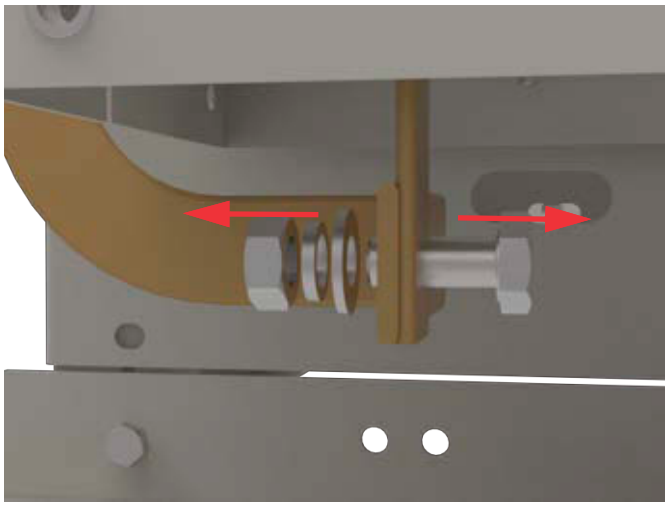
14.3 Split Gland Plates (if fitted)

Split gland plates are available to ease the cabling of the unit. To split the gland plate before cabling, follow these instruction.

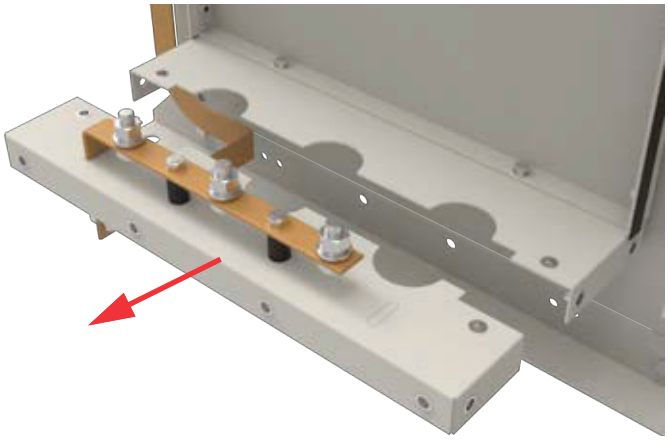
1 : Remove the M6 screw, washers and plates from each end of the gland plate.



2 : If fitted, move the bolt, nut and washers from the earth bar below the gland plate.



3 : Remove the M6 screws, washers and plates from each end of the gland plate.

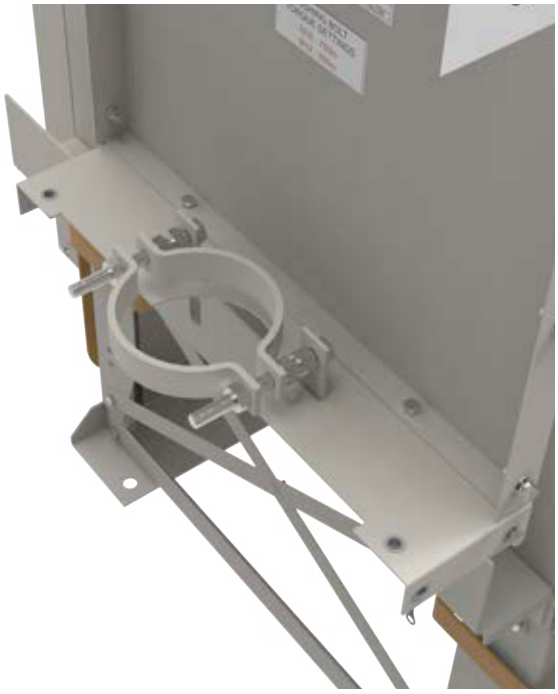


14.4 Split Gland Plates Fitted With Cable Clamps

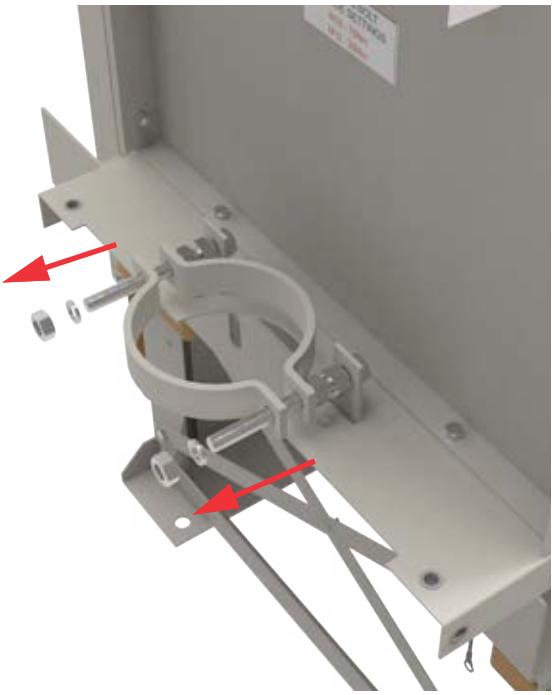
Various types of split gland plate are fitted with cable clamps. To remove the cable clamp for access, follow these instruction.

14.4.1 Single 3-core Cable Clamps

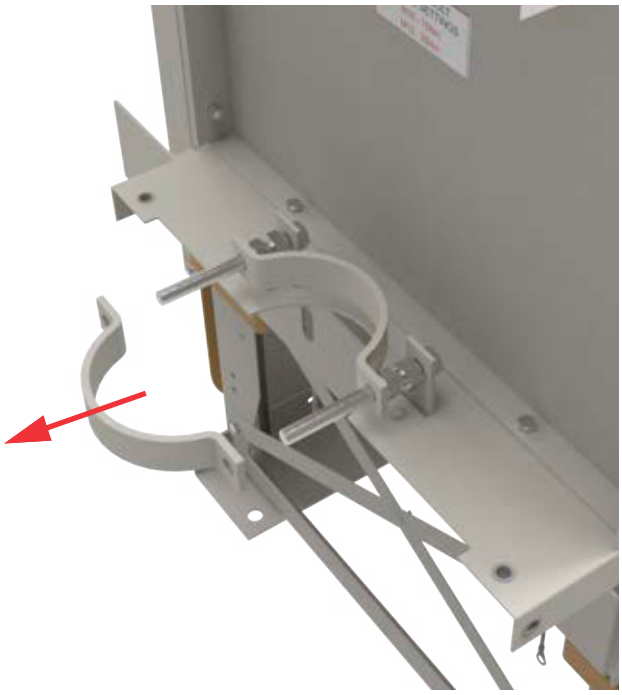
1 : Remove the front split gland plate **(see section "14.3 Split Gland Plates (if fitted)" on pg.44).**



2 : Remove the two M8 nuts and washers.



3 : Remove the front cable clamp.

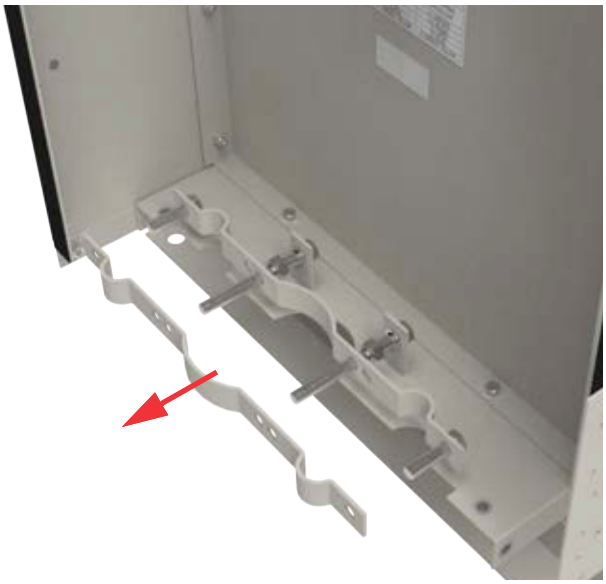


14.4.2 3 Single-core Cable Clamps

1 : Remove the front split gland plate **(see section “14.3 Split Gland Plates (if fitted)” on pg.44).**

2 : Remove the four M8 nuts and washers.

3 : Remove the front cable clamp.



15. CABLE CONNECTING RECOMMENDATIONS

15.1 Cable Terminations

The bushings for load break switches are located on the side of the unit. These bushings are type 'C' with in-line bolted connections M16 threaded in accordance with EN50181. The T-Off bushings are located at the rear of the unit are in-line bolted connections M12 threaded. All T-Off bushings are fitted with stress relief collars and MUST NOT be removed unless to fit a taper kit (see diagrams below).

If cable boxes are fitted, then the bushings are accessible by removing the cable box cover (**see section "14. Cable Boxes" on pg.42**).

The maximum cable size that can be used is*:

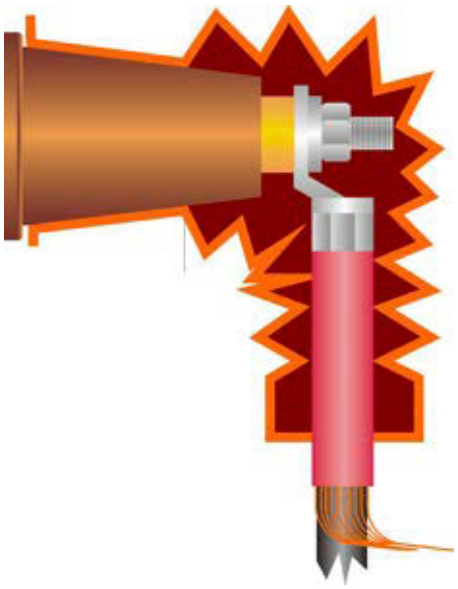
- 400mm² - three core cable
- 500mm² - single core cable

*** For other cable sizes, please contact your local sales office.**

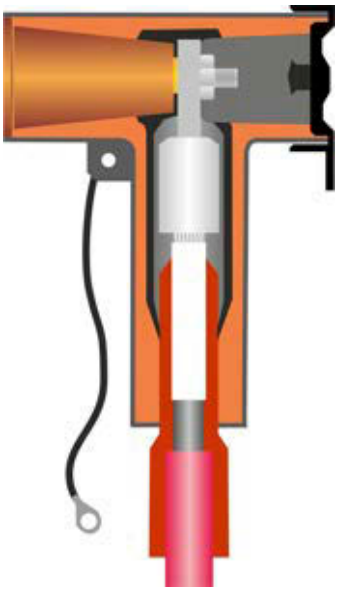
The following types of cable termination can be used with the SabreEcoTec:

Load Break Switches Bushings

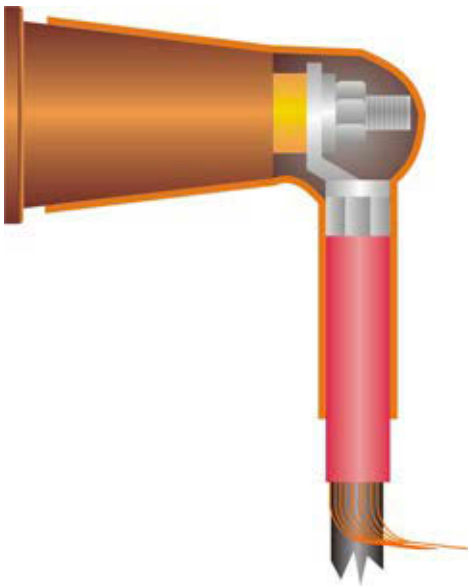
Insulating Bushing Boot



Plug-In Type

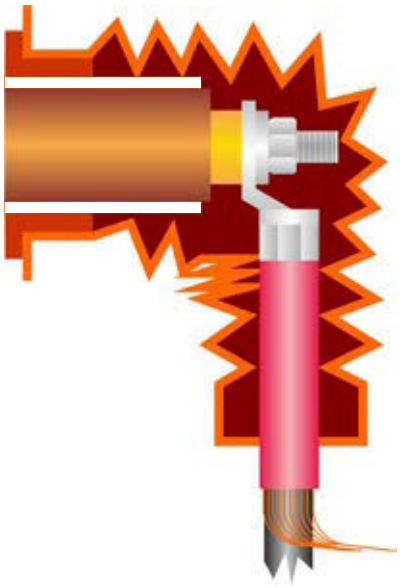


Heat Shrink Insulation Bushing Boot

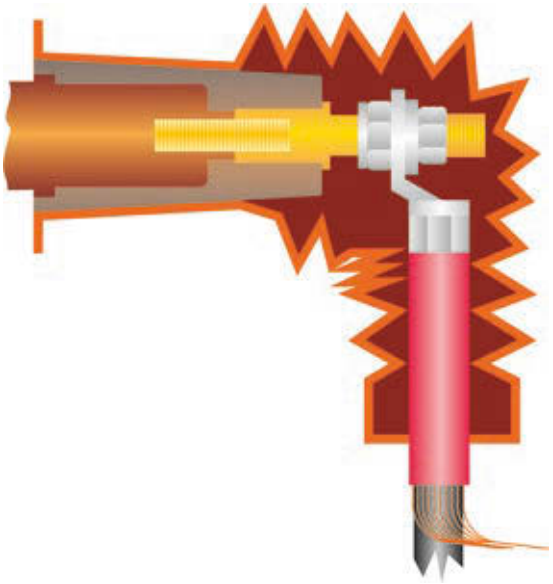


T-Off Bushings

Insulating Bushing Boot



T-Off Taper Kit (With white stress relief collar removed)



M16 copper thread or into copper - 75Nm

M12 copper thread or into copper - 35Nm

INFORMATION

It is recommended to have at least 1.5X thread into bushings, e.g. screw 18mm into M12 hole.

INFORMATION

Contact Lucy Electric for further cable termination details

INFORMATION

If plug-in termination is being used, lubricate the bushing and inside of the socket before fitting. Contact termination supplier for details of correct lubricate to be used.

CAUTION

Appropriate screened insulation boots should be used when in service and when HV testing is performed on site, this is to avoid any external tracking and discharge on the bushings.

15.2 Cable Connecting Recommendations

CAUTION

The unit must be fixed to the floor before any cable connections are carried out - see section "12.4.1 Floor fixing" on pg.27.

- No mechanical load must be exerted on the bushings during installation.
- MV cable lengths are to be cut for each phase.
- Cable ends must be prepared in accordance with the cable termination manufacturer's instructions.
- The terminal line must be perfectly aligned with the line of the bushing.

The depth of the cable trenches must be compatible with the cables curvature radius.

DANGER

Cable connections must be carried out with the unit de-energised.

Correct Assembly

It is essential that the cable terminal is aligned correctly on the bushings.

3 Single-core Cables

Incorrect Assembly

The cable termination must not pull on the bushing, as this can damage the unit and lead to gas leakage.

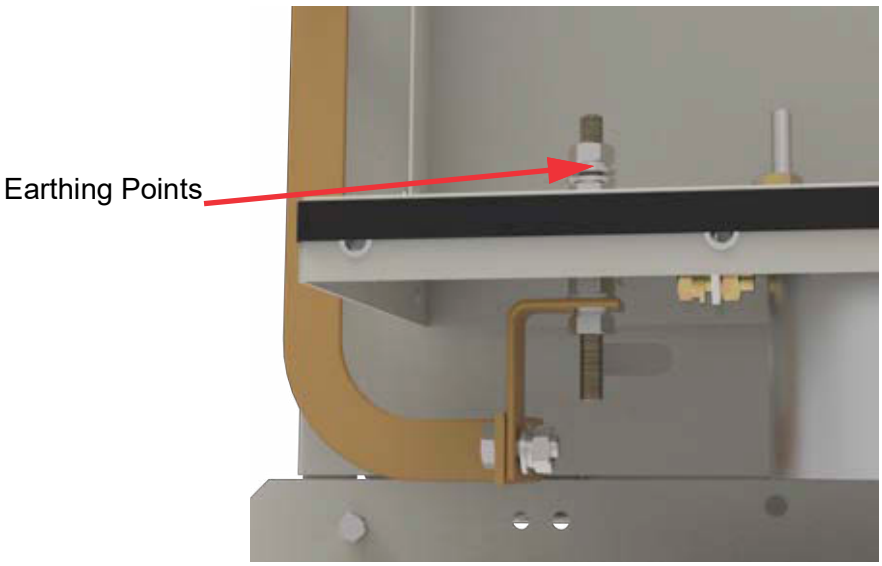
Single 3-core Cables

CAUTION

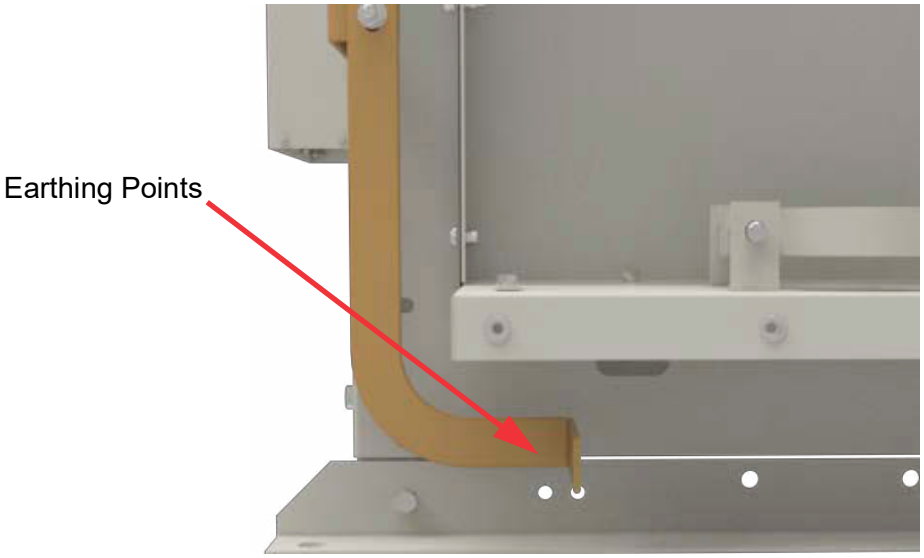
Ensure all cables are routed and laid in such a way that there is no stress on the bushings and secured using cable cleats, glands and cable clamps.

15.3 Cable Termination Earthing

For earthing cable terminations, there are gland plates with integral M12 earthing points as shown.



For other types of gland plates, there is also an external M12 earthing point for cable terminals.



15.4 Cable Installation - 3 Single Core

INFORMATION

Note: This procedure is based on the 3- Single Core cable system.

1 : To begin, ensure the cable box cover has been removed, **see section "14.1 Removing Switch Cable Box Covers" on page 42** or **see section "14.2 Removing T-Off Cable Box Cover" on page 43**

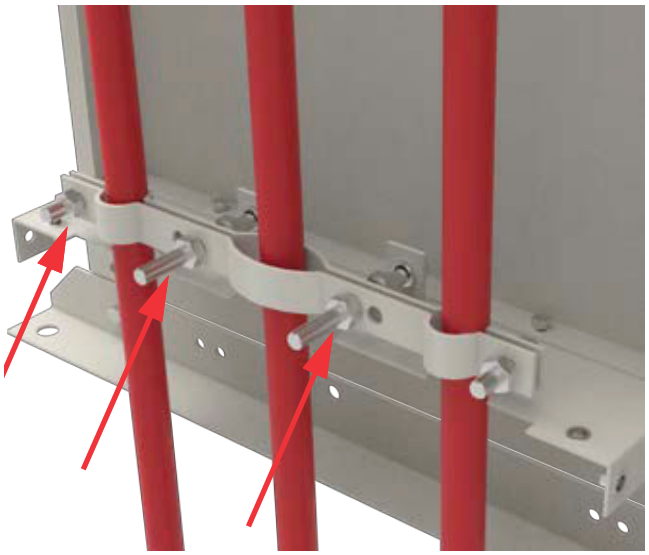
2 : Remove the front half of the gland plate, **see section "14.3 Split Gland Plates (if fitted)" on page 44** or **see section "14.4 Split Gland Plates Fitted With Cable Clamps" on page 45**

3 : Feed the incoming cables up into the cable box and cut to length.

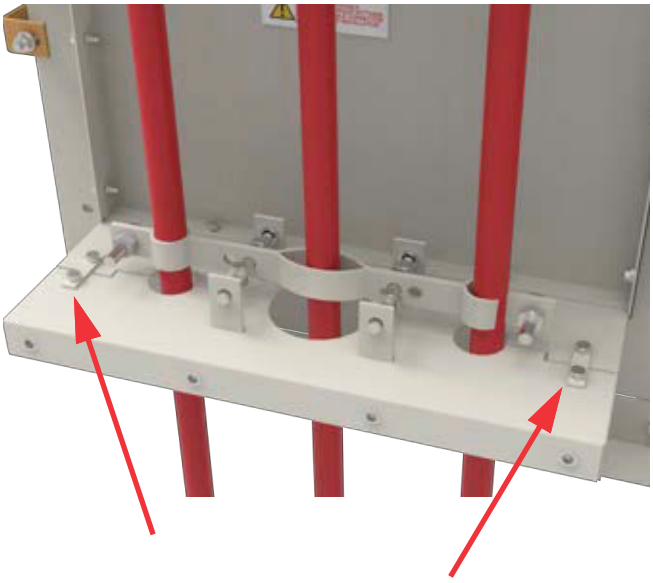
4 : Retrieve the grommets from the gland plate, cut to the correct diameter and slide down the incoming cable until the grommet can be fitted in to the rear half of the gland plate. Repeat this process for all three incoming cables.

5 : Fit the end terminations to the incoming cables as per manufactures instructions.

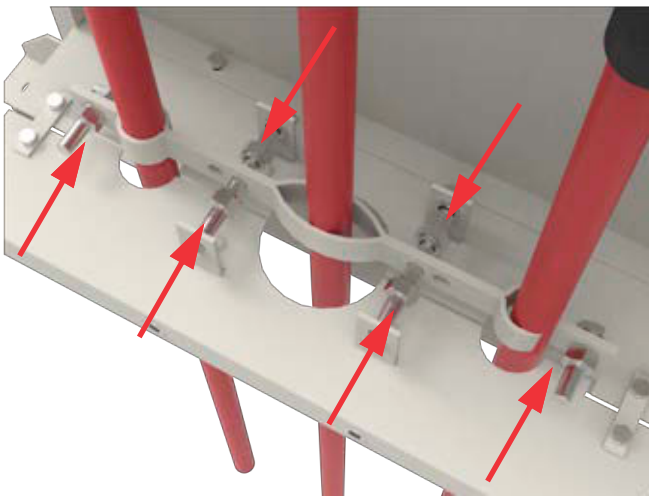
6 : Refit the clamp plate, four nuts and washers.



7 : Refit the front half of the gland plate using the two support plates, four bolts and washers.



8 : Adjust the nuts either side of the clamping bolts and the two end nuts to tighten the clamp plate on the cables, ensuring the cables are centrally positioned about each gland hole. The cable clamping must take the weight of each cable, ensuring no mechanical load is exerted on the bushings.



WARNING

Ensure the cable clamping takes the weight of the cables ensuring no mechanical load is exerted on the bushings.

INFORMATION

For earthing cable terminations, **see section "15.3 Cable Termination Earthing" on page 50**

15.5 Cable Installation - Single 3 Core

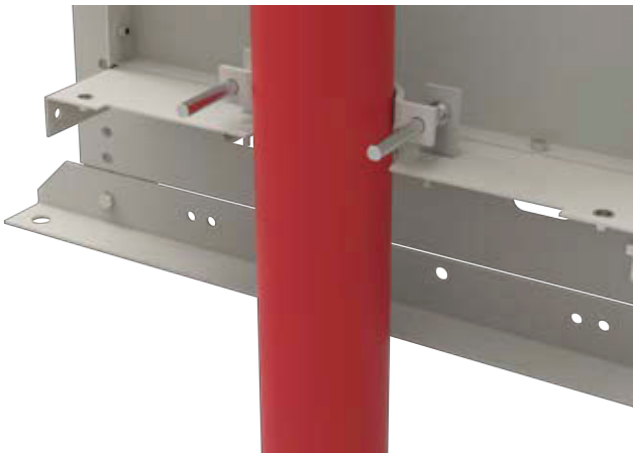
INFORMATION

Note: This procedure is based on the Single 3 Core cable system.

1 : To begin, ensure the cable box cover has been removed, **see section "14.1 Removing Switch Cable Box Covers" on page 42** or **see section "14.2 Removing T-Off Cable Box Cover" on page 43**

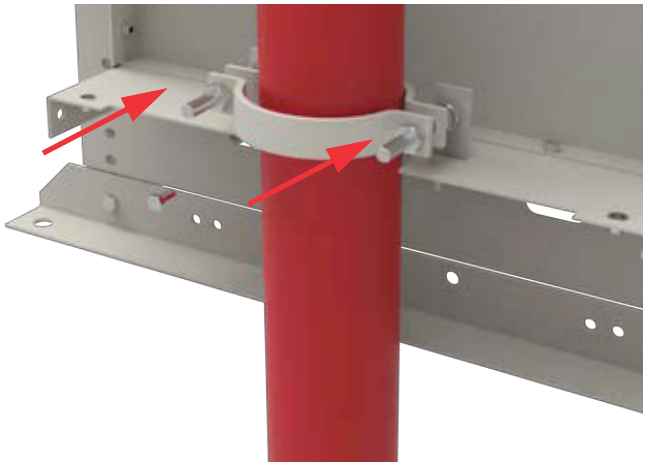
2 : Remove the front half of the gland plate, **see section "14.3 Split Gland Plates (if fitted)" on page 44** or **see section "14.4 Split Gland Plates Fitted With Cable Clamps" on page 45**

3 : Feed the incoming cable up into the cable box and cut to length.

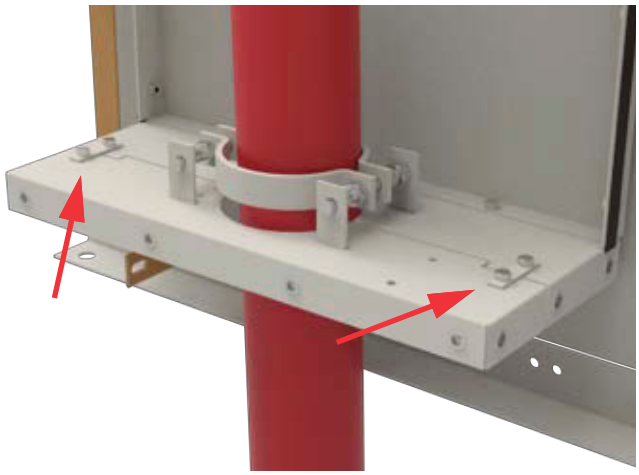


4 : Fit the end terminations to each core of the incoming cable as per manufactures instructions.

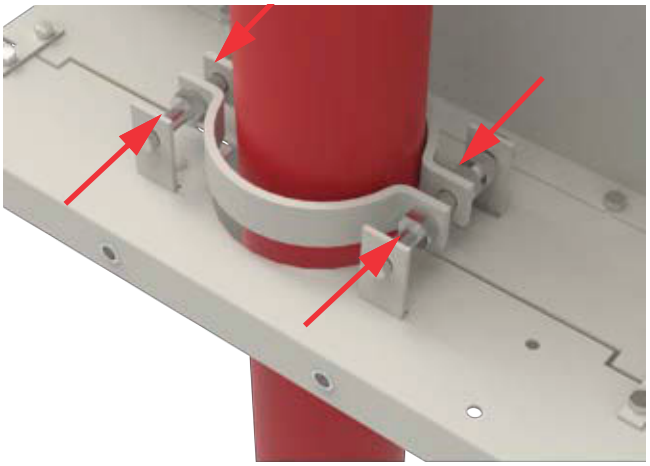
5 : Refit the front cable clamp, nuts and washers.



6 : Refit the front half of the gland plate using the two support plates, four bolts and washers.



7 : Adjust the nuts either side of the clamping bolts to tighten the clamp plate on the cable, ensuring the cable is centrally positioned about the gland hole. The cable clamping must take the weight of the cable, ensuring no mechanical load is exerted on the bushings.



WARNING **Ensure the cable clamping takes the weight of the cable ensuring no mechanical load is exerted on the bushings.**

INFORMATION **For earthing cable terminations,** **see section "15.3 Cable Termination Earthing" on page 50**

16. END-OF-LIFE-SERVICE

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

16.1 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.

16.2 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:

Tel: +44 (0) 1844 267 267

Fax: +44 (0) 1844 267 223

Email: technicaldepartment@lucyelectric.com

Lucy Electric international offices

Lucy Electric UK Limited

Howland road, Thame, Oxfordshire, OX9 3UJ,
United Kingdom.
Tel: +44 (0) 1844 267 267
E-mail: salesuk@lucyelectric.com
Aftersales:
contractmanagement@lucyelectric.com

Lucy Electric Manufacturing & Technologies India (Private) Ltd

Village Noorpura, Baska besides Polycab,
Halol Baroda Toll Road, Taluka Halol,
Panchmahal, Gujarat, 389350,
India.
Tel: +91 2676 304912

Lucy Electric India Private Ltd

2B-46 & 47, 2nd Floor,
Kurla West
Mumbai, 400070,
India.
Tel: +91 22 62366616

Lucy Electric GridKey Ltd

8 Argent Court, Sylvan Way,
Southfields Business Park,
Basildon, Essex, SS15 6TH, United Kingdom.
Tel: +44 (0) 1268 850000
E-mail: sales@gridkey.com.uk

Lucy Electric Gridkey Swindon

607 Delta, Welton Road,
Swindon, SN5 7XF.
E-mail: sales@gridkey.co.uk

Lucy Asia Pacific Sdn. Bhd

Unit 17-05-06, Level 17
PJX-HM Shah Tower,
No16A Jalan Persiaran Barat, 46050
Petaling Jaya, Selangor, Malaysia
Tel: +603 74910700
E-mail: salesmy@lucyelectric.com

Lucy Middle East F.Z.E.

PO Box 17335, Jebel Ali, Dubai,
United Arab Emirates.
Tel: +9714 812 9999
E-mail: salesme@lucyelectric.com
Aftersales: customer.service@lucyelectric.com

Lucy Electric (South Africa)

Unit 12 & 13,Block C, Honeydew Bussiness Park,
1503 Citrus Street, Laser Park, Honeydew, 2170,
South Africa.
Postal Address: P.O. Box 1078, Honeydew.
Tel: +27 11 0257490
E-mail: salesza@lucyelectric.com

Lucy Electric East Africa

13th Floor Landmark Plaza,
Argwings Knodhek Road,
Nairobi.
P.O. Box-00606 - 00400
Kenya.
Tel: +254 (0) 203 673 927

Lucy Electric (Thailand) Limited

388 Exchange Tower, 37th Flr Unit 3702
Sukhumvit Road, Klongtoey Sub district
Klongtoey District, Bangkok, 10110
Thailand
Tel: +66 (02) 663 4290
E-mail: salesthailand@lucyelectric.com

Lucy Equipamentos Elétricos Ltda

Av. das Araucárias 2558
Thomaz Coelho
CEP 83707-067
Araucária
Paraná State • Brazil
Tel: +55 (41) 2106 2801
E-mail: salesbrazil@lucyelectric.com

Lucy Switchgear Arabia Co. Ltd

Novotel Business Centre, PO Box 35340
Dammam 31488, Saudi Arabia.
Tel:+96 6138 147 910
E-mail: salesksa@lucyelectric.com

Lucy Switchgear Arabia Ltd

Tahlia St, Andlus Dist.
Jameel Square Center,
Office No 118,Jeddah, 21533,
Saudi Abria
Tel: +966 02 6648573

Lucy Electric Australasia Pty Ltd

Tel: +61 467 237 879
E-mail: salesaustralia@lucyelectric.com

engineering intelligent solutions

www.lucyelectric.com